

Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement

Summary

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ABSTRACT: The National Nuclear Security Administration (NNSA), an agency within the Department of Energy, has the responsibility to maintain the safety, security, and reliability of the United States' nuclear weapons stockpile. This Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) analyzes the potential environmental impacts of reasonable alternatives to continue transformation of the nuclear weapons complex to be smaller, and more responsive, efficient, and secure in order to meet national security requirements. The current Complex consists of sites located in seven states (California, Missouri, Nevada, New Mexico, South Carolina, Tennessee, and Texas). This SPEIS evaluates alternatives that would restructure special nuclear materials manufacturing and research and development facilities; consolidate special nuclear materials throughout the Complex; consolidate, relocate, or eliminate duplicative facilities and programs and improve operating efficiencies; and identify one or more sites for conducting NNSA flight test operations.

COOPERATING AGENCIES: The Department of the Air Force and the U.S. Army Garrison White Sands are cooperating agencies in the preparation of this Complex Transformation SPEIS.

PUBLIC COMMENTS: A 90-day comment period on this document begins with the publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register*. NNSA will consider comments received after the 90-day period to the extent practicable. NNSA will hold public hearings to receive comments on this document at the times and locations announced in local media and the DOE Notice of Availability. Written comments may also be submitted by U.S. mail to Mr. Theodore A. Wyka at the above address or by email to complextransformation@nnsa.doe.gov. This document and related information are available on the Internet at www.ComplexTransformationSPEIS.com.

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ACRONYMS AND ABBREVIATIONS

CMRR	Chemistry and Metallurgy Research building Replacement project
D&D	Decontamination and Decommissioning
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U. S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
HEU	Highly Enriched Uranium
HEUMF	Highly Enriched Uranium Materials Facility
LANL	Los Alamos National Laboratory
LANL SWEIS	Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory
LCF	Latent Cancer Fatality
LLNL	Lawrence Livermore National Laboratory
LLW	Low Level Waste
MEI	Maximally Exposed Individual
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NOI	Notice of Intent
NPT	Nuclear Non-proliferation Treaty
NTS	Nevada Test Site
ORR	Oak Ridge Reservation
Pantex	Pantex Plant
ROD	Record of Decision
ROI	Region of Influence
RRW	Reliable Replacement Warhead
SEAB	Secretary of Energy Advisory Board
SNL/NM	Sandia National Laboratories/New Mexico
SNL/CA	Sandia National Laboratories/California
SNM	Special Nuclear Material(s)
SRS	Savannah River Site
SSM PEIS	Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management
SSP	Stockpile Stewardship Program
TA	Technical Area
TTR	Tonopah Test Range
WSMR	White Sands Missile Range

CHEMICALS AND UNITS OF MEASURE

Ci	curie
ft	feet
ft ²	square feet
gal	gallons
hr	hour
MGY	million gallons per year
mi	miles
mi ²	square miles
mrem	millirem (one-thousandth of a rem)
MW	megawatt
MWe	megawatt electric
O ₃	ozone
t	metric tons
yd ³	cubic yards
yr	year

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Summary

S.1 INTRODUCTION

This *Complex Transformation¹ Supplemental Programmatic Environmental Impact Statement* (SPEIS) analyzes the potential environmental impacts of alternatives to make the U.S. nuclear weapons complex (Complex) smaller, and more responsive, efficient, and secure. These changes would build upon decisions made in the 1990s following the end of the Cold War and the cessation of U.S. nuclear weapons testing.

National security policies require the U.S. Department of Energy (DOE), through the National Nuclear Security Administration (NNSA), to maintain the U.S. nuclear weapons stockpile,² as well as core competencies in nuclear weapons.³ Since completion in 1996 of the *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (SSM PEIS) and associated Record of Decision (ROD) DOE has implemented these policies through the Stockpile Stewardship Program (SSP).⁴ The SSP emphasizes development and application of greatly improved scientific and technical capabilities to assess the safety, security, and reliability of existing nuclear warheads without the use of nuclear testing. Throughout the 1990s, DOE also took steps to consolidate the Complex from twelve sites in the late 1980s to its current configuration of three national laboratories (plus an associated flight test range), four industrial plants, and a nuclear test site, as shown in Figure S.1-1.

National Nuclear Security Administration

Established by Congress in 2000, the National Nuclear Security Administration (NNSA) is a semi-autonomous agency within the U.S. Department of Energy (DOE).

NNSA's primary mission is to provide the U.S. with safe, secure, and reliable nuclear weapons and to maintain core competencies in nuclear weapons. The NNSA needs a nuclear weapons complex of facilities capable of supporting this highly technical mission.

NNSA also has complementary missions in nuclear nonproliferation programs, excess fissile materials disposition, and provision of naval nuclear propulsion systems.

NNSA now proposes to continue the transformation of the Complex by further consolidating operations, which could result in the relocation of activities among sites. These changes, particularly alternatives that involve the construction or modification of major nuclear facilities, could have environmental impacts. These changes could also produce significant benefits, including improved safety, security, and environmental systems, reduced operating costs, and greater responsiveness to future changes in national security policy. NNSA's preferred alternatives (described in Section S.3.17) would achieve these benefits.

¹ In the Notice of Intent to prepare this SPEIS (71 FR 61731, October 19, 2006), NNSA's proposed action was referred to as "Complex 2030." NNSA now believes that the term Complex Transformation better reflects the proposed changes and alternatives evaluated, and has renamed this document the Complex Transformation SPEIS.

² The nuclear weapons stockpile consists of nuclear weapons that are both deployed to the various military services ("operationally-deployed") and "reserve weapons" that could be used to augment the operationally-deployed weapons or to provide replacements for warheads that experience safety or reliability problems.

³ Core competencies in nuclear weapons include research, design, development, and testing (including the ability to conduct nuclear testing); reliability assessment; certification; manufacturing; and surveillance capabilities.

⁴ In 1996, the program was named the Stockpile Stewardship and Management Program. It is now called the Stockpile Stewardship Program. There has been no change in the content or purpose of the program.

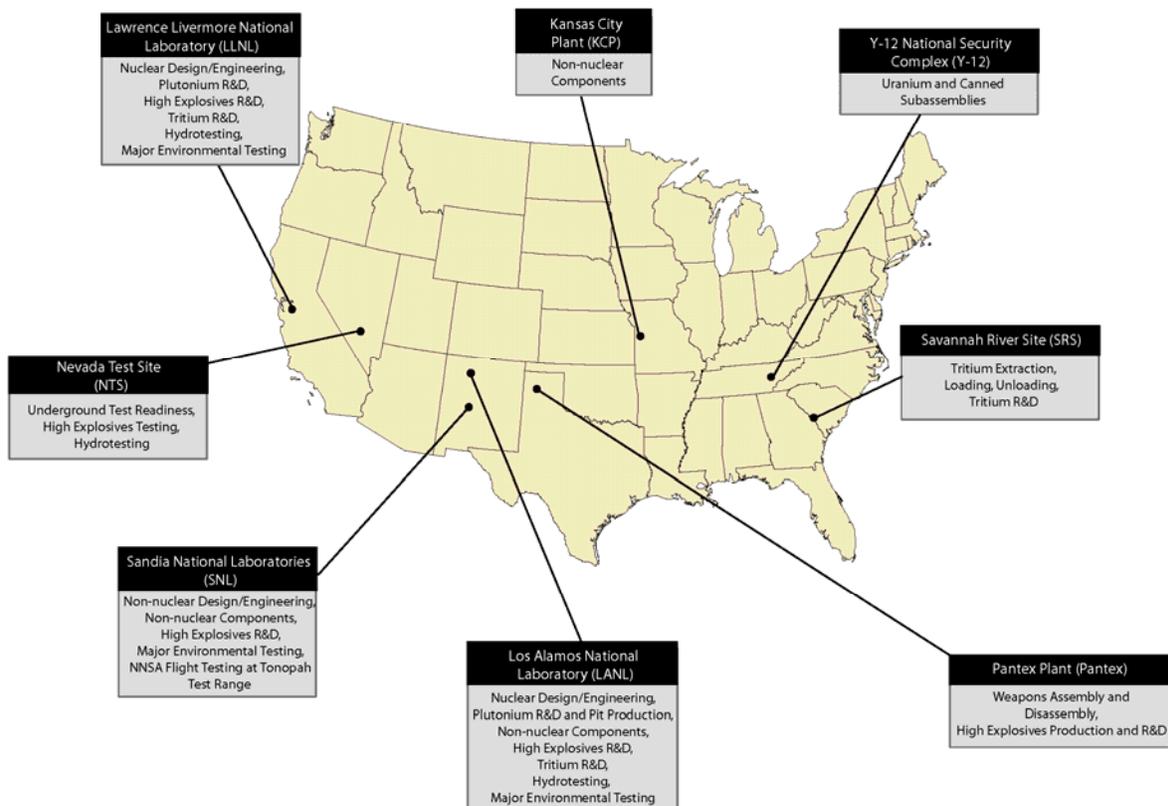


Figure S.1-1 — Nuclear Weapons Complex Sites and Current Major Responsibilities

The alternatives analyzed in this SPEIS are divided into two categories: programmatic and project-specific. Programmatic alternatives involve the restructuring of facilities that use or store significant (i.e., Category I/II⁵) quantities of special nuclear material (SNM).⁶ These facilities produce plutonium components (commonly called pits), produce highly-enriched uranium (HEU) components and canned subassemblies (CSAs), and assemble and disassemble nuclear weapons (including related high explosive component fabrication).

This SPEIS analyzes the potential environmental impacts of locating these facilities at up to three of five NNSA sites: Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico; Nevada Test Site (NTS) north of Las Vegas, Nevada; Pantex Plant (Pantex) in Amarillo, Texas; Savannah River Site (SRS) in Aiken, South Carolina; and Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee. Common to each of these programmatic alternatives, NNSA

⁵ Special nuclear material is categorized into Security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. Categories I and II require the highest level of security.

⁶ As defined in section 11 of the *Atomic Energy Act* of 1954, SNM is: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235; or (2) any material artificially enriched by any of the foregoing and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material.

also proposes to consolidate the storage of SNM currently at the Lawrence Livermore National Laboratory (LLNL) in Livermore, California, and at Pantex.

Based on this SPEIS and other information, NNSA expects to decide where facilities for plutonium, HEU, and assembly/disassembly activities would be located, whether to construct new or renovate existing facilities for these functions, and whether to further consolidate SNM storage. The programmatic alternatives are described in more detail in sections S.3.3 through S.3.7. Any programmatic decisions resulting from this SPEIS may require further project-specific *National Environmental Policy Act* (NEPA) review before implementation.

This SPEIS also analyzes project-specific alternatives to restructure research and development (R&D) and testing facilities. NNSA intends this SPEIS to provide sufficient analysis of potential environmental impacts to enable implementation of decisions related to these project-specific alternatives without further NEPA review. The decisions NNSA expects to make include:

- whether to eliminate or consolidate duplicative facilities for tritium and high explosives R&D, hydrodynamic testing, major environmental test facilities, and certain weapons support functions; where these facilities and operations would be located; and where construction activities might be required for future operations; and
- where to conduct NNSA flight test operations for gravity weapons.

The project-specific alternatives are described in sections S.3.8 through S.3.13.

The potential environmental impacts of each programmatic and project-specific alternative are summarized in Section S.3.16. NNSA has identified preferred programmatic and project-specific alternatives in this draft SPEIS. These are described in Section S.3.17. These preferred alternatives could change prior to issuance of the final SPEIS, expected in 2008.

S.1.1 Relevant History

In 1996, DOE prepared the SSM PEIS, which evaluated alternatives for maintaining the safety and reliability of the U.S. nuclear weapons stockpile and preserving competencies in nuclear weapons in the post-Cold War era. The SSM PEIS Record of Decision (ROD) (61 FR 68014, December 26, 1996) documented important decisions related to fulfilling these requirements without underground nuclear testing. Since issuing that ROD, NNSA has been implementing those decisions.

In the 1996 SSM PEIS, no new production facilities were proposed. The enduring types of weapons in the stockpile were at the mid-point of their anticipated design life of 20-25 years, and the life extension program plans for the enduring weapons were not yet fully developed. The weapons in the stockpile are now more than a decade older than when the SSM PEIS was prepared. Because the U.S. will maintain a nuclear deterrent in the form of a safe, secure, and reliable stockpile with the smallest number of weapons possible, NNSA needs to preserve its core competencies in nuclear weapons, and invest in some replacement nuclear facilities for research and production. Because these major nuclear facilities are more than 50 years old, the

ability to keep them safe, secure, and performing within realistic economic constraints is declining.

The 2001 Nuclear Posture Review⁷ concluded that a nuclear deterrent relying on a balance of capabilities and a smaller deployed weapons stockpile would provide a credible deterrent in a future of uncertain and evolving threats. The Nuclear Posture Review was the foundation for the Moscow Treaty,⁸ which was ratified by the U.S. and Russia in 2003. Implementation of the Moscow Treaty is cutting the U.S. nuclear weapons stockpile to about one-half the size in the Strategic Arms Reduction Treaty II, which was ratified by the U.S. in 1996 and Russia in 2000. To achieve the new balance between a responsive infrastructure and deployed stockpile size, one of the main purposes of the proposed actions in this SPEIS is to make the Complex more responsive. As discussed in Section S.2.1, responsiveness means the ability to successfully execute requirements of the national security mission on schedule and to efficiently react to new developments. A transformed Complex with demonstrated capabilities would ensure that the nation's nuclear deterrent would remain credible, and could support additional reductions in the stockpile, if directed by the President. A transformed Complex is also expected to be safer, more secure, and less costly to maintain.

S.1.2 Proposed Approach to Transformation of the Complex

NNSA's proposed approach to continuing transformation of the Complex builds on existing programs and management structures, so that transformation can be accomplished within currently projected funding levels as much as practicable. The cost and potential environmental impacts of the alternative actions in this SPEIS are primarily associated with the potential construction of new but smaller replacement nuclear facilities. Thus, a wide range of alternative configurations for these nuclear facilities is being evaluated from an economic perspective. NNSA has completed economic studies of the alternatives (TechSource 2007a, 2007b, 2007c, 2007d).

S.1.3 The Nuclear Weapons Complex Today

As shown on Figure S.1-1, the current Complex consists of eight sites located in seven states. The Complex enables NNSA to design, develop, manufacture, maintain, and work on nuclear weapons; certify their safety, security, and reliability; conduct surveillance on weapons in the stockpile; store Category I/II SNM; and dismantle and disposition retired weapons. Major sites within the Complex and their current primary responsibilities are described below.

Y-12 National Security Complex (Y-12) (Oak Ridge, Tennessee) – Y-12 manufactures uranium components for nuclear weapons, cases, and other nuclear weapons components comprising CSAs; evaluates and tests these components; maintains Category I/II quantities of highly-enriched uranium; conducts component dismantlement, storage, and disposition of their nuclear materials; and supplies highly-enriched uranium for use in naval reactors.

⁷ The Nuclear Posture Review is a classified report prepared by the Department of Defense that establishes the broad outline for future U.S. nuclear strategy, force levels, and infrastructure.

⁸ Treaty Between the United States of America and the Russian Federation on Strategic Offensive Reductions

Savannah River Site (SRS) (Aiken, South Carolina) – SRS extracts tritium and performs loading, unloading, surveillance of tritium reservoirs, and conducts tritium R&D.⁹ SRS does not maintain Category I/II quantities of SNM associated with NNSA weapons activities, but does maintain Category I/II quantities of SNM associated with other DOE activities, such as the Environmental Management (EM) program.

Pantex Plant (Pantex) (Amarillo, Texas) – Pantex dismantles retired weapons; fabricates high-explosive (HE) components and performs HE research and development (R&D); assembles HE, nuclear, and non-nuclear components into nuclear weapons; work on and modifies weapons; performs non-intrusive pit modification;¹⁰ and evaluates and performs surveillance of weapons. Pantex maintains Category I/II quantities of SNM for the weapons program and stores SNM in the form of surplus plutonium pits pending transfer to SRS for disposition.

Kansas City Plant¹¹ (KCP) (Kansas City, Missouri) – KCP manufactures and procures non-nuclear weapons components, and evaluates and tests these weapons components. KCP has no SNM.

Los Alamos National Laboratory (LANL) (Los Alamos, New Mexico) – LANL conducts research, design, and development of nuclear weapons; designs and tests advanced technology concepts; provides safety, security, and reliability assessments and certification of stockpile weapons; maintains production capabilities for limited quantities of plutonium components (i.e., pits) for delivery to the stockpile; manufactures nuclear weapon detonators for the stockpile; conducts plutonium and tritium R&D, hydrotesting, HE R&D, and environmental testing; and maintains Category I/II quantities of SNM.

Lawrence Livermore National Laboratory (LLNL) (Livermore, California) – LLNL conducts research, design, and development of nuclear weapons; designs and tests advanced technology concepts; provides safety, security, and reliability assessments and certification of stockpile weapons; conducts plutonium and tritium R&D, hydrotesting, HE R&D, and environmental testing; and maintains Category I/II quantities of SNM.

Sandia National Laboratories (SNL) (Albuquerque, New Mexico; Livermore, California; and other locations) – SNL conducts systems engineering of nuclear weapons; conducts research, design, and development of non-nuclear components; manufactures non-nuclear weapons components including neutron generators for the stockpile; provides safety, security, and reliability assessments of stockpile weapons; and conducts HE R&D and environmental testing. SNL/NM is currently removing its Category I/II SNM, and by the end of 2008 should no

⁹ Tritium is an isotope of hydrogen produced in nuclear reactors and used in nuclear weapons. Because of its short half-life, tritium must be replenished routinely. The Watts Bar Nuclear Power Plant (Spring City, Tennessee) is a commercial nuclear power plant owned and operated by the Tennessee Valley Authority (TVA) which produces tritium that is extracted from target rods at SRS. As a commercial power station, the Watts Bar Plant is not considered part of the nuclear weapons complex.

¹⁰ A pit is the central core of a nuclear weapon, usually made of plutonium or enriched uranium. Non-intrusive pit modification is modification to the external surfaces and features of a pit.

¹¹ The General Services Administration (GSA), as the lead agency, and NNSA, as a cooperating agency, are preparing an Environmental Assessment to evaluate the potential environmental impacts associated with relocating the facilities and infrastructure for the non-nuclear production activities conducted at KCP. This SPEIS does not assess alternatives for the activities conducted at KCP (see Section S.3.2.10).

longer need Category I/II SNM quantities on a permanent basis. The principal laboratory is located in Albuquerque, New Mexico (SNL/NM); a division of the laboratory (SNL/CA) is located in Livermore, California. SNL also operates the Tonopah Test Range (TTR) near Tonopah, Nevada, for flight testing of gravity weapons. No Category I/II quantities of SNM are permanently maintained at the TTR, although some test operations have involved SNM.

Nevada Test Site (NTS) (65 miles northwest of Las Vegas, Nevada) – NTS maintains the capability to conduct underground nuclear testing; conducts high hazard experiments involving nuclear material and high explosives; provides the capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; conducts hydrotesting and HE testing; conducts research and training on nuclear safeguards, criticality safety, and emergency response; and maintains Category I/II quantities of SNM.

S.1.4 Public Participation

The Council on Environmental Quality (CEQ) NEPA regulations require “...an early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action...” (40 CFR 1501.7). This is known as the public scoping process. The purpose of this scoping process is: (1) to inform the public about the proposed action and the alternatives being considered, and (2) to identify and clarify issues by soliciting public comments.

NNSA published a Notice of Intent (NOI) in the *Federal Register* on October 19, 2006 (71 FR 61731) and held public scoping meetings in November and December 2006 near all sites that might be affected and in Washington, D.C. (see Figure S.1-2). In addition to the meetings, the public was encouraged to provide comments via mail, e-mail, and fax. All comments received during the 90-day scoping period were reviewed by NNSA in preparing this draft of the Complex Transformation SPEIS. All late comments received were also reviewed and, in general, determined to be similar to previous comments received. More than 33,000 comment documents were received from individuals, interested groups, Native Americans, and Federal, state, and local officials during the public scoping period. A majority of the documents received were form letters or e-mail campaigns. Twenty different form letters or e-mails were submitted. A summary of the major scoping comments is provided below, and in more detail in Appendix D.

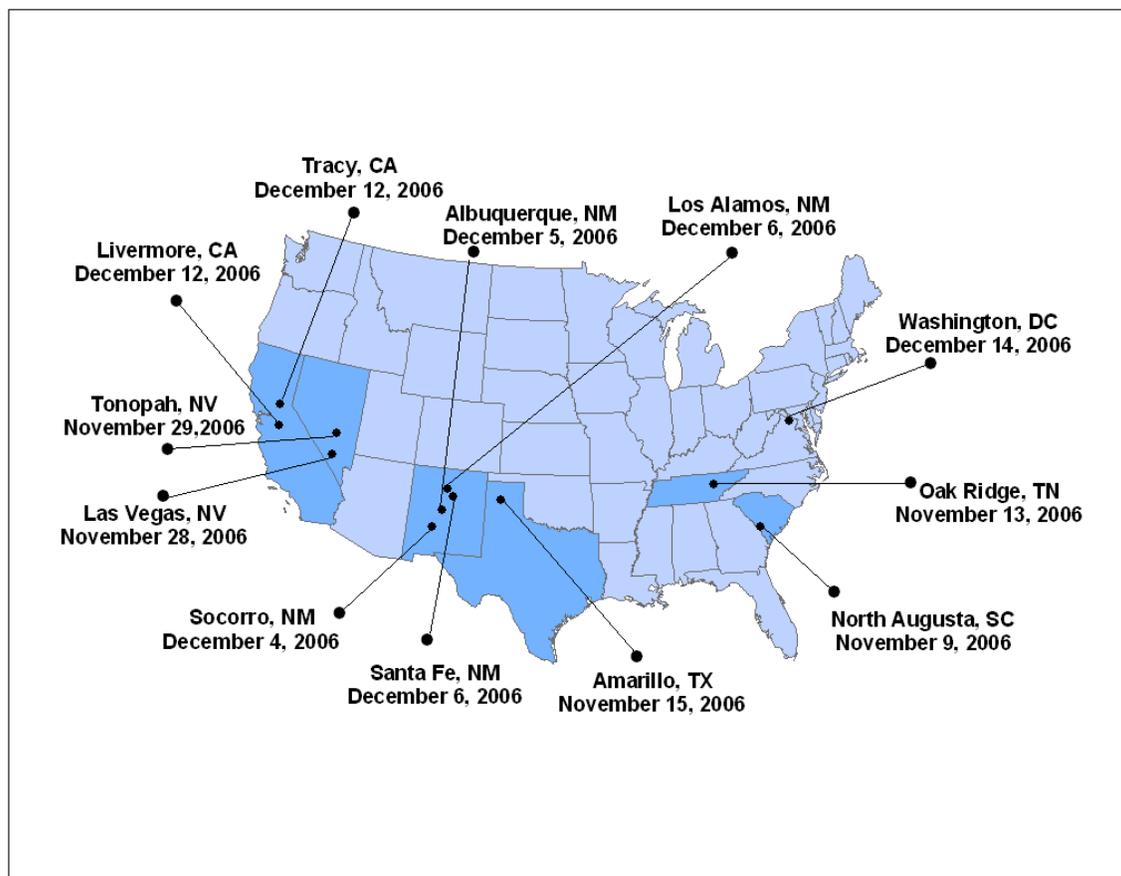


Figure S.1-2 — Public Scoping Meeting Locations and Dates

S.1.4.1 *Summary of Major Scoping Comments*

A summary of the major comments received during the scoping period and responses to these comments follows:

Comment: The majority of the comments expressed opposition to the nuclear weapons program and U.S. national security policies. Many of the comments stated that the U.S. is violating the Nuclear Nonproliferation Treaty (NPT). Many of the comments stated that NNSA should assess an additional alternative - disarmament in compliance with the NPT - and not design or build new nuclear weapons.

Response: The security policies of the U.S. require the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." Actions by the U.S., including its moratorium on nuclear testing accompanied by significant reductions in its strategic force structure, nuclear

weapons stockpile, and production infrastructure, constitute significant progress toward these goals. However, unless and until there are significant changes in national security policy, NNSA is required to design, produce, and maintain the nuclear weapons stockpile pursuant to requirements established by the President and funded by Congress. In conjunction with the 2001 NPR, President Bush set an objective of "...achieving a credible nuclear deterrent with the lowest-possible number of nuclear warheads consistent with our national security needs...". In recognition of this objective and the reduction in the U.S. stockpile since the end of the Cold War, this SPEIS qualitatively evaluates changes in the alternatives that would be appropriate if the stockpile is reduced below the level called for by the Moscow Treaty. Accordingly, this SPEIS analyzes alternatives that satisfy requirements of the existing national security policy framework, as well as a capability-based alternative that, while not capable of meeting current requirements, could meet those requirements if the stockpile were reduced below the level called for by the Moscow Treaty.

Comment: Commentors stated that the reliable replacement warhead (RRW) was not needed and should not be pursued.

Response: RRW refers to possible future warhead designs that could replace existing "legacy" warheads. The RRW would not affect the proposed action of this SPEIS related to restructuring SNM facilities, or the proposed action to restructure R&D facilities. The proposed actions are independent of whether an RRW is developed. Because the environmental impacts analyzed are based on the maintenance of the legacy weapons that are currently in the stockpile, a conservative estimate of the environmental impacts is provided in this SPEIS. If RRW is approved as part of the national strategy for providing a nuclear deterrent, it would enable a shift to fewer hazardous operations. However, a production capacity for plutonium and highly-enriched uranium components, as well as for weapons assembly and disassembly, will be required for the foreseeable future with or without implementation of RRW. Section S.3.15 provides a discussion of the RRW's possible impact on the nuclear weapons stockpile and decisions about the Complex facilities.

Comment: Commentors stated that NNSA should develop a fair and objective statement for the purpose and need that takes into account the broader missions of NNSA that include preventing proliferation, ensuring the effectiveness of the NPT, and developing strategies to ensure the peaceful denuclearization of existing and threshold nuclear states, and the underlying legal obligations and treaty commitments.

Response: The fundamental principle underlying NNSA's evaluation of alternatives is that the Stockpile Stewardship Program (SSP) must continue to support existing and reasonably foreseeable national security requirements. This is NNSA's obligation and responsibility under the *Atomic Energy Act*¹² and the *National Nuclear Security*

¹² 42 U.S.C. 2011 et seq.

*Administration Act.*¹³ This SPEIS does not analyze alternatives to U.S. national security policy. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for executing the SSP, which is based on requirements established by national security policy including the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. NNSA continues work in other areas, including those identified in comments. Nuclear weapons knowledge has and will continue to enable nonproliferation; however, they are not dealt with in this SPEIS.

Comment: Commentors asked why NNSA was not assessing a consolidated nuclear production center (one site for plutonium, enriched uranium, and weapons assembly/disassembly) as a reasonable alternative for transforming the Complex.

Response: A consolidated nuclear production center (CNPC) alternative was added as a reasonable alternative and is discussed in Section S.3.5 of this SPEIS. NNSA decided to analyze this alternative in order to assess the potential impacts of consolidating major nuclear weapons and SNM production missions at one site.

Comment: Commentors stated that pits will last up to 100 years and potentially longer; therefore, there is no need for new pit production capacity.

Response: This SPEIS addresses the environmental effects of both possessing and utilizing a pit production capacity in the event decisions are made to produce pits. While the current state of knowledge is that there may not be a need to produce pits in the near future because of the plutonium's longevity, NNSA cannot be certain that other issues associated with pits, other than the aging of plutonium materials, would never arise. Accordingly, prudent management requires that NNSA maintain a capacity to produce pits as long as this nation maintains its nuclear stockpile. A small pit fabrication capability is currently being maintained at LANL and is part of the No Action Alternative evaluated in this SPEIS.

Comment: Commentors asked why KCP was not being considered in this SPEIS, and stated that NNSA was not representing the full cost of Complex Transformation by excluding alternatives involving activities currently performed by KCP.

Response: Following the Non-nuclear Consolidation Environmental Assessment (DOE/EA-0792, 1993), NNSA decided to consolidate most non-nuclear operations to improve efficiency. In the SSM PEIS (1996), NNSA further considered alternatives with respect to non-nuclear operations, including relocating those capabilities to the NNSA national laboratories. The decision was made (61 FR 68014; December 26, 1996) to retain the existing facilities at the KCP. This was the environmentally preferable alternative, posed the least technical risk, and was the lowest cost alternative.

¹³ Title 32, *National Defense Authorization Act for Fiscal Year 2000*, Public Law 106-65

Because the non-nuclear operations at KCP are essential and do not duplicate the work at other sites, no proposal for combination or elimination of these missions was formulated. A recent analysis has concluded that transferring these KCP non-nuclear operations to a site other than one within the immediate Kansas City area would not be cost-effective (SAIC 2007). Consequently, the non-nuclear operations would remain at either the current KCP or a new facility in the Kansas City area, and would neither affect nor be affected by the decisions regarding the alternatives in this SPEIS.

Comment: Commentors requested an analysis of the risks and impacts of terrorist attacks on NNSA facilities.

Response: With respect to intentional destructive acts, substantive details of attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. A separate classified appendix to this Draft SPEIS has been prepared that evaluates the underlying facility threat assumptions with regard to malevolent, terrorist, or intentional destructive acts. The methodology for the analysis in this classified appendix is discussed in Appendix B. These data provide NNSA with information upon which to base, in part, decisions supported by this SPEIS.

Comment: Support for the continuation of the NNSA flight test mission at the Tonopah Test Range was received from the Tonopah community. Commentors demanded evidence of a compelling reason to move this mission from Tonopah.

Response: A detailed impact analysis was prepared for the NNSA flight testing alternatives and is presented in Section 5.15.4.2 of the SPEIS. The analysis discusses the potential socioeconomic impacts to the Tonopah community of NNSA flight testing alternatives.

Comment: Commentors expressed opposition to any new nuclear facilities. There was specific opposition to expanding pit production at LANL, as well as the proposed consolidated plutonium center (CPC). Commentors stated that the LANL Site-Wide EIS should follow the Complex Transformation SPEIS.

Response: NNSA added analysis of an alternative that would upgrade facilities at LANL for a smaller pit production capacity (up to 80 pits per year) than the baseline capacity (125 pits per year, single shift) of the proposed CPC (see Section S.3.4.1.2). NNSA is evaluating increasing its current capacity to produce nominally 20 pits per year at LANL in a site-wide EIS (LANL 2006a). It is expected that a final LANL Site-wide EIS will be issued prior to completion of this SPEIS, but NNSA will not make any new decisions specifically related to pit production at LANL prior to the completion of this SPEIS.

Comment: Commentors stated that a site near the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, should be considered as a reasonable location for a CPC.

Response: In order to determine the reasonable site alternatives for a CPC, all existing, major DOE sites were initially considered as a potential host location for a CPC. Sites that do not maintain Category I/II SNM were eliminated from consideration, as were sites that do not conduct major NNSA program activities. WIPP did not meet these siting criteria. Other DOE sites were not considered reasonable locations because they do not satisfy certain criteria such as population encroachment, mission compatibility, or synergy with the site's existing mission. Following this process, NNSA decided that Los Alamos, NTS, Pantex, SRS, and Y-12 constitute the range of reasonable site alternatives for a CPC.

S.1.4.2 *Key Changes to the Scope of the Complex Transformation SPEIS Resulting from Public Comments*

As a result of the scoping process, NNSA made the following significant changes to the scope of the Complex Transformation SPEIS:

- A consolidated centers of excellence (CCE) alternative was added as a reasonable alternative (see Section S.3.5). NNSA would consolidate plutonium, uranium, and weapon assembly/disassembly functions into a CNPC at one site or into Consolidated Nuclear Centers (CNCs) at two sites.
- A discussion was added of effects on the Complex of an even smaller nuclear weapons stockpile than the current level envisioned under the Moscow Treaty (see Section 5.11 of the SPEIS).
- A discussion was added of the RRW's possible impact on the nuclear weapons stockpile and decisions about Complex Transformation. An analysis was added to determine what, if any, changes to the Complex would be required if the RRW were to be developed (see Section S.3.15).
- A more detailed analysis of the potential impacts of NNSA flight testing was added in order to inform the public and NNSA of the potential socioeconomic impacts to the Tonopah community from the alternatives (see Section 5.15.4.2 of the SPEIS).
- An analysis of a smaller pit production facility (50 to 80 pits per year) was added (see Section S.3.4.1.2).
- A more detailed explanation of why the Kansas City Plant non-nuclear operations are not included in this SPEIS was added (see Section S.3.2.10).

S.2 PURPOSE AND NEED FOR AGENCY ACTION

NNSA maintains the safety, security, and reliability of the U.S. nuclear weapons stockpile through the Stockpile Stewardship Program (SSP). The SSP involves the integrated activities of three NNSA national laboratories, four industrial plants, and a nuclear test site. The SSP helps identify the changes in the Complex that may be required for NNSA to continue to meet its national security requirements as established by the President and funded by Congress. The purpose and need underlying the alternatives analyzed in this Complex Transformation SPEIS derive from changes in national security policy since the 1996 SSM PEIS ROD, as well as considerations of aging facilities at nuclear sites, aging weapons, and evolving safeguards and security requirements for Category I/II SNM. The underlying purpose and need addressed in this SPEIS is to:

- Maintain core competencies in nuclear weapons;
- Maintain a safe and reliable nuclear weapons stockpile; and
- Create a responsive nuclear weapons infrastructure that is cost-effective, and has adequate capacity to meet reasonably foreseeable national security requirements; and consolidate Category I/II SNM at fewer sites and locations within sites to reduce the risk and safeguards costs.

The fundamental principle underlying NNSA's evaluation of alternatives is that the SSP must continue to support existing and reasonably foreseeable national security policy. This is NNSA's obligation and responsibility under the *Atomic Energy Act* and the *National Nuclear Security Administration Act*. This SPEIS does not analyze alternative U.S. national security policies. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for execution of the program based on the existing policy and foreseeable changes in this policy.

This SPEIS discusses producing reliable replacement warheads (RRWs) as compared to maintaining legacy warheads¹⁴ with Life Extension Programs.¹⁵ Transformation of the Complex infrastructure is required whether or not development of RRW proceeds. Section S.3.15 provides additional information relative to RRW.

S.2.1 Responsiveness of the Nuclear Weapons Complex Infrastructure

The current nuclear weapons production infrastructure is not sufficiently responsive or cost-effective. Responsiveness is the ability to quickly react to new developments and threats and successfully execute SSP requirements. Lack of responsiveness is evidenced by difficulties in executing weapon production schedules in support of maintenance, retrofit and Life Extension Programs, and by the lack of a sufficient pit production capability.

¹⁴ A legacy warhead is a weapon in the current stockpile.

¹⁵ NNSA has taken an aggressive approach to warhead refurbishment. Through enhanced surveillance and assessment efforts, NNSA has developed an improved understanding of the effects of aging on warhead safety, security, and reliability. Using this knowledge, NNSA is able to plan refurbishments to replace or fix components systematically, before aging-related changes jeopardize warhead safety or reliability. This is known as the Life Extension Program.

A reliable and responsive infrastructure is a cornerstone of the new triad discussed in the 2001 Nuclear Posture Review (Figure S.2-1) and in Section 3111 of the National Defense Authorization Act for FY 2006 (Public Law 109-163). The purpose of a reliable and responsive infrastructure is to deter adversaries from trying to seek advantage – an attempt to seek advantage would be detected and negated by a quick response. A more responsive infrastructure is expected to permit further reductions in the nuclear weapons stockpile. In the context of the SSP, this responsiveness could permit deeper reductions in the number of reserve weapons that support the deployed stockpile.

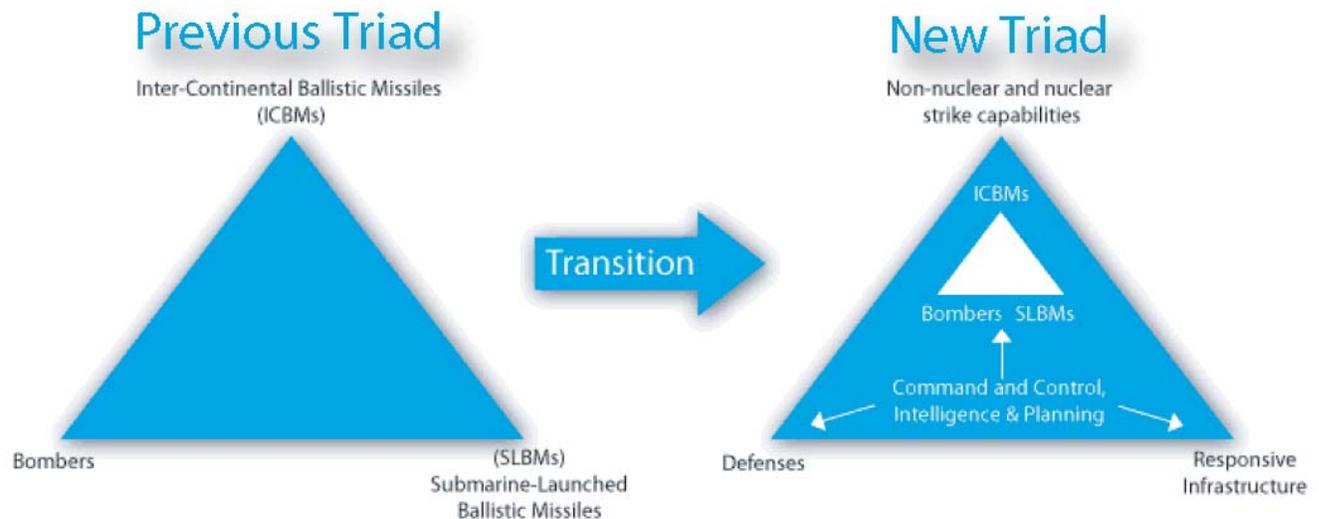


Figure S.2-1 — Transition to the New Triad

S.2.2 Laboratory Technical and Industrial Base Capabilities

The underlying purpose and need for the laboratory technical and industrial base capabilities of the SSP remain unchanged from that described in the 1996 SSM PEIS. National security policies still require the core competencies and capabilities of NNSA and its national laboratories, production plants, and the test site. They are basic needs that must be maintained for the foreseeable future in order for NNSA to meet its national security obligations.

S.2.3 Adequate Production Capacity for a Smaller Stockpile

A precise prediction of the future production capacity needed to work on or replace aging legacy weapons cannot be made. Further, a capacity to produce components does not mean that those quantities of components would actually be produced. National security requirements will determine actual production. The Complex must be able to produce what is likely to be required.

For the nuclear production alternatives, this SPEIS assesses manufacturing capacity operated in a single shift, five days per week, to produce 50-125 weapons per year. The bounding case of

producing up to 200 weapons per year assumes operations in multiple shifts and extended work weeks.

S.2.4 A Smaller Infrastructure Footprint for More Cost-Effective Operations

In 2005, a Secretary of Energy Advisory Board (SEAB) task force recommended that NNSA consider a smaller, modernized infrastructure footprint to improve responsiveness, cost effectiveness, and security for high-risk special nuclear materials (SEAB 2005).

S.2.5 Enhanced Security for Special Nuclear Materials

The attacks of September 11, 2001, altered security requirements in the NNSA Complex. As a result, security measures and their costs have increased significantly. Most of the effects on NNSA infrastructure are a result of changes to the Design Basis Threat (DBT). The DBT is a profile of the type, composition, and capabilities of a potential adversary. The DBT is used to design safeguards systems to protect against acts of sabotage and to prevent theft of high-risk (Category I/II) SNM. The details of the DBT, which DOE uses to establish its safeguards systems, are classified. However, the net effect of changes in the DBT has stimulated proposed actions an examination of alternatives for consolidating Category I/II SNM at fewer sites and locations within sites to improve security and reduce costs.

S.3 ALTERNATIVES

S.3.1 Development of Reasonable Alternatives

NNSA has been evaluating how to establish a more responsive nuclear weapons infrastructure since the Nuclear Posture Review was transmitted to Congress in early 2002. The Stockpile Stewardship Conference in 2003 (DoD 2003), the Department of Defense Strategic Capabilities Assessment in 2004 (DoD 2004), the recommendations of the SEAB Task Force on the Nuclear Weapons Complex Infrastructure in 2005 (SEAB 2005), and the Defense Science Board Task Force on Nuclear Capabilities in 2006 (DoD 2006) have provided information for NNSA's evaluation.

In 2006, NNSA developed a planning scenario for the future of the Complex (NNSA 2006). This effort was a continuation of NNSA's planning for a Complex that would be more responsive to changing national security requirements, as determined by the President and funded by Congress, and could be operated more efficiently. The planning scenario was developed to determine if significant economic and security benefits could be realized if the Complex were reduced in size, capacity, number of sites with Category I/II SNM (and locations of Category I/II SNM within sites), and excess and redundant facilities eliminated - in other words, whether and how the Complex could be made more secure and efficient.

S.3.1.1 Proposed Actions

NNSA's proposed action is to restructure the nuclear weapons complex to make it smaller and more responsive, efficient and secure, while meeting national security requirements. Two basic

types of proposed actions result from the needs identified for a more responsive NNSA Complex infrastructure:

- Restructure SNM Facilities (Programmatic Alternatives)
- Restructure R&D and Testing Facilities (Project-Specific Alternatives)

S.3.1.1.1 Restructure SNM Facilities

The following functional capabilities are included in this proposed action:

- Plutonium operations, including pit manufacturing, Category I/II SNM storage, and related R&D;
- Enriched uranium operations, including canned subassembly¹⁶ manufacturing, assembly, and disassembly; Category I/II SNM storage; and related R&D; and
- Weapons assembly and disassembly (A/D) and high explosives (HE) production.

To consolidate SNM facilities, which would be a long-term process carried out over a decade or more, the SPEIS alternatives address broad issues such as where to locate those facilities and whether to construct new or renovate existing facilities for these functions. As such, this SPEIS analysis is “programmatic” for the proposed action to restructure SNM facilities, meaning that tiered, project-specific NEPA documents could be needed to inform decisions on these facilities if existing site-wide EISs or other NEPA documents were insufficient.

As shown on Figure S.3.1-1, these “programmatic alternatives” are:

- **No Action Alternative.** As described in Section S.3.3, the No Action Alternative represents continuation of the status quo including implementation of past decisions. Under the No Action Alternative, NNSA would not make major changes to the SNM missions now assigned to NNSA sites.
- **Programmatic Alternative 1: Distributed Centers of Excellence (DCE).** As described in Section S.3.4, the DCE alternative retains the three major SNM functional capabilities (plutonium operations, uranium operations, and weapon assembly/disassembly) involving Category I/II quantities of SNM at two or three separate Complex sites. This alternative would create a consolidated plutonium center (CPC) for R&D, storage, processing, and manufacture of plutonium parts (pits) for the nuclear weapons stockpile. Production rates of 125 pits per year for single shift operations and 200 pits per year for multiple shifts and extended work weeks are assessed for a CPC.¹⁷ A CPC could consist of new facilities, or modifications to existing facilities at one of the following sites: Los

¹⁶ Canned subassembly – The component of a nuclear weapon which contains the secondary, including uranium and lithium components.

¹⁷ See Section S.3.14 for a discussion of a new CPC with a smaller capacity.

Alamos,¹⁸ NTS, Pantex, SRS, or Y-12. This SPEIS also considers an upgrade of facilities at Los Alamos to produce up to 80 pits per year. Highly-enriched uranium and uranium storage, and uranium operations, would continue at Y-12. As part of this alternative, a new Uranium Processing Facility (UPF) and an upgrade to existing facilities at Y-12 are analyzed. The weapons Assembly/Disassembly/High Explosives (A/D/HE) mission would remain at Pantex.

- **Programmatic Alternative 2: Consolidated Centers of Excellence (CCE).** As described in Section S.3.5, the CCE Alternative consolidates the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM at one or two sites. Two options are assessed: (1) the single site option (referred to as the consolidated nuclear production center [CNPC] option); and (2) the two-site option (referred to as the consolidated nuclear centers [CNC] option). The CCE Alternative assesses three major facilities: (1) a CPC; (2) a consolidated uranium center (CUC), which would be similar to the UPF but would also include HEU storage and non-nuclear support functions; and (3) an A/D/HE Center, which would assemble/disassemble nuclear weapons, and fabricate high explosives. Under the CNPC option, a new CNPC could be established at Los Alamos, NTS, Pantex, SRS, or Y-12. This SPEIS analyzes the impacts of each of these facilities separately and in combination with one another. If Pantex or Y-12 were not selected for this option, weapons operations at Pantex, Y-12, or both sites would cease. Under the CNC option, the plutonium and uranium nuclear component manufacturing missions could be separate from the A/D/HE mission. The A/D/HE functions could remain at Pantex or be transferred to the NTS, while the plutonium and/or uranium missions could be located at sites different than the A/D/HE function. The CCE Alternative assesses production rates of 125 weapons per year for single shift operations and 200 weapons per year for multiple shifts and extended work weeks.¹⁹
- **Programmatic Alternative 3: Capability-Based Alternative.** As described in Section S.3.6, under this alternative, NNSA would maintain a basic capability for manufacturing components for all stockpile weapons, as well as laboratory and experimental capabilities to support stockpile decisions, but would reduce production capabilities at existing or planned facilities. Under this alternative, pit production at LANL would not be expanded beyond a capability to provide 50 pits per year. Production capacities at Pantex, Y-12, and the SRS would be reduced to a capability-based level.²⁰

¹⁸ In general, when referring to the Los Alamos National Laboratory, this SPEIS refers to this site as “LANL.” The term “Los Alamos” is used to describe this site as an alternative location for a CPC or Consolidated Nuclear Production Center (CNPC).

¹⁹ See Section S.3.14 for a discussion of a new CNPC with a smaller capacity.

²⁰ A capability-based capacity is defined as the facility capacity inherent with the facilities and equipment required to manufacture one component of any stockpile system. In the Notice of Intent to prepare this SPEIS, this capacity was referred to as a “nominal capacity”.

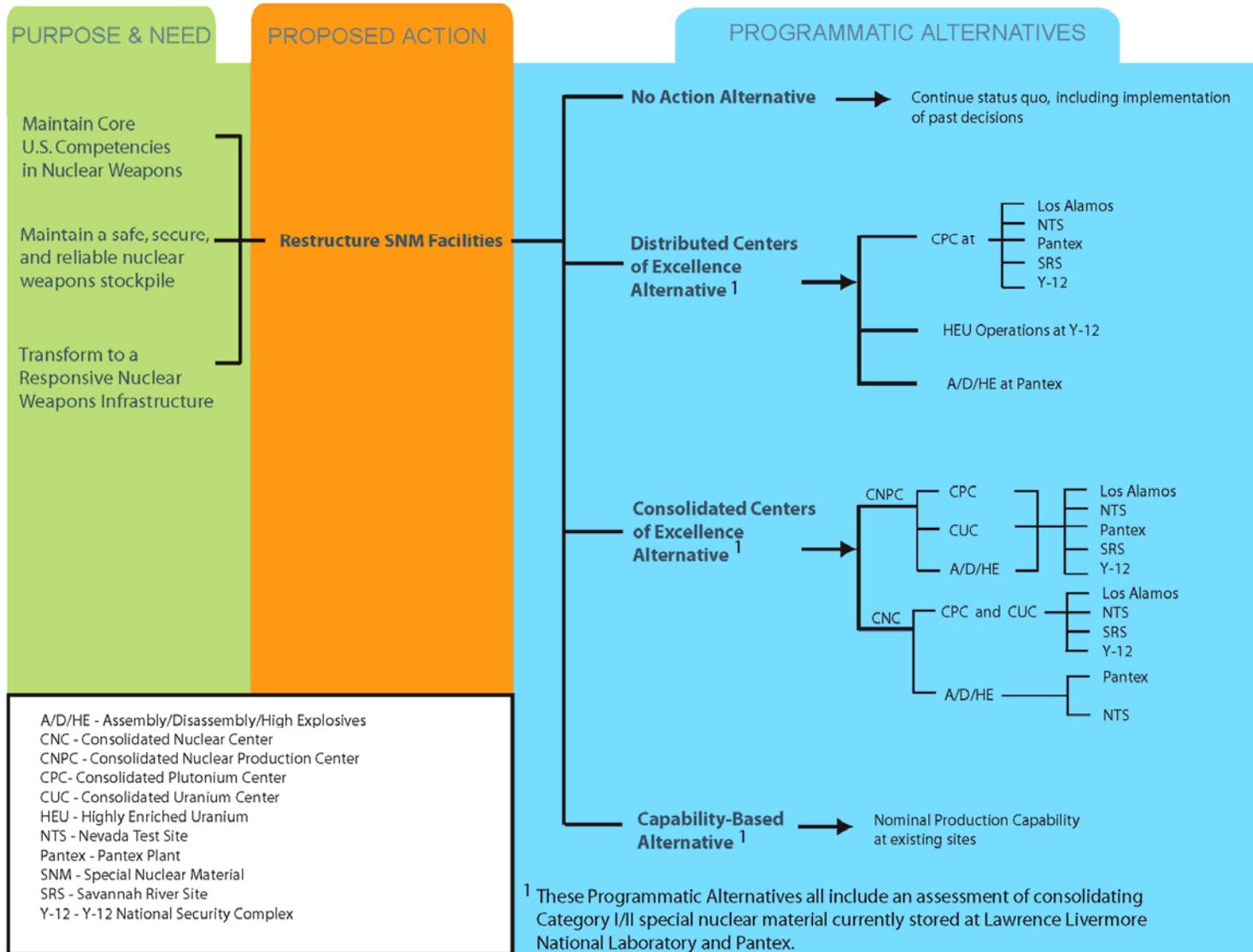


Figure S.3.1-1 — Programmatic Alternatives

The DCE Alternative, CCE Alternative, and the Capability-Based Alternative all include proposals to consolidate Category I/II SNM involving LLNL²¹ and Pantex. Those proposals are described in Section S.3.7.

S.3.1.1.2 Restructure R&D and Testing Facilities

In pursuit of a more responsive and cost-effective infrastructure, NNSA is considering a restructuring of the R&D and testing facilities within the Complex. For the proposed action to restructure R&D and testing facilities, the alternatives focus on near-term issues to consolidate, relocate, or eliminate facilities and programs and improve operating efficiencies. The following capabilities are being evaluated in this SPEIS:

- High Explosives R&D
- Tritium R&D
- Flight Test Operations
- Hydrodynamic Testing
- Major Environmental Testing

The analysis of alternatives for these capabilities is “project specific,” meaning that no further NEPA review would likely be needed to implement decisions consistent with the alternatives analyzed in this SPEIS. Restructuring of these facilities is expected to be pursued regardless of which programmatic alternative is selected for SNM facilities. The project-specific alternatives, shown on Figure S.3.1-2, were developed to achieve significant benefits in making the Complex more secure and efficient. In addition to these project-specific alternatives for restructuring R&D and testing, this SPEIS also addresses alternatives related to non-nuclear component design and engineering work at SNL/California.

Project-Specific Analysis

A project-specific analysis is a detailed analysis of the environmental impacts of a proposed action and the reasonable alternatives. The project-specific analysis is intended to support actions that could be implemented after the SPEIS ROD, without any additional NEPA analysis.

²¹ The LLNL SWEIS (DOE 2005) assesses the environmental impacts of transporting SNM to and from LLNL and other NNSA sites, SRS, and WIPP. That analysis includes consideration of transportation actions involving greater quantities of SNM and more shipments than are identified in this SPEIS. As such, the transportation activities associated with consolidating SNM from LLNL are included in the existing No Action Alternative and can proceed without additional NEPA analysis. For completeness, however, this SPEIS includes the environmental impacts associated with such actions.

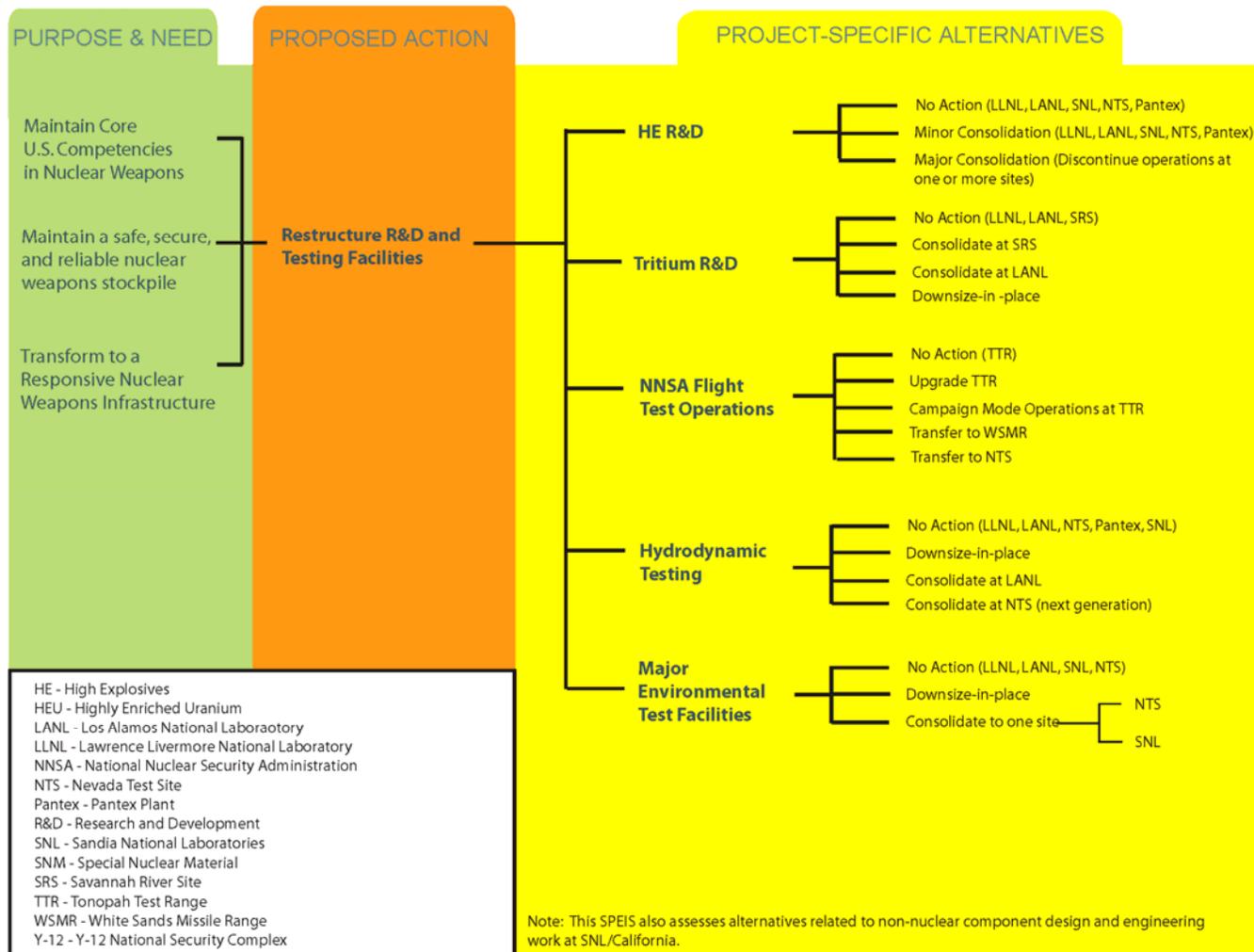


Figure S.3.1-2 — Alternatives to Restructure R&D and Testing Facilities

S.3.2 Overview of NNSA Sites and Missions

S.3.2.1 *Los Alamos National Laboratory*

LANL was established as a nuclear weapons design laboratory in 1943. Its facilities are located on approximately 28,000 acres about 25 miles northwest of Santa Fe, New Mexico. LANL is a multidisciplinary research facility engaged in a variety of programs for NNSA, DOE, other Government agencies, and the private sector. Its primary mission is the implementation of the Stockpile Stewardship Program. Other missions involve emergency response, arms control, nonproliferation, and environmental activities. LANL conducts R&D activities in the basic sciences, mathematics, and computing, with application to these mission areas and to a broad range of programs including: non-nuclear defense; nuclear and non-nuclear energy; material science; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment.

With regard to nuclear weapons, LANL is responsible for the design of the nuclear explosive package in certain U.S. weapons (LLNL has this responsibility for the other weapons).²² LANL performs research, design, development, testing, surveillance, assessment, and maintains certification capabilities in support of the SSP. In addition, LANL could nominally produce 20 pits per year, as announced in the Record of Decision for the 1999 LANL Site-Wide EIS (64 FR 50797, September 20, 1999). LANL also conducts surveillance of pits and manufactures some non-nuclear components (e.g., detonators).

S.3.2.2 *Lawrence Livermore National Laboratory*

LLNL was established as a nuclear weapons design laboratory in 1952. LLNL's main site is located on approximately 821 acres in Livermore, California. LLNL also operates a 7,000-acre "Experimental Test Site" known as Site 300, which is located approximately 12 miles east of the main laboratory. Site 300 is used primarily for high explosives testing, hydrodynamic testing, and other experimentation, such as particle beam research.

LLNL is a multidisciplinary research facility engaged in a variety of programs for NNSA, DOE, other government agencies, and the private sector. Its primary mission is implementation of the SSP. Other missions involve related emergency response, arms control, and nonproliferation activities. LLNL conducts research and development activities in the basic sciences, mathematics, and computing, with application to these mission areas, and to a broad range of programs including: non-nuclear defense; nuclear and non-nuclear energy; high-energy density

²² The general responsibilities assigned to LLNL and LANL for nuclear explosive packages are complementary. LANL and LLNL compete for assignment of the responsibility for design and development of the nuclear explosive package for a nuclear weapons system. In the early design definition phase, both laboratories perform systems studies, preliminary development work, and initial design definition. NNSA, in consultation with the DoD and the cognizant military service, then selects either LANL or LLNL to work with SNL to design and develop the new weapon system. LANL or LLNL designs and develops the nuclear physics package and associated support hardware; SNL designs and develops the arming, fuzing, and firing system, other warhead electronics, external cases and mounts, and performs systems integration to develop the complete weapon system. There are nuclear explosive packages in the current legacy stockpile that have been designed and developed by both LANL and LLNL.

physics; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment. With respect to nuclear weapons, LLNL is responsible for the design of the nuclear explosive package in certain weapons (LANL has this responsibility for the other weapons). LLNL maintains research, design, development, testing, surveillance, assessment, and certification capabilities in support of Stockpile Stewardship.

S.3.2.3 *Nevada Test Site*

NTS occupies approximately 867,000 acres in the southeastern part of Nye County in southern Nevada. It is located about 65 miles northwest of Las Vegas. It is a remote, secure facility with restricted airspace that maintains the capability for conducting underground testing of nuclear weapons and evaluating the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials. The first nuclear test at NTS was conducted in 1951. Since the signing of the Threshold Test Ban Treaty in 1974, it has been the only U.S. site used for nuclear weapons testing. The last nuclear test was conducted in 1992. Approximately one-third of the land (located in the eastern and northwestern portions of the site) has been used for nuclear weapons testing; one-third (located in the western portion of the site) has been reserved for future missions, and one-third has been reserved for R&D, nuclear device assembly, diagnostic canister assembly, and radioactive waste management. In addition, DOE is preparing an application seeking Nuclear Regulatory Commission authorization to construct and operate a repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain, an area on the southwestern boundary of the site.

A primary NNSA mission at NTS is the implementation of SSP, and includes maintaining the readiness and capability to conduct underground nuclear weapons tests and conducting such tests within 24-36 months, if so directed by the President. Other aspects of stockpile stewardship at NTS include conventional HE tests, dynamic experiments, and hydrodynamic testing. The Nuclear Emergency Search Team based at NTS maintains the readiness to respond to any type of nuclear emergency, including search and recovery for lost or stolen weapons, and conducts training exercises related to nuclear weapons and radiation dispersal threats. The Device Assembly Facility houses criticality machines and stores SNM in support of a range of NNSA missions.

S.3.2.4 *Tonopah Test Range*

The Tonopah Test Range (TTR), managed and operated by SNL, is a 179,200-acre site located at the very northern end of the Nevada Test and Training Range, about 32 miles southeast of Tonopah, Nevada. TTR is used for NNSA flight testing of gravity-delivered nuclear weapons (bombs). The actual flight tests are conducted with one or more denuclearized warheads, called joint test assemblies, which are dropped from DoD aircraft or simply flown over the test range. The primary purpose of evaluation activities is the timely detection and correction of problems in the hardware interfaces for gravity weapons, and to ensure that components conform to design and reliability requirements throughout their life. DoD also currently uses TTR for exercises and as an emergency divert base for aircraft.

S.3.2.5 *Pantex Plant*

Pantex is located approximately 17 miles northeast of Amarillo, Texas, on 15,997 acres. Its missions are research and development of chemical high explosives for nuclear weapons; fabrication of high-explosives components essential to nuclear weapon function; assembly, disassembly, maintenance, and surveillance of nuclear weapons in the stockpile; dismantlement of nuclear weapons being retired from the stockpile; and interim storage of plutonium components from dismantled weapons. Weapons activities involve the handling (but not processing) of uranium, plutonium, and tritium components, as well as a variety of non-radioactive hazardous or toxic chemicals.

Pantex is authorized to assemble, disassemble, and modify weapons in accordance with the ROD for the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components* (62 FR 3880, January 27, 1997). Although the specifics of nuclear weapons operations at Pantex are classified, approximately one-half of the current and future Pantex workload involves dismantling nuclear weapons. Under all alternatives, dismantlement operations would continue and there are no proposals in this SPEIS to increase activity levels beyond those previously evaluated.²³

S.3.2.6 *Sandia National Laboratories*

SNL was established as a non-nuclear design and engineering laboratory separate from LANL in 1949. The principal laboratory is located in Albuquerque, New Mexico (SNL/NM); a division of the laboratory (SNL/CA) is located in Livermore, California, near LLNL. Sandia Corporation (the contractor that operates SNL under contract with NNSA) also operates the TTR in Nevada.

SNL conducts multidisciplinary research and engineering activities in a variety of programs for NNSA, DOE, other Government agencies, and the private sector. Its primary mission is implementation of the SSP and related systems engineering and non-nuclear component design and engineering. Other missions involve arms control and nonproliferation activities. In addition, SNL conducts R&D activities in advanced manufacturing, electronics, information, pulsed power, energy, environment, transportation, and biomedical technologies.

In regard to nuclear weapons, SNL is responsible for cradle-to-grave oversight of the non-nuclear components and is the system integrator for assuring the safety and reliability of the entire weapons system. SNL maintains research, design, development, testing, surveillance, assessment, and certification capabilities in support of the SSP. In addition, SNL performs some non-nuclear manufacturing functions, including the fabrication of neutron generators and production of limited quantities of microelectronic parts.

²³ In the Notice of Intent for this SPEIS, NNSA stated that the proposed action would accelerate nuclear weapons dismantlement activities; these activities are already occurring. For example, during fiscal year 2007, NNSA increased its rate of dismantling nuclear weapons by 146 percent over the previous year's rate.

S.3.2.7 *White Sands Missile Range*²⁴

The White Sands Missile Range (WSMR), located in south central New Mexico, is the largest installation in the DoD. WSMR is a Major Range and Test Facility Base under the Department of the Army Test and Evaluation Command, Developmental Test Command, providing test and evaluation services to the Army, Air Force, Navy, other government agencies, and industry. The range covers more than 3,000 square miles of land and 10,026 square miles of contiguous restricted airspace fully managed, scheduled, and controlled by WSMR. Holloman Air Force Base is located adjacent to the range's east boundary and has capabilities for aircraft support and staging. WSMR has a full suite of flight test instrumentation including radar, telemetry, and optical equipment that would allow for complete coverage of a NNSA gravity weapons flight test. WSMR has extensive experience conducting flight tests with requirements and flight test scenarios similar to the NNSA flight test program, including requirements concerning penetrating weapons, weapons recovery, and test materials.

S.3.2.8 *Savannah River Site*

SRS is located in south-central South Carolina and occupies approximately 198,420 acres in Aiken, Barnwell, and Allendale Counties. The site was established in 1950 and is approximately 15 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina. The major nuclear facilities at SRS have included fuel and target fabrication facilities, nuclear material production reactors, chemical separation plants used for recovery of plutonium and uranium isotopes, a uranium fuel processing area, and the Savannah River National Laboratory, which provides technical support. The initial mission at SRS was production of heavy water and strategic radioactive isotopes (plutonium-239 and tritium) in support of national defense. Today, the main weapons mission at SRS is tritium supply management and R&D.

Tritium, an important component of nuclear weapons, decays and must be replaced periodically to meet weapons specifications. Tritium recycling facilities empty tritium from weapons reservoirs, purify it to eliminate the helium decay product, and fill replacement reservoirs with specification tritium for nuclear stockpile weapons. Filled reservoirs are delivered to Pantex for weapons assembly and to the DoD as replacements for weapons reservoirs. The Tritium Extraction Facility takes rods, which have been irradiated in a commercial light water reactor, and extracts tritium for use in the nation's nuclear weapons. As a NNSA mission that is separate from weapons activities, a mixed oxide fuel fabrication facility is under construction and a pit disassembly and conversion facility is planned to be built at SRS to disposition surplus plutonium.

S.3.2.9 *Y-12 Site*

Y-12 is one of three primary installations on the DOE Oak Ridge Reservation (ORR), which covers a total of approximately 35,000 acres in Oak Ridge, Tennessee. The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park

²⁴ WSMR is not currently part of the NNSA nuclear weapons complex. However, WSMR is being considered as a location for NNSA Flight Testing.

(formerly the Oak Ridge K-25 Site). Construction of Y-12 started in 1943 as part of the World War II Manhattan Project. Y-12 consists of approximately 800 acres. The early missions of the site included the separation of uranium-235 from natural uranium by electromagnetic separation and the manufacture of weapons components from uranium and lithium. Y-12 is the primary site for enriched uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Y-12 is the source of secondaries, cases, and certain other weapons components that comprise CSAs. Y-12 also dismantles weapons components, stores and manages SNM, supplies SNM to naval and research reactors, and dispositions surplus materials.

S.3.2.10 *Kansas City Plant and Non-Nuclear Fabrication*

The bulk of the manufacturing of non-nuclear components for the stockpile is done at the KCP. This manufacturing consists of electrical, electronic, electromechanical, and mechanical components (plastics, metals, and composites), and assembly of arming, fuzing, and firing systems of a nuclear warhead. Some limited manufacturing of non-nuclear components also occurs at Y-12 (fabrication of large metal components), SNL (neutron generators and microelectronic parts), and LANL (detonators). Other than limited production of non-nuclear components at LANL, Y-12, and SNL, the remaining non-nuclear components are either acquired by or manufactured at KCP. KCP also performs surveillance inspection and testing of non-nuclear weapons components. For the reasons set forth below, this SPEIS does not evaluate alternatives for continuing the transformation of non-nuclear manufacturing activities.

In the 1990s, DOE prepared the Non-nuclear Consolidation Environmental Assessment (DOE/EA-0792, 1993) for the purpose of better managing non-nuclear manufacturing activities within the Complex and decreasing the long-term operating costs of these activities. This Environmental Assessment proposed consolidating most non-nuclear manufacturing functions in existing facilities at KCP; it also analyzed three alternatives in which the manufacture of electrical and mechanical components would be consolidated at sites other than KCP. Based on the evaluations in this Environmental Assessment, DOE issued a Finding of No Significant Impact (FONSI) (58 FR 48043, September 14, 1993) on its proposal to consolidate non-nuclear component manufacturing and related activities, and decided to consolidate most non-nuclear operations at KCP to improve efficiency. DOE explained its determination that the non-nuclear consolidation proposal could be separated from the Reconfiguration Programmatic Environmental Impact Statement (PEIS) (59 FR 17344, June 21, 1994) because decisions regarding the configuration and consolidation of facilities for the manufacture of non-nuclear components would not affect or predetermine the outcome of alternatives or decisions regarding the configuration of the nuclear activities of the weapons complex.

In the SSM PEIS (1996), DOE considered additional alternatives with respect to non-nuclear operations, including relocating those capabilities to one or more of the national security laboratories. DOE decided (61 FR 68014, December 26, 1996) to retain the existing facilities at the KCP because this was the environmentally preferable alternative, posed the least technical risk, and was the lowest cost alternative. Because the non-nuclear operations at KCP are essential and do not duplicate the work at other sites, no proposal for combination or elimination of these missions was deemed reasonable for evaluation in this supplement to the SSM PEIS. A

recent analysis of transferring these non-nuclear operations to a location other than one in the immediate vicinity of the Kansas City area concluded that "...no prospects for economic benefits are apparent..." (SAIC 2007).

KCP occupies a large and aging industrial complex in Kansas City located on a site with other facilities operated by the U.S. General Services Administration (GSA). The current KCP complex is much larger than is required by NNSA and, because of its age and size, is expensive to operate. GSA is preparing an Environmental Assessment with NNSA as a cooperating agency to inform a decision on whether to construct a new, appropriately sized facility for NNSA in the Kansas City area or to refurbish the existing facility. NNSA expects to make a decision on how to modernize its facility for non-nuclear electrical and mechanical components before it makes any decisions regarding the alternatives analyzed in this SPEIS. Consequently, NNSA will continue the manufacture of most non-nuclear components at either the current KCP or a new facility nearby.

S.3.3 No Action Alternative

Under the programmatic No Action Alternative, NNSA would continue operations to support national security requirements using the existing Complex. As shown on Figure S.1-1, the current Complex consists of multiple sites located in seven states. The Complex enables NNSA to design and manufacture nuclear weapons; conduct surveillance on nuclear weapons in the stockpile; and dismantle retired nuclear weapons. Under the No Action Alternative, NNSA sites would continue to perform the weapons functions identified in Section S.3.2. A summary of the functions, and the sites where these functions are performed, follows.

Weapon Design and Certification. Nuclear weapons are designed at three NNSA national laboratories; these laboratories also certify the weapons safety and reliability for inclusion in the stockpile. LLNL and LANL design and engineer the nuclear physics package for nuclear weapons. SNL designs and engineers non-nuclear components and is responsible for systems engineering of nuclear weapons. The laboratories provide the science and technology foundation for the SSP and rely on facilities across the Complex to support essential plutonium, uranium, non-nuclear materials, tritium, and high explosives research and development, as well as hydrodynamic, environmental, and flight testing.

Plutonium Operations and Pit Manufacture. Pits refer to the central nuclear core of the primary of a nuclear weapon, and typically contain Pu-239 and/or HEU. Subsequent to the 1996 SSM PEIS ROD, an interim pit manufacturing capability was established at LANL. In the 1999 LANL SWEIS ROD, DOE decided that LANL would produce nominally 20 pits per year. NNSA is currently preparing a LANL SWEIS that evaluates an alternative to produce up to 80 pits per year in order to obtain at least 50 certified²⁵ pits per year. LANL manufactures pits in the Plutonium Facility Complex, consisting of six primary buildings located in Technical Area-55 (TA-55). This activity is supported by numerous laboratory, storage facilities, administrative offices and waste management facilities, located throughout LANL. Both LANL and LLNL currently perform R&D on Category I/II quantities of plutonium.

²⁵ "Certified pits," as used in the LANL SWEIS, has the same meaning as "pits to the stockpile."

Uranium Operations and Secondary and Case Fabrication. The energy released by the primary explosion of a weapon activates the secondary assembly. Secondary assemblies may contain HEU, lithium deuteride, and other materials. Implosion of the secondary assembly creates the thermonuclear explosion. Heavy metal cases surround the secondary assemblies. Uranium operations and secondary and case fabrication are generally performed at Y-12, where they are combined into CSAs. Most highly-enriched uranium materials reserved for weapons are retained at Y-12. NNSA is currently constructing a Highly-Enriched Uranium Materials Facility (HEUMF) at Y-12 to consolidate highly-enriched uranium storage. LANL, LLNL, and NTS currently retain smaller Category I/II quantities of highly-enriched uranium for R&D. This activity requires high security facilities as well as support, laboratory, waste management, and administrative facilities.

Weapons Assembly/Disassembly and High Explosives Production. Weapons assembly and disassembly refers to the assembly, dismantlement, and reassembly of complete nuclear weapons. This activity is primarily conducted at Pantex, which is the principal facility in the Complex that handles complete nuclear weapons. Facilities include heavily fortified work areas, storage facilities, administrative buildings and support laboratories. Waste management facilities are also required. Pantex also produces and machines the high explosives that surround the nuclear components of nuclear weapons. Pantex is authorized to assemble, disassemble, and modify weapons in accordance with the ROD for the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components* (62 FR 3880, January 27, 1997). Although the specifics of nuclear weapons operations at Pantex are classified, approximately one-half of its current and future workload is associated with dismantling nuclear weapons.

Category I/II SNM Storage. Quantities of SNM are categorized into security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. Category I/II SNM are the most attractive materials and require the most extensive and expensive security provisions. These facilities consist of heavily fortified storage or processing buildings surrounded by security fences with highly trained, heavily armed security personnel. Category I/II SNM storage facilities are currently located at LANL, LLNL, Pantex, SRS, Y-12, SNL/NM, and NTS. All Category I/II quantities of SNM are planned to be removed from SNL/NM by the end of 2008.

Tritium Production and R&D. Tritium is a short-lived radioactive isotope of hydrogen used to increase yield in nuclear weapons. The production of tritium is carried out in a Tennessee Valley Authority reactor. Tritium extraction, purification, and reservoir loading (which are collectively referred to as the "tritium supply management" missions) are carried out at SRS in the Tritium Extraction Facility, which became operational in late 2006, and the H-Area New Manufacturing Facility, which became operational in 1994. Tritium R&D is primarily performed at SRS and LANL (in the Weapons Engineering Tritium Facility). Very limited tritium operations are performed at LLNL in the Tritium Facility within Superblock,²⁶ primarily to support preparation of tritium targets for the National Ignition Facility, and at SNL/NM in the Neutron Generator Production Facility to support neutron generator production. Tritium operations require supporting laboratory, waste management, and administrative facilities.

²⁶ "Superblock," LLNL's defense plutonium research and development facilities.

High Explosives R&D. High explosives are used in the primary assembly of nuclear weapons. The development of safer, more stable and more energetic forms of this material is referred to as high explosives research and development. The R&D work includes confined and unconfined detonation of experimental quantities of high explosives. High explosives R&D is conducted at LANL, LLNL, SNL/NM, Pantex, and NTS. This activity entails development laboratories, administrative buildings and test fire facilities. Waste management facilities are also required.

Flight Test Operations. Flight test operations assess how weapon systems function in realistic delivery conditions. Denuclearized test weapons are assembled at Pantex. These denuclearized weapons are then subjected to realistic aircraft flight and release conditions. This program is conducted at the TTR for gravity weapons (bombs). Facilities include a drop zone, target facilities, observation and test equipment, and administrative buildings. Flight testing for ballistic and cruise missiles is conducted at existing DoD test ranges.

Hydrodynamic Test Facilities. Hydrodynamic testing refers to high-explosive experiments to study weapons physics and to assess the performance and safety of nuclear weapons. These activities are principally conducted at LLNL and LANL, with some supporting activities at NTS, SNL/NM and Pantex. High energy radiographic facilities support the hydrodynamic testing capabilities with dynamic radiography. This activity also entails laboratory and administrative office space.

Major Environmental Test Facilities. Environmental test facilities are used to assess the safety, reliability and performance of the nation's nuclear weapons systems through subjecting weapons to differing environmental conditions (shock, vibration, high temperatures, etc.). These facilities test complete (denuclearized) weapons or major weapons subsystems. Major environmental test facilities are located at SNL/NM, LLNL, LANL, and NTS. These facilities are supported by storage, support laboratory, and administrative office building space. Small environmental test laboratories and capabilities also exist at Pantex and SRS. These smaller test laboratories support component R&D and production, and are an integral part of the production/certification process.

S.3.3.1 *Limitations of the Existing Complex*

The existing Complex is aging, too big, and maintains redundant capabilities that were required to sustain the Cold War stockpile. Many of the facilities are being operated beyond their useful life. In fact, parts of the Complex were built during the Manhattan Project of the 1940s and several production facilities still in use today date from that period. There are high costs to maintain this infrastructure. Reliance on aging facilities increases operating costs and in some instances subjects workers to unnecessary risk.

There are several thousand buildings in the Complex today, covering more than 35 million square feet of floor space, that support weapons activities. Maintaining this much space requires the expenditure of extensive resources for maintenance, safety, and security. In 2006, approximately 27,000 management and operating contractor personnel were employed at major NNSA sites to support weapons activities. NNSA is continuing to consolidate operations and

reduce floor space, on a site-by-site basis, and these efforts would continue under the No Action Alternative.

S.3.4 Programmatic Alternative 1: Distributed Centers of Excellence

Under this alternative, NNSA would transform the Complex by consolidating the major functions required to support the nuclear weapons stockpile to distributed centers of excellence (DCE). The major decisions regarding implementation of the DCE programmatic alternative would be setting the baseline plutonium production capacity and locating a facility for long-term plutonium component (pit) manufacturing and R&D. The facility for long-term plutonium operations is referred to as the consolidated plutonium center, or CPC. The CPC could either be a completely new configuration of buildings at Los Alamos, NTS, Pantex, SRS, or Y-12, or an upgrade of existing and planned facilities at Los Alamos (two alternatives, referred to as the “50/80” and “Upgrade”) or planned facilities at SRS. For uranium operations, this alternative includes a new Uranium Processing Facility (UPF) or an upgrade to existing facilities at Y-12. No changes are envisioned for the A/D/HE mission at Pantex.

S.3.4.1 Consolidated Plutonium Center (CPC)

CPC Requirements and Assumptions

- A CPC would provide the facilities and equipment to perform pit manufacturing, pit surveillance, SNM storage to support production, and plutonium R&D.
- Stockpile requirements are based on national security requirements directed by the President based on joint recommendations from DOE and DoD. CPC capacity and production output would be designed to meet the national security requirements, which could include production of new pits for maintenance of the legacy stockpile or replacement weapons (e.g., Reliable Replacement Warheads).
- A CPC would provide a manufacturing capacity of 125 pits per year (single shift) with a contingency of 200 pits per year through multiple shifts and extended work weeks.²⁷ A CPC would be capable of supporting the surveillance program at a rate of one pit being destructively evaluated per pit type in the stockpile per year. For Los Alamos, this SPEIS also assesses an alternative (referred to as the “50/80 Alternative”) that would result in a smaller pit production capacity (up to 80 pits per year), based on the use of the existing and planned plutonium infrastructure at that site.
- A new CPC would be constructed over a six-year period, and would be fully operational by approximately 2022. A CPC would be designed for a service life of at least 50 years.

²⁷ If NNSA were to construct a new CPC to produce 80 pits per year, the reduction in square footage would be small compared to the square footage of a new facility designed for 125 pits per year. From a facility design perspective, a 125 pits per year plant is an optimal minimum, and no major cost savings can be achieved from designing a new facility with a capacity less than 125 pits per year. Section S.3.4.1.2 discusses smaller capacity pit production related to upgrades to facilities at LANL.

- The NNSA sites being considered as potential locations for a CPC and consolidation of Category I/II SNM are Los Alamos, NTS, Pantex, SRS, and Y-12.
- A newly constructed CPC would consist of a central core area, surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS), which encloses all operations involving Category I/II quantities of SNM (Figure S.3.4.1-1). The area enclosed by the PIDAS would be approximately 40 acres. A buffer area would provide unobstructed view of the area surrounding the PIDAS. All administrative and non-SNM support buildings would be located outside of the buffer area. Approximate 110 acres would be required for all CPC facilities. Land requirements for the CPC Alternatives are shown in Table S.3.4-1.

Table S.3.4-1 – Land Requirements for CPC Alternatives

Greenfield Alternative ²⁸ (Los Alamos, NTS, Pantex, SRS, Y-12)	Construction (acres)	Operation (acres)	
	140	110*	
		PIDAS	Non-PIDAS
	40	70	
Upgrade Alternative (Los Alamos)	13	6.5 (All within PIDAS)	
50/80 Alternative (Los Alamos)	6.5	2.5 (All within PIDAS)	

* Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

S.3.4.1.1 Site Alternatives

Figures S.3.4.1-2 through S.3.4.1-6 identifies the reference locations for a CPC at the five alternative sites. NNSA would not make a decision as to a specific location at any site for a new CPC based on this SPEIS; specific locations would be evaluated in a future NEPA review for the site selected if required.²⁹ The reference locations were identified at each site to provide a basis to evaluate the potential environmental impacts of a CPC. The characterization of the affected environment in Chapter 4 of this SPEIS addresses the entire site and the affected region surrounding the site, which generally extends to a 50-mile radius.

Two of the sites under consideration for the pit production function (Los Alamos and SRS) have existing or planned facilities that could be used to support pit production activities, and which could influence the location of any new facilities. This SPEIS analyzes options that would use these facilities. Section S.3.4.1.2 discusses the Los Alamos options. At SRS, the reference location was selected to provide proximity to planned facilities for the disposition of surplus plutonium: the Pit Disassembly and Conversion Facility (PDCF) and the Mixed-Oxide (MOX) Fuel Fabrication Facility. This location would support either a new independent CPC or use the infrastructure associated with the NNSA PDCF and MOX facilities to support a CPC.

²⁸ “Greenfield,” in this context, refers to a completely new facility that would not use existing facilities and therefore requires significantly more acreage.

²⁹ Such a specific location at Los Alamos is evaluated in the LANL SWEIS that is currently being prepared.

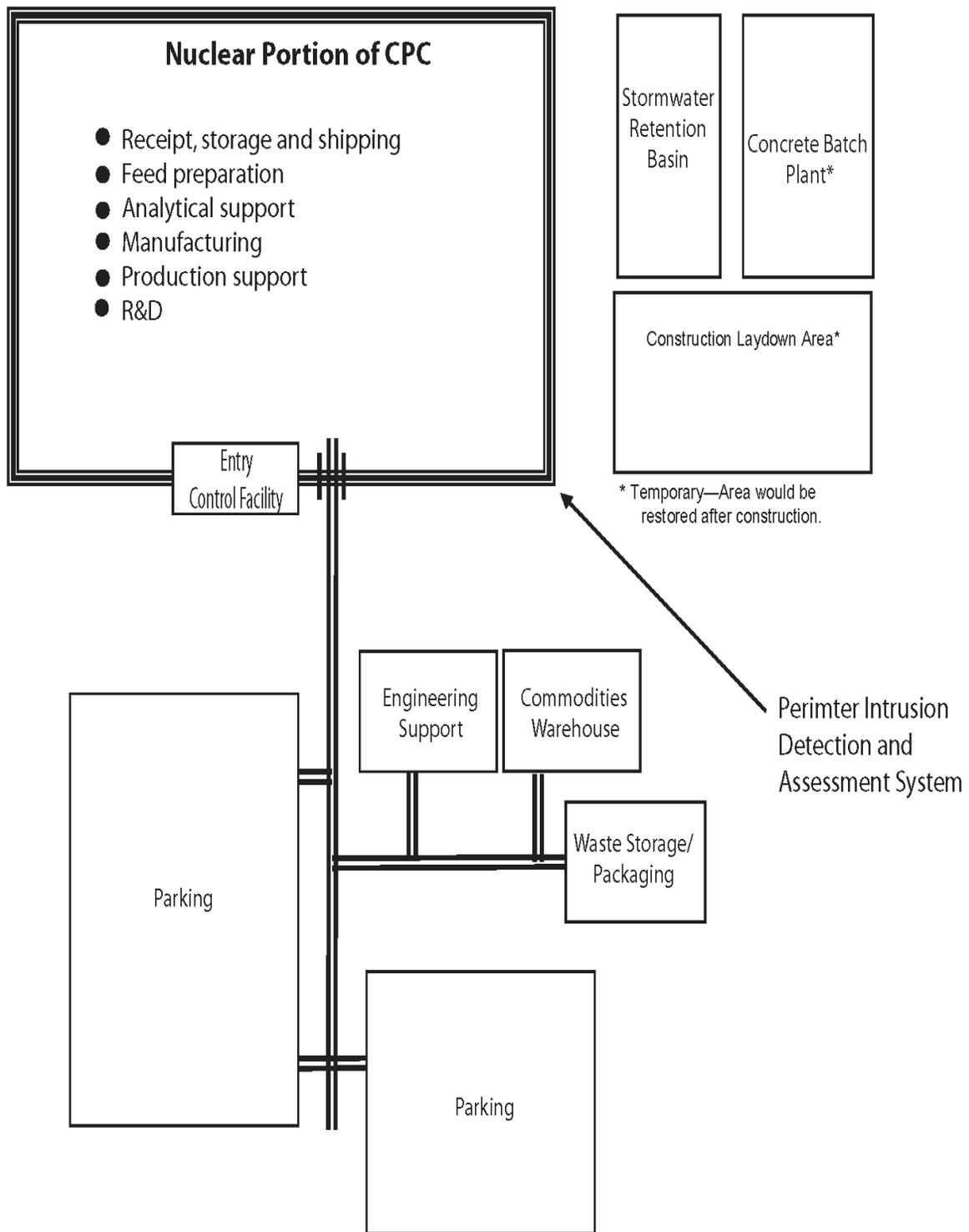


Figure S.3.4.1-1 — Generic Layout of a CPC

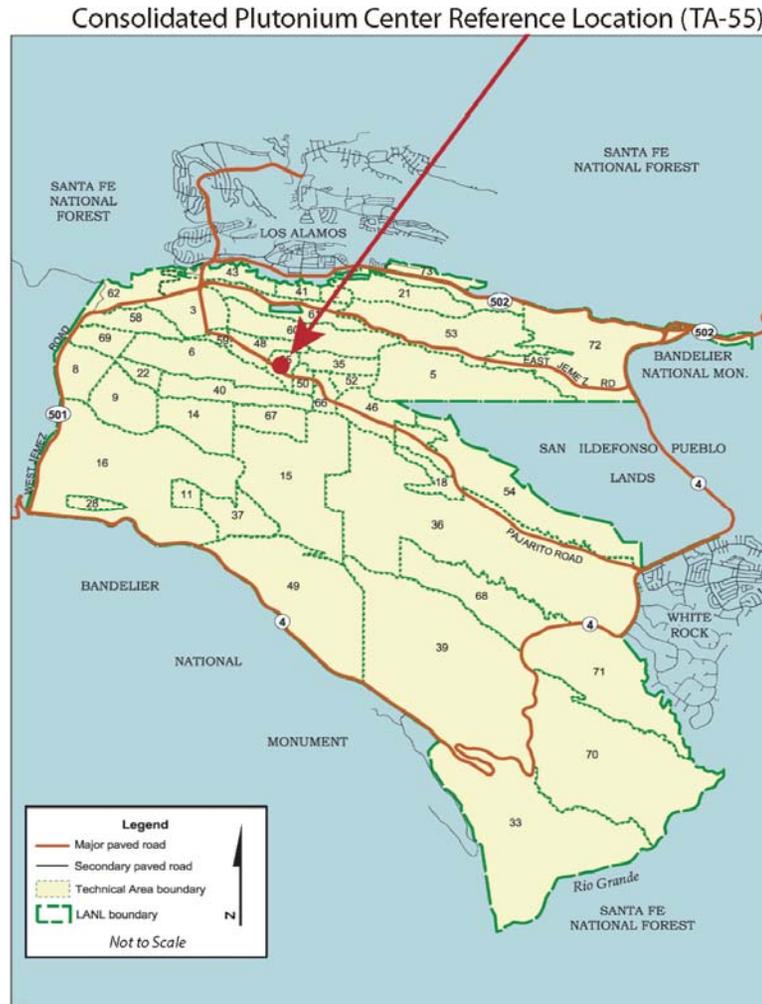


Figure S.3.4.1-2 — Los Alamos Consolidated Plutonium Center Reference Location

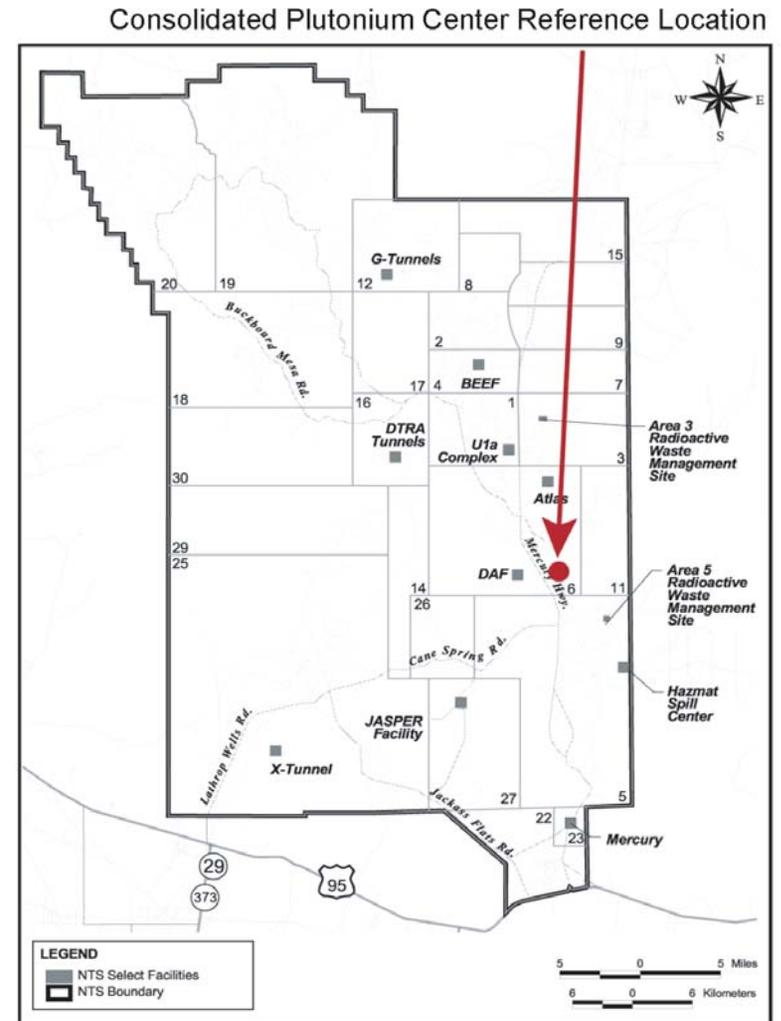


Figure S.3.4.1-3 — NTS Consolidated Plutonium Center Reference Location

Consolidated Plutonium Center Reference Location

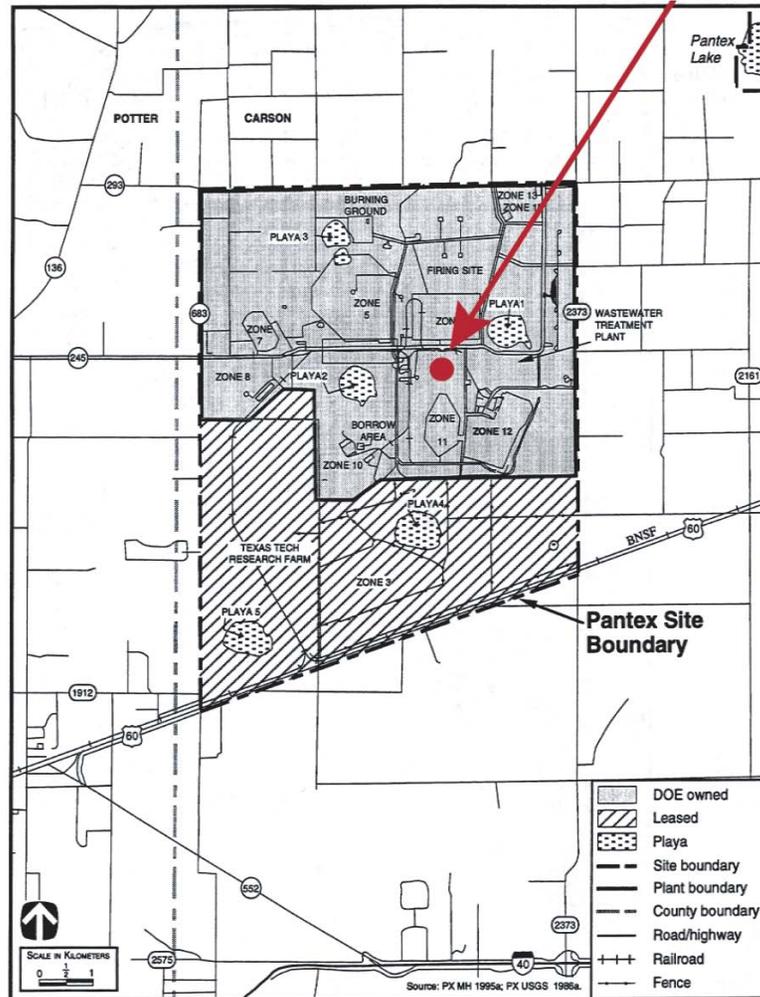


Figure S.3.4.1-4 — Pantex Consolidated Plutonium Center Reference Location

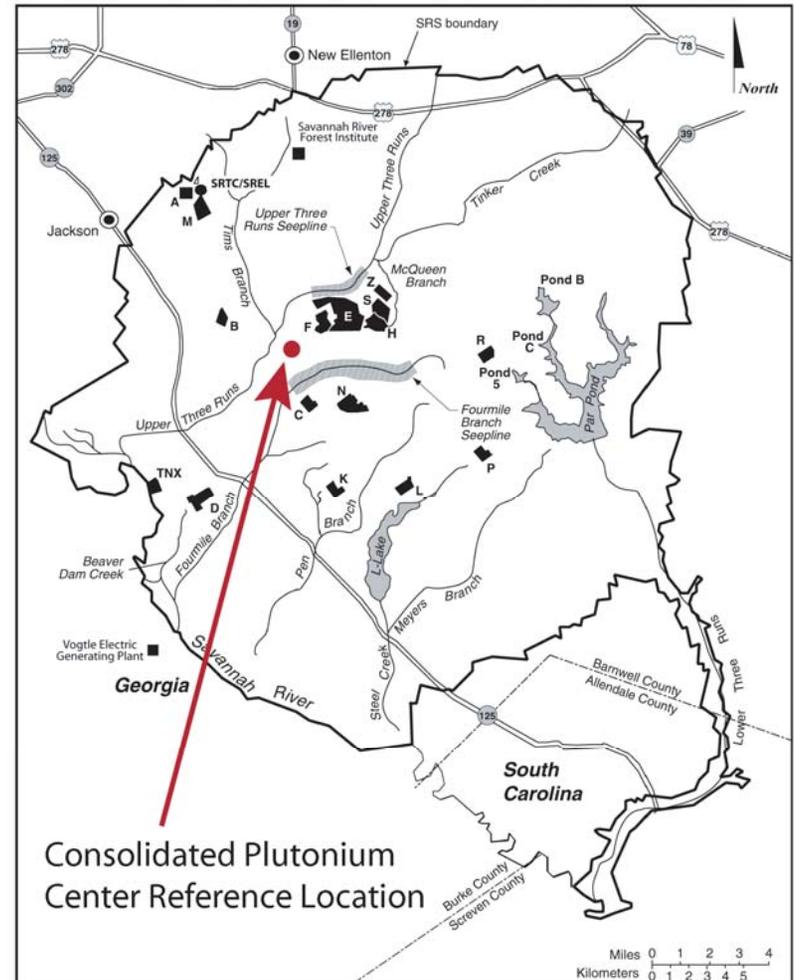


Figure S.3.4.1-5 — SRS Consolidated Plutonium Center Reference Location

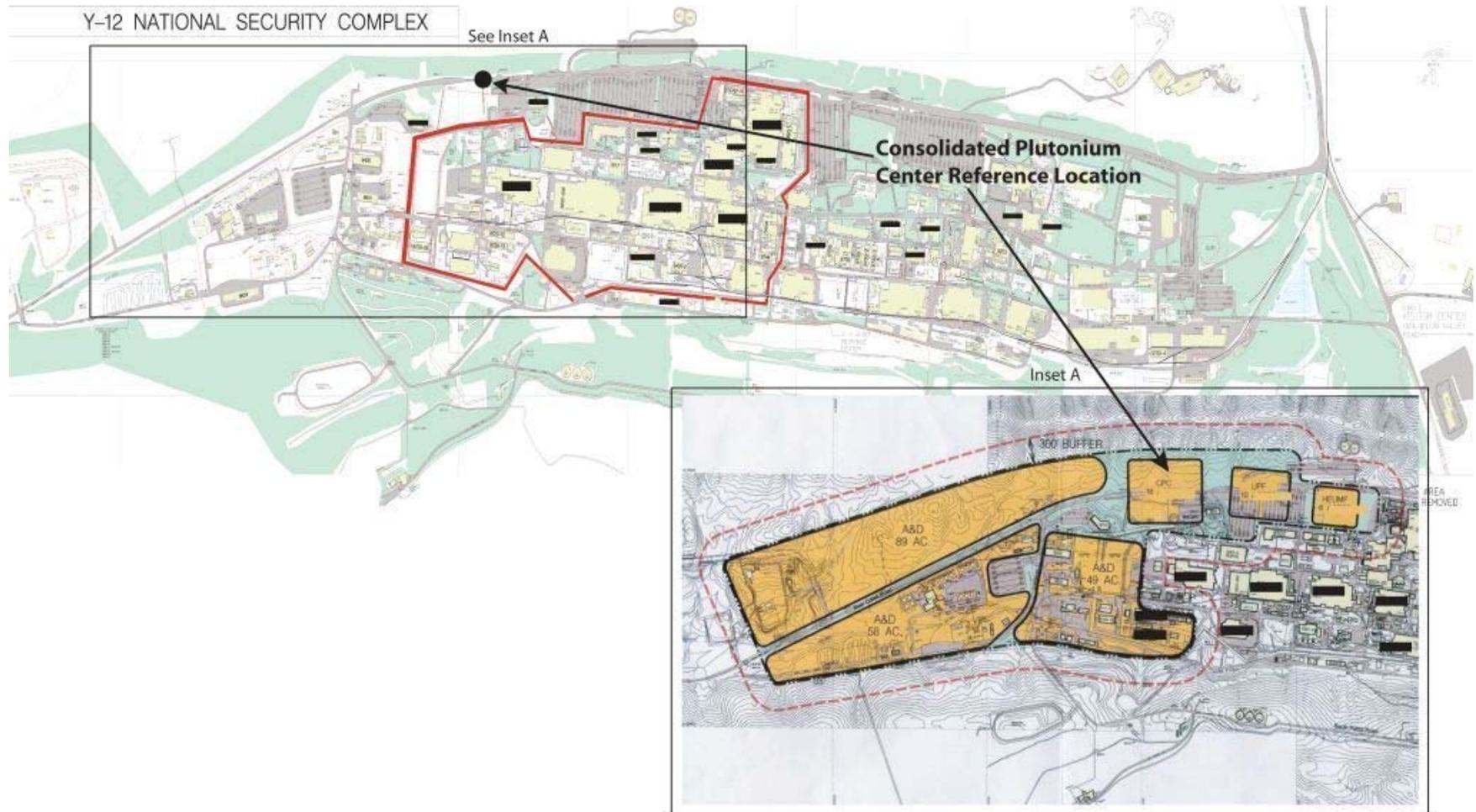


Figure S.3.4.1-6 — Y-12 Consolidated Plutonium Center Reference Location

S.3.4.1.2 Los Alamos CPC Alternatives

For purposes of assessing a CPC at Los Alamos, this SPEIS evaluates three approaches: (1) a Greenfield CPC alternative (previously discussed in Section S.3.4.1), in which new nuclear facilities would be constructed to achieve consolidation of plutonium capabilities; (2) an alternative in which existing and planned facilities at Los Alamos are upgraded and augmented with new facilities to achieve a baseline of 125 pits per year (Upgrade Alternative); and (3) an upgrade to existing and planned facilities at Los Alamos to provide up to approximately 80 pits per year (50/80 Alternative³⁰). These latter two approaches are addressed in this section.

S.3.4.1.2.1 Los Alamos Upgrade Alternative

Los Alamos could support pit production requirements using existing and/or new facilities at TA-55, which is the current site for the Plutonium Facility (PF-4). The planned Chemistry and Metallurgy Research Building Replacement (CMRR) Facility would be located in TA-55. In addition, LANL has several existing and planned facilities capable of supporting plutonium operations, including: the Radioactive Liquid Waste Treatment Facility, the solid waste characterization and disposal site (in TA-54), the Sigma Building (in TA-03), the Radiochemistry Facility (in TA-48), a new radiography facility (in TA-55), and a new solid-waste staging facility.

Estimated Modifications to Support the Los Alamos Upgrade Alternative

Using the existing and planned facilities in TA-55, pit production capacity could be increased to approximately 125 pits per year (single shift) by the following:

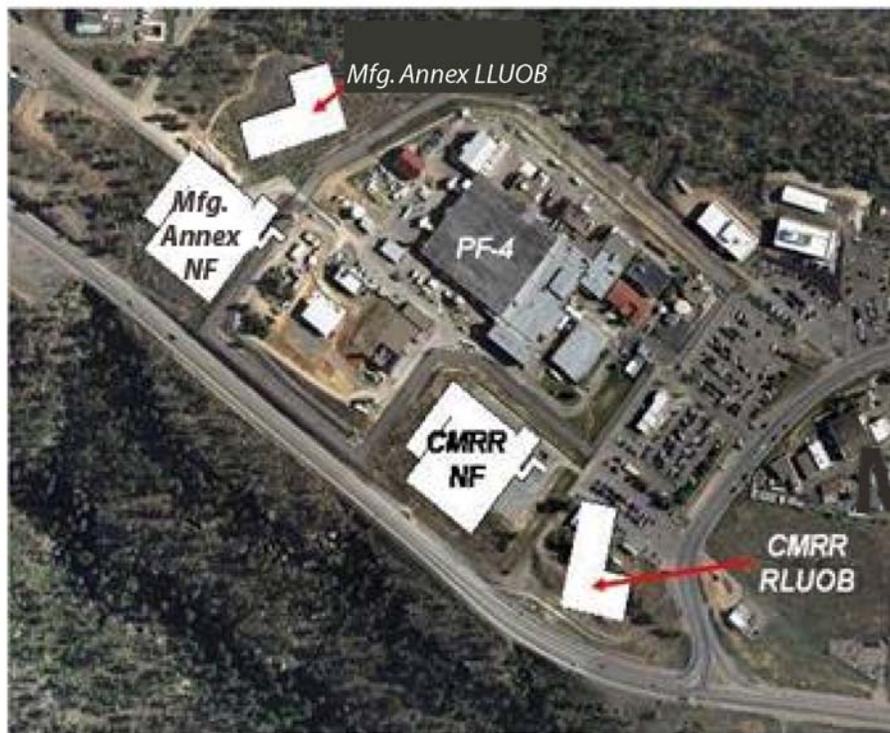
1. Expanding the scope and the size of the planned CMRR Facility; and/or
2. Constructing a new facility (known as the “Manufacturing Annex”) to augment existing pit-manufacturing capacity, the planned CMRR Facility, and related infrastructure capacity.

Both approaches would result in the addition of up to 400,000 square feet of additional space at TA-55, either as one or more stand-alone facilities (e.g., the Manufacturing Annex, which would be comprised of a Manufacturing Annex Nuclear Facility and a light laboratory/utility/office building [LLUOB]) or as an addition to the CMRR. This SPEIS analyzes the environmental impacts of the addition of a Manufacturing Annex to provide the additional pit manufacturing, supply/recovery, and/or analytical chemistry support.

Based on prior planning information (NNSA 2007), the new Manufacturing Annex would be approximately the same size as the buildings in the current CMRR project (which would consist of the Chemistry and Metallurgy Research Replacement Nuclear Facility and a radiological laboratory/utility/office building [RLUOB]). This annex would be located near the existing PF-4 structure to minimize the logistics of material and personnel movements between the facilities,

³⁰ The name “50/80 Alternative” reflects the fact that this alternative would expand pit production capacity up to 80 pits per year.

which would take place through hardened tunnels. An overhead conceptual view of this configuration is shown in Figure S.3.4.1-7.



Note: RLUOB = Radiological Laboratory/Utility/Office Building
CMRR NF = Chemistry and Metallurgy Research Replacement Nuclear Facility
LLUOB = Light Laboratory/Utility/Office Building

Figure S.3.4.1-7 — TA-55 Site Plan Showing the Proposed CMRR and Manufacturing Annex facilities

S.3.4.1.2.2 Los Alamos Upgrade Alternative to Provide Up To 80 Pits per Year (“50/80 Alternative”)

The 50/80 Alternative is evaluated to provide NNSA with an alternative that has a pit production capacity of less than 125 pits per year. PF-4 at TA-55 is the only existing plutonium facility capable of being upgraded to support reduced national security requirements without major construction. Implementation of this 50/80 Alternative (if selected) would be planned to minimize disruption of LANL’s interim pit production activities.

The 50/80 Alternative differs from a Greenfield CPC in several important aspects. First, NNSA assumes this facility would produce up to approximately 80 pits per year; a CPC would produce 125 pits per year (single shift) and is assessed at the higher rate of 200 pits per year (multiple shifts and extended work weeks). Second, the upgraded facility may not have a design life of 50 years (the design life for a CPC) without additional upgrades because some parts of the existing facility have already operated about 40 years. Modifications would include major upgrades to the residue recovery/metal feed facilities in the 400 Area of PF-4. Many of the gloveboxes in

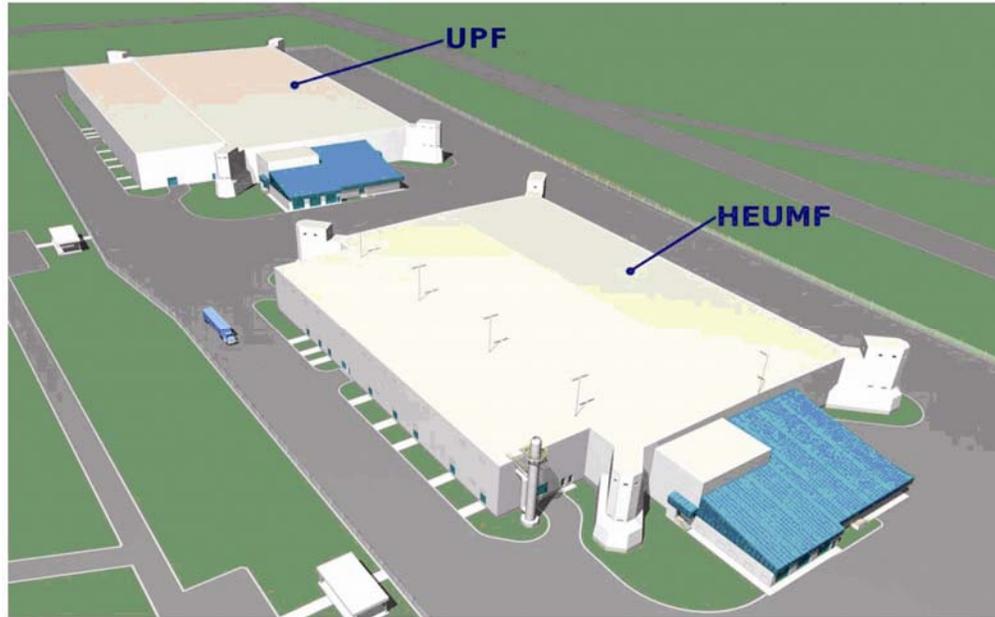
this part of the facility would have to be replaced. Replacement of these older gloveboxes would be required to ensure that the recovery/feed process operations are adequate to supply plutonium metal to the manufacturing operations. There would also be significant glovebox decontamination/decommissioning/disposal operations as new process development and certification operations are moved into other areas of PF-4. In addition, various manufacturing equipment would be added to or replaced in the fabrication areas of PF-4 to increase capacity and reliability.

The 50/80 Alternative includes completing the previously analyzed CMRR facility, which could require expansion by up to 9,000 additional square feet, to accommodate pit manufacturing operations. Modifications to existing facilities at TA-55 could be required to accommodate additional workers employed in pit manufacturing. The construction of these new facilities would disturb 6.5 acres during construction and add approximately 2.5 acres to the permanent TA-55 footprint.

S.3.4.2 *Uranium Processing Facility at Y-12*

Y-12 manufactures nuclear weapons secondaries, cases, and other weapons components; evaluates and performs testing of these weapon components; maintains Category I/II quantities of HEU; conducts dismantlement, storage, and disposition of nuclear weapons materials; and supplies HEU for use in naval reactors. A proposed UPF would consolidate many of Y-12's operations into an integrated manufacturing facility sized to satisfy all identified programmatic needs. A UPF would be sited adjacent to the HEUMF (currently under construction) to allow the two facilities to function as one integrated operation. Transition of Y-12 operations to this configuration would enable the high security area to be reduced by 90 percent. This would significantly improve physical protection; optimize material accountability; enhance worker, public, and environmental, safety, and health protection; and consolidate operations to greatly reduce operational costs.

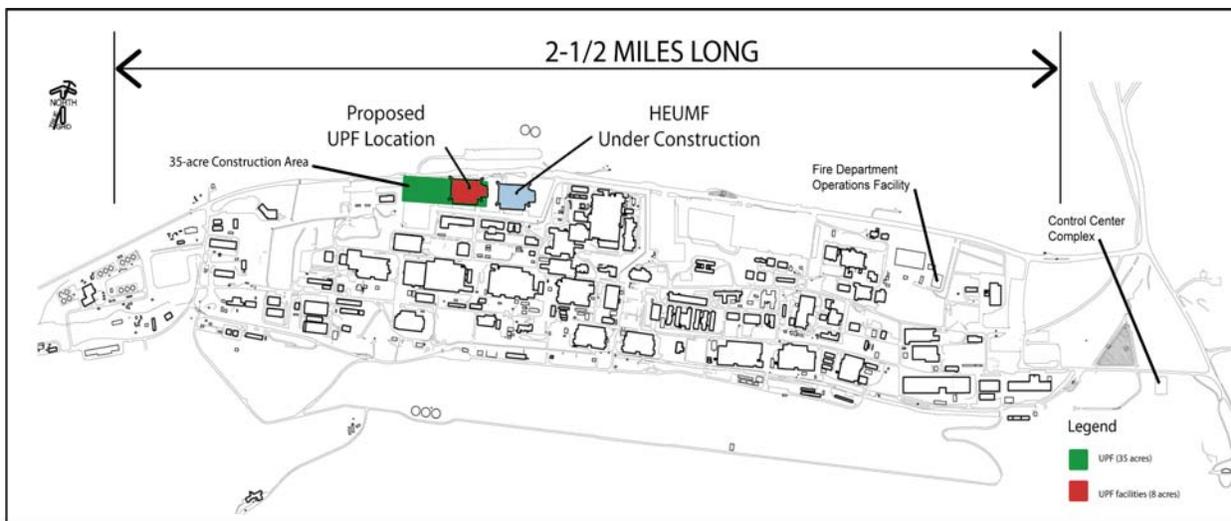
A UPF would replace multiple existing enriched uranium and other processing facilities. The current operating and support areas occupy approximately 633,000 square feet in multiple buildings, while the UPF would result in approximately a 33 percent reduction, to approximately 400,000 square feet in one building. Figure S.3.4.2-1 shows an artist's rendering of the proposed UPF. Figure S.3.4.2-2 shows the proposed location of the UPF relative to other buildings at Y-12.



Source: NNSA 2005c.

Figure S.3.4.2-1 — Artist’s Rendering of the UPF Adjacent to the HEUMF

The design service life of a UPF would be 50 years. The preliminary schedule for the project assumes that site preparation would begin in approximately 2010 should NNSA decide to construct this facility. Under this proposed schedule, a UPF would be completed by approximately 2016, and operations would begin by 2018. As shown on Figure S.3.4.2-2, construction of the UPF would require approximately 35 acres of land, which includes acreage for a construction laydown area and temporary parking. Once constructed, the UPF facilities would occupy approximately 8 acres.



Source: NNSA 2007.

Figure S.3.4.2-2 — Location of the UPF Relative to Other Buildings at Y-12

S.3.4.3 *Upgrade Existing Enriched Uranium Facilities at Y-12*

NNSA could upgrade the existing Y-12 enriched uranium (EU) facilities. In that case, there would be no UPF and the current high-security area would not be reduced. The upgrade projects would be internal modifications to the existing facilities and would improve worker health and safety and extend the life of existing facilities. For continued operations in the existing facilities, major investments would be required for roof replacements; structural upgrades; heating, ventilating, and air conditioning replacements; and fire protection system replacement/upgrades. The projects would improve airflow controls between clean, buffer, and contamination zones; upgrade internal electrical distribution systems; and upgrade a number of building structures to comply with current natural phenomena requirements (DOE-STD-1023-95).

S.3.5 Programmatic Alternative 2: Consolidated Centers of Excellence

An alternative under consideration in this Complex Transformation SPEIS is consolidated centers of excellence (CCE). The CCE alternative would consolidate the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM into a consolidated nuclear production center (CNPC) at one site or into consolidated nuclear centers (CNC) at two sites. The requirements and assumptions for the CCE are:

- A CCE alternative would be sized and configured to support the U.S. nuclear weapons stockpile projected to exist after full implementation of the Moscow Treaty. The upper bound of the capacities would be sized to support delivery of 125 weapon assemblies per year in five-day, single-shift operations. Multiple shift operation and extended work weeks would yield up to 200 weapon assemblies per year.
- The CCE alternative includes three major facilities: the CPC, consolidated uranium center (CUC), and the A/D/HE Center. As explained in Section S.3.5.2, there is an option to separate the weapon A/D/HE mission to allow NNSA to consider an alternative that locates the nuclear production facilities at a different site than the weapons A/D/HE mission.
- All Category I/II SNM required by NNSA would be stored at the CCE facilities to support future NNSA needs.
- CCE facilities would be designed to have a useful service life of at least 50 years without major facility renovation beyond normal maintenance.
- CCE facilities would be located at one or more of the following sites: Los Alamos, Pantex, NTS, SRS, and Y-12.
- A modular arrangement of facilities (campus) is assumed for the CCE options rather than separate operational wings in a single large facility. The facilities making up the CCE campus could be configured so that they can be constructed sequentially. A single building to house the CCE functions was not considered to be reasonable due to the need

to bring facilities on-line in a sequential manner and the fundamental differences in uranium, plutonium, and assembly/disassembly operations.³¹ The assumed schedule for the CCE functional facilities is:

Facility	Start Detailed Facility Design	Begin Operations
CUC	2009	2018
CPC	2012	2022
A/D/HE Center	2015	2025

- A CCE would consist of a central core area that includes all operations involving Category I/II quantities of SNM, as well as all support facilities that require lower levels of security protection. This core area would be surrounded by a PIDAS. A buffer area would provide unobstructed view of the area surrounding the PIDAS. The land requirements for the operation of a CNPC and CNC are shown in Tables S.3.5-1 and S.3.5-2 respectively.

Table S.3.5-1 – Land Requirements to Operate a CNPC

Operation (acres)	Total Area: 545 Acres*	
	PIDAS	Non-PIDAS
Total: 235	Total: 310	
<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100 	

*Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities, including the HEUMF.

Table S.3.5-2 – Land Requirements to Operate a CNC

Operation (acres)	Total Area: 195*	
	PIDAS	Non-PIDAS
Total: 55	Total: 140	
<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50 acres 	

*Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities, including the HEUMF.

³¹ The facilities that would constitute a CCE would be separate buildings in a campus because they have different and unique safety and operational requirements, and it would not be technically feasible to make them part of a single large facility without having separate systems for the operation of the three facilities and other physical features (blast wall separation, etc.) to keep them separate. They would be built in sequence because they are very complex facilities and the potential realities of construction logistics, cash flow, and start-up management would not support a single facility. Building them in sequence reduces the construction management risk and allows lessons learned from one to benefit the others. The CUC would be first because the existing uranium facilities at Y-12 (except the HEUMF) are aging. The CPC would be built second because the LANL facilities can handle the immediate need for pits. The weapons A/D/HE facilities would be built last because there is less programmatic urgency than for the CUC and CPC.

S.3.5.1 *Consolidated Nuclear Production Center (CNPC) Option*

This option would consolidate the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM into a single campus at one site. Depending on the site selected for the CNPC, this option could result in the cessation of NNSA weapons operations at Y-12 and/or Pantex. Under this option, NNSA would construct and operate a CNPC at SRS, Y-12, Pantex, NTS, or Los Alamos. The CNPC would comprise three major facilities: CPC, CUC, and the A/D/HE Center. The description of the CPC is contained in Section S.3.4.1 and is not repeated below. The sections below describe the other major CNPC facilities: the CUC (Section S.3.5.1.1) and the A/D/HE Center (Section S.3.5.1.2). In addition, Section S.3.5.1.3 describes the transport of plutonium and HEU to the CNPC. Finally, Section S.3.5.1.4 discusses site-specific characteristics of the candidate sites for a CNPC. These characteristics affect the manner in which a CNPC might be implemented. For example, a CNPC located at Pantex would not require the construction of the A/D/HE Center, as Pantex currently performs those missions in existing facilities that would not require major renovations in the reasonably foreseeable future. Section S.3.5.1.4 also identifies the reference locations for the CNPC at each site alternative. A generic layout of the CNPC is shown in Figure S.3.5.1-1.

S.3.5.1.1 **Consolidated Uranium Center**

The CUC would have a nuclear facility located within a PIDAS, and non-nuclear support facilities outside of it. The nuclear facility would consist of a UPF and a storage facility for HEU.³² The nuclear facility would process HEU, produce nuclear weapon secondary components, provide the capability to perform HEU R&D in support of LANL and LLNL, and store HEU. The non-nuclear facilities would contain the production operations and support functions. The non-nuclear facilities would also contain the chemical processes, fabrication operations, support functions associated with the production of lithium-hydride and lithium-deuteride components, and general manufacturing capabilities. For this analysis, it is assumed that the CUC could be built at any of the sites on approximately the same timeframe that a UPF could be built at Y-12. The CUC would be constructed over a six year period, beginning in approximately 2010, with completion by approximately 2016, and operations beginning by approximately 2018. The land requirements for the CUC are shown in Table S.3.5-3.

Table S.3.5-3 – Land Requirements for CUC*

Construction (acres)	50	
Operation (acres)	Total Area: 35**	
	PIDAS	Non-PIDAS
	15	20

* At Y-12, a UPF would be constructed (see Section S.3.4.2). The UPF would require a total area of 8 acres rather than the 35 acres for a CUC.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

³² A CUC at Y-12 would not require construction of a new HEU storage facility because NNSA is already building a modern storage facility (the HEUMF) at that site.

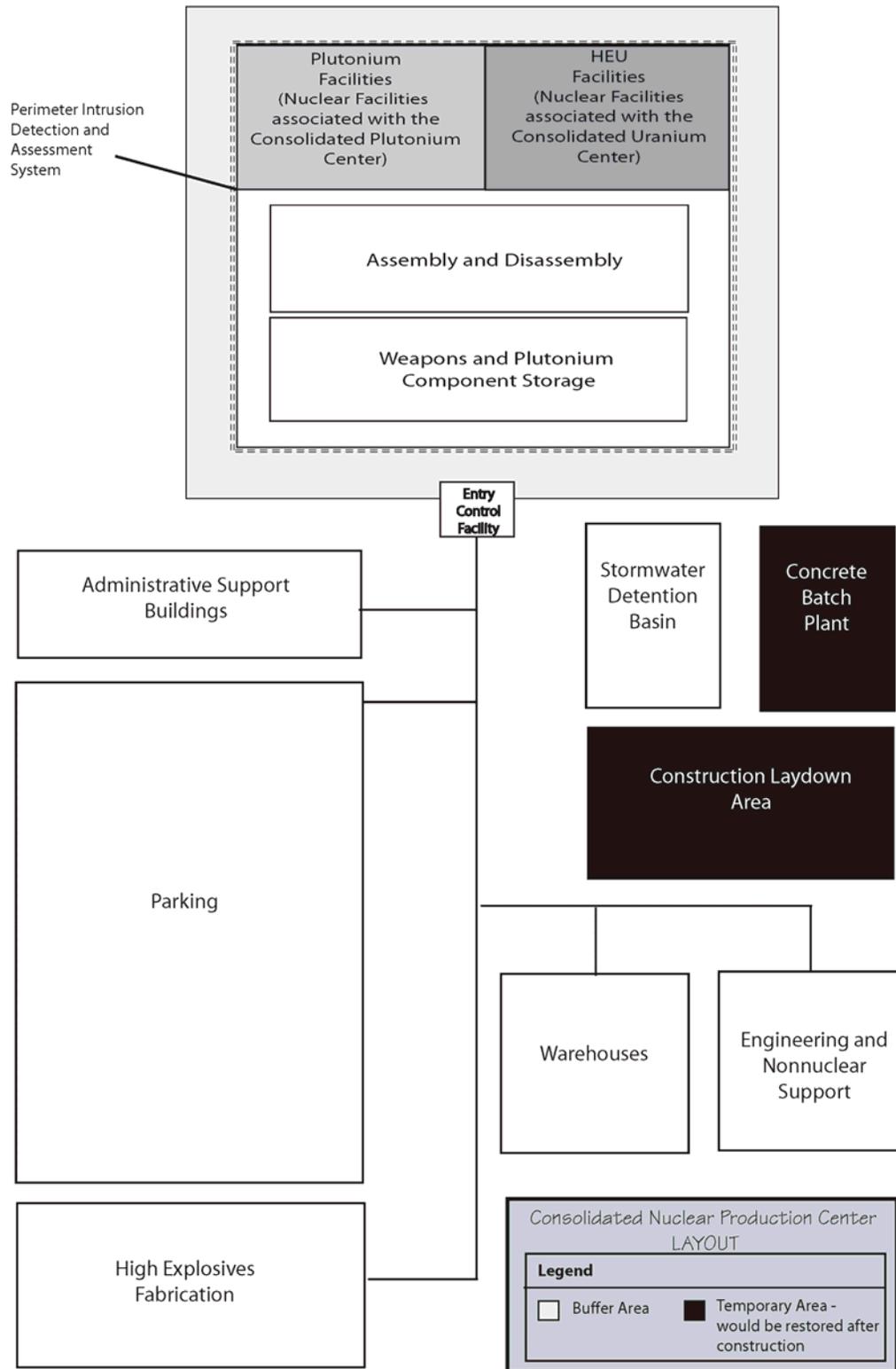


Figure S.3.5.1-1 — Generic Layout of the Consolidated Nuclear Production Center

S.3.5.1.2 Assembly/Disassembly/High Explosives Center

The A/D/HE Center would carry out the following major missions:

- Assemble warheads;
- Dismantle weapons that are surplus to the strategic stockpile and sanitize,³³ store, or dispose of their components;
- Develop and fabricate explosive components; and
- Conduct surveillance related to certifying weapon safety and reliability.

The A/D/HE Center would contain nuclear facilities located within the PIDAS, and non-nuclear facilities outside the PIDAS. The nuclear facilities would contain the cells and bays in which maintenance, modification, disassembly, and assembly operations are conducted. The facilities would be designed to mitigate the effects of the unlikely accidental detonation of the weapon’s explosive components.

As shown in Table S.3.5-4, an area of 180 acres would be provided in the PIDAS for weapons assembly and disassembly facilities, and for weapons and component storage. Located outside the PIDAS would be a buffer zone and non-nuclear facilities for HE fabrication, administrative support, and disposal of explosive materials. This area would be approximately 120 acres. The A/D/HE Center would be constructed over a six-year period beginning in approximately 2020, with completion by approximately 2025, and operations beginning by approximately 2025.

Table S.3.5-4 – Land Requirements for A/D/HE Center*

Construction (acres)	300	
Operation (acres)	Total Area: 300**	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120

* At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

S.3.5.1.3 Transport of Plutonium and HEU to a CNPC

If NNSA were to construct and operate a CNPC, plutonium and HEU would be consolidated at the CNPC. This would entail three potential movements of these materials: (1) transfer of LANL’s Category I/II plutonium to the CNPC, if LANL is not selected as the host site for the CNPC; (2) transfer of Pantex’s non-excess Category I/II plutonium to the CNPC, if Pantex is not selected as the host site for the CNPC; and (3) transfer of Y-12’s Category I/II HEU to the CNPC, if Y-12 is not selected as the host site for the CNPC. Each of these movements is discussed below.

- Transfer of LANL’s Category I/II inventories of nuclear material essential to the programmatic mission of NNSA would be transferred to the eventual CNPC Site. This would involve approximately 4 shipments of material.

³³ Sanitization involves the obliteration and demilitarization of classified weapons parts.

- Transfer of Pantex’s non-excess Category I/II plutonium to the CNPC would involve:
 - Less than 60 metric tons of plutonium, mostly in pit form;
 - Approximately 470 shipments would be required, beginning in approximately 2025 and lasting 5 years.

- Transfer of Y-12’s Category I/II HEU to the CNPC would involve:
 - Up to 252 metric tons of HEU;
 - Approximately 540 shipments would be required, beginning after approximately 2023 and lasting 5 years.

S.3.5.1.4 Site-Specific Features Relevant to a CNPC

This section describes implementation of a CNPC at each candidate site. While the CNPC requirements would be the same at each site, the means of achieving them would vary depending upon the existing facilities and infrastructure at a site. This section also identifies the reference location for a CNPC at each site.

S.3.5.1.4.1 Los Alamos

A CNPC located at Los Alamos would require the construction of a CPC (which could either be a “Greenfield CPC” or an upgrade to existing LANL facilities), a CUC, and an A/D/HE Center. There would not be enough acreage at TA-55 to locate an entire CNPC. Thus, a CNPC at LANL could be divided between two TAs (TA-55 [which could be the site for the CPC and the CUC], and TA-16 [A/D/HE Center]) or completely located at TA-16. Figure S.3.5.1-2 identifies the reference locations for the CPC, CUC, and the A/D/HE Center at LANL. Because the CPC, CUC, and A/D/HE Center would be constructed sequentially, construction requirements for these three facilities would not create simultaneous impacts and are analyzed as sequential actions in this SPEIS.

S.3.5.1.4.2 NTS

A CNPC located at NTS would require the construction of a CPC, a CUC, and an A/D/HE Center (which would be an upgrade to the existing Device Assembly Facility, as described in this section). Figure S.3.5.1-3 shows the reference locations for the CPC, CUC, and the A/D/HE Center at NTS.

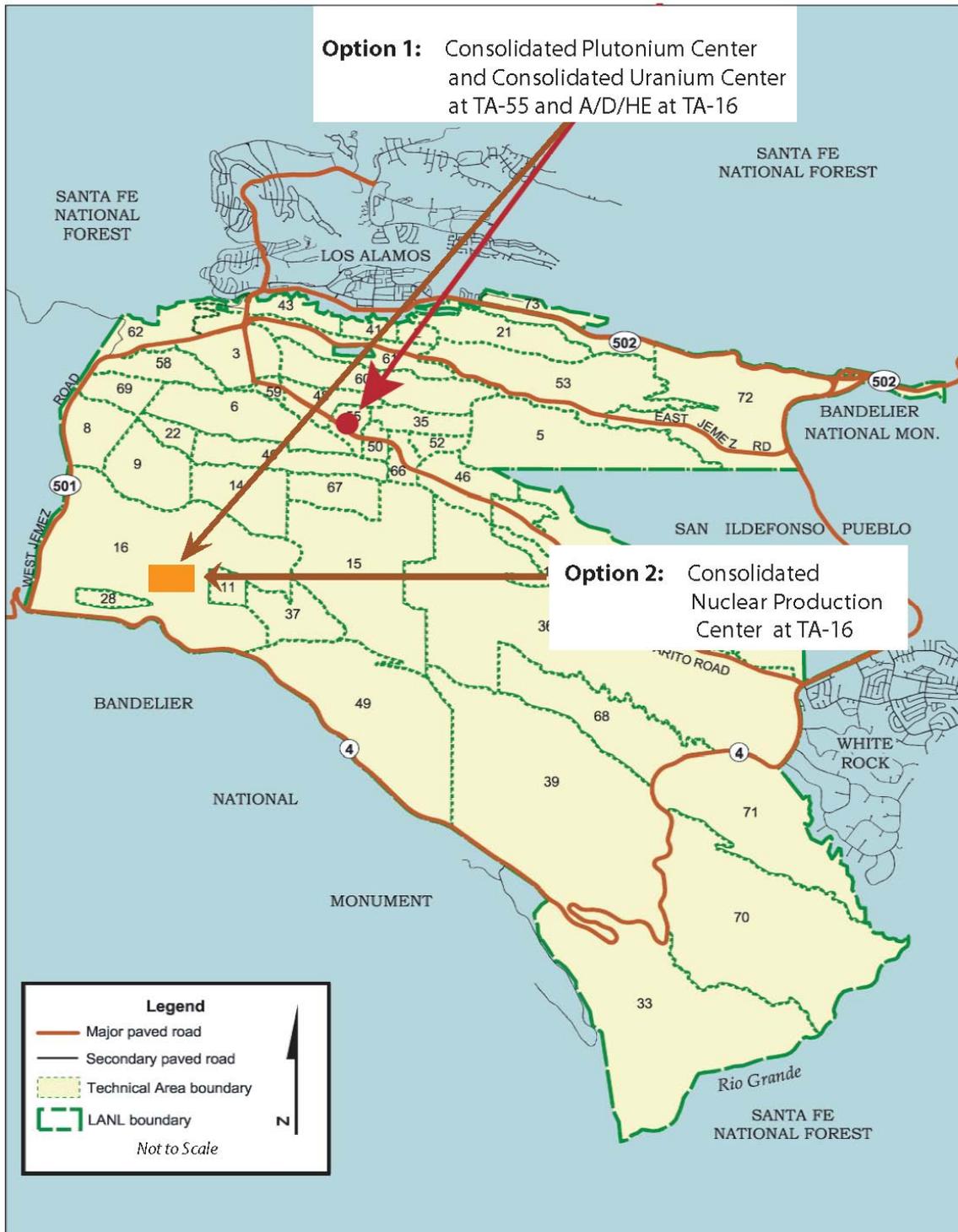


Figure S.3.5.1-2 — Los Alamos Consolidated Nuclear Production Center Reference Locations

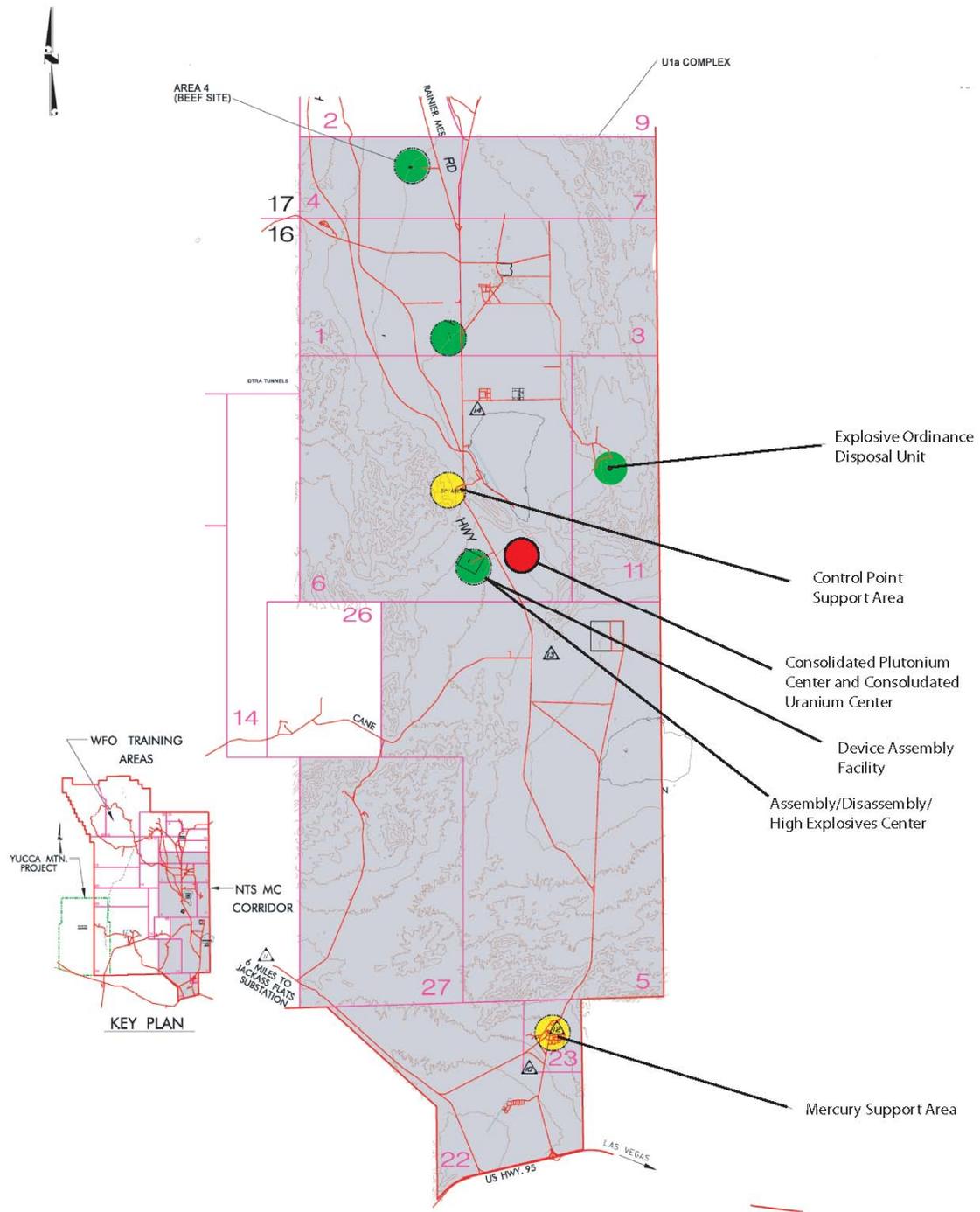


Figure S.3.5.1-3 — NTS Consolidated Nuclear Production Center Reference Locations

An A/D/HE Center could make use of the existing capabilities at NTS such that construction requirements would be reduced compared to an A/D/HE Center located at other sites (other than Pantex). An A/D/HE Center at NTS could maximize use of existing facilities at the Device Assembly Facility (DAF), the underground complex of tunnels at U1a, the Big Explosive Experimental Facility (BEEF), the Explosives Ordnance Disposal Unit, existing site infrastructure, and the support areas of Mercury, the Control Point, and Area 6 Construction (Figure S.3.5.1-3). By utilizing these existing assets, the need for additional construction would be minimized.

S.3.5.1.4.3 Pantex

A CNPC located at Pantex would not require the construction of an A/D/HE Center, as Pantex currently performs these missions in existing facilities. As such, a CNPC at Pantex would involve construction of a CPC and a CUC. Figure S.3.5.1-4 identifies the reference location for a CPC and CUC at Pantex.

S.3.5.1.4.4 SRS

A CNPC at SRS would require the construction of a CPC, a CUC, and an A/D/HE Center. Figure S.3.5.1-5 identifies the reference location for a CNPC at SRS.

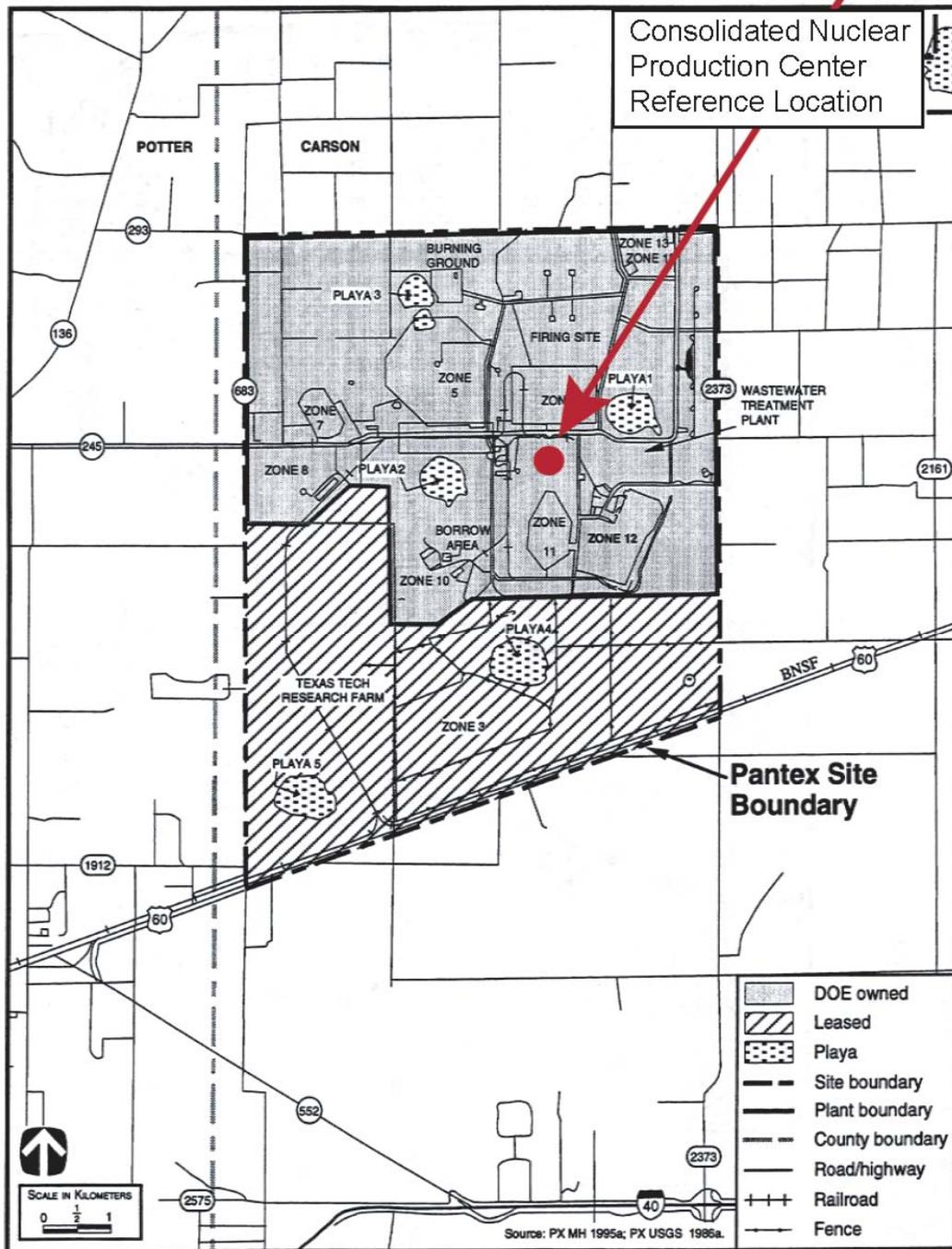


Figure S.3.5.1-4 — Pantex CNPC Reference Location

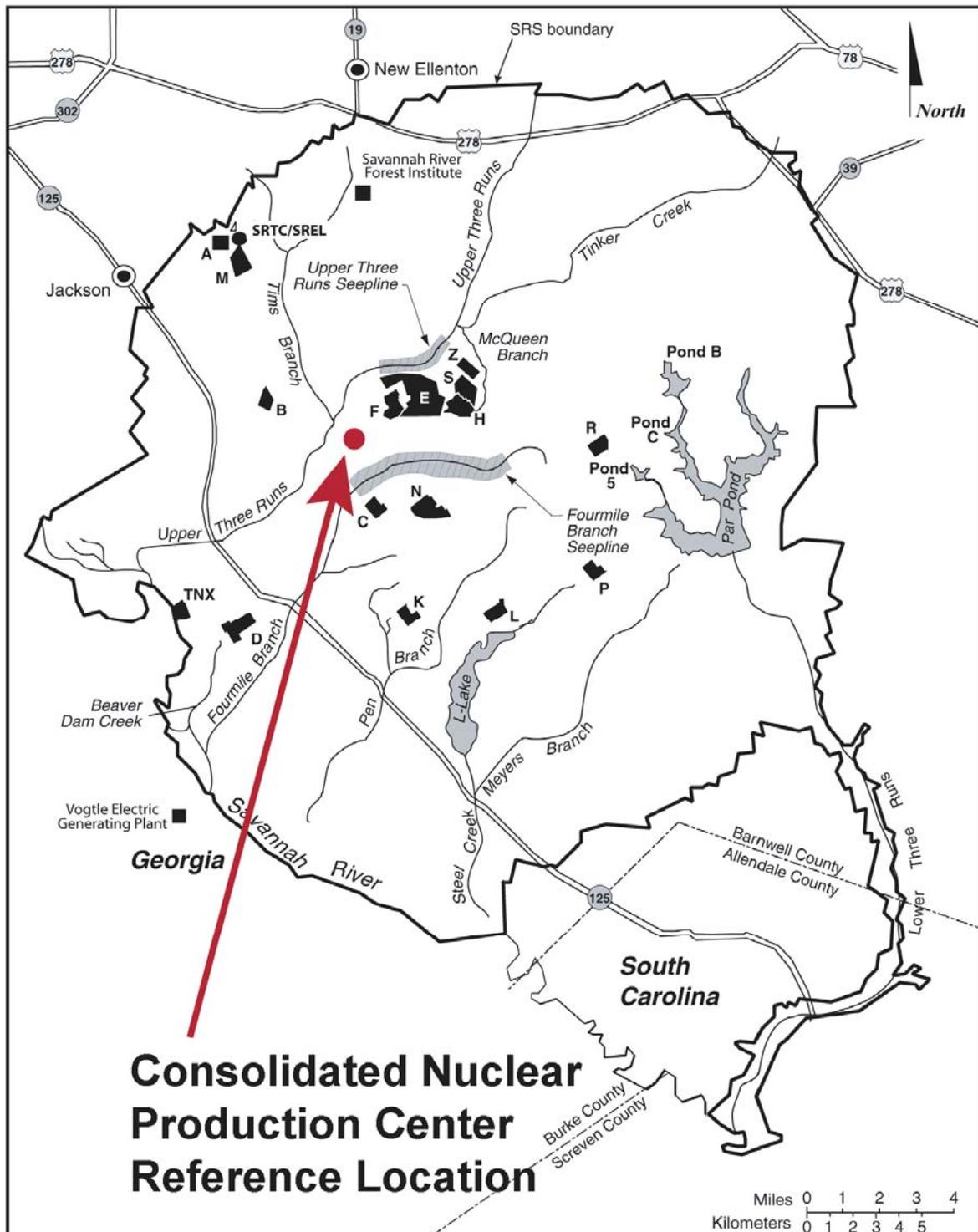


Figure S.3.5.1-5 — SRS CNPC Reference Location

S.3.5.1.4.5 Y-12

A CNPC located at Y-12 would require the construction of a CPC, a UPF, and an A/D/HE Center. A CUC at Y-12 would not require construction of a new HEU storage facility because NNSA is already building a modern storage facility there (the HEUMF). Figure S.3.5.1-6 identifies the reference locations for a CPC, UPF, and the A/D/HE Center at Y-12. The HE component of the A/D/HE Center would be located on the ORR approximately 4.5 miles west of Y-12 due to buffer requirements and available real estate.

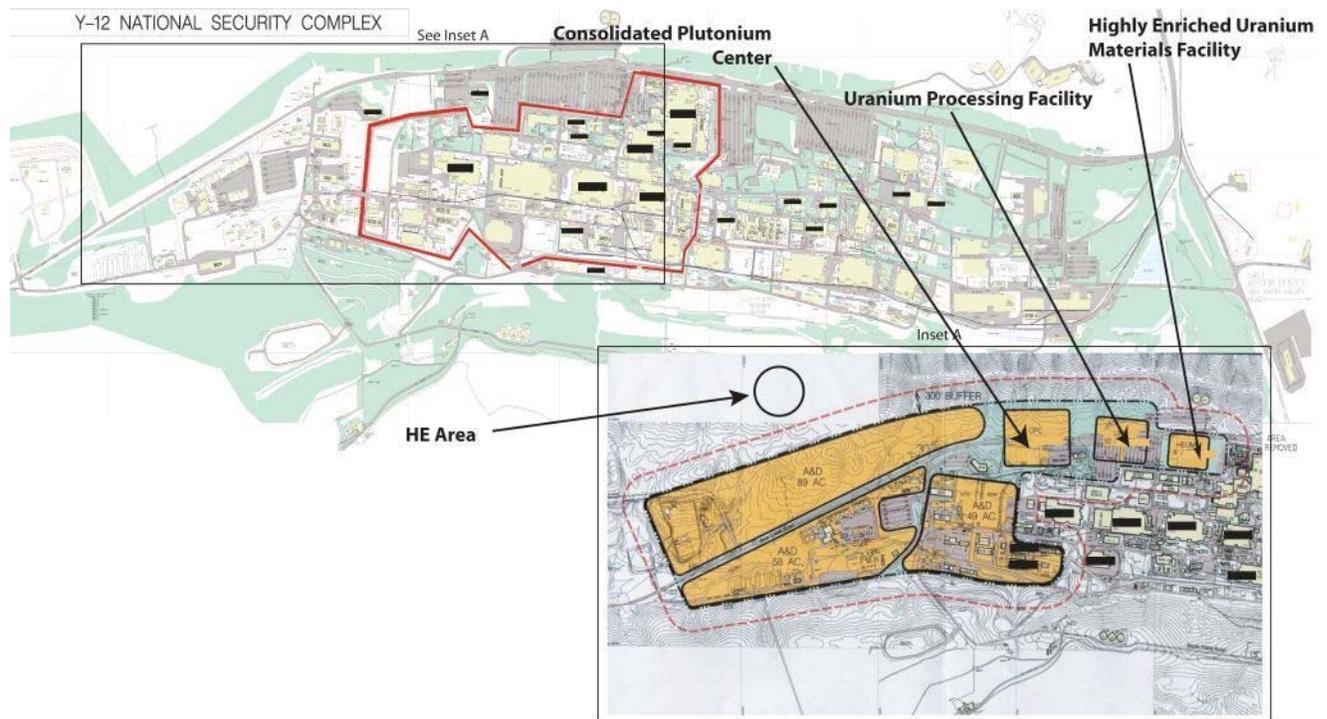


Figure S.3.5.1-6 — Y-12 CNPC Reference Location

S.3.5.2 Consolidated Nuclear Center Option

This option would separate the weapon A/D/HE mission to allow NNSA to consider an alternative that locates the nuclear production facilities at a different site from the weapons A/D mission. Under this option, NNSA would construct and operate a CPC and CUC at one site and an A/D/HE Center at either Pantex or NTS. A generic layout of a CNC is shown in Figure S.3.5.2-1.

The descriptions of the facilities that constitute a CNC are contained in Section S.3.5.1. Operationally, the major difference between a CNPC and a CNC is the need for transportation between the nuclear production facilities and an A/D/HE Center. For example, once steady-state operations are achieved in a CNPC, all nuclear missions would occur at a single site and there would be virtually no radiological transportation within the Complex (with the exception of nuclear weapon and waste shipments).

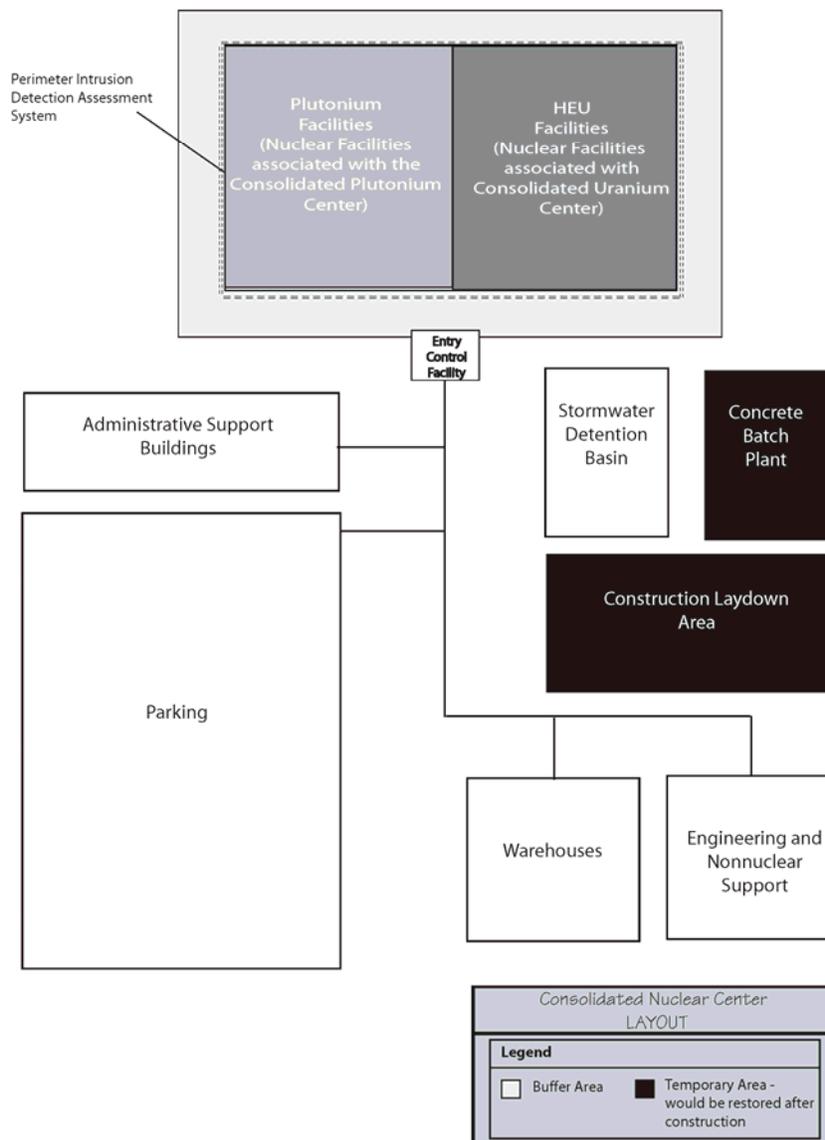


Figure S.3.5.2-1 — Generic Layout of the Consolidated Nuclear Center

Under a CNC option, radiological transportation would be required between the nuclear production facilities and the A/D/HE Center. This SPEIS assesses the radiological transportation impacts of the alternative configurations shown in Table S.3.5.2-1.

Table S.3.5.2-1 – Alternative Configurations of the CNC

If A/D/HE Center is at:	Then CNC would be located at one of the following locations:			
	SRS	NTS	Los Alamos	Y-12
Pantex	X	X	X	X
NTS	X		X	X

S.3.6 Programmatic Alternative 3: Capability-Based Alternative

In the 2001 Nuclear Posture Review (NPR), the President established the objective of achieving a credible nuclear deterrent with the lowest possible number of nuclear warheads consistent with our national security needs. An alternative in this SPEIS, referred to as the “Capability-Based Alternative,” has been developed to analyze the potential environmental impacts associated with operation of a Complex that would support stockpiles smaller than required to meet anticipated future national security needs. For pit production, a capability-based alternative would be similar to the pit production capacity being assessed in the LANL SWEIS (DOE 2006a).

The objective of this alternative is to identify potential environmental impacts associated with operations to support a smaller stockpile. In addition, analysis of this alternative enhances NNSA’s understanding of the infrastructure that might be appropriate if the U.S. continues to reduce stockpile levels. In this alternative, NNSA would maintain a basic manufacturing capability to produce nuclear weapons, as well as laboratory and experimental capabilities to support stockpile decisions. This would reduce the operational capacity of production facilities to a throughput of approximately 50 weapons per year. This alternative involves:

- Pit production at LANL of 50 pits per year;
- Reductions of production capacities at Pantex, Y-12, and SRS.

This SPEIS also assesses even further stockpile reductions beyond those that are the basis for the Capability-Based Alternative.

S.3.7 Category I/II SNM Consolidation Actions Common to All of the Programmatic Action Alternatives

Category I/II quantities of SNM are stored at seven NNSA sites: LLNL, LANL, NTS, Pantex, SNL/NM, SRS, and Y-12. NNSA is seeking to reduce security costs and increase safety through SNM consolidation. As a result, the future complex is expected to have fewer sites and fewer locations within sites with Category I/II quantities of SNM. This section describes actions related to Category I/II SNM consolidation that are common to each of the programmatic action alternatives.

S.3.7.1 *Transfer Category I/II SNM from LLNL to Other Sites and Phase-out Operations at Superblock Involving Category I/II quantities of SNM*

NNSA is assessing the removal of Category I/II SNM from LLNL by approximately 2012, and the phase-out of operations at the Superblock involving Category I/II quantities of SNM. Although the exact quantities of Category I/II SNM are classified, the Category I/II SNM at LLNL can be divided up into three basic categories, in the percentages indicated, along with the receiver site for this material, and the number of trips required (see Table S.3.7-1).

Table S.3.7-1 – Category I/II SNM at LLNL

Category I/II SNM Category	Percentage	Receiver Site	# Trips
SNM Excess to Programmatic Missions ³⁴	49	SRS	10
SNM Required for Programmatic Missions	47	LANL ³⁵	9
Waste	4	WIPP	1

Source: NNSA 2007.

The LLNL SWEIS (DOE 2005) assesses the environmental impacts of transporting SNM to and from LLNL and other DOE sites as part of the proposed action, which NNSA decided to implement (70 FR 71491, November 29, 2005). That analysis includes consideration of transportation actions involving greater quantities of SNM and more shipments than are identified in Table S.3.7-1. As such, the transportation activities identified in Table S.3.7-1 are included in the existing No Action Alternative. For completeness, however, this SPEIS assesses the environmental impacts associated with:

- Packaging and Unpackaging Category I/II SNM
- Transporting Category I/II SNM from LLNL to Receiver Sites

This SPEIS also assesses phasing out Category I/II SNM Operations from LLNL Superblock.

S.3.7.2 Transfer Category I/II SNM from Pantex Zone 4 to Zone 12

Under this alternative, NNSA would transfer more than 10,000 pits currently stored at Pantex in Zone 4 to Zone 12. The storage in Zone 4 is approximately 74,200 square feet. Because there is insufficient storage space in existing Zone 12 facilities, a new underground reinforced concrete storage facility would be required. Transfer of the pits from Zone 4 to Zone 12 would enable all Category I/II SNM at Pantex to be consolidated into a central location, close to the assembly, modification, and disassembly operations. This would reduce the area at Pantex requiring a high level of security.

³⁴ In 2007, DOE prepared a Supplement Analysis (SA) that evaluated the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium from Hanford, LLNL and LANL. The SA concluded that the potential environmental impacts associated with this consolidation would not be a significant change from the potential environmental impacts associated with the alternatives analyzed in previous NEPA reviews (DOE/EIS-0229-SA-4). Subsequently, DOE decided to transfer surplus non-pit weapons-usable plutonium from LLNL to SRS for consolidated storage. Nonetheless, for completeness, this SPEIS includes an analysis of the transportation risk associated with disposition of all surplus plutonium from LLNL to SRS.

³⁵ This analysis also evaluates NTS as an interim storage location for the LLNL Category I/II SNM required for programmatic missions. Under this option, the material would be transferred to NTS for interim storage in the Device Assembly Facility until eventual transfer to LANL.

ALTERNATIVES to RESTRUCTURE R&D and TESTING FACILITIES

S.3.8 High Explosives R&D

Energetic materials (high explosives [HE], propellant and pyrotechnic powders) provide specific quantities of energy needed for a nuclear weapon to function. Stewardship of the stockpile requires a broad spectrum of energetic material R&D. In the nuclear portion of a weapon system, HE is used for the main charge and associated triggering systems. More specifically, HE R&D is required to assure stability and dependability of HE in nuclear weapons. HE R&D is conducted at LLNL, LANL, SNL/NM, NTS, and Pantex. The project-specific alternatives for HE R&D are shown in Table S.3.8-1.

Table S.3.8-1 — High Explosives R&D Alternatives

- **No Action** — continue operations at LLNL, LANL, SNL/NM, NTS, and Pantex
- **Minor Consolidation** — multiple options to consolidate or transfer some operations, but operations would continue at all sites
- **Major Consolidation** — multiple options to consolidate or transfer operations to fewer sites, and discontinue operations at sites that transfer missions

S.3.9 Tritium R&D

Tritium, a radioactive isotope of hydrogen, is an essential component (used to increase the yield) of every warhead in the current and projected U.S. nuclear weapons stockpile. Because warheads depend on tritium to perform as designed, an understanding of the properties of tritium is essential, and there is a need for tritium R&D. Within the Complex, tritium R&D involves activities such as: storage, purification, separation, engineering and physics performance, aging, analysis of surveillance data, diagnostics, enhanced surveillance, modeling and simulation, and compatibility testing.

Over the past 15 years there has been substantial consolidation of tritium facilities. However, there are still opportunities for further reductions and/or consolidations. The alternatives for tritium R&D are shown in Table S.3.9-1.

Table S.3.9-1 — Tritium R&D Alternatives

- **No Action** — continue operations at LLNL, LANL, SRS, and SNL/NM¹
- **Consolidate Tritium R&D at SRS** — move gas transfer system R&D support from LLNL² and LANL to SRS
- **Consolidate Tritium R&D at LANL** — move gas transfer system R&D support from LLNL to LANL
- **Reduce Tritium R&D In Place** — LLNL, LANL, and SRS would reduce operations

¹Tritium Operations at SNL/NM are primarily associated with the Neutron Generator Production Facility, which would be unaffected under all alternatives.

²Does not include National Ignition Facility (NIF) target R&D and filling NIF targets. Those operations would remain at LLNL under all alternatives.

S.3.10 NNSA Flight Test Operations for Gravity Weapons

SNL manages Flight Test Operations for gravity weapons (bombs) to assure compatibility of the hardware necessary for the interface between the weapon and the delivery system, and to assess weapon system functions in realistic delivery conditions. The actual flight tests are conducted with both the B83 and B61 weapons, which are pulled from the stockpile and converted into units called Joint Test Assemblies (JTAs). These tests are presently conducted at the TTR, a 280 square-mile site, located about 140 air-miles northwest of Las Vegas, Nevada. NNSA operates this facility under the terms of a land use agreement with the United States Air Force. This agreement expires in 2019.

Conversion of nuclear weapons into JTAs is a multi-step operation. Pantex denuclearizes nuclear weapons that become JTAs. These JTAs are not capable of producing nuclear yield. They may then be further modified at SNL. JTAs are then dropped from aircraft at various altitudes and velocities. Depleted uranium may be present in JTAs, but because there is no explosive event, the depleted uranium is contained within the weapon case and completely recovered after each test. There is no contamination of the soil as the result of a JTA flight test. In some cases, JTAs are flown at velocities and altitudes of interest and not dropped. In this case, the aircraft returns to its base with the JTA on-board. In an average year, 10 JTAs are tested at TTR.

The alternatives for NNSA flight testing are shown in Table S.3.10-1. The selection of any of the alternatives for flight test operations is unconnected to, and will not impact, the continuation of ongoing DOE environmental restoration activities and responsibilities at TTR resulting from past testing by the Atomic Energy Commission.

Table S.3.10-1 — NNSA Flight Test Operations Alternatives

- **No Action** — continue operations at TTR
- **Upgrade Alternative** — continue operations at TTR and upgrade equipment with state-of-the-art mobile technology
- **Campaign Mode Operations** — continue operations at TTR but reduce permanent staff and conduct tests with DOE employees from other sites
- **Transfer to WSMR** — move NNSA Flight Testing from TTR to WSMR
- **Transfer to NTS** — move NNSA Flight Testing from TTR to NTS

S.3.11 Hydrodynamic Testing

Hydrodynamic testing (hydrotesting) consists of high-explosive experiments to assess the performance and safety of nuclear weapons. Hydrodynamic tests (except for some underground sub-critical experiments at the NTS) do not normally employ fissile materials. Data from experiments including hydrotesting, coupled with modeling and simulation using high performance computers, is used to certify the safety, reliability, and performance of the nuclear physics package of nuclear weapons without nuclear testing. Hydrotesting is conducted at LLNL, LANL, NTS, Pantex, and SNL/NM. The alternatives for hydrotesting are shown in Table S.3.11-1.

Table S.3.11-1 — Hydrodynamic Testing Alternatives

- **No Action** – continue hydrotesting at LLNL, LANL, NTS, Pantex, and SNL/NM
- **Reduce in Place**
 - Consolidate LLNL hydrotesting to Contained Firing Facility (CFF)
 - Consolidate LANL hydrotesting to Dual Axis Radiographic Hydrodynamic Test (DARHT) facility
 - Consolidate NTS hydrotesting to single confined and single open-air sites
 - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidate at LANL**
 - Integrate hydrotesting program at LANL
 - Construct new CFF-like facility at LANL
 - Discontinue hydrotesting at LLNL once CFF-like facility is operational
 - Maintain BEEF at NTS
 - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidate at NTS¹**
 - Integrate hydrotesting program at NTS
 - Construct new DARHT-like facility at NTS
 - Construct new CFF-like facility at NTS
 - Discontinue hydrotesting at LLNL, LANL, Pantex, and SNL/NM

¹The NTS Alternative is considered a “next generation” alternative because NNSA is not proposing these changes at this time.

S.3.12 Major Environmental Test Facilities

Environmental testing supports a primary NNSA mission of maintaining and demonstrating the safety, reliability, and performance of the nation’s nuclear weapons systems. The environmental testing facilities (ETFs) are divided into two categories – base ETFs and system ETFs. The base ETFs are those facilities and laboratory scale (or “table-top”) items used to evaluate components or subassemblies in the environments defined by the Stockpile-to-Target Sequence (STS) and the Military Characteristics requirements for each nuclear weapon in the stockpile. Every laboratory within the NNSA complex has some base capability essential for day-to-day operations. The system ETFs are those facilities used to test full-scale weapons systems (with or without SNM) or those unique major facilities that are used for development and certification of components, cases, accessories, subsystems, and systems. This SPEIS focuses on a subset of base and system ETFs, referred to as “major” ETFs, that are costly to maintain or have potentially significant environmental impacts. Major ETFs are located at SNL/NM, LANL, LLNL, and NTS. The alternatives for major ETFs are shown in Table S.3.12-1.

Table S.3.12-1 — Major ETF Alternatives
<ul style="list-style-type: none"> • No Action — Maintain status quo at each site. All facilities must be maintained, or upgraded to meet current safety and security standards. • Downsize-in-Place — No duplication of capability within a given site, but there may be duplication from site to site - phase out aging and unused facilities. • Consolidate ETF Capabilities at One Site (NTS or SNL/NM) — Entails construction of new facilities at consolidation site. This alternative also includes an option to move LLNL Building 334 ETF capabilities to Pantex.

S.3.13 Sandia National Laboratories, California (SNL/CA), Weapons Support Functions

Facilities at SNL/CA are used to perform non-nuclear component design and engineering work. The SNL/CA facilities at Livermore consist of 29 buildings, the majority of which are small laboratories and office structures. The major facilities include the Combustion Research Facility (CRF), Building 910, Building 914, Building 916, Building 927, the Micro and Nano Technologies Laboratory (MANTL), and the Distributed Information Systems Laboratory (DISL). The alternatives for continuing the SNL/CA weapons support functions are shown in Table S.3.13-1. Acceptance of these activities at SNL/NM would be accommodated in existing facilities.

Table S.3.13-1 — SNL/CA Weapons Support Functions Alternatives
<ul style="list-style-type: none"> • No Action — Maintain current non-nuclear component design and engineering work at SNL/CA with SNL personnel • Consolidate SNL/CA non-nuclear component design and engineering work to SNL/NM

S.3.14 Alternatives Considered But Eliminated from Detailed Study

NNSA has determined that some alternatives suggested during the scoping process do not merit further study for the reasons set forth below:

Consolidate the Three Nuclear Weapons Laboratories (LLNL, LANL and SNL). The three weapons laboratories possess most of the nation's core intellectual and technical competencies in nuclear weapons. The laboratories perform basic research, design, system engineering, development testing, reliability assessment, and certification of nuclear performance. In 1995, the President concluded that the continued vitality of all three nuclear weapons laboratories was essential to the nation's ability to fulfill the requirements of stockpile stewardship in the absence of underground nuclear testing (White House 1995). While this conclusion has not changed, NNSA continues to make the laboratories more efficient and effective, as indicated by the alternatives to consolidate, relocate, or eliminate duplicative facilities and programs.

Pursue Dismantlement and Refrain from Designing and Building New Nuclear Weapons. This SPEIS assesses reasonable alternatives for maintaining a safe, secure, and reliable nuclear weapons stockpile. This includes a Capability-Based Alternative that would support a stockpile much smaller than currently planned and a qualitative discussion of how other alternatives might be adapted if the President directs further reductions in the size of the stockpile. Each of these alternatives would maintain weapons design, R&D, and manufacturing capabilities, because these are necessary to ensure the safety, security, and reliability of the nuclear weapons stockpile. These alternatives are consistent with the Nuclear Nonproliferation Treaty. With respect to not designing or building new nuclear weapons, this SPEIS does not propose to design or build new nuclear weapons. Decisions to design or build new weapons are made by the President and the Congress.

Curatorship Alternative. Under this proposed approach, NNSA would rely upon the surveillance and non-nuclear testing program to determine when work on nuclear weapons is necessary. Only if there is compelling evidence that components have degraded, or will soon degrade, and could cause a significant loss of safety or reliability, would NNSA replace the affected parts with new ones that would be remanufactured as closely to their original design as possible. A core assumption of this approach is that absent detectable changes, the well designed and thoroughly tested warheads in the stockpile would remain as safe and reliable as the laboratories have certified them to be today. While NNSA acknowledges that aspects of curatorship are an accurate description of how the SSP works, NNSA eliminated curatorship from detailed study as a stand-alone alternative because it does not define a programmatic alternative distinctly different from the range of alternatives analyzed in this SPEIS.

Smaller CUC/CNC/CNPC Alternative. Because this SPEIS includes an analysis of an alternative that would produce up to 80 pits per year (the 50/80 Alternative), DOE also considered whether there should be an alternative at this production level for secondary components (CUC) and the A/D/HE Center. In determining whether to assess a smaller CUC/CNC/CNPC alternative, NNSA considered three different perspectives — programmatic risk, cost effectiveness, and environmental impacts. That analysis (NNSA 2007) concluded that, among other reasons, the cost and environmental impacts of the CUC/CNC/CNPC would not be

highly sensitive to capacity at these low production rates. Chapter 3, Section 3.15 presents a summary of that NNSA 2007 analysis.

Relative to the CPC, NNSA identified the following potential alternatives, but eliminated them from detailed study for the reasons set forth below:

New CPC with a Smaller Capacity. NNSA considered whether it would be reasonable to build a new CPC with a capacity of fewer than 125 pits per year (single shift). In a detailed report published in September 2007,³⁶ NNSA concluded that if it constructed a new pit facility with a capacity to produce 80 pits per year, the reduction in square footage would be small (less than a few percent) compared to a new facility designed for 125 pits per year (single shift). The reason for this is that the reduction in the number of equipment processing stations is only 6 stations from the total estimated requirement of 132 major processing stations. Reductions in the processing stations based on a lower production requirement only decreases a small amount of equipment that would be needed to provide production assurances in the capacity increase from 80 pits per year to 125 pits per year (single shift). From a design perspective for a new facility, a 125 pits per year plant is an optimal minimum. The expected environmental impacts of construction and operation of a CPC at 125 pits per year would not be significantly different from 80 pits per year and the larger capacity provides better assurance of meeting the purpose and need for production of pits.

Purchase Pits. While there is no national policy that prohibits purchase of defense materials such as pits from foreign sources, NNSA has determined that the uncertainties associated with obtaining them from foreign sources render this alternative unreasonable for an assured long-term supply.

Upgrade Building 332 at Lawrence Livermore National Laboratory. Building 332 at LLNL is located in what is known as the “Superblock”. This building is a plutonium R&D facility containing a wide variety of plutonium processing and fabrication technologies but offering minimal production capabilities. Activities in Building 332 include developing and demonstrating improved technologies for plutonium metal preparation, casting, fabrication, and assembly; fabrication of components for subcritical tests; surveillance of LLNL pits; support for LANL pit surveillance and specimen fabrication; and fundamental and applied research in plutonium metallurgy. Building 332 does not have a pit manufacturing mission and is small in comparison to the production facilities at LANL. Additionally, because of the significant population around LLNL, an upgrade alternative at LLNL is undesirable.

Consider Other Sites for the CPC. In order to determine the reasonable site alternatives for a CPC, all existing, major DOE sites were initially considered as a host location for a CPC. Sites that do not maintain Category I/II SNM were eliminated from consideration, as were sites that did not conduct major NNSA program activities. Other DOE sites were not considered reasonable locations because they do not satisfy certain criteria such as low surrounding population, mission compatibility, or synergy with the site’s existing mission. The NOI To Prepare a Supplement to the Stockpile Stewardship and Management Programmatic

³⁶ Plutonium Processing Facility Reduced Capacity Study, NNSA, September 2007.

Environmental Impact Statement--Complex 2030 stated that Los Alamos, NTS, Pantex, SRS, and Y-12 would constitute the range of reasonable site alternatives for a CPC (71 FR 61731).

Redesign Weapons to Require Less or No Plutonium. The pits in the enduring nuclear weapons stockpile were designed and built with plutonium, and in an era when nuclear testing was being conducted to verify these designs. Replacing these pits with new ones that would use little or no plutonium (i.e., using highly-enriched uranium instead) for the sole reason of not building a long-term, assured pit production facility would not be reasonable. Nuclear testing would likely be required to verify performance of a design that uses uranium instead of plutonium. In addition, these new pits would require costly changes in the weapon delivery systems.

Do Not Produce New Pits. The latest studies on plutonium aging indicate that the pits currently in the stockpile may be viable for more than 85 years. However, it may become necessary to manufacture new pits for a number of reasons including: consequences of an aging phenomena not previously considered, new weapon design, or a change in other components in the weapon (for example a change in the HE to be used or unavailability of certain materials or components). Prudent management of NNSA's mission dictates that it has the capability to produce all components necessary for the stockpile.

NNSA Flight Testing. In addition to the White Sands Missile Range (WSMR), NNSA considered other existing DoD flight test ranges, including Eglin Air Force Base, the U.S. Navy's China Lake testing and training range, and the Utah Test and Training Range (UTTR). A team of NNSA officials visited these sites, discussed their availability and assets with the technical staff and management of these facilities, and evaluated their ability to conduct NNSA flight test operations. Although Eglin has many desirable assets, it was eliminated from further consideration because of the available terrain, geological features, and the short depth to groundwater. With respect to China Lake, although the technical assets were sufficient to support NNSA flight test operations, the geology and soils are not considered adequate. At UTTR, the existing assets, such as optical systems, radar, and communications are all dated and its management has no plans for upgrading or replacing them. Additionally, soil composition is moist and soft over the entire range and is not suitable.

Tritium R&D. NNSA considered changes to the tritium missions at SNL/NM (related to neutron generator production), at SRS (for tritium production), and at LLNL (for NIF target loading), but determined that there were no reasonable alternatives for changing these missions (see Chapter 3, Section 3.15).

S.3.15 Considerations Related to the Reliable Replacement Warhead (RRW)

The current status of the RRW is that a feasibility study has been completed, a design competition has been concluded, and the joint DoD/DOE Nuclear Weapons Council has selected a design concept. If authorized and funded by the Congress, the design concept would undergo further study and refinement over the coming years and cost estimates would be prepared by the DoD and the NNSA. The first RRW is being considered as a possible replacement for the

Navy's W76 Trident warhead starting as early as the 2014 timeframe. The first RRW would not have a different military requirement than the W76 warhead it would replace.

The possibility that NNSA might be directed to develop an RRW does not have significant ramifications on the alternatives analyzed or their potential impacts. Pit production and other production activities would be allocated between legacy weapons and RRWs – production capacity would not be increased if NNSA is directed to develop an RRW. Development of an RRW would not require significant changes to the activities and proposed facilities that are analyzed as part of the alternatives evaluated in this SPEIS. If an RRW were developed and produced, it is likely that this production would be in lieu of maintenance and production activities for legacy weapons.

S.3.15.1 *RRW Effect on the Proposed Actions and Alternatives*

Consideration of RRW would assist NNSA in making informed decisions on the capabilities that might be required in select facilities if a decision is made to proceed with the RRW. However, the RRW would not affect the SNM consolidation efforts or the action alternatives related to restructuring SNM facilities, nor the action alternatives related to the restructure of R&D and testing facilities, nor Complex transformation in general.

- **Restructure SNM Facilities:** The proposed action is based on the current site configuration that houses a very large inventory of SNM that needs to be consolidated in more modern facilities independent of whether an RRW is developed.
- **Restructure R&D and Testing Facilities:** Tritium R&D, high-explosives R&D, hydrodynamic, environmental, and flight test facilities are needed to support the maintenance of the safety, security, and reliability of the existing stockpile as well as potential RRW warheads. The R&D and flight test facilities retained will be those necessary to support either a future legacy stockpile or an RRW-based stockpile.

S.3.15.2 *Potential Effects of the RRW on Complex Transformation*

One of the objectives of the RRW is to simplify component and subassembly fabrication and warhead assembly/disassembly processes. In general, simplifying the design to one with fewer, less complex parts would reduce costly production operations in the Complex. Coordination and cooperation between the design laboratories and production plants to achieve this objective were encouraged by NNSA in the design competition for RRW. However, the fact that more weight and volume are available to RRW designers provides greater flexibility to simplify the manufacture, assembly, disassembly, and maintenance of weapons. In addition to the positive benefits on the Complex of a design that is easier to produce, the proposed reduction of hazardous and problematic materials from RRW designs has the potential to reduce environmental impacts from operation of the Complex. The proposed increase in safety (e.g., elimination of conventional high explosives for the main charge) and security features in RRW designs has the potential to reduce the cost of normal operations and severity of accidents.

S.3.15.3 *RRW's Use of Radioactive and Hazardous Materials*

The environmental impacts of the action alternatives in this SPEIS are based on the manufacturing materials and processes needed to support legacy weapons with life extension programs. An RRW is only in the feasibility study stage. However, the RRW design objectives are directed at reducing the use of radioactive and hazardous materials compared to legacy weapons. Because the environmental impacts in this SPEIS are based on legacy weapons, these impacts should be larger than the potential impacts of an RRW if it were to go into production.

S.3.16 **Comparison of Impacts**

This comparison of potential environmental impacts is based on the information in Chapter 4, Affected Environment, and analyses in Chapter 5, Environmental Impacts. Table S.3.16-1 presents a comparison of the environmental impacts for construction and operation associated with the No Action Alternative, DCE Alternative, CCE Alternative, and Capability-Based Alternative. The No Action Alternative is also presented in Table S.3.16-1 as a benchmark for comparison of the impacts associated with the action alternatives. Table S.3.16-1 focuses on those resources for which there is the greatest potential for significant environmental impact. For a more complete discussion of the impacts of the alternatives, the reader is directed to Chapter 3 (Table 3.16-1) and Chapter 5 of this SPEIS. With respect to the Category I/II SNM consolidation proposals that are common to the programmatic action alternatives, Table S.3.16-2 presents a summary comparison of the potential impacts associated with alternatives for Category I/II SNM Consolidation for LLNL and Table S.3.16-3 presents a summary comparison of impacts associated with Category I/II SNM Consolidation at Pantex.

In addition to the comparisons presented in Table S.3.16-1, Table S.3.16-2, and Table S.3.16-3, this section presents an overview of the major environmental impacts associated with the programmatic alternatives presented in the SPEIS. This presentation focuses on the major discriminators between the programmatic alternatives with respect to land use, employment, transportation, and accidents. A detailed analysis of the environmental impacts associated with all alternatives (by specific site) is presented in Chapter 5, Sections 5.1 through 5.9. A detailed transportation analysis is presented in Section 5.10.

A detailed analysis of the project-specific alternatives is contained in Section 5.13 (HE R&D), Section 5.14 (Tritium R&D), Section 5.15 (Flight Testing), Section 5.16 (Hydrodynamic Testing), Section 5.17 (Major Environmental Test Facilities), and Section 5.18 (Non-Nuclear Weapons Support Functions at SNL/CA). Tables S.3.16-3 through S.3.16-8 summarizes the differences in impacts for the project-specific alternatives.

S.3.16.1 *Land Use for Programmatic Alternatives*

For land use, both the No Action Alternative and the Capability-Based Alternative have the least impacts, in that the total area of the seven Complex sites analyzed in this SPEIS (LANL, LLNL, NTS, Pantex, SNL, SRS, and Y-12) remains the same at approximately 1,000,000 total acres.

For the DCE Alternative, the Complex would remain the same size, but a CPC would be constructed at one of five site alternatives. This would disturb an area of approximately 140 acres during construction, resulting in a 110-acre facility within the existing boundaries of one of these sites. For Los Alamos, the disturbed land area could be smaller because an alternative to use existing and planned facilities is being considered along with a Greenfield CPC alternative. At Y-12, if the UPF were constructed, consolidation from existing facilities could ultimately reduce the areas associated with nuclear production activities requiring the highest levels of security from 150 acres to approximately 15 acres.

Under the CCE Alternative, the Complex's size could be reduced. Depending upon the option (Consolidated Nuclear Production Center [CNPC] or Consolidated Nuclear Centers [CNC]), this alternative would involve the construction of facilities at one or two sites, and could result in a 545-acre facility at one of five candidate sites. If Los Alamos, NTS, or SRS were selected as the site for CCE facilities, both Pantex and Y-12 could be closed. This would reduce the size of the Complex by 16,777 acres. If Pantex (but not Y-12) were selected for CCE facilities, Y-12 could close and the size of the Complex reduced by approximately 800 acres. If Y-12 (but not Pantex) were selected for CCE facilities, Pantex could close and the Complex would be reduced by 15,977 acres.

S.3.16.2 *Impacts on Complex Facilities for Programmatic Alternatives*

Under the No Action Alternative, NNSA would continue the trend of closing, replacing, and upgrading older facilities, consistent with decisions based on previous NEPA analyses and applicable regulatory requirements. Surplus facilities with no inherent value to DOE, NNSA, or the community would ultimately be dispositioned or undergo decontamination and decommissioning (D&D) consistent with overall modernization plans. For example, at Y-12, excess buildings and infrastructure have been closed over the past decade, and approximately 244 buildings, with more than 1.1 million square feet, have been demolished or removed. In the future, as part of the environmental cleanup strategic planning, DOE and NNSA are developing an Integrated Facility Disposition Project (IFDP). The IFDP is a strategic plan for disposing of legacy materials and facilities at Oak Ridge National Laboratory and Y-12 that uses an integrated approach. Under the IFDP, the D&D of approximately 188 facilities at Oak Ridge National Laboratory and 19 facilities at Y-12, as well as the remediation of soil and groundwater contamination, would occur over the next decade. The IFDP will be conducted as a remedial action under the *Comprehensive Environmental Response, Compensation, and Liability Act*. Similar activities at other NNSA sites are ongoing. For instance, at LLNL, approximately 20 facilities with a combined floor space of 234,443 square feet are being deactivated.

With respect to the Programmatic Alternatives, if a site other than Pantex and Y-12 is selected for a CNPC, Pantex and Y-12 could be closed. At Pantex, this would involve closing approximately 400 buildings totaling 1.8 million square feet. At Y-12, approximately 5.3 million square feet of floor space and approximately 390 facilities would be closed. For each of the programmatic action alternatives, moving plutonium storage to Zone 12 at Pantex would result in closing more than 74,200 square feet of storage facilities in Zone 4.

S.3.16.3 *Impacts on Complex Facilities for Project-Specific Alternatives*

With respect to potential cumulative impacts, project-specific actions could also affect the total number of facilities and square footage devoted to NNSA weapons activities. This could result in additional facility closures or transfer of facilities from the NNSA to another user. For example, if flight testing were moved from TTR, approximately 195 buildings and structures, covering approximately 180,000 square feet, could be closed or transferred to another user. For the Hydrodynamic Testing Consolidation-in-Place Alternative, 29 facilities at LANL, LLNL, and SNL/NM, with a combined floor space of 56,475 square feet could be closed or transferred. For alternatives that move HE R&D from LLNL Site 300, up to 35,000 square feet of floor space could be closed or transferred. If NNSA were to ultimately close Site 300, up to 115 buildings with a floor space of approximately 340,000 square feet could be closed or transferred.

S.3.16.4 *Employment under the Programmatic Alternatives*

For employment, the No Action Alternative would have the least impacts with the workforce remaining at the current level of approximately 27,000 management and operating contractors supporting weapons activities at the major sites analyzed in this SPEIS.

For the DCE Alternative, a new CPC could be constructed at Los Alamos, NTS, Pantex, SRS, or Y-12. If constructed, approximately 850 construction jobs and an operational workforce of approximately 1,780 could be employed at the CPC. If Los Alamos is not selected for a new CPC, Los Alamos would lose about 610 jobs.

The CCE Alternative has the greatest potential for employment impacts. The construction of CCE facilities could require more than 4,000 construction jobs and an operational workforce of approximately 4,500 could be added to the selected site(s). If Pantex is not selected for CCE facilities, Pantex could be closed, resulting in a loss of approximately 1,650 jobs. If CCE facilities are not located at Y-12, Y-12 could be closed with a loss of approximately 6,500 jobs.

For the Capability-Based Alternative, the reduced level of production would entail the loss of approximately 3,000 jobs (400 at Pantex, 15 at SRS, and 2,600 at Y-12).

S.3.16.5 *Transportation under the Programmatic Alternatives*

For the No Action Alternative, there would be no impacts to the existing transportation requirements of the Complex. Pits would continue to be transported from LANL to Pantex, Canned subassemblies (CSAs) would continue to be transported from Y-12 to Pantex, tritium reservoirs would continue to be transported between SRS and Pantex, and other required parts and materials would be transported among various NNSA sites.

For the DCE Alternative, transportation related to pit production could increase if a CPC were located at a site other than Pantex. If the CPC were located at Pantex, no off-site transportation related to pit production would be required.

For the CCE Alternative, if facilities were located at sites other than Y-12 and Pantex, less than 60 tons of plutonium, mostly in pit form, presently being stored at Pantex would be transported to the CNPC, and up to 252 tons of HEU would be transported from Y-12 to the CNPC. For the CNPC option, annual transportation related to nuclear production would cease once the CNPC becomes operational. For the CNC option, there would be annual transportation related to pits and CSAs between the CPC, CUC, and an A/D/HE Center.

For the Capability-Based Alternative, transportation requirements would be the same as for the No Action Alternative, except that only 25 percent of the existing number of CSAs would need to be transported from Y-12 to Pantex, and tritium shipments could be reduced by approximately 50 percent.

S.3.16.6 *Accidents and Malicious Acts in Programmatic Alternatives*

For the No Action Alternative and the Capability-Based Alternative there would be no major difference in accident risks and consequences. For the DCE and CCE Alternatives, the location of any new facilities could impact the risks and consequences associated with accidents. In general, if missions were conducted at locations with populations lower than the populations at the sites where those missions are currently conducted, potential consequences would likely decrease. For example, if a CNPC were located at NTS, potential consequences associated with the A/D/HE mission, the CUC mission, and the CPC mission would be reduced compared to the No Action Alternative because of the greater distance to the site boundary and the smaller population within the surrounding area.

A draft classified appendix to this SPEIS has been prepared that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix B (Section B.12.3) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems. As discussed in that section, the NNSA strategy for the mitigation of environmental impacts resulting from extreme events, including intentional destructive acts or terrorism, has three distinct components: (1) prevent or deter terrorists from making successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. These data will provide NNSA with information upon which to base, in part, decisions regarding transformation of the Complex. The draft classified appendix evaluates several intentional destructive act scenarios for alternatives at the following sites (LANL [both at TA-16 and TA-55], LLNL, NTS, SRS, Pantex, and Y-12) and calculates consequences to the noninvolved worker, maximally exposed individual, and population in terms of radiation dose and LCFs. Although the results of the analyses cannot be disclosed in this unclassified SPEIS, the following general conclusion can be made: the potential consequences of intentional destructive acts are highly dependent upon

distance to the site boundary and size of the surrounding population- the closer and higher the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities, as new security features can be incorporated into their design. In other words, protection forces needed to defend new facilities may be smaller due to inherent security features included in a new facility.

S.3.16.7 *Infrastructure Demands for the Programmatic Alternatives*

Electricity.

Under the No Action Alternative, all sites have an adequate existing electrical infrastructure to support current and planned activities.

LANL has adequate electricity to support all of the alternatives. However, operation of a CNPC would have the potential to use approximately 96 percent of the peak power capacity that is available.

At NTS, the existing infrastructure would be adequate to support all construction requirements. To support operations for a CUC, CNC, or CNPC, NTS would need to procure additional power.

At Pantex, the existing infrastructure would be adequate to support all construction requirements. To support operations for a CUC or CNPC, Pantex would need to procure additional power.

At SRS and Y-12, the existing infrastructure would be adequate to support the construction and operation of all alternatives. Construction and operation would have a negligible impact on current site infrastructure.

Water.

Under the No Action Alternative, all sites have an adequate existing water infrastructure to support current and planned activities.

LANL has adequate water rights to support a CPC, CUC, or A/D/HE Center. However, operation of multiple new facilities (CNC or CNPC) would exceed the current LANL water rights.

At NTS, the sustainable site capacity for water would be adequate to support the construction and operation of all alternatives.

At Pantex, the existing wellfield capacity would be adequate to support the construction and operation of all alternatives.

At SRS and Y-12, the existing water infrastructure would be adequate to support the construction and operation of all alternatives.

S.3.17 Preferred Alternatives

CEQ regulations require an agency to identify its preferred alternative to meet its purpose and need, if one exists, in a Draft EIS (40 CFR 1502.14(e)). At this time, NNSA has identified the preferred alternatives as described below. This is based on the consideration of environmental impacts described in this Draft SPEIS, as well as consideration of other factors such as mission and infrastructure compatibility, economic analyses, safety, safeguards and security, and workforce training and retention.

Restructuring SNM Facilities Preferred Alternatives

Pursue Distributed Centers of Excellence as follows:

- **Plutonium Manufacturing and R&D:** Los Alamos (50/80 Alternative) would provide up to 80 pits per year enabled by construction and operation of the Chemistry and Metallurgy Research Replacement - Nuclear Facility (CMRR-NF). Other national security actinide needs and missions would be supported at TA-55 on a priority basis (e.g., emergency response, material disposition, nuclear energy).
- **Uranium Manufacturing and R&D:** Y-12 would continue as the uranium center providing component and canned subassembly production, surveillance and dismantlement. Independent of this SPEIS, NNSA is completing construction of the HEUMF and consolidating HEU storage in that facility; and can proceed with the preliminary design of a UPF that could be located at any of the sites under consideration in this SPEIS.
- **Assembly/Disassembly/High Explosives Production and Manufacturing:** Pantex would remain the Assembly/Disassembly/High Explosives production and manufacturing center. Consolidate non-destructive surveillance operations at Pantex.
- **Consolidation of Category I/II SNM:** Phase-out Category I/II operations at LLNL Superblock by the end of 2012. Consolidate Category I/II SNM at Pantex within Zone 12, and close Zone 4.

Restructuring R&D and Testing Facilities Preferred Alternatives

HE R&D. Reduce footprint of NNSA weapons activity HE production and R&D; reduce number of firing sites as well. Use of energetic materials for environmental testing (e.g., acceleration or sled tracks, shock loading, or in explosive tubes) is not included in HE R&D. Consolidate weapons HE R&D and testing at the following locations by 2010.

- Pantex would remain the HE production (formulation, processing, and testing) and machining center. All HE production and machining to support nuclear explosive package (NEP) development is performed at Pantex. HE experiments up to 22 kg HE could remain at Pantex;

- NTS would remain the R&D testing center for large quantities of HE (greater than 10 kg);
- LLNL would be the HE R&D center for formulation, processing, and testing (less than 10 kg) HE at the High Explosives Applications Facility (HEAF);
- SNL/NM would remain the energetic devices R&D center (less than 1 kg of HE) at the existing Explosives Test Facility (ETF); and
- LANL would produce HE detonators and conduct contained HE R&D.

Maintain one open-burn/open detonation area at each site for safety and disposal purposes.

Tritium R&D. Consolidate Tritium R&D at SRS. SRS would remain the site for tritium supply management and provide R&D support to production operations and gas transfer system development. Neutron generator loading at SNL/NM and production of National Ignition Facility targets at LLNL, which involve small quantities of tritium, would continue and would not be included in this consolidation. Move bulk quantities of tritium from LANL to SRS by 2009. Remove tritium materials above the 30 gram level from the Weapons Engineering Tritium Facility (WETF) at LANL by 2012.

NNSA Flight Test Operations. Cease NNSA operation of TTR in approximately 2009 and conduct flight testing at a DoD facility. No Category I/II SNM will be used in future flight tests.

Hydrodynamic Testing. Cease open-air hydrotesting at LANL and LLNL in 2009, and conduct future open-air hydrotesting at NTS. Consolidate in-place LANL and LLNL hydrotesting facilities. Close CFF at LLNL in approximately 2015 which could enable transfer or closure of Site 300. As the LANL Dual Axis Radiographic Hydrodynamic Test (DARHT) facility approaches end of life in approximately 2025, plan for a next generation facility at the NTS.

Major Environmental Test Facilities. Consolidate major environmental testing at SNL/NM and conduct infrequent operations requiring Category I/II SNM in security campaign mode. Close LANL and LLNL major environmental testing facilities by 2010 (except those in LLNL Building 334). Move environmental testing of nuclear explosive packages currently performed in LLNL Building 334 to Pantex by 2012. As SNL/NM facilities used for infrequent Category I/II SNM testing (Annular Core Research Reactor and Aerial Cable Facility) reach the end of their life, NNSA would evaluate building replacement facilities at NTS.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
Land Use							
LANL	Current and planned activities would continue as required to accomplish assigned missions. LANL has approximately 2,000 structures with approximately 8.6 million square feet under roof, spread over an area of approximately 25,600 acres.	<i>Greenfield CPC:</i> Potential disturbance of 140 acres for construction and 110 acres for operation. <i>Upgrade:</i> Potential disturbance of 13 acres for construction and 6.5 acres for operation. <i>50/80:</i> Potential disturbance of 6.5 acres for construction and 2.5 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.	Potential disturbance of 300 acres from construction and 300 acres from operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 1.2% of LANL total land area.	195 acres (includes 50 acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 1% of LANL total land area.	545 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Two non-contiguous TAs would be used for the CNPC. Land required would be approximately 2.3% of LANL total land area. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	Potential disturbance of 6.5 acres. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.
NTS	Current and planned activities would continue as required to accomplish assigned missions. Approximately 45 percent of NTS is currently unused or provides buffer zones for ongoing programs or projects, while about 7-10 percent (60,000 – 86,500 acres) of the site has been disturbed.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of NTS total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of NTS total land area.	Because NTS would use existing capabilities at the DAF, potential land disturbance for construction and operation would be approximately 200 acres. Land required would be less than 1% of NTS total land area.	195 acres (includes 50-acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans.	445 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	NTS would be unaffected by the Capability-Based Alternative.
Pantex	Current and planned activities would continue on the 15,977-acre site as required to accomplish assigned missions. No new land disturbance expected.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of Pantex total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of Pantex total land area.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	545 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 would close, reducing the size of the Complex by approximately 800 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
SRS	Current and planned activities would continue on the 198,420-acre site as required to accomplish assigned missions. Approximately 77 acres of additional land would be disturbed by construction of the Mixed-Oxide (MOX) Fuel Fabrication Facility which broke ground August 2007 and the Pit Disassembly and Conversion Facility (PDCF) scheduled to break ground in 2010.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area.	Potential disturbance of 300 acres from construction and 300 acres from operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area	195 acres (includes 50 acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans.	545 acres (includes 100 acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue on the 800-acre site located on the 35,000-acre Oak Ridge Reservation as required to accomplish assigned missions.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 17.5% of Y-12 total land area	UPF could disturb approximately 35 acres for construction and 8 acres for operation at Y-12. Land uses would remain compatible with surrounding areas and with land use plans. UPF would enable protected area to be reduced by 90%.	Potential disturbance of 300 acres for construction and 300 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 37.5% of Y-12 total land area.	Y-12 performs the CUC mission; therefore the impact of a CNC at this site is identical to the CPC impact.	518 acres (includes 100 acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Pantex would close, reducing the size of the Complex by 15,977 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Visual Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	Construction activities would create short-term, temporary visual impacts. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	New facilities would not be visible outside of NTS boundary; change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	NTS would be unaffected by the Capability-Based Alternative.
Pantex	Current and planned activities	Short-term, temporary visual	Construction activities	No A/D/HE Center is	Pantex performs the	New facilities would be	Planned activities

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	would continue as required resulting in no additional impacts.	impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	would create short-term, temporary visual impacts. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	obstructed from off-site view. Change would be consistent with currently developed areas. No change to VRM Classification.	would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Current and planned activities would continue with short-term impacts to visual resources resulting from construction of the MOX/PDCF facilities in the F-Area. Changes would be consistent with existing structures of the area and no change to VRM classification would be required.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Construction activities would create short-term, temporary visual impacts. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	New facilities would be obstructed from off-site view. Change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	UPF could disturb approximately 35 acres at Y-12. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Site Infrastructure							
LANL	Current and planned activities would continue as required resulting in no additional impacts. The current power pool peak power capacity is 130 megawatts-electric [MWe]). The available site capacity is 43 MWe.	Under all approaches, existing infrastructure would be adequate to support construction and operation requirements. Operation of a CPC would have the potential to use approximately 26% of the peak power capacity that is available.	Existing infrastructure would be adequate to support construction and operation requirements. Operation of a CUC would have the potential to use approximately 43% of the peak power capacity that is available.	Operation of A/D/HE Center would have the potential to use approximately 28% of the peak power capacity that is available.	Although the CNC operations would not exceed LANL electrical power capacity, the total load could approach approximately 70% of the peak power capacity that is available.	Operation of a CNPC would have the potential to use approximately 96% of the peak power capacity that is available.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
NTS	Current and planned activities would continue as required resulting in no additional impacts. NTS would be expected to continue using	Existing infrastructure would be adequate to support construction and operation requirements. Power requirements would be 64%	Existing infrastructure would be adequate to support construction requirements. Power requirements would be	Existing infrastructure would be adequate to support construction. Power requirements would be 69% of	Power requirements would be 288% of available site electrical energy capacity. For operations, NTS would need to procure additional	Power requirements would be 357% of available site electrical energy capacity. For operations, NTS would need to procure additional	NTS would be unaffected by the Capability-Based Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	101,377 MWh of electricity per year. Electrical usage is below current site capacity.	of available site electrical energy capacity.	224% of available site electrical energy capacity. For operations, NTS would need to procure additional power.	available site electrical energy capacity.	power.	power.	
Pantex	Current and planned activities would continue as required resulting in no additional impacts to site infrastructure. Pantex would be expected to continue using about 81,850 MWh of electricity per year.	Existing infrastructure would be adequate to support construction and operation requirements. Power requirements would be 40% of available site electrical capacity.	Existing infrastructure would be adequate to support construction requirements. During operations, power requirements would be 140% of available site electrical energy capacity. To support a CUC, Pantex would have to procure additional power.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	During operations, power requirements would be 148% of available site electrical energy capacity. To support a CNPC, Pantex would have to procure additional power.	Planned activities would continue as required to support smaller stockpile requirements. Infrastructure needs would be reduced.
SRS	Current and planned activities would continue, with the increased electrical usage from the MOX/PDCF facilities for a electrical use of 405,000 MWh/yr (370,000 MWh/yr existing plus 35,000 MWh/yr for the MOX/PDCF facilities)	Existing infrastructure would be adequate to support construction and operation requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support operation requirements. Operation would require 15% of available electrical site capacity. Operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Operation requirements would have a negligible impact on current site infrastructure.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts to site infrastructure. Y-12 would be expected to continue using about 350,000 MWh of electricity per year.	Existing infrastructure would be adequate to support construction and operation requirements. During operations, power requirements would be <1% of available site electrical capacity.	Existing infrastructure would be adequate to support construction and operation requirements. During operations, power requirements would be <1% of available site electrical capacity.	Existing infrastructure would be adequate to support construction requirements. During operations, power requirements would be 1.5% of available site electrical capacity.	By definition, there is no CNC at Y-12.	Existing infrastructure would be adequate to support operation requirements. During operations, power requirements would be 7.1% of available site electrical capacity.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Air Quality							
LANL	Current and planned activities would continue as required resulting in no additional impacts. The area encompassing LANL and Los Alamos County is classified as an attainment area for all six criteria pollutants. Simultaneous operation of LANL's air emission sources	Construction activities would create temporary increase in air quality impacts, but would not result in violations of the National Ambient Air Quality Standards (NAAQS). Operations would result in incremental increases less than 5% of baseline for most	Construction activities would create temporary increased in air quality impacts similar to CPC. For operations, CUC contribution to non-radiological emissions would not cause any standard or guideline to be exceeded.	Construction activities would create temporary increase in air quality impacts that could result in exceeding PM ₁₀ regulatory limits. Operations could have the potential to exceed the 24-hour standard for nitrogen	Operations would result in incremental increases less than 5% of baseline for most pollutants. The greatest increase would occur for total suspended particulates (TSP), which could increase by approximately 28%.	Operations could have the potential to exceed the 24-hour standard for nitrogen dioxide and the 24-hour standard for TSP.	The higher level of pit production would result in the annual emission of an additional 0.000019 curies per year of plutonium from the Plutonium Facility Complex.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	at maximum capacity, as described in the Title V permit application, would not exceed any state or Federal ambient air quality standards.	pollutants. The greatest increase would occur for total suspended particulates (TSP), which could increase by approximately 28%.		dioxide and the 24-hour standard for TSP.			
NTS	Current and planned activities would continue as required resulting in no additional impacts. No emission limits for any criteria air pollutants or HAPS have been exceeded. Measured concentration of non-radiological criteria pollutants are below regulatory requirements. The estimated annual dose to the public from radiological emissions from current and past NTS activities is well below the 10 millirem per year dose limit.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	NTS would be unaffected by the Capability-Based Alternative.
Pantex	Current and planned activities would continue as required resulting in no additional impacts. Pantex is in compliance with all National Ambient Air Quality standards.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Emissions from current and planned MOX/PDCF facilities would result in no additional impacts. SRS is in compliance with all National Ambient Air Quality standards.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for operations. No NAAQS exceeded.	Negligible impacts to air quality for operations. No NAAQS exceeded.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue, resulting in no additional impacts. Y-12 is designated non-attainment area for 8-hour ozone and is in compliance with all other National Ambient Air Quality standards.	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated using dust suppression), and the 8-hour	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC plus UPF impact.	Potential to exceed PM-10 and ozone levels due to high background levels.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by CPC operations.	using dust suppression), and the 8-hour ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by UPF operations.	using dust suppression), and the 8-hour ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by A/D/HE Center operations.			
Water Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Approximately 359 million gallons of groundwater are used at LANL. Discharges were in compliance with discharge permits.	For construction and operation of the Greenfield CPC, annual groundwater use would increase by approximately 22%. However, LANL water use would remain within water rights.	For construction and operation, the increase in groundwater consumption would be approximately 29%. LANL water use would remain within water rights.	For construction and operation, annual groundwater use would increase by approximately 36%. LANL water use would be within water rights.	Annual groundwater use would increase by approximately 52%. LANL groundwater use would exceed water rights by approximately 2 million gallons/year.	Annual groundwater use would increase by approximately 110%. LANL groundwater use would exceed water rights by approximately 212 million gallons/year.	Same a No Action Alternative.
NTS	Current and planned activities would continue with an expected demand for groundwater of 634 million gallons per year. The annual maximum production capacity of site potable supply wells is approximately 2.1 billion gallons per year while the sustainable site capacity is estimated to be approximately 1.36 billion gallons per year	For construction and operation, annual groundwater use would require approximately 7% of sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	For construction and operation, annual groundwater use would require less than 8% of sustainable water capacity. No impact on groundwater availability or quality is anticipated.	For construction and operation, annual groundwater use would require approximately 10% of sustainable water capacity. No impact on groundwater availability or quality is anticipated.	Operation of the CNC would use approximately 14.2% of the sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	Operation of the CNPC would use approximately 23.7% of the sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	NTS would be unaffected by the Capability-Based Alternative.
Pantex	Current and planned activities would continue as required with an expected demand for water of 130,000 million gallons per year. Pantex obtains its water from the	For construction and operation, annual groundwater use would increase by 68% compared to existing use. No impact on groundwater availability or	For construction and operation, annual groundwater use would increase by approximately 81% compared to existing use. No impact on	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	CNPC operations would increase groundwater use by approximately 150% compared to existing use. CNPC would require total of approximately 315.5	Planned activities would continue as required to support smaller stockpile requirements resulting in no

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	City of Amarillo, which obtains water from the Ogallala aquifer.	quality is anticipated from construction activities. Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CPC would be approximately 0.0003 percent of the estimated annual total depletion.	groundwater availability or quality is anticipated from construction activities. Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CUC would be approximately 0.0004 percent of the estimated annual total depletion.			million gallons/year. The Pantex wellfield has a water capacity of approximately 422.7 million gallons/ year. Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CNPC would be less than 1 percent of the estimated annual total depletion.	additional impacts.
SRS	Current and planned activities would continue as required with an expected demand for water (groundwater and surface water) of 3.5 billion gallons/yr plus a small increase for the operation of the MOX/PDCF facilities.	For construction and operation, annual water use would increase by approximately 2% compared to existing use.	For construction and operation, annual water use by 3% compared to existing use.	For construction and operation, annual water use would increase by approximately 4% compared to existing use.	Operation of CNC would increase water use by approximately 5% compared to existing use.	Operation of CNPC would increase water use by 9% compared to existing use.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required with an expected demand for water of approximately 2,000 million gallons per year.	For construction and operation, annual water use would increase by approximately 4% compared to existing use.	For construction and operation, annual water use would increase by approximately 5% compared to existing use.	For construction and operation, annual water use would increase by approximately 6% compared to existing use.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Operation of CNPC would increase water use by approximately 20% compared to existing use.	Planned activities would continue as required to support smaller stockpile requirements.
Biological Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	TA-55 contains core and buffer areas of environmental interest for the Mexican Spotted Owl. Potential impacts would be within previously and substantially developed areas.	TA-55 contains core and buffer areas of environmental interest for the Mexican Spotted Owl. Potential impacts would be within previously and substantially developed areas.	Potential impacts at TA-16 would be within previously and substantially developed areas.	Potential impacts would be within previously and substantially developed areas.	Same as CNC.	Same a No Action Alternative.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	Same as CUC.	Reference location is in highly developed area, impacts would be minimal.	Same as CNC.	NTS would be unaffected by the Capability-Based Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		portions that do not contain habitat sufficient to support biologically diverse species mix.					
Pantex	Current and planned activities would continue as required resulting in no additional impacts.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Reference location is in highly developed area, impacts would be minimal.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Some animals and birds could be temporarily displaced by construction of the MAX/PDCF facilities, but this would be small due to the areas existing partial development.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	Same as CUC.	Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biological diverse species mix.	Same as CNC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts.	Short-term impacts could occur during construction activities. Facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support	Same as CPC.	Short-term impacts could occur during construction activities. Facilities would be sited on previously disturbed land.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Reference location is in highly developed and previously disturbed area, therefore there would be no impacts to biological resources.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		biologically diverse species mix.					
Socioeconomics							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Employment at LANL is expected to continue to rise due to both increased pit production and increased remediation and D&D activities. If LANL's employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011.	<i>Greenfield CPC:</i> 850 workers during the peak year of construction. Total of 1,751 jobs. 1,780 operational workers, total of 3,667 jobs <i>Upgrade 125:</i> 300 workers during peak year of construction. Total of 618 jobs. 1,780 operational workers, total of 3,667 jobs. <i>50/80:</i> 190 workers during peak year of construction. Total of 391 jobs 680 operational workers, total of 1,401 jobs. Under all approaches there would be no appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,678 jobs. No appreciable changes to regional socioeconomic characteristics expected.	3,820 jobs during peak year of construction. Total 7,869 jobs. No appreciable changes to regional socioeconomic characteristics expected.	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	Employment at LANL is expected to continue to rise due to increased pit production.
LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a loss of approximately 610 jobs representing a decrease of 4.5 % of the workforce. The total loss of jobs in the economic area would be 1,260.							
NTS	Current level of NTS employment is expected to continue. Current and planned activities would continue as required resulting in no additional impacts.	850 workers during the peak year of construction. Total of 1,751 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,678 jobs. 935 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	525 jobs during peak year of construction. Total 1,025 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	NTS would be unaffected by the Capability-Based Alternative.
Pantex	Pantex is expected to continue present operations with an employment level of about 3,800 employees.	850 workers during the peak year of construction. Total of 1,579 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,414 jobs. 935 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	2,715 operational workers. Total of 5,319 jobs. No appreciable changes to regional socioeconomic characteristics expected. Y-12 could be closed, resulting in a loss of	Reduced operations would reduce the workforce from 1,644 to 1,230. This workforce, which currently represents approximately

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
						approximately 6,500 jobs.	1.6% of area employment, would fall to 1.2%. No major impact would occur.
SRS	The current level of employment at SRS is about 15,000, which is expected to be increased by the construction of the MOX/PDCF facilities which would add an additional 1,968 construction workers and once operational an additional 1,120 employees.	850 workers during the peak year of construction. Total of 1,460 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,233 jobs. 935 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	3,820 workers during the peak year of construction. Total of 6,561 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	Reduced operations would reduce the workforce by approximately 25 workers. This reduction would be inconsequential relative to the total site workforce.
Y-12	Y-12 is expected to continue present operations with an employment level of about 6,500 employees.	850 workers during the peak year of CPC construction. During operations, CPC would employ 1,780. No appreciable changes to regional socioeconomic characteristics expected.	Construction of UPF would require approximately 900 workers during the peak year of construction. During operations, UPF would employ 600. No appreciable changes to regional socioeconomic characteristics expected.	3,820 workers during the peak year of construction. Total of 19,864 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex could be closed, resulting in a loss of approximately 1,650 jobs.	Reduced operations would reduce the workforce from 6,500 to 3,900 workers. The loss of 2,600 direct jobs could result in the loss of up to 10,920 indirect jobs for a total of 13,520 jobs lost. This would represent 6.5 percent of the total ROI employment.
Environmental Justice							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Minority population: 57 percent within the census tracts containing LANL Low-Income population: 9.3 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CUC.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CNC.	Same as No Action Alternative.
NTS	Current and planned activities would continue as required	Minority population: 50 percent of ROI	Construction activities would not result in any	Same as CUC.	Operation activities would not result in any	Same as CNC.	NTS would be unaffected by the

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	resulting in no additional impacts.	Low-Income population: 11 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	disproportionately high or adverse effects on minority or low-income populations.		disproportionately high or adverse effects on minority or low-income populations.		Capability-Based Alternative.
Pantex	Current and planned activities would continue resulting in no disproportionate impacts to the 21% minority population or the 44,312 individuals living near the Pantex Plant identified as living below the Federal poverty level.	Minority population: 33.1 percent of ROI Low-Income population: 13 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Current activities and the construction and operation of the MOX/PDCF facilities are not expected to disproportionately impact the minority groups or 109,296 identified as living below the Federal poverty threshold living near SRS.	Minority population: 40.1 percent of ROI Low-Income population: 9 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CUC.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CNC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue resulting in no disproportionate impacts to the 7 % minority population or the 122,216 individuals living near Y-12 identified as living below the Federal poverty level.	Minority population: 11.1 percent of ROI Low-Income population: 12 percent of ROI Construction and operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CPC.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Health and Safety							
LANL	Current and planned activities would continue as required resulting in no additional impacts. SRS operations expected to cause total dose to the offsite MEI of 1.7	<i>Greenfield CPC:</i> Potential worker fatalities during construction: 0.6 <i>Upgrade:</i> 0.2 <i>50/80:</i> 0.1	Potential worker fatalities during construction: 0.9. Collective dose to population during operations: 0.376 person-	Potential fatalities during construction: 2.6. Collective dose to population during operations: 0.003 person-	Collective dose to population during operations: 0.376 person-rem; 2.3×10^{-4} LCFs. MEI dose: 0.046 mrem;	Collective dose to population during operations: 0.379 person-rem; 2.3×10^{-4} LCFs. MEI dose: 0.046 mrem;	Collective dose to population during operations: 2.5×10^{-8} person-rem ; 1×10^{-11} LCFs.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	mrem/yr. Worker dose from increased pit production at TA-55 would increase from 90 person-rem per year to 220 person-rem per year	<i>Greenfield CPC and Upgrade:</i> Collective dose to population during operations: 5.9×10^{-7} person-rem; 4×10^{-10} latent cancer fatalities (LCFs) MEI dose: 3.6×10^{-9} mrem; 2.2×10^{-15} LCFs annually. Worker dose: 333 person-rem; 0.20 LCFs annually. <i>50/80:</i> Collective dose to population during operations: 2.5×10^{-8} person-rem; 1×10^{-11} LCFs MEI dose: 3.0×10^{-9} mrem; 1.8×10^{-15} LCFs annually Worker dose: 154 person-rem; 0.09 LCFs annually.	rem; 2.3×10^{-4} LCFs annually MEI dose: 0.046 mrem; 2.8×10^{-8} LCFs annually Worker dose: 11 person-rem; 0.006 LCFs annually.	rem; 1.8×10^{-6} LCFs annually MEI dose: 3.52×10^{-4} mrem; 2.1×10^{-7} LCFs annually A/D/HE Center worker dose: 42 person-rem; 0.24 LCFs annually.	2.8×10^{-5} LCFs annually Worker dose: 344 person-rem; 0.21 LCFs annually.	2.86×10^{-5} LCFs annually Worker dose: 386 person-rem; 0.23 LCFs annually.	Worker dose from increased pit production at TA-55 would increase from 90 person-rem per year to 220 person-rem per year
<p>LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential health impacts to LANL employees and the population surrounding LANL. Radiation doses to workers would be expected to decrease by approximately 220 person-rem. Plutonium emissions would decrease by approximately 0.00084 Curies.</p>							
NTS	Current and planned activities would continue as required resulting in no additional impacts. NTS operations expected to produce MEI dose of approximately 0.2 mrem/yr.	Potential worker fatalities during construction: 0.7. Collective dose to population during operations: 2.7×10^{-8} person-rem; 2×10^{-11} LCFs. MEI dose: 1.6×10^{-9} mrem; 1×10^{-15} LCFs annually. Worker dose: 333 person-rem; 0.20 LCFs annually.	Potential worker fatalities during construction: 0.9. Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.80×10^{-6} LCFs. MEI dose: 4.06×10^{-3} mrem; 2.44×10^{-6} LCFs annually. Worker dose: 11 person-rem; 0.006 LCFs annually.	Potential worker fatalities during construction: 0.2. Collective dose to population during operations: 9.79×10^{-5} person-rem; 5.8×10^{-8} LCFs annually MEI dose: 3.12×10^{-5} mrem; 1.8×10^{-8} LCFs annually Worker dose: 42 person-rem; 0.24 LCFs annually.	Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.8×10^{-6} LCFs. MEI dose: 4.06×10^{-3} mrem; 2.5×10^{-9} LCFs annually. Worker dose: 344 person-rem; 0.21 LCFs annually.	Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.8×10^{-6} LCFs. MEI dose: 4.09×10^{-3} mrem; 2.5×10^{-9} LCFs annually. Worker dose: 386 person-rem; 0.23 LCFs annually.	NTS would be unaffected by the Capability-Based Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
Pantex	Current and planned activities would result in a dose to the MEI of 4.28×10^{-9} person-rem per year.	<p>Potential worker fatalities during construction: 0.7.</p> <p>Collective dose to population during operations: 1.2×10^7 person-rem; 7.2×10^{-11} LCFs.</p> <p>MEI dose: 1.7×10^{-8} mrem; 1×10^{-14} LCFs annually.</p> <p>Worker dose: 333 person-rem; 0.20 LCFs annually.</p>	<p>Potential worker fatalities during construction: 0.9</p> <p>Collective dose to population during operations: 0.138 person-rem; 8.3×10^{-5} LCFs.</p> <p>MEI dose: 0.019 mrem; 1.1×10^{-8} LCFs annually.</p> <p>Worker dose: 11 person-rem; 0.006 LCFs annually.</p>	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	<p>Collective dose to population during operations: 0.138 person-rem; 8.3×10^{-5} LCFs;</p> <p>MEI dose: 0.019 mrem; 1.1×10^{-8} LCFs annually.</p> <p>Worker dose: 386 person-rem; 0.23 LCFs annually.</p>	Reduced operations would reduce the number of workers involved in radiological operations from approximately 334 to 250. Total worker dose reduced from 44.1 person-rem to 33 person-rem. Statistically, LCFs would be reduced from 2.6×10^{-2} to 2.0×10^{-2} .
SRS	Current dose to the MEI from SRS operations is approximately 0.05 mrem/yr. Operation of the MOX/PDCF facilities is expected to add less than 1.8 person-rem to the 50 mile population surrounding SRS.	<p>Potential worker fatalities during construction: 0.7.</p> <p>Collective dose to population during operations: 5.9×10^7 person-rem; 4×10^{-10} LCFs.</p> <p>MEI dose: 3.6×10^{-9} mrem; 2.2×10^{-12} LCFs annually</p> <p>Worker dose: 333 person-rem; 0.20 LCFs annually.</p>	<p>Potential worker fatalities during construction: 0.9.</p> <p>Collective dose to population during operations: 0.138 person-rem; 8.3×10^{-5} LCFs.</p> <p>MEI dose: 3.36×10^{-3} mrem; 2.02×10^{-6} LCFs annually.</p> <p>Worker dose: 11 person-rem; 0.006 LCFs annually.</p>	<p>Potential worker fatalities during construction: 2.6.</p> <p>Collective dose to population during operations: 3.19×10^{-3} person-rem; 1.9×10^{-6} LCFs.</p> <p>MEI dose: 2.52×10^{-5} mrem; 1.5×10^{-8} LCFs annually.</p> <p>Worker dose: 42 person-rem; 0.24 LCFs annually.</p>	<p>Collective dose to population during operations: 0.426 person-rem; 2.6×10^{-4} LCFs.</p> <p>MEI dose: 3.36×10^{-3} mrem; 2.02×10^{-6} LCFs annually.</p> <p>Worker dose: 344 person-rem; 0.21 LCFs annually</p>	<p>Collective dose to population during operations: 0.429 person-rem; 2.6×10^{-4} LCFs .</p> <p>MEI dose: 3.39×10^{-3} mrem; 2.1×10^{-6} LCFs annually</p> <p>Worker dose: 386 person-rem; 0.23 LCFs annually.</p>	Reduced tritium operations would reduce the total tritium worker dose from 4.1 person-rem to 3.1 person-rem. Statistically, the number of LCFs would be reduced from 2.5×10^{-3} to 1.9×10^{-3} .
Y-12	Current and planned activities are expected to result in a dose to the MEI of about 0.4 mrem/yr.	<p>Potential worker fatalities during construction of CPC: 0.6</p> <p>Collective dose to population during CPC operations: 1.2×10^7 person-rem; 7.2×10^{-11} LCFs.</p> <p>MEI dose: 1.7×10^{-8} mrem; 1×10^{-11} LCFs annually.</p>	<p>Potential worker fatalities during construction of UPF: 0.7.</p> <p>Collective dose to population during UPF operations: 10.8 person-rem; 6.5×10^{-3} LCFs.</p> <p>MEI dose: 0.8 mrem; 4.8×10^{-4} LCFs annually.</p>	<p>Potential worker fatalities during construction: 0.2.</p> <p>Collective dose to population during A/D/HE Center operations: 0.032 person-rem; 1.9×10^{-5} LCFs.</p> <p>MEI dose: 3.75×10^{-3} mrem; 2.25×10^{-6} LCFs annually</p>	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	<p>Collective dose to population during operations: 10.8 person-rem ; 6.5×10^{-3} LCFs.</p> <p>MEI dose: 0.8 mrem; 4.8×10^{-4} LCFs annually.</p> <p>Worker dose: 386 person-rem; 0.23 LCFs annually.</p>	Reduced operations would reduce the number of workers involved in radiological operation from approximately 839 to 500, reducing the total worker dose from 32. person-rem to 19.1 person-rem. Statistically, the number of LCFs

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		Worker dose: 333 person-rem; 0.20 LCFs annually.	UPF worker dose: 12.6 person-rem; 0.008 LCFs annually.	Worker dose: 42 person-rem; 0.24 LCFs annually.			would be reduced from 1.9×10^{-2} to 1.1×10^{-2} .
Facility Accidents							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Under all alternatives analyzed in the LANL SWEIS, the facility accident with the highest radiological risk to the offsite population would be a lightning strike fire at the Radioassay and Nondestructive Testing Facility located in TA-54. If this accident were to occur, there could be 6 additional LCFs in the offsite population.	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 26 LCFs in the offsite population could result from such an accident. Offsite maximally exposed individual (MEI) would receive a dose of 87.5 rem. Statistically, MEI would have 1 chance in 19 of LCF. When probabilities are taken into account, the accident with the highest risk is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately 9×10^{-4} , or approximately 1 in 1,000. For the population, the LCF risk would be 0.19, or approximately 1 in 5.	Accident with the highest consequences to the offsite population is the fire in the EU warehouse. Approximately 0.06 LCFs in the offsite population could result from such an accident. Offsite MEI individual would receive a maximum dose of 0.926 rem. Statistically, MEI would have 1 chance in 1,800 of LCF. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 6×10^{-7} , or less than one in a million. For the population, the LCF risk would be 7.2×10^{-5} , or approximately 1 in 10,000.	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 3 LCFs in the offsite population could result from such an accident. Offsite MEI would receive a dose of 73.8 rem. Statistically, this MEI would have 1 chance in 23 of an LCF. When probabilities are taken into account for this accident, the LCF risk to the MEI would be approximately 9×10^{-6} , or approximately 1 in 100,000. For the population, the LCF risk would be 3×10^{-4} , meaning that an LCF would statistically occur once every 3,000 years in the population.	See CPC and CUC	See CPC and CUC and A/D/HE	Same as No Action Alternative.
<p>LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential accident impacts to LANL employees and the population surrounding LANL.</p>							
NTS	Current and planned activities would continue as required resulting in no additional impacts. The maximum reasonably foreseeable accident at the NTS would be	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 0.5 LCFs in the offsite population	Accident with the highest consequences to the offsite population could result	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal	See CPC and CUC.	See CPC and CUC and A/D/HE.	NTS would be unaffected by the Capability-Based Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	a non-nuclear explosion involving high explosives in a storage bunker, which has a probability of occurrence of 1 in 10,000,000. The following consequences are estimated if such an accident occurs: MEI dose of 34 rem, which would result in a 0.02 probability of an LCF; population dose of 5,800 to 110,000 person-rem, which would result in 3-55 LCFs.	could result from such an accident. An offsite MEI would receive a dose of approximately 2 rem. Statistically, the MEI would have a 0.001 chance of developing a LCF (i.e., about 1 chance in 1,000 of an LCF). When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 6×10^{-6} , or approximately 1 in 150,000. For the population, the LCF risk would be approximately 2×10^{-3} , meaning that an LCF would statistically occur once every 400 years in the population.	from such an accident. An offsite MEI would receive a maximum dose of 0.0037 rem. Statistically, the LCF risk to the MEI would be approximately 2×10^{-6} , or about 1 in half a million. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 2×10^{-9} , or about 1 in half a billion. For the population, the LCF risk would be approximately 9×10^{-7} , or about 1 in a million.	event. Approximately 0.06 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 0.29 rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF (i.e., about 1 chance in 57,000 of an LCF). When probabilities are taken into account for this accident, the LCF risk to the MEI would be approximately 2×10^{-8} , or less than 1 chance in a million. For the population, the LCF risk would be approximately 7×10^{-6} , or approximately once every 150,000 years.			
Pantex	Current and planned activities would continue as required resulting in no additional impacts. Potential accident scenarios and impacts for the No Action Alternative would be the same as presented in the A/D/HE facility column.	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 5.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 23.1 rem. Statistically, the MEI would have a 0.01 chance of developing a LCF (i.e., about 1 chance in 100 of an LCF). When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately	Accident with the highest consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.02 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.07 rem. Statistically, this MEI would have a 0.00004 chance of developing a LCF, or about 1 in 25,000. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 0.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 3.6 rem. Statistically, this MEI would have a 0.002 chance of developing a LCF (i.e., about 1 chance in 500 of an LCF). When probabilities are taken into account for this accident, the LCF risk to	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	See CPC and CUC and A/D/HE.	Planned activities would continue as required to support smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		8x10 ⁻⁵ , or approximately one in 10,000. For the population, the LCF risk would be 3x10 ⁻² , meaning that an LCF would statistically occur once every 31 years in the population.	LCF risk to the MEI would be approximately 3x10 ⁻⁸ , or approximately 1 in 33 million. For the population, the LCF risk would be 1x10 ⁻⁵ , or approximately 1 in 100,000.	the MEI would be 2x10 ⁻⁷ , or approximately 1 in 5 million. For the population, the LCF risk would be approximately 9x10 ⁻⁵ , or approximately 1 in 10,000. Note: the accidents described above are for the existing A/D/HE mission. No A/D/HE Center is proposed at Pantex because Pantex currently conducts this mission.			
SRS	Current and planned activities would continue as required resulting in no additional impacts. The bounding accident at SRS, which is associated with the plutonium disposition program, would cause an MEI dose of approximately 8.8 rem. The maximum population dose was 21,000 rem, which would equate to approximately 12.6 LCFs.	<p>Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 10.5 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of approximately 3 rem. Statistically, the MEI would have a 0.002 chance of developing a LCF, or about 1 in 500.</p> <p>When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 1x0⁻⁵, or approximately 1 in 100,000. For the population, the LCF risk would be approximately 6x10⁻², meaning that an LCF would statistically occur once every 18 years in the population.</p>	<p>Accident with the highest consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.03 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.01 rem. Statistically, this MEI would have a 7x10⁻⁶ chance of developing a LCF, or about 1 in 150,000.</p> <p>When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 4x10⁻⁹, or approximately 1 in 250 million. For the population, the LCF risk would be 2x10⁻⁵, or approximately 1 in 50,000.</p>	<p>Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 1.49 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 0.5 rem. Statistically, this MEI would have a 0.0003 chance of developing a LCF, or about 1 in 3,300.</p> <p>When probabilities are taken into account for this accident, the LCF risk to the MEI would be 3x10⁻⁸, or approximately 1 in 33 million. For the population, the LCF risk would be 1x10⁻⁴, or approximately 1 in 6,500.</p>	See CPC and CUC	See CPC and CUC and A/D/HE	Planned activities would continue as required to support smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
Y-12	Current and planned activities would continue as required resulting in no additional impacts. Potential accident scenarios and impacts for the No Action Alternative would be the same as presented in the UPF facility column.	<p>Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 177 LCFs in the offsite population could result from this accident. An offsite MEI would receive a dose of 219 rem. Statistically, the MEI would have a 0.1 chance of developing a LCF, or about 1 in 10.</p> <p>When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 2×10^{-3}, or approximately 1 in 500. For the population, the LCF risk would be 1.07, meaning that approximately 1 LCF would statistically occur once every year in the population.</p>	<p>Accident with the highest consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF, or about 1 in 5,000.</p> <p>When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 5×10^{-7}, or about 1 in 2 million. For the population, the LCF risk would be 4×10^{-4}, or about 1 in 2,500.</p> <p>Note: the accidents described above are for the UPF. No CUC is proposed at Y-12 because Y-12 currently conducts this mission.</p>	<p>Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 28.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 55 rem. Statistically, this MEI would have a 0.03 chance of developing a LCF, or about 1 in 30.</p> <p>When probabilities are taken into account for this accident, the LCF risk to the MEI would be 7×10^{-6}, or about 1 in 150,000. For the population, the LCF risk would be 3×10^{-3}, or about 1 in 350.</p>	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	See CPC and UPF and A/D/HE	Planned activities would continue as required to support smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.
Waste Management							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	<p>Construction (Greenfield/Upgrade/50/80 Upgrade) TRU solid (yd³): 0/200/0 LLW solid (yd³): 0/200/0</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,900 Mixed TRU solid (yd³): 0 Hazardous (tons): 0</p>		<p>TRU solid (yd³): 850 LLW liquid (gal): 8,925 LLW solid (yd³): 11,640 Mixed LLW liquid (gal): 3,622.4</p>	Same a No Action Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	<p>Wastes in 2005 were as follows:</p> <p>LLW (yd³): 7,080 Mixed LLW (yd³): 90 TRU Waste(yd³): 100 Mixed TRU(yd³): 130 Hazardous (lbs.): 43,400</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all regulatory requirements.</p>	<p>Hazardous liquid (gal): 6.5/4/4</p> <p>Operation (Greenfield/Upgrade/50/80 Upgrade) TRU solid (yd³): 850/850/575 Mixed TRU(yd³):310/310/2.6 LLW solid (yd³): 3,500/3,500/1,850 LLW liq (yd³): 0/0/19.5 Non-hazardous solid (tons): 3.6/3.6/265 Non-hazardous liquid (gal): 69,500/69,500/16,000</p>	<p>Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (yd³):3,515 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous solid (tons): 15 Hazardous liquid (gal): 0 Non-hazardous solid (yd³): 7,500 Non-hazardous liquid (gal): 50,000</p>	<p>Non-hazardous solid (tons): 7,100 Non-hazardous liquid (gal): 40,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (yd³): 1,350 Hazardous waste liquid (gal): 8,850 Non-hazardous Solid Waste (yd³): 15,000 Non-hazardous Liquid Waste (gal):46,000</p>		<p>Mixed LLW solid (yd³): 72.3 Mixed TRU solid (yd³): 310 Hazardous solid (tons): 1,368.6 Hazardous liquid (gal): 8,850.5 Non-hazardous solid (tons): 29,900 Non-hazardous liquid (gal): 165,500</p>	
NTS	<p>Current and planned activities would continue as required resulting in no additional impacts.</p> <p>Wastes from 2001</p> <p>LLW (yd³): 0 Hazardous (tons): 4.86 Sanitary (tons): 4,550</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all regulatory requirements.</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous (tons): 7 Non-hazardous solid (yd³): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operation TRU solid (yd³): 950 LLW liquid (gal): 0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6 Non-hazardous solid (yd³): 8,100 Non-hazardous liquid (gal): 75,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (gal):3,515 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous solid (tons): 15 Hazardous liquid (tons): 0 Non-hazardous solid (yd³): 7,500 Non-hazardous liquid (gal): 50,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,000 Mixed TRU solid (yd³): 0 Hazardous (tons): 0 Non-hazardous solid (yd³): 6,400 Non-hazardous liquid (gal): 40,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd³): 12,000 Non-hazardous Liquid Waste (gal):46,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):3,515 LLW solid (yd³): 12,000 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 15,600 Non-hazardous liquid (tons): 125,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):8,925 LLW solid (yd³): 12,640 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19.9 Hazardous liquid (ton): 6.5 Non-hazardous solid (yd³): 27,600 Non-hazardous liquid (gal): 171,000</p>	NTS would be unaffected by the Capability-Based Alternative.

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
Pantex	<p>The following existing levels of waste generation would be expected to continue:</p> <p>Wastes from 2005</p> <p>LLW (yd³): 96.8 Mixed LLW (yd³): 1.8 Hazardous (yd³): 711 Non-hazardous (yd³): 6,375 Sanitary (yd³): 944.9 TSCA (yd³): 2,036 Universal (yd³): 31</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all regulatory requirements.</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous waste (tons): 7 Non-hazardous solid (yd³): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operation TRU solid (yd³): 950 LLW liquid (yd³): 0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6 Non-hazardous solid (tons): 8,100 Non-hazardous liquid (gal): 75,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (gal):3,615 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,620 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous solid (tons): 15 Hazardous liquid (tons): 0 Non-hazardous solid (tons): 7,500 Non-hazardous liquid (yd³): 50,000</p>	<p>No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.</p>	<p>Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):3,615 LLW solid (yd³): 12,000 Mixed LLW liquid (gal): 3,620 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (tons): 0.6 Nonhazardous solid (yd³): 15,600 Nonhazardous liquid (gal): 125,000</p>	<p>Current and planned activities would continue as required to support smaller stockpile requirements.</p> <p>LLW (yd³): 73 Mixed LLW (yd³): 1.4 Hazardous (yd³): 530 Non-hazardous (yd³): 4,800 No major impacts are expected.</p>
	SRS	<p>Existing levels of waste generation of:</p> <p>Wastes from 2001</p> <p>TRU (yd³): 64.1 LLW (yd³): 4,610 Mixed TRU (yd³): 380 Hazardous (yd³): 45.3 Sanitary (yd³): 1,560</p> <p>And are expected to be increased by the construction of the MOX/PDCf facilities which are expected to add:</p> <p>TRU (yd³): 500 LLW (yd³): 270 Mixed (yd³): 6.5</p> <p>Existing waste management facilities are more than adequate to manage these</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous (tons): 7 Non-hazardous solid (yd³): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operation TRU solid (yd³): 950 LLW liquid (yd³): 0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6 Non-hazardous solid (yd³): 8,100 Non-hazardous liquid (gal): 75,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU Solid Waste (yd³): 0 Low Level Liquid Waste (gal): 3,515 Low Level Solid Waste (yd³): 8,100 Mixed Low Level Liquid Waste (gal): 3,616 Mixed Low Level Solid Waste (yd³): 70 Mixed TRU Solid Waste (yd³): 0 Hazardous waste solid (tons): 15 Hazardous waste liquid (tons): 0</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,000 Mixed TRU solid (yd³): 0 Hazardous (tons): 0 Non-hazardous solid (tons): 6,400 Non-hazardous liquid (gal): 40,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd³): 12,000 Non-hazardous Liquid</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):3,515 LLW solid (yd³): 12,000 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (tons): 0.6 Nonhazardous solid (tons): 15,600 Nonhazardous liquid (gal): 125,000</p>	<p>TRU solid (yd³): 950 LLW liquid (yd³):8,925 LLW solid (yd³): 12,040 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19.9 Hazardous liquid (tons): 6.5 Nonhazardous solid (yd³): 27,600 Nonhazardous liquid (gal): 171,000</p>

Table S.3.16-1 — Comparison of Environmental Impacts among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY-BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	wastes in compliance with all regulatory requirements.		Non-Hazardous Solid Waste (yd ³): 7,500 Non-Hazardous Liquid Waste (gal) : 50,000	Waste (gal):46,000			
Y-12	<p>Wastes generated in 2003: LLW liquid (yd³): 17.4 LLW solid (yd³): 7,800 Mixed LLW liquid (yd³): 17.9 Mixed LLW solid (yd³): 21.1</p> <p>Existing waste management facilities are more than adequate to manage these wastes in compliance with all regulatory requirements</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous (tons): 7 Non-hazardous solid (tons): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operations TRU solid (yd³): 950 LLW liquid (yd³):0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 8,100 Non-hazardous liquid (gal): 75,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed LLW solid (yd³): 4 Hazardous (tons): 4 Non-hazardous solid (yd³): 800 Non-hazardous liquid (gal): 0</p> <p>Operations TRU solid (yd³): 0 LLW liquid (gal):3,515 LLW solid (yd³): 7,800 Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd³): 21 Mixed TRU solid (yd³):0 Hazardous solid (tons): 14 Hazardous liquid (gal): 0 Non-hazardous solid (tons): 7,125 Non-hazardous liquid (gal): 50,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,900 Mixed TRU solid (yd³): 0 Hazardous (tons): 0 Non-hazardous solid (yd³): 7,100 Non-hazardous liquid (gal): 45,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd³): 12,000 Non-hazardous Liquid Waste (gal):46,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal): 3,515 LLW solid (yd³): 11,700 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 15,600 Non-hazardous liquid (gal): 125,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal): 8,925 LLW solid (yd³): 11,740 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd³): 23.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 18.9 Hazardous liquid (tons): 6.5 Non-hazardous solid (yd³): 27,225 Non-hazardous liquid (gal): 171,000</p>	<p>LLW liquid (yd³): 10.4 LLW solid (yd³): 4,700 Mixed LLW liquid (yd³): 10.7 Mixed LLW solid (yd³): 12.7</p>

Table S.3.16-2 — Summary of Impact Comparison of SNM Consolidation: Transfer SNM from LLNL

Resource	No Action Alternative	Remove Category I/II SNM from LLNL (Includes the impacts of phasing out Category I/II SNM operations from LLNL Superblock)
Land	No land issues	No land impacts or issues
Noise	No noise impacts	No change
Air Quality	No changes to air quality	<ul style="list-style-type: none"> • no emissions of radionuclides to air from Superblock; therefore, phasing out this facility would have no effect on radiological air quality • no non-radiological changes expected
Socioeconomic	No change	<ul style="list-style-type: none"> • if Superblock operated as Category III SNM facility: minor impacts to facility employment associated with security force reductions • if Superblock closed and undergoes D&D: employment would be expected to increase because of the D&D work, but would likely not be significant, and would be offset by the transfer of some personnel to LANL.
Transportation	No change. LLNL is authorized to transport approximately 584 shipments annually.	<ul style="list-style-type: none"> • less than 19 shipments of radiological material expected • population dose for all shipments: < 3 person-rem • LCF risk: <0.01
Human Health	There are no emissions of radionuclides from Superblock.	<ul style="list-style-type: none"> • phasing out Category I/II SNM operations from Superblock would have no effect on population doses to the surrounding population. • material-at-risk limit for Superblock reduced by 60%; • bounding accident source term for Superblock reduced by 60% • Superblock accident consequences reduced from 1.3 LCFs to 0.52
Waste Management	Small quantities of hazardous, and liquid and solid non-hazardous wastes	<ul style="list-style-type: none"> • if Superblock operated as Category III SNM facility: wastes would drop to 10% of current quantities (to 10 TRU waste drums per year and 40 LLW drums per year) • if Superblock closed and undergoes D&D: waste would increase in short-term; for bounding case, wastes could double to 200 TRU waste drums and 800 LLW drums for per year for several years

Table S.3.16-3 — Summary of Impact Comparison of SNM Consolidation: Transfer SNM from Pantex Zone 4 to Zone 12

Resource	No Action Alternative	Move Pu Storage from Zone 4 to Newly Constructed Underground Pu Storage Facility in Zone 12 at Pantex
Land	No land issues	Would disturb 57 acres of brown-field land for construction; 11 acres utilized once operational
Noise	No noise impacts	Minor increase in noise during construction of new 456,000 sq. ft. underground storage facility
Water	Water use limited to personal consumption of employees	Would require an additional 2,950,000 gallons of water for five-year construction period
Air Quality	No impacts to air from SNM storage	Minor fugitive dust emissions during construction of new underground storage facility
Socioeconomics	Currently employs 40 workers	No change
Transportation	No impacts	No impacts, all transportation on-site
Human Health	Average dose of 12 mrem to 10 radiological workers	Movement of material would entail an additional total dose of 1,100 person-rem, which would statistically translate into approximately 0.657 LCFs
Waste Management	No waste generation	Once material moved D&D of old facility would be expected to generate <ul style="list-style-type: none"> • 12,000 yd³ of solid waste • 700 yd³ of LLW

Table S.3.16-4 — Summary of Impact Comparison of Tritium R&D Alternatives

Resource	No Action	SRS Consolidation	LANL Consolidation	Downsize-in-Place
Land	Continue operations at LLNL, LANL, and SRS	No new land disturbed	No new land disturbed	No new land disturbed
Noise	Continue operations at LLNL, LANL, and SRS	No change	No change*	No change
Air Quality	Continue operations at LLNL, LANL, and SRS No change	<ul style="list-style-type: none"> • SRS tritium emissions increase by 1,000 Curies (2.4% increase over current tritium emissions) • LANL tritium emissions decrease by 1,000 Curies (42% decrease compared to current tritium emissions) • No change to non-radiological emissions 	No change*	No change
Socioeconomic	Continue operations at LLNL, LANL, and SRS No change	<ul style="list-style-type: none"> • 25 jobs restructured at LANL • 25 new jobs would be created at SRS 	No change*	No change
Human Health	Continue operations at LLNL, LANL, and SRS	<ul style="list-style-type: none"> • Average exposure to worker from tritium R&D would be approximately 4.3 mrem • Total worker dose: 0.11 person-rem • Worker LCF risk: 6.6×10^{-5} • MEI dose at SRS: increase by 0.0008 mrem/year; • 50-mile population dose: increase 0.041 person-rem. • LANL decreases would be similarly small 	No change*	No change
Waste Management	Continue operations at LLNL, LANL, and SRS	Wastes would change by less than 1%	No change*	No change

* Consolidation to LANL includes LLNL tritium R&D activities, which amount to one glovebox system.

Table S.3.16-5 — Summary of Impact Comparison of Major HE R&D Alternatives

Resource	No Action	Consolidate HE R&D to LANL	Consolidate HE R&D to LLNL	Consolidate HE R&D to Pantex	Consolidate HE R&D to SNL/NM	Consolidate HE R&D to NTS
Donor Sites	Not Applicable	SNL/NM, LLNL, Pantex	SNL/NM, LANL, Pantex	SNL/NM, LLNL, LANL	Pantex, LLNL, LANL	SNL/NM, LLNL, Pantex, LANL
Land	Continue operations at LANL, LLNL, SNL/NM, Pantex	5 acres disturbed at LANL in vicinity of the Two-Mile Mesa Complex (includes portions of TA-6, TA-22, and TA-40)	8-10 acres disturbed on main LLNL site near the HEAF	5.7 acres disturbed in vicinity of Zone 11 and Zone 12	13.5 acres disturbed in Technical Areas 2 or 3	15 acres disturbed in vicinity of the BEEF
Noise	Continue operations at LANL, LLNL, SNL/NM, Pantex	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	None detectable outside of HEAF.	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted
Air Quality	Continue operations at LANL, LLNL, SNL/NM, Pantex	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.
Socioeconomic	Continue operations at LANL, LLNL, SNL/NM, Pantex	<ul style="list-style-type: none"> • 125 peak construction jobs; • LANL: +300 jobs • LLNL: -175 jobs • SNL/NM: -45 jobs • Pantex: none 	<ul style="list-style-type: none"> • 150 peak construction jobs; • LLNL: +300 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • Pantex: none 	<ul style="list-style-type: none"> • 210 peak construction jobs; • Pantex: +160 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • LLNL: -175 jobs 	<ul style="list-style-type: none"> • 220 peak construction jobs; • SNL/NM: +325 jobs • LANL: -150 jobs • LLNL: -175 jobs • Pantex: -10 jobs 	<ul style="list-style-type: none"> • 250-300 peak construction jobs; • NTS: +250 jobs • LLNL: -175 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • Pantex: none

Table S.3.16-5 — Summary of Impact Comparison of Major HE R&D Alternatives (continued)

Resource	No Action	Consolidate HE R&D to LANL	Consolidate HE R&D to LLNL	Consolidate HE R&D to Pantex	Consolidate HE R&D to SNL/NM	Consolidate HE R&D to NTS
Human Health	Continue operations at LANL, LLNL, SNL/NM, Pantex	No change				
Waste Management	Continue operations at LANL, LLNL, SNL/NM, Pantex	Construction solid waste: 4,930 cubic yards. Operational wastes minimal.	Construction solid waste: 6,200 cubic yards. Operational wastes minimal.	Construction solid waste: 1,550 cubic yards. Operational wastes minimal.	Construction solid waste: 7,440 cubic yards. Operational wastes minimal.	Construction solid waste: 4,650 cubic yards. Operational wastes minimal.

Table S.3.16-6 — Summary of Impact Comparison of Flight Testing Alternatives

Resource	No Action Alternative	Mobile Upgrade Alternative	Campaign Mode at TTR Alternative	Move to NTS Alternative	Move to WSMR Alternative
Impacts to Land	No land issues	No land impacts or issues	Same as No Action	Disturb less than 2 acres at NTS Free up 3,047 acres at Tonopah	Disturb less than 2 acres at WSMR Free up 3,047 acres at Tonopah
Noise Impacts	No noise impacts to public	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Impact on Air Quality	No impacts to air	Same as No Action	Same as No Action	Temporary PM-10 emissions during Construction	Temporary PM-10 emissions during Construction
Socioeconomic Impacts	Currently employs 135 at Tonopah	No impact to jobs	Loss of 92 jobs at Tonopah	Loss of 135 at Tonopah and gain of 135 at NTS	Loss of 135 at Tonopah and gain of 135 at WSMR
Human Health Impacts	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)
Waste Management Impacts	Small quantities of hazardous and liquid and solid non-hazardous	Same as No Action	Same as No Action	Same as No Action	Same as No Action

Note 1: Some Flight Test operations utilize depleted uranium in the Join Test Assembly. There is no explosive event and the depleted uranium is contained within the weapon case. Following each flight test, the depleted uranium is removed.

Table S.3.16-7 — Summary of Impact Comparison of Hydrodynamic Testing Alternatives

Resource	No Action Alternative	Downsize in Place Alternative	Consolidate at LANL Alternative	Consolidate at NTS Alternative
Impacts to Land	No land issues	Would not require additional land	Require 5-7 acres additional land	Require 17 acres additional land
Noise Impacts	Limited to workers at facilities	Limited to workers at closure and facility sites	Limited to workers at closure construction and work sites	Limited to workers at closure construction and work sites
Impact on Air Quality	Less than 100 pounds of NOX and CO emissions/year from DARHT & CFF	Same as No Action	Construction PM-10 Emissions	Construction PM-10 Emissions
Socioeconomic Impacts	None as facilities do not employ but are used and managed by other programs	Closure employment of 313 man years	Closure employment of 508 man-years Construction employment of 60 man-years	Closure employment of 508 man-years Construction employment of 175 man-years
Human Health Impacts	No human health issues	No impacts	No impacts	No impacts
Waste Management Impacts	Small quantities of hazardous waste generated by DARHT and CFF	Additional waste from facility closures	Additional waste from facility closures	Additional waste from facility closures

Table S.3.16-8 — Summary of Impact Comparison of Major Environmental Test Facilities Alternatives

Resource	No Action Alternative	Consolidate in Place Alternative	Move All ETF to NTS	Move all ETF to SNL/NM
Impacts to Land	Currently has 500,708 sq ft of floor space at four sites	Reduce building floor space by 62,777 sq ft	Reduce building floor space by 546,385 sq ft but require 23.5 acres of land at NTS	Reduce building floor space by 159,268 sq ft but require 2.5 acres of land at SNL/NM
Noise Impacts	Limited to workers at work sites	Limited to workers at closure and work sites	Limited to workers at closure construction and work sites	Limited to workers at closure construction and work sites
Transportation	No transportation issues	No transportation issues	Closure D&D could cause traffic congest at LANL and Sandia	Closure D&D could cause traffic congestion at LANL
Impact on Air Quality	Small emissions from Bldg 836 at LLNL	Same as no action alternative	PM-10 issues during Construction	PM-10 issues during Construction
Socioeconomic Impacts	Currently employs 29 at LANL 6 at LLNL 224 at SNL/NM	Jobs Lost: 6 at LLNL 16 at SNL/NM	Jobs Lost: 29 at LANL 6 at LLNL 224 at SNL/NM	Jobs Lost: 29 at LANL 6 at LLNL 16 at SNL/NM
Human Health Impacts	No human health issues	Same as no action alternative	Same as no action alternative	Same as no action alternative
Waste Management Impacts	Small waste generation from DAF and SNL/NM	Additional waste from facility closures	Additional waste from facility closures	Additional waste from facility closures

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ABSTRACT: The National Nuclear Security Administration (NNSA), an agency within the Department of Energy, has the responsibility to maintain the safety, security, and reliability of the United States' nuclear weapons stockpile. This Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) analyzes the potential environmental impacts of reasonable alternatives to continue transformation of the nuclear weapons complex to be smaller, and more responsive, efficient, and secure in order to meet national security requirements. The current Complex consists of sites located in seven states (California, Missouri, Nevada, New Mexico, South Carolina, Tennessee, and Texas). This SPEIS evaluates alternatives that would restructure special nuclear materials manufacturing and research and development facilities; consolidate special nuclear materials throughout the Complex; consolidate, relocate, or eliminate duplicative facilities and programs and improve operating efficiencies; and identify one or more sites for conducting NNSA flight test operations.

COOPERATING AGENCIES: The Department of the Air Force and the U.S. Army Garrison White Sands are cooperating agencies in the preparation of this Complex Transformation SPEIS.

PUBLIC COMMENTS: A 90-day comment period on this document begins with the publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register*. NNSA will consider comments received after the 90-day period to the extent practicable. NNSA will hold public hearings to receive comments on this document at the times and locations announced in local media and the DOE Notice of Availability. Written comments may also be submitted by U.S. mail to Mr. Theodore A. Wyka at the above address or by email to complextransformation@nnsa.doe.gov. This document and related information are available on the Internet at www.ComplexTransformationSPEIS.com.

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ACRONYMS AND ABBREVIATIONS

A/D	Assembly/Disassembly
A/D/HE	Assembly/Disassembly/High Explosives
AC and MC	Analytical Chemistry and Materials Characterization
ACE	Altamont Commuter Express
ACHP	Advisory Council on Historic Preservation
ACRR	Annular Core Research Reactor
AEC	Atomic Energy Commission
AFB	Air Force Base
AF&F	Arming, Fuzing, and Firing
ALARA	as low as reasonably achievable
ALCM	Air-Launch Cruise Missile
ALOHA	Aerial Location of Hazardous Atmospheres
AQCR	Air Quality Control Region
ARF	airborne release fraction
ASER	annual site environmental report
ATEC	U.S. Army Test Evaluation Command
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
BACMs	Best Available Control Measures
BEA	Bureau of Economic Analysis
BEEF	Big Explosives Experimental Facility
BEIR	Biological Effects of Ionizing Radiation
Bison-m	Biota Information System of New Mexico
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMAP	Biological Monitoring and Abatement Program
BMPs	Best Management Practices
BNM	Bandelier National Monument
CA	Composite Analysis
CAA	<i>Clean Air Act</i>
CAIRS	Computerized Accident/Incident Reporting System
CAMU	corrective action management unit
CASSC	California Species of Special Concern
CAUs	Corrective Action Units
CD-0	critical decision on mission need
CEQ	Council on Environmental Quality
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFF	Contained Firing Facility
CFR	Code of Federal Regulations
CGTO	Consolidated Group of Tribes and Organizations
CHS	Center for Homeland Security
CIF	Consolidated Incineration Facility

CMR	Chemistry and Metallurgy Research
CMRR	Chemistry and Metallurgy Research Building Replacement Project
CNC	Consolidated Nuclear Center
CNPC	Consolidated Nuclear Production Center
CNPS	California Native Plant Society
Complex	nuclear weapons complex
Complex Transformation SPEIS	Complex Transformation Supplemental Programmatic Environmental Impact Statement
COPCs	contaminants of potential concern
CPC	Consolidated Plutonium Center
CRT	Cargo Restraint Transporter
CSAs	Canned Subassemblies
CUC	Consolidated Uranium Center
CWA	<i>Clean Water Act</i>
CWL	chemical waste landfill
CY	calendar year
D&D	Decontamination and Decommissioning
DA	design agency
DAF	Device Assembly Facility
DARHT	Dual Axis Radiographic Hydrodynamic Test
dB	decibel
dBA	A-weighted decibels
DAF	Device Assembly Facility
DCE	Distributed Centers of Excellence
DCGs	Derived Concentration Guidelines
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DP	Defense Programs
DPE	data processing equipment
DR	damage ratio
DTC	Developmental Test Command
DTRA	Defense Threat Reduction Agency
DTSC	Department of Toxic Substances Control
DU	Depleted Uranium
DWPF	Defense Waste Processing Facility
DWTF	Decontamination and Waste Treatment Facility
DX	Dynamic Experimentation
EA	Environmental Assessment
ECF	Entry Control Facility
EDE	effective dose equivalent
EE	Energy Efficiency and Renewable Energy
EFPC	East Fork Poplar Creek

EH	Office of Environment, Safety and Health
EIS	Environmental Impact Statement
EM	Environmental Management
EMAC	Ecological Monitoring and Compliance Program
EOA	expanded operations alternative
EODU	Explosive Ordnance Disposal Unit
EOL	End-of-Life
EOS	Equation of state
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERPG	Emergency Response Planning Guideline
ESL	Effects Screening Level
ETB	Engineering Test Bay
ETF	Environmental Test Facility
ETTP	East Tennessee Technology Park
EU	enriched uranium
EWTF	Explosives Waste Treatment Facility
FBI	Federal Bureau of Investigation
FE	facilities engineering
FGZ	fine-grain zone
FLAME	Fire Laboratory for Accreditation of Models and Experiments
FM	Farm-to-Market Road
FMD	Fissile Materials Disposition
FONSI	Finding of No Significant Impact
FPPA	<i>Farmland Protection Policy Act</i>
FTE	Full Time Employee
FWHM	Full Width at Half Maximum
FXR	Flash X-Ray
GCD	Greater Confinement Disposal
GIF	Gamma Irradiation Facility
GPD	gallons per day
GPS	Global Positioning System
GSA	General Services Area
GTS	Gas Transfer System
GWPP	groundwater protection program
HAN	hydroxylamine nitrate
HANDSS-55	“handling and segregation system for 55-gallon drums”
HANMF	H-Area New Manufacturing Facility
HAPs	Hazardous Air Pollutant
HE	High Explosives
HEAF	High Explosives Application Facility
HEPA	high-efficiency particulate air
HETB	Hardened Engineering Test Building
HEU	Highly Enriched Uranium
HEUMF	Highly Enriched Uranium Materials Facility
HEWTF	High Explosives Wastewater Treatment Facility

HI	Hazard Index
HLW	high level radioactive waste
HPS	Hantavirus Pulmonary Syndrome
HQ	Hazard Quotient
HR	Human Resources
HSC	Hazardous Materials Spill Center
HTM	High-Tech Mobile
HVAC	heating, ventilating, and air conditioning
HWDU	Hazardous waste disposal units
HWMF	hazardous waste management facility
HWSU	Hazardous Waste Storage Unit
HWTPF	Hazardous Waste Treatment and Processing Facility
HYDEC	hydride/dehydride casting
I	Interstate Highway
ICD-9-CM	International Classification of Disease, 9th Revision, Clinical Modification
ICRP	International Commission on Radiological Protection
IFF	Identification, Friend or Foe
IH	Industrial Hygiene
INEEL	Idaho National Engineering and Environmental Laboratory
INRAD	intrinsic radiation
IOM	Institution of Medicine
IPT	Integrated Project Team
ISCORS	Interagency Steering Committee on Radiation Standards
ISCST	Industrial Source Complex Short Term
ISD	Independent School District
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ITRD	Innovative Treatment Remediation Demonstration
IWQPs	Inland Water Quality Parameters
JTA	Joint Test Assemblies
KAFB	Kirtland Air Force Base
KCP	Kansas City Plant
KCRIMS	Kansas City Responsive Infrastructure Manufacturing and Sourcing
KTF	Kauai Test Facility
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LANL SWEIS	Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory
LANSCCE	Los Alamos Neutron Science Center
LB/TS	Large Blast Thermal Simulator
LCF	latent cancer fatality
LDRGIF	Low Dose Rate Gamma Irradiation Facility
LLNL	Lawrence Livermore National Laboratory
LLW	low level waste

LOS	Level of Service
LPF	leak path factor
M&O	Management and Operations
MACCS	MELCOR Accident Consequence Code System
MACCS2	MELCOR Accident Consequence Code System Version 2
MACs	maximum allowable concentrations
MAR	material at risk
MBTA	<i>Migratory Bird Treaty Act</i>
MC&A	Material Control and Accountability
MCL	maximum contaminant level
MDC	maximum detectable concentration
MDL	maximum detection limit
MEI	maximally exposed individual
MEK	methyl ethyl ketone
MLLW	mixed low level waste
MOX	Mixed Oxide
MPF	Modern Pit Facility
MPF EIS	Modern Pit Facility Environmental Impact Statement
mrem	millirem
MRTFB	Major Range and Test Facility Base
MSGP	Multi-Sector General Permit
MVAs	motor vehicle accidents
MVM	million vehicle miles
MWDU	Mixed Waste Disposal Unit
NAAQS	National Ambient Air Quality Standards
NAFB	Nellis Air Force Base
NC	numerically controlled
NCRP	National Council on Radiation Protection Measurements
NDA	nondestructive assay
NDEP	Nevada Division of Environmental Protection
NE	Office of Nuclear Energy
NECI	Northeast Center Impact Area
NEP	Nuclear Explosive Package
NEPA	<i>National Environmental Policy Act</i>
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEST	Nuclear Emergency Search Team
NGPF	Neutron Generator Production
NHP	National Hydrotesting Program
NHPA	<i>National Historic Preservation Act</i>
NMAAQs	New Mexico Ambient Air Quality Standards
NMAQCR	New Mexico Air Quality Control Regulations
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NN	Nonproliferation and National Security
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration

NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPR	Nuclear Posture Review
NPS	National Park Service
NPT	Nuclear Nonproliferation Treaty
NPTEC	Nonproliferation Test and Evaluation Complex
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	Nevada Site Office
NSTec	National Security Technologies
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
NWS	National Weather Service
NWSM	Nuclear Weapons Stockpile Memorandum
NWSP	Nuclear Weapons Stockpile Plan
OB/OD	Open Burn/Open Detonation
OEPG	Office of Environmental Policy and Guidance
ORNL	Oak Ridge National Laboratory
ORPS	Occurrence Reporting and Processing System
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
OST	Office of Secure Transportation
OU _s	operable units
PA	Performance Assessment
PAAA	<i>Price-Anderson Amendments Act</i>
Pantex	Pantex Plant
PCBs	polychlorinated biphenyls
pCi/L	picocuries per liter
PDCF	Pit Disassembly and Conversion Facility
PF-4	Plutonium Facility, Building 4
PHERMEX	Pulsed High Energy Radiation Machine Emitting X-Rays
PHETS	Permanent High Explosive Test Site
PIDAS	Perimeter Intrusion Detection and Assessment System
PIXY	Pulse Intense X-Ray
PMDA	Plutonium Management and Disposition Agreement
POL _s	petroleum, oils, lubricants
PPE	personal protective equipment
ppy	pits per year
PQL	practical quantitation limit
PSD	Prevention of Significant Deterioration
PSRs	Potential release sites
Pu	Plutonium
PUREX	Plutonium-Uranium Extraction Process
QASPR	Qualification Alternatives to Sandia Pulsed Reactor
R&D	Research and Development

RANT	Radioassay and Nondestructive Testing
RCRA	<i>Resource Conservation and Recovery Act</i>
rem	roentgen equivalent man
REOP	Real Estate Operating Permit
RF	respirable fraction
RFI	RCRA facility investigation
RIMSII	Regional Input-Output Modeling System
RLWTF	Radioactive Liquid Waste Treatment Facility
RMWMF	Radioactive and Mixed Waste Management Facilities
ROD	Record of Decision
ROGs/POCs	reactive organic gases/precursor organic compounds
ROI	Region of Influence
RRF	respirable release fraction
RRW	Reliable Replacement Warhead
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
S.C.	South Carolina State Highway
SAAQS	State Ambient Air Quality Standards
SASN	Silver acetylide-silver nitrate
SCDHEC	South Carolina Department of Health and Environmental Control
SEAB	Secretary of Energy Advisory Board
SEIS	Supplemental Environmental Impact Statement
SFNF	Santa Fe National Forest
SGT	Safeguards Transporters
SHIST	Seismic Hardrock in Site Test
SHPO	State Historic Preservation Office
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
SMR	standardized mortality rate
SNF	Spent nuclear fuel
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SNL/CA	Sandia National Laboratories/California
SNM	Special nuclear material
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRARP	Savannah River Archaeological Research Program
SREL	Savannah River Ecology Laboratory
SRS	Savannah River Site
SS&C	sand, slag and crucible
SSM	Stockpile Stewardship and Management
SSM PEIS	Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management
SSO	Sandia Site Office
SSP	Stockpile Stewardship Program
SST	Safe Secure Trailers
STP	Site Treatment Plan
STS	Stock-to-Target Sequence

SVOC	Semi-volatile organic compound
SWEIS	Site-Wide Environmental Impact Statement
SWSC	Sanitary Wastewater Systems Consolidation
SWTF	Solid Waste Transfer Facility
T&E	Threatened and Endangered
TA	Technical Area
TA-55	Technical Area 55
TBF	Terminal Ballistics Facility
TBP	tributyl phosphate
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Property
TECC	Transportation and Emergency Control Center
TEDE	Total Effective Dose Equivalent
TEF	Tritium Extraction Facility
TLD	Thermoluminescent dosimeter
TNRCC	Texas Natural Resource Conservation Commission
TPCB	Transurance Pad Cover Building
TPDES	Texas Pollutant Discharge Elimination System
TRAGIS	Transportation Routing Analysis Geographic Information System
Trinity NHL	Trinity Site National Historic Landmark
TRU	transuranic
TRUPACT-II	Transuranic Package Transporter
TSCA	Toxic Substance Control Act
TSD	Transportation Safeguards Division
TSP	total suspended particulates
TSPI	Time Space Positioning Information
TTR	Tonopah Test Range
TVA	Tennessee Valley Authority
UC	University of California
UPF	Uranium Processing Facility
US	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
USPHS	United States Public Health Service
UXO	unexploded ordnance
VOC	volatile organic compound
VPP	Voluntary Protection Program
WAC	Waste Acceptance Criteria
WCRRF	Waste Compaction, Reduction, and Repackaging Facility
WEF	Waste Examination Facility
WETF	Weapons Engineering Tritium Facility
WFO	Work for Others

WIPP	Waste Isolation Pilot Plant
WSMR	White Sands Missile Range
WSRC	Westinghouse Savannah River Company
WTG	Weapons Test Group
WVDP	West Valley Demonstration Project
WVDP Waste EIS	West Valley Demonstration Project Waste Management EIS
WWTF	Wastewater Treatment Facility
XTF	Cross-wind Fire Facility
Y-12	Y-12 National Security Complex

CHEMICALS AND UNITS OF MEASURE

Bq	Becquerel
C	Celsius
Ci	curie
cm	centimeters
CFC	chlorofluorocarbons
CO	carbon monoxide
dB	decibel
dBA	decibel A-weighted
DCE	1, 2-dichloroethylene
DNA	deoxyribonucleic acid
F	Fahrenheit
ft	feet
ft ²	square feet
ft ³	cubic feet
ft ³ /s	cubic feet per second
g	grams
gal	gallons
ha	hectares
hr	hour
in	inches
kg	kilograms
km	kilometers
km ²	square kilometers
kV	kilovolts
kVA	kilovolt-ampere
kW	kilowatts
kWh	kilowatt hours
L	liters
lb	pounds
m	meters
m ²	square meters
m ³	cubic meters
m/s	meters per second
mg	milligram (one-thousandth of a gram)
mg/L	milligrams per liter
MGD	million gallons per day

MGY	million gallons per year
mi	miles
mi ²	square miles
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
MVA	megavolt-ampere
MW	megawatt
MWe	megawatt electric
MWh	megawatt hour
NO ₂	nitrogen dioxide
NOX	nitrogen oxides
O ₃	ozone
Pb	lead
PCB	polychlorinated biphenyl
pCi	picocurie (one-trillionth of a curie)
pCi/L	picocuries per liter
PM ₁₀	particulate matter (less than 10 microns in diameter)
ppb	parts per billion
ppm	parts per million
ppbv	parts per billion by volume
rem	roentgen equivalent man
s	seconds
SO ₂	sulfur dioxide
T	short ton
t	metric tons
TCA	1, 1, 1-trichloroethane
TCE	trichloroethylene
yd ³	cubic yards
yr	year
μCi	microcurie (one-millionth of a curie)
μCi/g	microcuries per gram
μg	microgram (one-millionth of a gram)
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/m ³	micrograms per cubic meter

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	Multiply By	To Get	If You Know	Multiply By	To Get
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile
Area					
square inch	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^9
mega-	M	1 000 000 = 10^6
kilo-	k	1 000 = 10^3
hecto-	h	100 = 10^2
deka-	da	10 = 10^1
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement

Volume II

Chapters 5 - 15 and
Appendices A - G

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Volume II

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ACRONYMS AND ABBREVIATIONS

A/D	Assembly/Disassembly
A/D/HE	Assembly/Disassembly/High Explosives
AC and MC	Analytical Chemistry and Materials Characterization
ACE	Altamont Commuter Express
ACHP	Advisory Council on Historic Preservation
ACRR	Annular Core Research Reactor
AEC	Atomic Energy Commission
AFB	Air Force Base
AF&F	Arming, Fuzing, and Firing
ALARA	as low as reasonably achievable
ALCM	Air-Launch Cruise Missile
ALOHA	Aerial Location of Hazardous Atmospheres
AQCR	Air Quality Control Region
ARF	airborne release fraction
ASER	annual site environmental report
ATEC	U.S. Army Test Evaluation Command
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
BACMs	Best Available Control Measures
BEA	Bureau of Economic Analysis
BEEF	Big Explosives Experimental Facility
BEIR	Biological Effects of Ionizing Radiation
Bison-m	Biota Information System of New Mexico
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMAP	Biological Monitoring and Abatement Program
BMPs	Best Management Practices
BNM	Bandelier National Monument
CA	Composite Analysis
CAA	<i>Clean Air Act</i>
CAIRS	Computerized Accident/Incident Reporting System
CAMU	corrective action management unit
CASSC	California Species of Special Concern
CAUs	Corrective Action Units
CD-0	critical decision on mission need
CEQ	Council on Environmental Quality
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFF	Contained Firing Facility
CFR	Code of Federal Regulations
CGTO	Consolidated Group of Tribes and Organizations
CHS	Center for Homeland Security
CIF	Consolidated Incineration Facility

CMR	Chemistry and Metallurgy Research
CMRR	Chemistry and Metallurgy Research Building Replacement Project
CNC	Consolidated Nuclear Center
CNPC	Consolidated Nuclear Production Center
CNPS	California Native Plant Society
Complex	nuclear weapons complex
Complex Transformation SPEIS	Complex Transformation Supplemental Programmatic Environmental Impact Statement
COPCs	contaminants of potential concern
CPC	Consolidated Plutonium Center
CRT	Cargo Restraint Transporter
CSAs	Canned Subassemblies
CUC	Consolidated Uranium Center
CWA	<i>Clean Water Act</i>
CWL	chemical waste landfill
CY	calendar year
D&D	Decontamination and Decommissioning
DA	design agency
DAF	Device Assembly Facility
DARHT	Dual Axis Radiographic Hydrodynamic Test
dB	decibel
dBA	A-weighted decibels
DAF	Device Assembly Facility
DCE	Distributed Centers of Excellence
DCGs	Derived Concentration Guidelines
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DP	Defense Programs
DPE	data processing equipment
DR	damage ratio
DTC	Developmental Test Command
DTRA	Defense Threat Reduction Agency
DTSC	Department of Toxic Substances Control
DU	Depleted Uranium
DWPF	Defense Waste Processing Facility
DWTF	Decontamination and Waste Treatment Facility
DX	Dynamic Experimentation
EA	Environmental Assessment
ECF	Entry Control Facility
EDE	effective dose equivalent
EE	Energy Efficiency and Renewable Energy
EFPC	East Fork Poplar Creek

EH	Office of Environment, Safety and Health
EIS	Environmental Impact Statement
EM	Environmental Management
EMAC	Ecological Monitoring and Compliance Program
EOA	expanded operations alternative
EODU	Explosive Ordnance Disposal Unit
EOL	End-of-Life
EOS	Equation of state
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERPG	Emergency Response Planning Guideline
ESL	Effects Screening Level
ETB	Engineering Test Bay
ETF	Environmental Test Facility
ETTP	East Tennessee Technology Park
EU	enriched uranium
EWTF	Explosives Waste Treatment Facility
FBI	Federal Bureau of Investigation
FE	facilities engineering
FGZ	fine-grain zone
FLAME	Fire Laboratory for Accreditation of Models and Experiments
FM	Farm-to-Market Road
FMD	Fissile Materials Disposition
FONSI	Finding of No Significant Impact
FPPA	<i>Farmland Protection Policy Act</i>
FTE	Full Time Employee
FWHM	Full Width at Half Maximum
FXR	Flash X-Ray
GCD	Greater Confinement Disposal
GIF	Gamma Irradiation Facility
GPD	gallons per day
GPS	Global Positioning System
GSA	General Services Area
GTS	Gas Transfer System
GWPP	groundwater protection program
HAN	hydroxylamine nitrate
HANDSS-55	“handling and segregation system for 55-gallon drums”
HANMF	H-Area New Manufacturing Facility
HAPs	Hazardous Air Pollutant
HE	High Explosives
HEAF	High Explosives Application Facility
HEPA	high-efficiency particulate air
HETB	Hardened Engineering Test Building
HEU	Highly Enriched Uranium
HEUMF	Highly Enriched Uranium Materials Facility
HEWTF	High Explosives Wastewater Treatment Facility

HI	Hazard Index
HLW	high level radioactive waste
HPS	Hantavirus Pulmonary Syndrome
HQ	Hazard Quotient
HR	Human Resources
HSC	Hazardous Materials Spill Center
HTM	High-Tech Mobile
HVAC	heating, ventilating, and air conditioning
HWDU	Hazardous waste disposal units
HWMF	hazardous waste management facility
HWSU	Hazardous Waste Storage Unit
HWTPF	Hazardous Waste Treatment and Processing Facility
HYDEC	hydride/dehydride casting
I	Interstate Highway
ICD-9-CM	International Classification of Disease, 9th Revision, Clinical Modification
ICRP	International Commission on Radiological Protection
IFF	Identification, Friend or Foe
IH	Industrial Hygiene
INEEL	Idaho National Engineering and Environmental Laboratory
INRAD	intrinsic radiation
IOM	Institution of Medicine
IPT	Integrated Project Team
ISCORS	Interagency Steering Committee on Radiation Standards
ISCST	Industrial Source Complex Short Term
ISD	Independent School District
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ITRD	Innovative Treatment Remediation Demonstration
IWQPs	Inland Water Quality Parameters
JTA	Joint Test Assemblies
KAFB	Kirtland Air Force Base
KCP	Kansas City Plant
KCRIMS	Kansas City Responsive Infrastructure Manufacturing and Sourcing
KTF	Kauai Test Facility
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LANL SWEIS	Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory
LANSCCE	Los Alamos Neutron Science Center
LB/TS	Large Blast Thermal Simulator
LCF	latent cancer fatality
LDRGIF	Low Dose Rate Gamma Irradiation Facility
LLNL	Lawrence Livermore National Laboratory
LLW	low level waste

LOS	Level of Service
LPF	leak path factor
M&O	Management and Operations
MACCS	MELCOR Accident Consequence Code System
MACCS2	MELCOR Accident Consequence Code System Version 2
MACs	maximum allowable concentrations
MAR	material at risk
MBTA	<i>Migratory Bird Treaty Act</i>
MC&A	Material Control and Accountability
MCL	maximum contaminant level
MDC	maximum detectable concentration
MDL	maximum detection limit
MEI	maximally exposed individual
MEK	methyl ethyl ketone
MLLW	mixed low level waste
MOX	Mixed Oxide
MPF	Modern Pit Facility
MPF EIS	Modern Pit Facility Environmental Impact Statement
mrem	millirem
MRTFB	Major Range and Test Facility Base
MSGP	Multi-Sector General Permit
MVAs	motor vehicle accidents
MVM	million vehicle miles
MWDU	Mixed Waste Disposal Unit
NAAQS	National Ambient Air Quality Standards
NAFB	Nellis Air Force Base
NC	numerically controlled
NCRP	National Council on Radiation Protection Measurements
NDA	nondestructive assay
NDEP	Nevada Division of Environmental Protection
NE	Office of Nuclear Energy
NECI	Northeast Center Impact Area
NEP	Nuclear Explosive Package
NEPA	<i>National Environmental Policy Act</i>
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEST	Nuclear Emergency Search Team
NGPF	Neutron Generator Production
NHP	National Hydrotesting Program
NHPA	<i>National Historic Preservation Act</i>
NMAAQs	New Mexico Ambient Air Quality Standards
NMAQCR	New Mexico Air Quality Control Regulations
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NN	Nonproliferation and National Security
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration

NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPR	Nuclear Posture Review
NPS	National Park Service
NPT	Nuclear Nonproliferation Treaty
NPTEC	Non-Proliferation Test and Evaluation Complex
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	Nevada Site Office
NSTec	National Security Technologies
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
NWS	National Weather Service
NWSM	Nuclear Weapons Stockpile Memorandum
NWSP	Nuclear Weapons Stockpile Plan
OB/OD	Open Burn/Open Detonation
OEPG	Office of Environmental Policy and Guidance
ORNL	Oak Ridge National Laboratory
ORPS	Occurrence Reporting and Processing System
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
OST	Office of Secure Transportation
OUs	operable units
PA	Performance Assessment
PAAA	<i>Price-Anderson Amendments Act</i>
Pantex	Pantex Plant
PCBs	polychlorinated biphenyls
pCi/L	picocuries per liter
PDCF	Pit Disassembly and Conversion Facility
PF-4	Plutonium Facility, Building 4
PHERMEX	Pulsed High Energy Radiation Machine Emitting X-Rays
PHETS	Permanent High Explosive Test Site
PIDAS	Perimeter Intrusion Detection and Assessment System
PIXY	Pulse Intense X-Ray
PMDA	Plutonium Management and Disposition Agreement
POLs	petroleum, oils, lubricants
PPE	personal protective equipment
ppy	pits per year
PQL	practical quantitation limit
PSD	Prevention of Significant Deterioration
PSRs	Potential release sites
Pu	Plutonium
PUREX	Plutonium-Uranium Extraction Process
QASPR	Qualification Alternatives to Sandia Pulsed Reactor
R&D	Research and Development

RANT	Radioassay and Nondestructive Testing
RCRA	<i>Resource Conservation and Recovery Act</i>
rem	roentgen equivalent man
REOP	Real Estate Operating Permit
RF	respirable fraction
RFI	RCRA facility investigation
RIMSII	Regional Input-Output Modeling System
RLWTF	Radioactive Liquid Waste Treatment Facility
RMWMF	Radioactive and Mixed Waste Management Facilities
ROD	Record of Decision
ROGs/POCs	reactive organic gases/precursor organic compounds
ROI	Region of Influence
RRF	respirable release fraction
RRW	Reliable Replacement Warhead
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
S.C.	South Carolina State Highway
SAAQS	State Ambient Air Quality Standards
SASN	Silver acetylide-silver nitrate
SCDHEC	South Carolina Department of Health and Environmental Control
SEAB	Secretary of Energy Advisory Board
SEIS	Supplemental Environmental Impact Statement
SFNF	Santa Fe National Forest
SGT	Safeguards Transporters
SHIST	Seismic Hardrock in Site Test
SHPO	State Historic Preservation Office
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
SMR	standardized mortality rate
SNF	Spent nuclear fuel
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SNL/CA	Sandia National Laboratories/California
SNM	Special nuclear material
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRARP	Savannah River Archaeological Research Program
SREL	Savannah River Ecology Laboratory
SRS	Savannah River Site
SS&C	sand, slag and crucible
SSM	Stockpile Stewardship and Management
SSM PEIS	Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management
SSO	Sandia Site Office
SSP	Stockpile Stewardship Program
SST	Safe Secure Trailers
STP	Site Treatment Plan
STS	Stock-to-Target Sequence

SVOC	Semi-volatile organic compound
SWEIS	Site-Wide Environmental Impact Statement
SWSC	Sanitary Wastewater Systems Consolidation
SWTF	Solid Waste Transfer Facility
T&E	Threatened and Endangered
TA	Technical Area
TA-55	Technical Area 55
TBF	Terminal Ballistics Facility
TBP	tributyl phosphate
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Property
TECC	Transportation and Emergency Control Center
TEDE	Total Effective Dose Equivalent
TEF	Tritium Extraction Facility
TLD	Thermoluminescent dosimeter
TNRCC	Texas Natural Resource Conservation Commission
TPCB	Transurance Pad Cover Building
TPDES	Texas Pollutant Discharge Elimination System
TRAGIS	Transportation Routing Analysis Geographic Information System
Trinity NHL	Trinity Site National Historic Landmark
TRU	transuranic
TRUPACT-II	Transuranic Package Transporter
TSCA	Toxic Substance Control Act
TSD	Transportation Safeguards Division
TSP	total suspended particulates
TSPI	Time Space Positioning Information
TTR	Tonopah Test Range
TVA	Tennessee Valley Authority
UC	University of California
UPF	Uranium Processing Facility
US	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
USPHS	United States Public Health Service
UXO	unexploded ordnance
VOC	volatile organic compound
VPP	Voluntary Protection Program
WAC	Waste Acceptance Criteria
WCRRF	Waste Compaction, Reduction, and Repackaging Facility
WEF	Waste Examination Facility
WETF	Weapons Engineering Tritium Facility
WFO	Work for Others

WIPP	Waste Isolation Pilot Plant
WSMR	White Sands Missile Range
WSRC	Westinghouse Savannah River Company
WTG	Weapons Test Group
WVDP	West Valley Demonstration Project
WVDP Waste EIS	West Valley Demonstration Project Waste Management EIS
WWTF	Wastewater Treatment Facility
XTF	Cross-wind Fire Facility
Y-12	Y-12 National Security Complex

CHEMICALS AND UNITS OF MEASURE

Bq	Becquerel
C	Celsius
Ci	curie
cm	centimeters
CFC	chlorofluorocarbons
CO	carbon monoxide
dB	decibel
dBA	decibel A-weighted
DCE	1, 2-dichloroethylene
DNA	deoxyribonucleic acid
F	Fahrenheit
ft	feet
ft ²	square feet
ft ³	cubic feet
ft ³ /s	cubic feet per second
g	grams
gal	gallons
ha	hectares
hr	hour
in	inches
kg	kilograms
km	kilometers
km ²	square kilometers
kV	kilovolts
kVA	kilovolt-ampere
kW	kilowatts
kWh	kilowatt hours
L	liters
lb	pounds
m	meters
m ²	square meters
m ³	cubic meters
m/s	meters per second
mg	milligram (one-thousandth of a gram)
mg/L	milligrams per liter
MGD	million gallons per day

MGY	million gallons per year
mi	miles
mi ²	square miles
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
MVA	megavolt-ampere
MW	megawatt
MWe	megawatt electric
MWh	megawatt hour
NO ₂	nitrogen dioxide
NOX	nitrogen oxides
O ₃	ozone
Pb	lead
PCB	polychlorinated biphenyl
pCi	picocurie (one-trillionth of a curie)
pCi/L	picocuries per liter
PM ₁₀	particulate matter (less than 10 microns in diameter)
ppb	parts per billion
ppm	parts per million
ppbv	parts per billion by volume
rem	roentgen equivalent man
s	seconds
SO ₂	sulfur dioxide
T	short ton
t	metric tons
TCA	1, 1, 1-trichloroethane
TCE	trichloroethylene
yd ³	cubic yards
yr	year
μCi	microcurie (one-millionth of a curie)
μCi/g	microcuries per gram
μg	microgram (one-millionth of a gram)
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/m ³	micrograms per cubic meter

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	Multiply By	To Get	If You Know	Multiply By	To Get
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile
Area					
square inch	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^9
mega-	M	1 000 000 = 10^6
kilo-	k	1 000 = 10^3
hecto-	h	100 = 10^2
deka-	da	10 = 10^1
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

Chapter 1
INTRODUCTION

Chapter 1 INTRODUCTION

Chapter 1 presents an overview of this Supplemental Programmatic Environmental Impact Statement (SPEIS). The chapter briefly explains the national security policies and planning factors affecting the determination of alternatives in this SPEIS, which are more fully explained in Chapter 2. Chapter 1 provides the National Environmental Policy Act (NEPA) context and strategy and it summarizes related NEPA documents. The chapter concludes with an overview of the public involvement process and a discussion of the organization of this SPEIS.

1.0 INTRODUCTION

This *Complex Transformation*¹ Supplemental Programmatic Environmental Impact Statement (SPEIS) analyzes the potential environmental impacts of alternatives to make the U.S. nuclear weapons complex (Complex) smaller, and more responsive, efficient, and secure. These changes would build upon decisions made in the 1990s following the end of the Cold War and the cessation of U.S. nuclear weapons testing.

National security policies require the U.S. Department of Energy (DOE), through the National Nuclear Security Administration (NNSA), to maintain the U.S. nuclear weapons stockpile,² as well as core competencies in nuclear weapons.³ Since completion in 1996 of the *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (SSM PEIS) and associated Record of Decision (ROD), DOE has implemented these policies through the Stockpile Stewardship Program (SSP).⁴ The SSP emphasizes development and application of greatly improved scientific and technical capabilities to assess the safety, security, and reliability of existing nuclear warheads without the use of nuclear testing. Throughout the 1990s, DOE also took steps to consolidate the Complex from twelve sites in the late 1980s to its current configuration of three national laboratories (plus an associated flight test range), four industrial plants, and a nuclear test site as shown in Figure 1-1.

National Nuclear Security Administration

Established by Congress in 2000, the National Nuclear Security Administration (NNSA) is a semi-autonomous agency within the U.S. Department of Energy (DOE).

NNSA's primary mission is to provide the U.S. with safe, secure, and reliable nuclear weapons and to maintain core competencies in nuclear weapons. The NNSA needs a nuclear weapons complex of facilities capable of supporting this highly technical mission.

NNSA also has complementary missions in nuclear non-proliferation programs, excess fissile materials disposition, and provision of naval nuclear propulsion systems.

¹ In the Notice of Intent to prepare this EIS (71 FR 61731, October 19, 2006), NNSA's proposed action was referred to as "Complex 2030." NNSA now believes that the term "Complex Transformation" better reflects the proposed changes and alternatives evaluated, and has renamed this document the "Complex Transformation SPEIS."

² The nuclear weapons stockpile consists of nuclear weapons that are both deployed to the various military services ("operationally-deployed") and "reserve weapons" that could be used to augment the operationally-deployed weapons or to provide replacements for warheads that experience safety or reliability problems.

³ Core competencies in nuclear weapons include research, design, development, and testing (including the ability to conduct nuclear testing); reliability assessment; certification; manufacturing; and surveillance capabilities.

⁴ In 1996, the program was named the Stockpile Stewardship and Management Program. It is now called the Stockpile Stewardship Program. There has been no change in the content or purpose of the program.

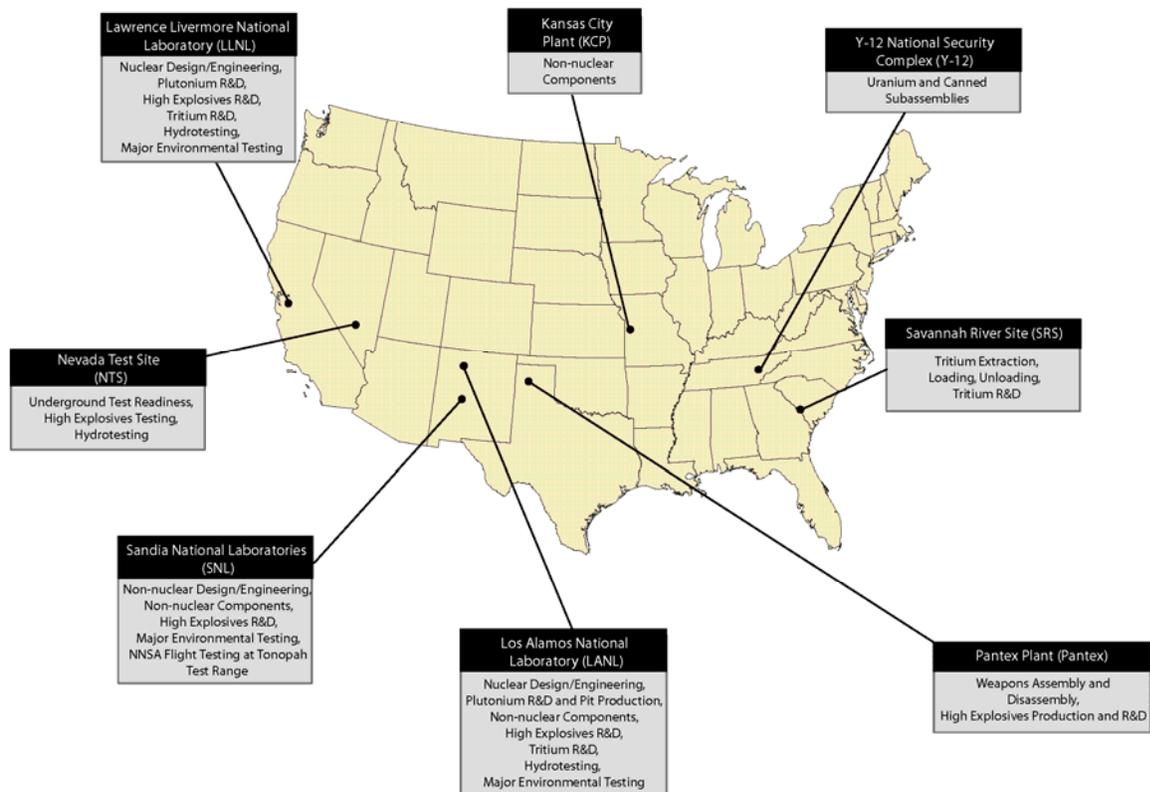


Figure 1-1 — Nuclear Weapons Complex Sites and Current Major Responsibilities

NNSA now proposes to continue the transformation of the Complex by further consolidating operations, which could result in the relocation of activities among sites. These changes, particularly alternatives that involve the construction or modification of major nuclear facilities, could have environmental impacts. These changes could also produce significant benefits, including improved safety, security, and environmental systems, reduced operating costs, and greater responsiveness to future changes in national security policy.

The alternatives analyzed in this SPEIS are divided into two categories: programmatic and project-specific. Programmatic alternatives involve the restructuring of facilities that use or store significant (i.e., Category I/II⁵) quantities of special nuclear material (SNM).⁶ These facilities produce plutonium components (commonly called pits), produce highly-enriched uranium (HEU) components, and assemble and disassemble nuclear weapons (including related high explosive component fabrication).

⁵ Special nuclear material is categorized into Security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. Categories I and II, which require the highest level of security, are the focus of the proposed actions in this SPEIS.

⁶ As defined in section 11 of the Atomic Energy Act of 1954, SNM is: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235; or (2) any material artificially enriched by any of the foregoing and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material.

This SPEIS analyzes the potential environmental impacts of locating these facilities at up to three of five NNSA sites: Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico; Nevada Test Site (NTS) north of Las Vegas, Nevada; Pantex Plant (Pantex) in Amarillo, Texas; Savannah River Site (SRS) in Aiken, South Carolina; and Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee. Common to each of these programmatic alternatives, NNSA also proposes to consolidate the storage of SNM currently at the Lawrence Livermore National Laboratory (LLNL) in Livermore, California, and at Pantex.

Based on this SPEIS and other information, NNSA expects to decide where facilities for plutonium, HEU, and assembly/disassembly activities would be located, whether to construct new or renovate existing facilities for these functions, and whether to further consolidate SNM storage. The programmatic alternatives are described in more detail in Chapter 3, sections 3.3 through 3.6. Any programmatic decisions resulting from this SPEIS may require further project-specific *National Environmental Policy Act* (NEPA) review before implementation.

This SPEIS also analyzes project-specific alternatives to restructure research and development (R&D) and testing facilities. NNSA intends this SPEIS to provide sufficient analysis of potential environmental impacts to enable implementation of decisions related to these project-specific alternatives without further NEPA review. The decisions NNSA expects to make include:

- whether to eliminate or consolidate duplicative facilities for tritium and high explosives R&D, major hydrodynamic testing, environmental test facilities, and certain weapons support functions; where these facilities and operations would be located; and where construction activities might be required for future operations; and
- where to conduct NNSA flight test operations for gravity weapons.

The project-specific alternatives are described in Chapter 3 in Sections 3.8 through 3.13.

The potential environmental impacts of each alternative are summarized in Section 3.16. NNSA has identified preferred programmatic and project-specific alternatives in this draft SPEIS. These are described in Section 3.17. These preferred alternatives could change prior to issuance of the final SPEIS, expected in 2008.

1.1 COMPLEX TRANSFORMATION

In 1996, DOE prepared the SSM PEIS, which evaluated alternatives for maintaining the safety and reliability of the U.S. nuclear weapons stockpile and preserving U.S. competencies in nuclear weapons in the post-Cold War era. The SSM PEIS Record of Decision (ROD) (61 FR 68014, December 26, 1996) documented important decisions related to fulfilling these requirements without underground nuclear testing. Since that ROD, NNSA has been implementing those decisions.

The SSM PEIS analyzed the potential impacts of alternatives for managing the nuclear arsenal for about 10 years based on the weapons stockpile proposed by the Strategic Arms Reduction Treaty (START)-II and the need for enhanced experimental facilities to replace nuclear testing. Thus, the decisions resulting from the SSM PEIS were focused on: (1) constructing enhanced

experimental facilities at the NNSA national laboratories, and (2) downsizing or consolidating the production infrastructure in view of a projected smaller stockpile. Today, NNSA has to take a longer view, for the reasons highlighted below. The national security policies and treaties mentioned below are explained further in Chapter 2.

1.1.1 Maintaining Nuclear Deterrence

In the 1996 SSM PEIS, no new production facilities were proposed. The enduring types of weapons in the stockpile were at the mid-point of their anticipated design life of 20-25 years, and the life extension program plans for the enduring weapons were not yet fully developed. The weapons in the stockpile are now more than a decade older than when the SSM PEIS was prepared. Because the U.S. will maintain a nuclear deterrent in the form of a safe, secure, and reliable stockpile with the smallest number of weapons possible, NNSA needs to preserve its core competencies in nuclear weapons, and invest in some replacement nuclear facilities for research and production. Because these major nuclear facilities are more than 50 years old, the ability to keep them safe, secure, and performing within realistic economic constraints is declining.

The 2001 Nuclear Posture Review⁷ concluded that a nuclear deterrent relying on a balance of capabilities and a smaller deployed weapons stockpile would provide a credible deterrent in a future of uncertain and evolving threats. The Nuclear Posture Review was the foundation for the Moscow Treaty, which was ratified by the U.S. and Russia in 2003. Implementation of the Moscow Treaty is cutting the U.S. nuclear weapons stockpile to about one-half the size in the Strategic Arms Reduction Treaty II, which was ratified by the U.S. in 1996 and Russia in 2000. To achieve the new balance between a responsive infrastructure and deployed stockpile size, one of the main purposes of the proposed actions in this SPEIS is to make the Complex more responsive. As discussed in Chapter 2, responsiveness means the ability to successfully execute requirements of the national security mission on schedule and react to new developments. A transformed Complex with demonstrated capabilities would ensure that the nation's nuclear deterrent would remain credible, and could support additional reductions in the stockpile, if directed by the President and the Congress. A transformed Complex is also expected to be safer, more secure, and less costly to maintain.

1.1.2 Security for Nuclear Weapons and Special Nuclear Materials (SNM)

There is classified national security policy to enhance the security of U.S. nuclear weapons and associated SNM. This policy came into effect after September 11, 2001 and its requirements reflect a reassessment of the terrorist threat. Today, seven of the eight major NNSA sites store SNM. Consolidation of these materials at fewer sites, and fewer locations at those sites, would enhance security at a reduced cost.

1.1.3 Proposed Approach to Transformation of the Complex

NNSA's proposed approach to continuing transformation of the Complex builds on existing

⁷ The Nuclear Posture Review establishes the broad outline for future U.S. nuclear strategy, force levels, and infrastructure. The Nuclear Posture review is a classified report prepared by the Department of Defense.

programs and management structures, so that much of the transformation could be accomplished within currently projected funding levels. The cost and potential environmental impacts of the alternatives in this SPEIS are primarily associated with the construction of new nuclear facilities. Thus, a wide range of alternative configurations for these nuclear facilities is being evaluated. NNSA has completed detailed economic studies of the alternatives (TechSource 2007a, 2007b, 2007c, 2007d).

1.2 THE NUCLEAR WEAPONS COMPLEX TODAY

As shown on Figure 1-1, the current Complex consists of eight sites located in seven states. The Complex enables NNSA to design, develop, manufacture, maintain, and repair nuclear weapons; certify their safety, security, and reliability; conduct surveillance on weapons in the stockpile; store Category I/II SNM; and dismantle and disposition retired weapons. Major sites within the Complex and their current primary responsibilities are described below.

Y-12 National Security Complex (Y-12) (Oak Ridge, Tennessee) – Y-12 manufactures uranium components for nuclear weapons, cases, and other nuclear weapons components; evaluates and tests these components; maintains Category I/II quantities of highly-enriched uranium; conducts component dismantlement, storage, and disposition of their nuclear materials; and supplies highly enriched uranium for use in naval reactors.

Savannah River Site (SRS) (Aiken, South Carolina) – SRS extracts tritium and performs loading, unloading, surveillance of tritium reservoirs, and conducts tritium R&D.⁸ SRS does not maintain Category I/II quantities of SNM associated with NNSA weapons activities, but does maintain Category I/II quantities of SNM associated with other DOE activities, such as the Environmental Management (EM) program.

Pantex Plant (Pantex) (Amarillo, Texas) – Pantex dismantles retired weapons; fabricates high-explosive (HE) components and performs HE research and development (R&D); assembles HE, nuclear, and non-nuclear components into nuclear weapons; repairs and modifies weapons; performs non-intrusive pit modification;⁹ and evaluates and performs surveillance of weapons. Pantex maintains Category I/II quantities of SNM for the weapons program and stores SNM in the form of surplus plutonium pits pending transfer to SRS for disposition.

Kansas City Plant¹⁰ (KCP) (Kansas City, Missouri) – KCP manufactures and procures non-nuclear weapons components, and evaluates and tests these weapons components. KCP has no SNM.

⁸ Tritium is an isotope of hydrogen produced in nuclear reactors and used in nuclear weapons. Because of its short half-life, tritium must be replenished routinely. The Watts Bar Nuclear Power Plant (Spring City, Tennessee) is a commercial nuclear power plant owned and operated by the Tennessee Valley Authority (TVA) which produces tritium that is extracted from target rods at SRS. As a commercial power station, the Watts Bar Plant is not considered part of the nuclear weapons complex.

⁹ A pit is the central core of a nuclear weapon, usually made of plutonium or enriched uranium. Non-intrusive pit modification is modification to the external surfaces and features of a pit.

¹⁰ The General Services Administration (GSA), as the lead agency, and NNSA, as a cooperating agency, are preparing an Environmental Assessment to evaluate the potential environmental impacts associated with relocating the facilities and infrastructure for the non-nuclear production activities conducted at KCP. This SPEIS does not assess alternatives for the activities conducted at KCP (see Section 3.2.10).

Los Alamos National Laboratory (LANL) (Los Alamos, New Mexico) – LANL conducts research, design, and development of nuclear weapons; designs and tests advanced technology concepts; provides safety, security, and reliability assessments and certification of stockpile weapons; maintains production capabilities for limited quantities of plutonium components (i.e., pits) for delivery to the stockpile; manufactures nuclear weapon detonators for the stockpile; conducts plutonium and tritium R&D, hydrotesting, HE R&D, and environmental testing; and maintains Category I/II quantities of SNM.

Lawrence Livermore National Laboratory (LLNL) (Livermore, California) – LLNL conducts research, design, and development of nuclear weapons; designs and tests advanced technology concepts; provides safety, security, and reliability assessments and certification of stockpile weapons; conducts plutonium and tritium R&D, hydrotesting, HE R&D, and environmental testing; and maintains Category I/II quantities of SNM.

Sandia National Laboratories (SNL) (Albuquerque, New Mexico; Livermore, California; and other locations) – SNL conducts systems engineering of nuclear weapons; conducts research, design, and development of non-nuclear components; manufactures non-nuclear weapons components including neutron generators for the stockpile; provides safety, security, and reliability assessments of stockpile weapons; and conducts HE R&D and environmental testing. SNL/NM is currently removing its Category I/II SNM, and by the end of 2008 should no longer need Category I/II SNM quantities on a permanent basis. The principal laboratory is located in Albuquerque, New Mexico (SNL/NM); a division of the laboratory (SNL/CA) is located in Livermore, California. SNL also operates the Tonopah Test Range (TTR) near Tonopah, Nevada, for flight testing of gravity weapons including research, development, and testing of nuclear weapons components and delivery systems. No Category I/II quantities of SNM are permanently maintained at the TTR, although some test operations have involved SNM.

Nevada Test Site (NTS) (65 miles northwest of Las Vegas, Nevada) – NTS maintains the capability to conduct underground nuclear testing; conducts high hazard experiments involving nuclear material and high explosives; provides the capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; conducts hydrotesting and HE testing; conducts research and training on nuclear safeguards, criticality safety, and emergency response; and maintains Category I/II quantities of SNM.

1.2.1 Nuclear Weapons

A general understanding of nuclear weapons, including the components that make up a weapon and the physical processes involved, helps one understand the alternatives evaluated in the Complex Transformation SPEIS. Figure 1-2 presents a simplified diagram of a modern nuclear weapon. An actual nuclear weapon produced in the U.S. is much more complicated, consisting of many thousands of parts. The nuclear weapon primary is composed of a central core called a pit, which is usually made of plutonium-239, enriched uranium, or both.

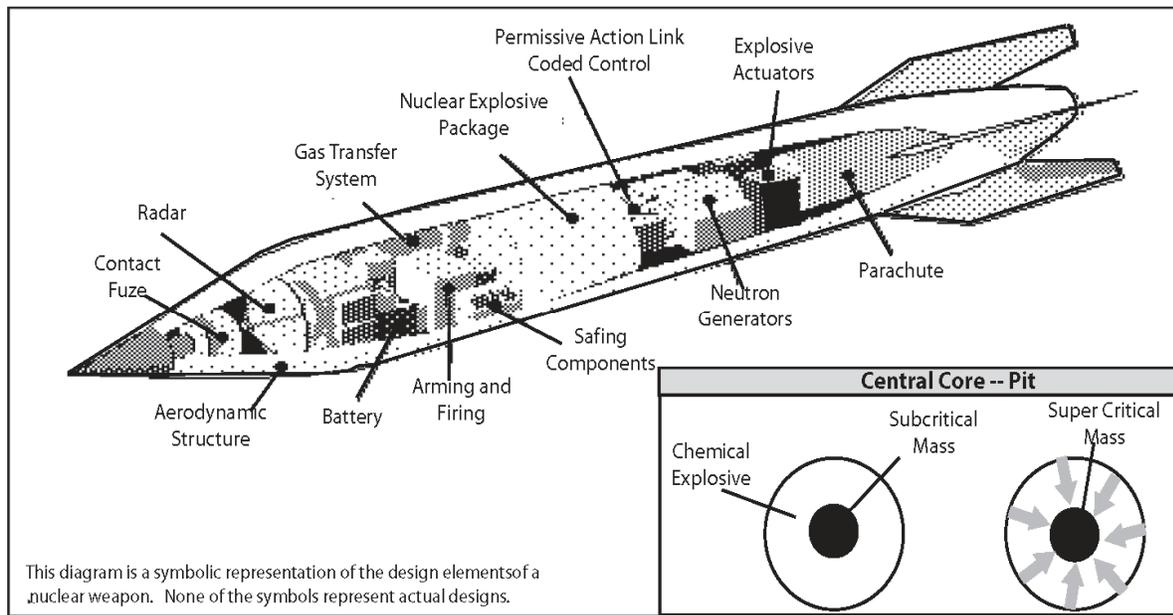


Figure 1-2 — Simplified Modern Nuclear Weapon

The pit is surrounded by a layer of high explosives, which, when detonated, compresses the pit to a super-critical mass, initiating a nuclear reaction. This reaction is generally thought of as the nuclear fission "trigger," which activates the secondary assembly component (containing tritium) to produce a thermonuclear fusion reaction. The remaining non-nuclear components consist of everything from arming and firing systems to batteries and parachutes. As identified in Section 1.2, the production and assembly of many of these components are accomplished at NNSA facilities. The assembly/disassembly of nuclear weapons is done only at Pantex at the present time.

1.3 INTRODUCTION OF THE ALTERNATIVES

NNSA announced its intent to prepare this SPEIS in the Federal Register on October 19, 2006 (71 FR 61731). As explained in Section 1.6, input from the scoping process assisted NNSA in defining the alternatives that are analyzed in this SPEIS. As explained in Chapter 2, these alternatives are grouped into two categories: (1) Restructure SNM Facilities; and (2) Restructure Research and Development (R&D) and Testing Facilities.

1.3.1 Restructure SNM Facilities

The following functional capabilities are considered in this proposed action:

- Plutonium operations, including pit manufacturing, Category I/II SNM storage, and related R&D;
- Enriched uranium operations, including canned subassembly (CSA) manufacturing, assembly, and disassembly, Category I/II SNM storage, and related R&D; and
- Weapons assembly and disassembly (A/D) and high explosives (HE) production.

To consolidate SNM facilities, which would be a long-term process carried out over a decade or more, the SPEIS alternatives address broad issues such as where to locate those facilities and whether to construct new or renovate existing facilities for these functions. As such, this SPEIS analysis is “programmatically” for the proposed action to restructure SNM facilities, meaning that tiered, project-specific NEPA documents could be needed to inform decisions on these facilities if existing site-wide EISs or other NEPA documents were insufficient. The alternatives are fully described in Chapter 3.

1.3.2 Restructure R&D and Testing Facilities

NNSA also proposes to restructure R&D and testing facilities to eliminate duplicative or unnecessary redundancies. The R&D and testing capabilities and capacities being evaluated in this SPEIS:

- High Explosives R&D
- Tritium R&D
- Flight Test Operations
- Major Hydrodynamic Testing
- Major Environmental Testing

“Downsize-in-place” and “consolidate to fewer locations” are the main alternatives for all functions except flight testing. Flight testing alternatives are to upgrade the TTR, move the mission to the NTS, or move the mission to the Department of Defense (DoD) White Sands Missile Range (WSMR). The alternatives are fully described in Chapter 3.

1.3.3 No Action Alternative

As required by the *National Environmental Policy Act* (NEPA), NNSA is considering a No Action Alternative that represents continuation of the status quo. The No Action Alternative provides a baseline from which changes resulting from the alternatives can be compared. The No Action Alternative includes the continued implementation of decisions made pursuant to the SSM PEIS, the Tritium Supply and Recycling PEIS, and other project-specific and site-specific Environmental Impact Statements (EISs) and Environmental Assessments (EAs). Section 1.5.2 discusses the pertinent major NEPA documents and their relationship to this Complex Transformation SPEIS.

1.4 RELEVANT HISTORY - EVOLUTION OF THE COMPLEX IN THE POST-COLD WAR ERA

A safe and reliable U.S. nuclear weapons stockpile has been a cornerstone of national security policy for more than 60 years. Since the inception of nuclear weapons, the U.S. has maintained a safe and reliable nuclear deterrent force, even as military requirements have changed and technological developments have evolved. Under the *Atomic Energy Act of 1954* (42 U.S.C. 2011 et seq.), DOE is responsible for providing nuclear weapons to support U.S. national security strategy. The *National Nuclear Security Administration Act* (Pub. L. 106–65, Title XXXII) assigned this responsibility to NNSA within DOE.

In January 1991, DOE completed a Nuclear Weapons Complex Reconfiguration (Complex-21) Study which identified significant cost savings that could be achieved by reducing the size of the Complex. DOE then initiated a PEIS (which became known as the Reconfiguration PEIS) examining alternatives for reconfiguring the Complex. However, in December 1991, DOE decided to separate proposals for transforming non-nuclear production from the Reconfiguration PEIS because proposals and decisions regarding transformation of non-nuclear production would neither significantly affect, nor be affected, by proposals and decisions regarding transformation of nuclear production. Thus, proposals for transforming the non-nuclear production could proceed independently from, and more quickly than, proposals and decisions regarding the nuclear portion of the Complex.

On January 27, 1992, DOE issued a NOI (57 FR 3046) to prepare an EA for the consolidation of non-nuclear production activities within the Complex (DOE/EA-0792). On September 14, 1993 (58 FR 48043), DOE published a Finding of No Significant Impact (FONSI) regarding its proposal to consolidate non-nuclear component production (58 FR 48043). This proposal included termination of non-nuclear production missions at the Mound Plant in Ohio, the Pinellas Plant in Florida, and the Rocky Flats Plant in Colorado. The electrical and mechanical component manufacturing functions were consolidated at the KCP. Detonator production, neutron generator tritium target loading, and beryllium technology were consolidated at LANL; neutron generator and related component production were relocated to SNL in New Mexico.

In October 1993, President Clinton issued Presidential Decision Directive 15 (PDD-15), which directed DOE to establish the Stockpile Stewardship Program. PDD-15 significantly redirected the nuclear weapons program. Throughout the Cold War, the DoD and the DOE nuclear weapons laboratories had based much of their confidence in the reliability of nuclear weapons on performance data from atmospheric and underground nuclear tests. However, since 1992, the U.S. has been observing a moratorium on nuclear testing.

To ensure weapons reliability during the moratorium on testing, DOE proposed to invest in new scientific tools to assess the complicated phenomena involved in the detonation of nuclear weapons. DOE also began to develop sophisticated tools and computer-based simulation techniques to assess various aging phenomena as nuclear weapons were expected to serve well beyond their originally anticipated lifetimes. These actions enhanced the experimental, computational and simulation capabilities at the laboratories. DOE deferred spending on the production complex because there were no new weapons production requirements and because of uncertainty about the future stockpile requirements.

In October 1994, DOE concluded that the alternatives described in the Reconfiguration PEIS no longer contained alternatives for reconfiguration of the Complex. That conclusion was based on several factors, including: comments offered at the September-October 1993 Reconfiguration PEIS scoping meetings; the

Complex Changes

The nuclear weapons complex of the 1980's looked much different than it does today. Back then, there were 14 sites producing thousands of nuclear weapons and components annually, and conducting underground nuclear tests at the NTS to verify the safety and reliability of the weapons in the stockpile. Today, the Complex has shrunk down to approximately 50% of the facility square footage, and significantly less production capacity. Today, the safety and reliability of the stockpile is based on surveillance of stockpile weapons, experiments, computation and simulation, rather than underground nuclear testing.

anticipation that no production of new nuclear weapons types would be required for the foreseeable future; budget constraints; and the DOE decision to prepare a separate PEIS on Storage and Disposition of Weapons-Usable Fissile Materials (DOE/EIS-0229).

Consequently, DOE separated the Reconfiguration PEIS into two new PEISs: (1) a Tritium Supply and Recycling PEIS (DOE/EIS-0161), and (2) the 1996 SSM PEIS (DOE/EIS-0236). The Final PEIS for Tritium Supply and Recycling was issued on October 27, 1995 (60 FR 55021). In a Record of Decision (ROD) on May 14, 1999 (64 FR 26369), DOE decided it would produce the tritium needed to maintain the nuclear weapons stockpile at a commercial light-water reactor owned and operated by the TVA and extract tritium at a new DOE-owned Tritium Extraction Facility at the SRS. With regard to the SSM PEIS, DOE issued an NOI on June 6, 1995 (60 FR 31291), a final SSM PEIS on November 19, 1996 (61 FR 58871), and a ROD on December 26, 1996 (61 FR 68014). The following decisions announced in the SSM PEIS ROD have been implemented:

- The National Ignition Facility is being constructed at LLNL;
- The Contained Firing Facility was constructed and is operational at LLNL;
- The Atlas Facility was constructed and is operational at LANL;
- A small pit fabrication capability and capacity was established at LANL;
- Non-nuclear fabrication activities were downsized at existing KCP facilities;
- Reductions in production capacity for secondary assemblies and cases at Y-12, non-nuclear components at KCP and high explosives and weapon assembly/ disassembly at Pantex are continuing;
- Strategic reserves of enriched uranium are in storage at Y-12;
- Strategic reserves of plutonium (in the form of plutonium pits) are in storage at Pantex; and
- Plutonium-242 oxide was transferred from SRS to LANL for storage.

In accordance with the decisions announced in the RODs for the 1996 SSM PEIS, the Non-nuclear Consolidation EA, and the Tritium Supply and Recycling PEIS, DOE began transforming the Complex. Today, the size of the Complex is approximately 50 percent smaller than its peak during the Cold War. It now comprises more than 35 million square feet of facilities at the sites shown on Figure 1-1. DOE has also prepared other NEPA documents that have continued the transformation of the Complex. Section 1.5.2 discusses these NEPA documents and their relationship to this SPEIS.

1.5 NEPA STRATEGY FOR THIS SUPPLEMENT

NEPA ensures that environmental information is available to public officials and citizens before decisions are made and actions are taken (40 CFR Part 1500-1508). With the continuing evolution of nuclear weapon requirements, NNSA believes it necessary to consider further transformation of the Complex to improve its efficiency and responsiveness in meeting national security requirements and enhancing the security of special nuclear materials. The 1996 SSM PEIS was the last programmatic review of the Stockpile Stewardship Program (SSP). In this SPEIS, NNSA evaluates alternatives to transform the Complex so that it can be more responsive to changing national security requirements and to enhance the security of SNM.

This SPEIS has been prepared in accordance with Section 102(2)(C) of NEPA (42 U.S.C. 4321 et seq.), and regulations promulgated by the CEQ (40 CFR Parts 1500-1508) and DOE's regulations implementing NEPA (10 CFR Part 1021), and follows DOE's NEPA guidance. NNSA conducted a public scoping process for this SPEIS (Section 1.6) and has used the best available information for the analyses in the SPEIS.

1.5.1 Decisions Regarding the Complex Transformation

This SPEIS assesses reasonable alternatives for transforming the Complex to a more efficient, responsive and secure one. If NNSA decides to proceed with major transformation actions, such as the construction of new nuclear facilities that are not evaluated in a separate site-specific NEPA analysis, a project-specific NEPA document would be prepared; these documents would rely on analyses in this Complex Transformation SPEIS. Project-specific NEPA documents would use more detailed design information than is available for this SPEIS to evaluate reasonable site-specific alternatives as well as the No Action Alternative.

Based on this SPEIS, NNSA expects to decide:

- whether to consolidate SNM at fewer sites or fewer locations within sites;
- whether to construct new or renovate existing SNM facilities, and where any new facilities would be located;
- whether to eliminate or consolidate duplicative facilities for tritium and high explosives R&D, major hydrotest and environmental test facilities and where these facilities would be located; and
- where to conduct NNSA flight test operations.

1.5.2 Relevant NEPA Documents

As mentioned in Section 1.5.1, DOE has prepared and is preparing other EISs that would continue the on-going transformation of the Complex. These documents, and their relationship to the Complex Transformation SPEIS, are discussed in the following sections.

1.5.2.1 *Completed NEPA Actions*

1993 - *Non-nuclear Consolidation Environmental Assessment, DOE/EA-0792*

The Non-Nuclear Consolidation EA analyzed the proposed consolidation of the facilities within the Complex that manufactured non-nuclear components for nuclear weapons. On September 14, 1993, DOE issued a Finding of No Significant Impact (FONSI), which resulted a decision to remove defense activities from the Mound Plant in Miamisburg, Ohio; and from the Pinellas Plant in Pinellas, Florida; and to end non-nuclear activities at the Rocky Flats Plant in Golden, Colorado (58 FR 36658). These activities were relocated to existing facilities at KCP in Kansas City, Missouri, and LANL and SNL in New Mexico. This decision also resulted in the transfer of the tritium handling activities performed at the Mound Plant to SRS. As described in Section 1.5.4.2, NNSA now is cooperating with the General Services Administration in the preparation

of an EA regarding the proposed relocation of non-nuclear production activities to a new location in the Kansas City area.

1995 - Tritium Supply and Recycling PEIS, DOE/EIS-0161

The Tritium Supply and Recycling PEIS evaluated alternatives for the siting, construction, and operation of tritium supply and recycling facilities, including the use of a commercial light water reactor (CLWR) for the production of tritium. In the ROD, DOE decided to pursue a dual-track approach to pursue tritium production in a CLWR and an accelerator (60 FR 63878, December 12, 1995). The accelerator option was later discontinued. The ROD also called for the construction of a new Tritium Extraction Facility at SRS. With respect to this Complex Transformation SPEIS, the decisions based on the Tritium Supply and Recycling PEIS apply equally to all alternatives and are not being reconsidered. That is, tritium would continue to be produced and extracted pursuant to the decisions made as a result of the Tritium Supply and Recycling PEIS and tiered project-specific NEPA documents.

1996 - Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, DOE/EIS-0236 (SSM PEIS) (DOE 1996c)

The SSM PEIS evaluated alternatives for maintaining the safety and reliability of the nation's nuclear stockpile and preserving U.S. competencies in nuclear weapons in the post-Cold War era. The SSM PEIS ROD (61 FR 68014, December 26, 1996) announced important decisions related to fulfilling these requirements without underground nuclear testing. Since that ROD, NNSA has been implementing these decisions, as described in Section 1.4. As such, the SSM PEIS ROD, as modified to account for decisions in subsequent site-wide and project-specific NEPA documents, is the foundation for the No Action Alternative in this Complex Transformation SPEIS. DOE has previously prepared three Supplemental PEISs related to the SSM PEIS. These three documents involved the National Ignition Facility (NIF), the Modern Pit Facility, and the LLNL.

1996 - Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, DOE/EIS-0243 (NTS SWEIS)

The NTS SWEIS evaluated four alternatives for the continued operation of NTS: (1) No Action Alternative, (2) Discontinuation of Operations, (3) Expanded Use, and (4) Alternate Use of Withdrawn Lands. Included in the NTS SWEIS was an evaluation of reasonable alternatives for NNSA flight testing at TTR. On December 13, 1996, DOE published a ROD (61 FR 65551) selecting the Expanded Use Alternative. Under that decision, NNSA is continuing the multi-program use of the NTS. The continuing nuclear weapons activities included sub-critical experiments (i.e., explosively driven experiments with special nuclear material in which there is no self-sustaining nuclear reaction), readiness to conduct and the conduct of nuclear testing if ordered by the President, and other elements of the Stockpile Stewardship Program. In July 2002, DOE issued a Supplemental Analysis (SA) which concluded that there is no need to supplement the NTS SWEIS. For purposes of this Complex Transformation SPEIS, the analyses and decisions in the NTS SWEIS, ROD, and SA represent the No Action Alternative at NTS. That is, if the NNSA decides to not proceed with any changes affecting NTS, then NNSA would conduct operations at NTS within the framework of the NTS SWEIS, ROD, and SA.

1997 - Final Environmental Impact Statement for the Continued Operation of Pantex and Associated Storage of Nuclear Weapons Components, DOE/EIS-0225 (Pantex SWEIS)

The Pantex SWEIS evaluated alternatives for the continued operation of Pantex. The SWEIS examined environmental impacts resulting from a reasonable range of activity levels by assessing the operations on 2,000, 1,000, and 500 weapons per year. DOE issued a ROD providing for: continuing nuclear weapon operations involving assembly and disassembly of nuclear weapons; HE component fabrication; implementing facility projects, including upgrades and construction consistent with conducting these operations; and continuing to provide interim storage at Pantex for up to 20,000 pits (62 FR 3880, January 27, 1997). In April 2002, DOE completed a SA which concluded that there was no need to supplement the Pantex SWEIS. For purposes of this Complex Transformation SPEIS, the analyses and decisions in the Pantex SWEIS, ROD, and SA represent the No Action Alternative at Pantex. That is, if the NNSA decides to not proceed with any changes affecting Pantex, then NNSA would conduct operations at Pantex within the framework of the Pantex SWEIS, ROD, and SA.

1999 - Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor, DOE/EIS-0288 (CLWR EIS)

The CLWR EIS evaluated alternatives for producing tritium in CLWRs. In the ROD (64 FR 26369, May 14, 1999), DOE selected the TVA's Watts Bar Unit 1, Sequoyah Unit 1, and Sequoyah Unit 2 reactors for use in irradiating target rods to produce tritium. With respect to this Complex Transformation SPEIS, the decisions based on the CLWR EIS apply equally to all alternatives and are not being reconsidered. That is, tritium would continue to be produced in the TVA reactors.

1999 - Final Environmental Impact Statement for Construction and Operation of a Tritium Extraction Facility at the Savannah River Site, DOE/EIS-0271 (TEF EIS)

In the Tritium Extraction Facility (TEF) EIS, DOE evaluated alternative designs and locations at the SRS for the construction and operation of a TEF. The TEF extracts tritium from irradiated tritium-producing burner absorber rods (TPBARS) received at SRS from a Tennessee Valley Authority reactor. With respect to the Complex Transformation SPEIS, the decisions based on the TEF EIS (64 FR 26 369, May 14, 1999) apply equally to all alternatives. The TEF became operational in 2006, and DOE would continue to operate the TEF at the SRS.

1999 - Site-wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory, DOE/EIS-0238 (LANL SWEIS)

The LANL SWEIS evaluated alternatives for the continued operation of LANL. The LANL SWEIS also evaluated site-specific alternatives for implementing production of up to 50 pits per year using a single shift (80 pits per year with multiple shifts), consistent with the SSM PEIS ROD. The LANL SWEIS ROD provided for the continuation of all activities presently undertaken at LANL, at the highest level of activity. That ROD increased pit production capability up to 20 pits per year, but DOE deferred any decision to expand pit manufacturing beyond that level (64 FR 50797, September 20, 1999). For purposes of this Complex

Transformation SPEIS, the analyses and decisions in the LANL SWEIS ROD represent the No Action Alternative at LANL. That is, if the NNSA decides to not proceed with any changes affecting LANL, then NNSA would conduct operations at LANL within the framework of the LANL SWEIS and ROD. As explained in section 1.5.2.2, NNSA is currently preparing a new LANL SWEIS.

1999 - Site-wide Environmental Impact Statement for the Operation of Sandia National Laboratories, DOE/EIS-0281 (SNL SWEIS)

The SNL SWEIS evaluated alternatives for the continued operation of SNL. The ROD provided for expanding SNL operations to the highest reasonable levels that could be supported by current facilities and their potential expansion as well as construction of new facilities for future actions specifically identified in the SWEIS (64 FR 69996, December 15, 1999). In August 2006, DOE/NNSA/Sandia Site Office (SSO) completed a SA (DOE/EIS-0281-SA-04) which concluded that the environmental impacts of current and projected SNL/NM operations were within the envelope of consequences established in the 1999 SNL/NM SWEIS. For purposes of this Complex Transformation SPEIS, the analyses and decisions in the SNL SWEIS, ROD, and SA represent the No Action Alternative at SNL. That is, if the NNSA decides to not proceed with any changes affecting SNL, then NNSA would conduct operations at SNL within the framework of the SNL SWEIS, ROD, and SA.

2001 - Site-wide Environmental Impact Statement for the Y-12 National Security Complex, DOE/EIS-0309 (Y-12 SWEIS)

The Y-12 SWEIS evaluated alternatives for the continued operation of Y-12. The ROD provided for the continued operations at Y-12 at the planning basis operations level to meet NNSA mission requirements and other DOE program activities together with construction and operation of two new facilities: a HEU Materials Facility and the Special Materials Complex (SMC) (67 FR 11296, March 13, 2002). The SMC was subsequently cancelled. For purposes of this Complex Transformation SPEIS, the analyses and decisions in the Y-12 SWEIS and ROD represent the No Action Alternative at Y-12. That is, if the NNSA decides to not proceed with any changes affecting Y-12, then NNSA would conduct operations at Y-12 within the framework of the Y-12 SWEIS and ROD or any newly approved SWEIS and ROD. As explained in section 1.5.2.2, NNSA is currently preparing a new Y-12 SWEIS.

2002 - Environmental Impact Statement for the Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory, DOE/EIS-319 (TA-18 EIS)

The TA-18 EIS evaluated alternatives for the relocation of TA-18 capabilities and materials at LANL. The ROD provided for the relocation of Category I/II missions and related materials to the Device Assembly Facility (DAF) at NTS (67 FR 79906, December 31, 2002). For purposes of this Complex Transformation SPEIS, the TA-18 missions that were relocated to the DAF represent existing operations at NTS.

2004 - *Environmental Impact Statement for the Proposed Chemistry and Metallurgy Research Building Replacement Project, Los Alamos, New Mexico, DOE/EIS-0350 (CMRR EIS)*

The CMRR EIS evaluated alternatives for replacing the existing Chemistry and Metallurgy Research building at LANL. The ROD provided for the construction of a new Chemistry and Metallurgy Replacement (CMRR) facility at LANL Technical Area 55 as a single, above-ground, consolidated SNM-capable, Hazard Category 2 laboratory building (69 FR 6967, February 12, 2004) with a separate administrative office and support functions building. The first phase of the CMRR Project is the Radiological Laboratory Utility Building, also known as the Rad Lab. NNSA has begun construction of the Radiological Laboratory. NNSA has determined that the Radiological Laboratory is needed at LANL regardless of the decisions made subsequent to this SPEIS, and continued construction of the Radiological Laboratory is considered part of the No Action Alternative for this SPEIS. NNSA is continuing design of the CMRR nuclear facility, but has not begun construction. NNSA will decide whether to construct the CMRR nuclear facility after completion of this SPEIS. If Los Alamos is chosen as the site for pit production, the full CMRR could be incorporated into a site-adapted complex of facilities. Should another site be selected for pit production, the full CMRR could still be constructed at LANL as a bridging strategy to serve as an interim capability pending the availability of the new pit production facility. In either case, NNSA has determined that preliminary design of the CMRR nuclear facility would be applicable to any future pit production facility at any site analyzed in this SPEIS

2005 - *Site-wide EIS (SWEIS) for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic EIS, DOE/EIS-0348 and DOE/EIS-0236-S3 (LLNL SWEIS)*

The LLNL SWEIS evaluated alternatives for the continued operation of LLNL and the use of SNM in the NIF. The ROD provided for continued management and operation of LLNL, an increase in administrative and material-at-risk limits for plutonium and tritium, and the use of plutonium, other fissile materials, fissionable materials, and lithium hydride in experiments conducted at the NIF (70 FR 71491, November 29, 2005). For purposes of this Complex Transformation SPEIS, the analyses and decisions in the LLNL SWEIS and ROD represent the No Action Alternative at LLNL. That is, if NNSA decides to not proceed with any changes affecting LLNL, then NNSA would conduct operations at LLNL within the framework of the LLNL SWEIS and ROD.

2007 - *Programmatic Environmental Impact Statement for Defense Threat Reduction Agency (DTRA) Activities on White Sands Missile Range, NM (WSMR PEIS)*

In March 2007, DTRA, an agency of the DoD, completed the WSMR PEIS to evaluate the potential environmental impacts associated with testing activities on WSMR over a 10-year period. Issues that are addressed in the WSMR PEIS include:

- Continued operation and maintenance of various test structures used as targets for weapon system evaluations;

- Construction of new test structures, enlargement of existing test beds and possible development of new test beds;
- Testing, operations and maintenance activities;
- Use of chemical and biological simulants; and
- Planned improvements to DTRA's facilities.

The DTRA issued a ROD for the WSMR PEIS on May 27, 2007 (72 FR 29306). Based on that ROD, DTRA intends to increase DTRA testing activities at the WSMR. NNSA is considering an alternative to move NNSA Flight Testing to the WSMR, and so has incorporated information from the WSMR PEIS into this SPEIS, as appropriate.

2007 – Supplement Analysis, Storage of Surplus Plutonium Materials at the Savannah River Site (DOE/EIS-0229-SA4)

In 1996, DOE finalized the Storage and Disposition of Weapons-Usable Fissile Materials PEIS (DOE/EIS-0229), which analyzed the potential environmental consequences of alternatives for long-term storage, including storage pending disposition, and disposition of weapons-usable fissile materials from the dismantlement of U.S. nuclear weapons. For plutonium storage, DOE decided to consolidate part of its weapons-usable plutonium storage by upgrading and expanding existing and planned facilities at Pantex (plutonium pits) and SRS (non-pit plutonium). In 2007, DOE prepared this Supplement Analysis (SA) to evaluate the need for additional NEPA review regarding a proposal to consolidate storage at the SRS of surplus, non-pit weapons-usable plutonium from the Hanford site (Hanford), LANL, or LLNL. The SA shows that the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium, from Hanford, LLNL and LANL, would not be a significant change from the potential environmental impacts associated with the alternatives analyzed in previous NEPA reviews. The conclusions in the SA led to an amended ROD for the Storage and Disposition of Weapons-Usable Fissile Materials PEIS, which DOE issued in September 2007, stating that DOE does not need to conduct additional NEPA review prior to transferring surplus non-pit weapons-usable plutonium materials from Hanford, LLNL, and LANL to SRS for consolidated storage (72 FR 51807). Consequently, as applicable to this SPEIS, NNSA can move surplus, non-pit, weapons-usable plutonium to SRS from LLNL and/or LANL without any further NEPA review.

1.5.2.2 Ongoing NEPA Analyses

LANL - Site-wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico, DOE/EIS-0380D (Draft LANL SWEIS)

NNSA issued a Draft LANL SWEIS in June 2006 that evaluates alternatives for the continued operation of LANL and expects to issue the Final LANL SWEIS prior to completion of the Final Complex Transformation SPEIS. The LANL SWEIS analyzes alternatives to expand pit production at LANL, including construction and operation of the nuclear facility portion of the CMRR facility. The Expanded Operations Alternative in the LANL SWEIS assumes more efficient use of floor space in the existing Plutonium Facility in order to obtain 50 certified pits each year by producing up to 80 pits per year.

This SPEIS also analyzes three alternatives that would involve the nuclear facility portion of CMRR and the Plutonium Facility: the Los Alamos Upgrade Alternative, the Los Alamos 50/80 Alternative., and the Capability-Based Alternative. These alternatives would involve additional process efficiencies and, possibly for the Los Alamos Upgrade Alternative and the Los Alamos 50/80 Alternative, require physical expansion of facilities or construction of additional facilities to provide for the manufacture of more pits than are evaluated in the LANL SWEIS.

NNSA will not make any new decisions specifically related to pit production at LANL prior to the completion of this SPEIS. In the interim, pit production at LANL will continue within the existing capacity of nominally 20 pits per year, as announced in the ROD for the 1999 LANL SWEIS (64 FR 50797, September 20, 1999). After completing this SPEIS, if NNSA makes a programmatic decision to increase pit production at Los Alamos, then NNSA would amend the LANL SWEIS ROD, as appropriate. In addition, if the programmatic decision is to increase pit production at Los Alamos above the level analyzed in the LANL SWEIS, or if the increased production would rely upon modification of existing facilities or new construction not analyzed in the LANL SWEIS, then NNSA would evaluate the need to prepare additional site-specific NEPA analysis prior to issuing an Amended ROD.

Y-12 - Site-wide Environmental Impact Statement for the Y-12 National Security Complex, DOE/EIS-0309 (Draft Y-12 SWEIS)

NNSA expects to issue a Draft Y-12 SWEIS in 2008 that will evaluate alternatives for the continued operation of Y-12 to support modernization. In the Y-12 SWEIS, NNSA is assessing a UPF, which would consolidate the existing enriched uranium operations into a new modern facility. The NOI for the Y-12 SWEIS was published in November 2005 (70 FR 71270). As explained in Chapter 3 of this SPEIS, the UPF is also included within the scope of this SPEIS. NNSA will not make any specific decisions regarding the UPF prior to the completion of this Complex Transformation SPEIS.

KCP - Environmental Assessment for the Transformation of Facilities and Infrastructure for the Non-Nuclear Production Activities Conducted at the National Nuclear Security Administration's Kansas City Plant at Kansas City, Missouri, DOE/EA-1592 (KCP EA)

The General Services Administration (GSA), as the lead agency, and the NNSA, as a cooperating agency, announced the availability of a draft EA on December 10, 2007 (72 FR 69690) that evaluates the potential environmental impacts of a proposal for GSA to procure the construction of a new facility to house NNSA's procurement and manufacturing operations for non-nuclear components. GSA would lease the facility from a private developer on NNSA's behalf, and NNSA would relocate its operations from the existing KCP at the Bannister Federal Complex in Kansas City, Missouri, to the new facility. The relocation would involve moving approximately two-thirds of the existing capital and process equipment to the new facility. The proposed facility would be at least 50 percent smaller than the existing facility and would be designed to allow for rapid reconfiguration to meet changing requirements. The new facility would reduce annual operating costs and improve responsiveness, facility utilization, and reliability in supplying non-nuclear components. In addition to these operating improvements, the new facility would reduce the environmental footprint of KCP operations, including improved energy efficiency, lower emissions, and less waste generation. The KCP EA also

analyzes alternatives of keeping NNSA's non-nuclear procurement and manufacturing operations at the Bannister Federal Complex in existing or new buildings.

The existing KCP is located on the Bannister Federal Complex with GSA and shares buildings and utilities with GSA. At this time, NNSA anticipates that, should NNSA decide to move to a new location, it would coordinate closure of the DOE portion of the Bannister Road complex with the redevelopment of the GSA portion. Therefore, disposition and cleanup activities for the existing NNSA facilities at Bannister Road are not part of the current proposed action and would be addressed in appropriate environmental analyses.

The proposed action would continue the consolidation and reduction of the manufacture and maintenance of non-nuclear components that DOE began after completion of the Non-nuclear Consolidation EA in 1993 and continued after the SSM PEIS in 1996. Even with recently completed activities to reduce operations within the existing facilities (as announced in the 1996 SSM PEIS ROD), the current KCP complex is much larger than NNSA requires and, because of its age and size, it remains expensive to operate.

Because the non-nuclear operations at KCP are essential and do not duplicate work at other sites, no proposal to combine or eliminate these operations was formulated. Thus, NNSA is not proposing to relocate these activities to another geographic area. Nonetheless, NNSA did consider whether moving these operations to another geographic area should be evaluated as a reasonable alternative. A recent analysis of transferring KCP operations to a site other than one within the immediate Kansas City area concluded that "no prospects for economic benefits are apparent" (SAIC 2007). This is primarily because of the longer move and restart period that would be required, which would forfeit a potential savings of \$100 million per year from completing the relocation. In addition, relocation outside the Kansas City area would require extending operation of the current facility in order to build the inventory that would be needed for a long transition, could result in additional loss of key personnel, require additional training, and result in other unnecessary management challenges. Moreover, because of the nature of KCP operations, NNSA does not expect that constructing and operating a new facility in a different location from that proposed would offer any significant benefits. GSA and NNSA expect to make decisions on the proposal regarding a new facility for non-nuclear component procurement and manufacturing operations prior to completion of this SPEIS. If no significant environmental impacts are identified through preparation of the KCP EA, NNSA and GSA could issue a FONSI and move forward with this non-nuclear proposal in order to achieve significant benefits, including cost savings, continuity of operations, and preservation of technical competence independent of other proposals for transformation of the Complex. Consequently, the non-nuclear operations would remain at either the current KCP or a new facility in the Kansas City area, and would neither affect nor be affected by the decisions regarding the alternatives in this SPEIS.

NTS and WSMR - Environmental Assessment for the Geological Characterization at White Sands Missile Range, White Sands, New Mexico, and Nevada Test Site, Las Vegas, Nevada.

This EA evaluates the environmental impacts of conducting tests to characterize the geology at WSMR and NTS. Characterization activities would include drilling approximately 100 test holes to a 100-foot depth to characterize the geology at each proposed testing location. NNSA

needs to understand the geology at both WSMR and NTS to determine which of these locations could best characterize bomb structural performance in flight test operations for future NNSA management decisions. Once the data from characterization activities are available, the data would be incorporated into this SPEIS. This EA is expected to be completed in 2008.

NTS – Supplement Analysis to the NTS SWEIS

NNSA is currently preparing an SA to the NTS SWEIS to determine whether there is a need to supplement the NTS SWEIS. This SA is expected to be completed in 2008.

Pantex – Supplement Analysis to the Pantex SWEIS

NNSA is preparing an SA to the Pantex SWEIS to determine whether there is a need to supplement the Pantex SWEIS. This SA is expected to be completed in 2008.

Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste (LLW)

DOE is responsible for the disposal of GTCC LLW, pursuant to the Low-Level Radioactive Waste Policy Amendments Act of 1985. DOE announced its intent in the Federal Register (at 72 FR 40135) on July 23, 2007, to prepare an EIS for the disposal of GTCC LLW. In addition, DOE proposed to include DOE LLW and transuranic waste having characteristics similar to GTCC LLW and which may not have an identified path to disposal (referred to as GTCC-like waste) in the scope of the EIS. DOE proposes to evaluate alternatives for this waste, including disposal in a geologic repository, in intermediate depth boreholes, and in enhanced near surface facilities. Candidate locations for these disposal facilities include the Idaho National Laboratory (INL) in Idaho; LANL and Waste Isolation Pilot Plant (WIPP) in New Mexico; NTS and the proposed Yucca Mountain repository in Nevada; SRS in South Carolina; the Oak Ridge Reservation (ORR) in Tennessee; the Hanford Site (Hanford) in Washington, and generic commercial facilities. Disposal impacts will be evaluated in the Draft EIS for the Disposal of GTCC LLW. With respect to the Complex Transformation SPEIS, the GTCC LLW disposal project could affect LANL and NTS should a ROD be issued selecting one or either of those sites for the disposal of GTCC LLW and GTCC-like waste.

1.6 PUBLIC PARTICIPATION

1.6.1 Background

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations require “an early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action” (40 CFR §1501.7). This is known as the public scoping process. The purpose of this scoping process is: (1) to inform the public about the proposed action and the alternatives being considered, and (2) to identify and clarify issues by soliciting public comments.

NNSA published a Notice of Intent (NOI) in the *Federal Register* on October 19, 2006 (71 FR 61731) and held public scoping meetings in November and December 2006 near all sites that might be affected and in Washington, D.C. (see Figure 1-3). In addition to the meetings, the public was encouraged to provide comments via mail, e-mail, and fax. All comments received during the 90-day scoping period were reviewed by NNSA in preparing this draft of the Complex Transformation SPEIS. All late comments received were also reviewed and, in general, determined to be similar to previous comments received. More than 33,000 comment documents were received from individuals, interested groups, Native Americans, and Federal, state, and local officials during the public scoping period. A majority of the documents received were form letters or e-mail campaigns. Twenty different form letters or e-mails were submitted. A summary of the major scoping comments is provided below, and in more detail in Appendix D.

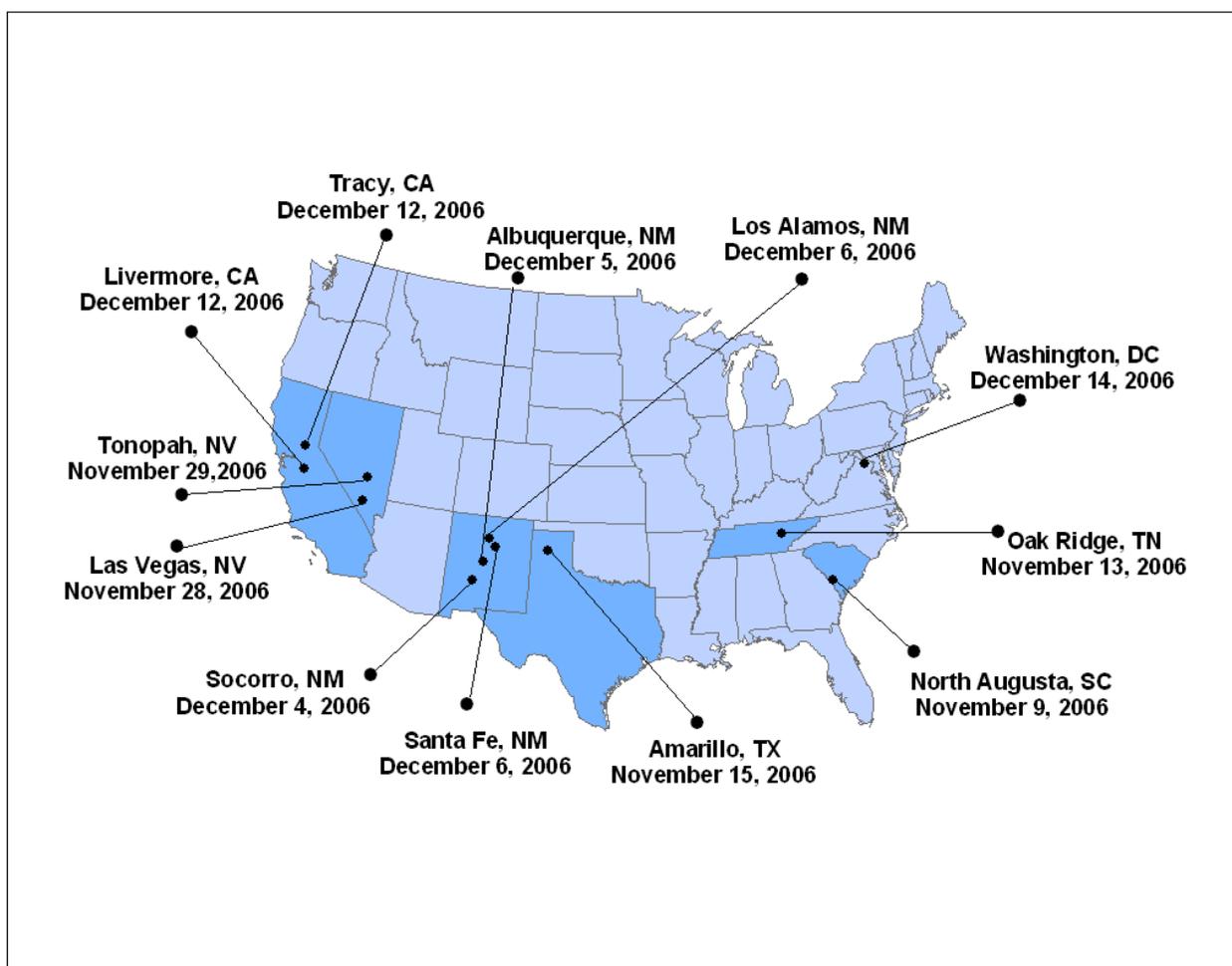


Figure 1-3 — Public Scoping Meeting Locations and Dates

1.6.2 Summary of Major Scoping Comments

A summary of the major comments received during the scoping period and responses to these comments follows:

Comment: The majority of the comments expressed opposition to the nuclear weapons program and U.S. national security policies. Many of the comments stated that the U.S. is violating the Nuclear Non-proliferation Treaty (NPT). Many of the comments stated that NNSA should assess an additional alternative - disarmament in compliance with the NPT - and not design or build new nuclear weapons.

Response: The security policies of the U.S. require the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." Actions by the U.S., including its moratorium on nuclear testing accompanied by significant reductions in its strategic force structure, nuclear weapons stockpile, and production infrastructure, constitute significant progress toward these goals. However, unless and until there are significant changes in national security policy, NNSA is required to design, produce, and maintain the nuclear weapons stockpile pursuant to requirements established by the President and Congress. In conjunction with the 2001 NPR, President Bush set an objective of "...achieving a credible nuclear deterrent with the lowest-possible number of nuclear warheads consistent with our national security needs..." In recognition of this objective and the reduction in the U.S. stockpile since the end of the Cold War, this SPEIS qualitatively evaluates changes in the alternatives that would be appropriate if the stockpile is reduced below the level called for by the Moscow Treaty. Accordingly, this SPEIS analyzes alternatives that satisfy requirements of the existing national security policy framework, as well as a capability-based alternative that, while not capable of meeting current requirements, could meet those requirements if the stockpile were reduced below the level called for by the Moscow Treaty.

Comment: Commentors stated that the reliable replacement warhead (RRW) was not needed and should not be pursued.

Response: RRW refers to possible future warhead designs that could replace existing "legacy" warheads. The RRW would not affect the proposed action of this SPEIS related to restructuring SNM facilities, or the proposed action to restructure R&D facilities. The proposed actions are independent of whether an RRW is developed. Because the environmental impacts analyzed are based on the maintenance of the legacy weapons that are currently in the stockpile, a conservative estimate of the environmental impacts is provided in this SPEIS. If RRW is approved as part of the national strategy for providing a nuclear deterrent, it would enable a shift to fewer hazardous operations. However, a production capacity for plutonium and highly-enriched

uranium components, as well as for weapons assembly and disassembly, will be required for the foreseeable future with or without implementation of RRW. Chapter 2 provides a discussion of the RRW's possible impact on the nuclear weapons stockpile and decisions about the Complex facilities.

Comment: Commentors stated that NNSA should develop a fair and objective statement for the purpose and need that takes into account the broader missions of NNSA that include preventing proliferation, ensuring the effectiveness of the NPT, and developing strategies to ensure the peaceful denuclearization of existing and threshold nuclear states, and the underlying legal obligations and treaty commitments.

Response: The fundamental principle underlying NNSA's evaluation of alternatives is that the Stockpile Stewardship Program (SSP) must continue to support existing and reasonably foreseeable national security requirements. This is NNSA's obligation and responsibility under the *Atomic Energy Act*¹¹ and the *National Nuclear Security Administration Act*¹². This SPEIS does not analyze alternatives to U.S. national security policy. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for executing the SSP, which is based on requirements established by national security policy including the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. NNSA continues work in other areas, including those identified in comments. Nuclear weapons knowledge has and will continue to enable nonproliferation; however, they are not dealt with in this SPEIS.

Comment: Commentors asked why NNSA was not assessing a consolidated nuclear production center (one site for plutonium, enriched uranium, and weapons assembly/disassembly) as a reasonable alternative for transforming the Complex.

Response: A consolidated nuclear production center (CNPC) alternative was added as a reasonable alternative and is discussed in Section 3.5 of this SPEIS. NNSA decided to analyze this alternative in order to assess the potential impacts of consolidating major nuclear weapons and SNM production missions at one site.

Comment: Commentors stated that pits will last up to 100 years and potentially longer; therefore, there is no need for new pit production capacity.

Response: This SPEIS addresses the environmental effects of both possessing and utilizing a pit production capacity in the event decisions are made to produce pits. While the current state of knowledge is that there may not be a need to produce pits in the near future because of the plutonium's longevity, NNSA cannot be certain that other issues associated with pits, other than the plutonium materials, would never arise. Accordingly, prudent management requires at least a capacity to produce pits as long as this nation maintains its nuclear stockpile. A small pit fabrication capability is

¹¹ 42 U.S.C. 2011 et seq.

¹² Title 32, *National Defense Authorization Act for Fiscal Year 2000*, Public Law 106-65

currently being maintained at LANL and is part of the No Action Alternative evaluated in this SPEIS.

Comment: Commentors asked why KCP was not being considered in this SPEIS, and stated that NNSA was not representing the full cost of Complex Transformation by excluding alternatives involving activities currently performed by KCP.

Response: Following the Non-nuclear Consolidation Environmental Assessment (DOE/EA-0792, 1993), NNSA decided to consolidate most non-nuclear operations to improve efficiency. In the SSM PEIS (1996), NNSA further considered alternatives with respect to non-nuclear operations, including relocating those capabilities to the NNSA national laboratories. The decision was made (61 FR 68014; December 26, 1996) to retain the existing facilities at the KCP. This was the environmentally preferable alternative, posed the least technical risk, and was the lowest cost alternative.

Because the non-nuclear operations at KCP are essential and do not duplicate the work at other sites, no proposal for combination or elimination of these missions was formulated. A recent analysis has concluded that transferring these KCP non-nuclear operations to a site other than one within the immediate Kansas City area would not be cost-effective (SAIC 2007). Consequently, the non-nuclear operations would remain at either the current KCP or a new facility in the Kansas City area, and would neither affect nor be affected by the decisions regarding the alternatives in this SPEIS.

Comment: Commentors requested an analysis of the risks and impacts of terrorist attacks on NNSA facilities.

Response: With respect to intentional destructive acts, substantive details of attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. A separate classified appendix to this Draft SPEIS has been prepared that evaluates the underlying facility threat assumptions with regard to malevolent, terrorist, or intentional destructive acts. The methodology for the analysis in this classified appendix is discussed in Appendix B. These data provide NNSA with information upon which to base, in part, decisions supported by this SPEIS.

Comment: Support for the continuation of the NNSA flight test mission at the Tonopah Test Range was received from the Tonopah community. Commentors demanded evidence of a compelling reason to move this mission from Tonopah.

Response: A detailed impact analysis was prepared for the NNSA flight testing alternatives and is presented in Section 5.15.4.2 of the SPEIS. The analysis discusses the potential socioeconomic impacts to the Tonopah community of NNSA flight testing alternatives.

Comment: Commentors expressed opposition to any new nuclear facilities. There was specific opposition to expanding pit production at LANL, as well as the proposed consolidated plutonium center (CPC). Commentors stated that the LANL Site-Wide EIS should follow the Complex Transformation SPEIS.

Response: NNSA added analysis of an alternative that would upgrade facilities at LANL for a smaller pit production capacity (up to 80 pits per year) than the baseline capacity (125 pits per year, single shift) of the proposed CPC (see Section 3.4.1.2). NNSA is evaluating increasing its current capacity to produce nominally 20 pits per year at LANL in a site-wide EIS (LANL 2006a). It is expected that a final LANL Site-wide EIS will be issued prior to completion of this SPEIS.

Comment: Commentors stated that a site near the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, should be considered as a reasonable location for a CPC.

Response: In order to determine the reasonable site alternatives for a CPC, all existing, major DOE sites were initially considered as a potential host location for a CPC. Sites that do not maintain Category I/II SNM were eliminated from consideration, as were sites that did not conduct major NNSA program activities. WIPP did not meet these siting criteria. Other DOE sites were not considered reasonable locations because they do not satisfy certain criteria such as population encroachment, mission compatibility, or synergy with the site's existing mission. Following this process, NNSA decided that Los Alamos, NTS, Pantex, SRS, and Y-12 constitute the range of reasonable site alternatives for a CPC.

1.6.3 Key Changes to the Scope of the Complex Transformation SPEIS Resulting from Public Comments

As a result of the scoping process, NNSA made the following significant changes to the scope of the Complex Transformation SPEIS:

- A consolidated centers of excellence (CCE) alternative was added as a reasonable alternative (see Section 3.5). NNSA would consolidate plutonium, uranium, and weapon assembly/disassembly functions into a CNPC at one site or into Consolidated Nuclear Centers (CNCs) at two sites.
- A discussion was added of effects on the Complex of an even smaller nuclear weapons stockpile than the current level envisioned under the Moscow Treaty (see Section 5.11).
- A discussion was added of the RRW's possible impact on the nuclear weapons stockpile and decisions about Complex Transformation. An analysis was added to determine what, if any, changes to the Complex would be required if the RRW were to be developed (see Chapter 2).

- A more detailed analysis of the potential impacts of NNSA flight testing was added in order to inform the public and NNSA of the potential socioeconomic impacts to the Tonopah community from the alternatives (see Section 5.15.4.2).
- An analysis of a smaller pit production facility (50 to 80 pits per year) was added (see Section 3.4.1.2).
- A more detailed explanation of why the Kansas City Plant non-nuclear operations are not included in this SPEIS was added (see Section 3.2.10).

1.7 ORGANIZATION OF THIS COMPLEX TRANSFORMATION SUPPLEMENTAL PEIS

The SPEIS consists of four volumes. This includes a stand alone Summary; Volumes I and II, which contains the main analyses and technical appendixes that support the analyses, along with additional project information; and Volume III, a classified appendix. Volumes I and II contain the following information:

Chapter 1 - Introduction...presents an overview of the SPEIS, summarizes the relevant history and changes to national security policy, introduces the alternatives, identifies the decisions expected to be made, explains the relationship of this SPEIS to other relevant NEPA documents, and includes an overview of the public involvement process.

Chapter 2 - Purpose and Need for NNSA Action...discusses relevant factors such as the stockpile history, aging and the need for weapon repairs. It also more fully discusses the framework of national security policies and treaties that establish requirements for the NNSA leading to the proposed actions and alternatives.

Chapter 3 - Alternatives...provides a detailed description of the alternatives, including a discussion of alternatives that were considered and eliminated from detailed analysis. This chapter also includes a summary comparison of the potential environmental impacts of the SPEIS alternatives and identifies the preferred alternatives.

Chapter 4 - Affected Environment...presents information regarding the site-specific environments that might be affected by the alternatives. The following sites are included: LANL, LLNL, NTS, Pantex, SNL, SRS, TTR, Y-12, and the DoD WSMR.

Chapter 5 - Environmental Impacts...analyzes the potential impacts on the environment from the alternatives. Impacts are compared to the projected environmental conditions that would be expected if continuing the status quo (i.e., the No Action Alternative).

Chapter 6 - Cumulative Impacts... analyzes the impacts of other past, present, and reasonably foreseeable future projects.

Chapters 7-15... includes the following information: unavoidable adverse impacts (Chapter 8); the relationship between short-term and long-term uses (Chapter 9); irreversible and irretrievable resource commitments (Chapter 9); environmental, safety, and health regulations that would apply to the alternatives (Chapter 10); an index (Chapter 11); a list of references (Chapter 12); a

glossary (Chapter 13); a list of preparers (Chapter 14); and a list of agencies, organizations, and persons to whom copies of this SPEIS were sent (Chapter 15).

Appendices... includes technical information in support of the environmental analyses. These appendices contain the following information: additional details of the alternatives; human health and accident analyses; additional details regarding environmental studies of special concern; environmental impact methodology; project studies and notices; scoping comments; and contractor disclosure.

Volume III - contains the Classified Appendix, which analyzes the potential consequences of intentional malevolent acts (e.g., sabotage, terrorism).

Chapter 2
PURPOSE AND NEED

Chapter 2 PURPOSE AND NEED

Chapter 2 discusses the underlying purpose and need addressed by the proposed action and alternatives in this Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS). It addresses relevant national security policy considerations and issues associated with maintaining the safety, security, and reliability of the nuclear weapons stockpile. The Chapter concludes with a discussion of the potential for a Reliable Replacement Warhead (RRW), nonproliferation issues and the possibility of future reductions in the size of the stockpile.

2.0 PURPOSE AND NEED FOR AGENCY ACTION

The security policies of the United States (U.S.) require the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. The Stockpile Stewardship Program (SSP)¹ is the National Nuclear Security Administration's (NNSA) program that fulfills these requirements. Broad in scope and technically complex, the SSP involves the integrated activities of three NNSA national laboratories, four industrial plants, and a nuclear test site. The SSP helps adjust the nuclear weapons complex (Complex) as required by NNSA to continue to meet national security requirements established by the President and the Congress. The purpose and need underlying the alternatives analyzed in this *Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Complex Transformation SPEIS) derive from changes in national security policy since the Record of Decision (ROD) on the 1996 Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM PEIS), as well as the effects of aging facilities; aging weapons; and evolving security requirements. The underlying purpose and need addressed in this SPEIS are the following:

- Maintain core competencies in nuclear weapons;
- Maintain a safe and reliable nuclear weapons stockpile; and
- Create a responsive nuclear weapons infrastructure that is cost-effective, and has adequate capacity to meet reasonably foreseeable national security requirements; and consolidate Category I/II SNM at fewer sites and locations within sites to reduce the risk and safeguards costs.

The fundamental principle underlying NNSA's evaluation of alternatives is that the SSP must continue to support existing and reasonably foreseeable national security requirements. This is NNSA's obligation and responsibility under the *Atomic Energy Act* and the *National Nuclear Security Administration Act*. This SPEIS does not analyze alternatives to the United States' national security policy. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for execution of the program based on the existing policy and foreseeable changes in this policy.

¹ In 1996, the program was named the Stockpile Stewardship and Management Program. It is now called the Stockpile Stewardship Program. There has been no significant change in the objectives of the program.

The alternatives analyzed in this SPEIS are based on the need for a more responsive Complex infrastructure that has:

- All necessary technical and industrial capabilities;
- Adequate production capacity for a smaller stockpile, including pit production;
- A smaller size for more cost-effective operations; and
- Enhanced security, particularly for activities involving special nuclear materials.

A more responsive Complex would also have the capabilities needed to produce a Reliable Replacement Warhead (RRW) if the President and the Congress decide that NNSA should develop one. An RRW would be pursued if it is able to enhance the safety, security, and reliability of the stockpile over the long term without nuclear testing.² Transformation of the Complex infrastructure is required whether or not an RRW is developed. If there is a decision to proceed with RRW or remain with life-extension legacy weapons, NNSA must have the infrastructure to support those decisions. The current estimate is that the first RRW could not be produced before 2014. NNSA will not make a decision on whether to proceed with an RRW in this SPEIS. NNSA can proceed with Complex Transformation with or without RRW. The relationship of RRWs to the proposed actions and alternatives in this SPEIS are discussed in this chapter using the best available information.

The possibility that NNSA might be directed to develop an RRW does not affect the alternatives analyzed or their potential impacts. Pit production and other production activities would be allocated between legacy weapons and RRWs – production capacity would not be increased if NNSA is directed to develop an RRW. Development of an RRW would enable less hazardous materials and operations but it would not require changes to the proposed facilities that are analyzed as part of the alternatives evaluated in this SPEIS. If an RRW were developed and produced, it is intended that its production would be in lieu of refurbishment and production activities for legacy weapons.

2.1 NATIONAL SECURITY POLICY CONSIDERATIONS

There are four principal national security policies and three treaties relevant to the SSP. They are:

- Presidential Decision Directives through 1996 and Public Law (103-160);
- Presidential Directives after 1996 and Public Law (109-163);
- Annual Nuclear Weapons Stockpile Plans;
- Nuclear Posture Reviews (1994 and 2001);
- Treaty on the Nonproliferation of Nuclear Weapons (NPT) (1968);
- Proposed Comprehensive Test Ban Treaty (1995); and
- Strategic Offensive Reductions Treaty (2003) – referred to as the Moscow Treaty.

² Current U.S. Policy is to refrain from nuclear testing while maintaining an ability to resume testing. The NTS maintains the U.S. ability to conduct tests if authorized by the President. The Environmental Impacts associated with nuclear testing are analyzed in the NTS Site-Wide Environmental Impact Statement (DOE/EIS-0243).

These policies and treaties form the foundation for the Stockpile Stewardship Program. They determine today's national security requirements that the alternatives analyzed in this SPEIS must satisfy. Earlier policies and treaties formed the foundation for the Stockpile Stewardship and Management Program (SSM), as well as the 1996 SSM PEIS. Figure 2-1 illustrates the relationship of the new national security policies to the purpose and need and alternatives evaluated in this SPEIS.

2.1.1 Presidential Directives through 1996 and Public Law (103-160)

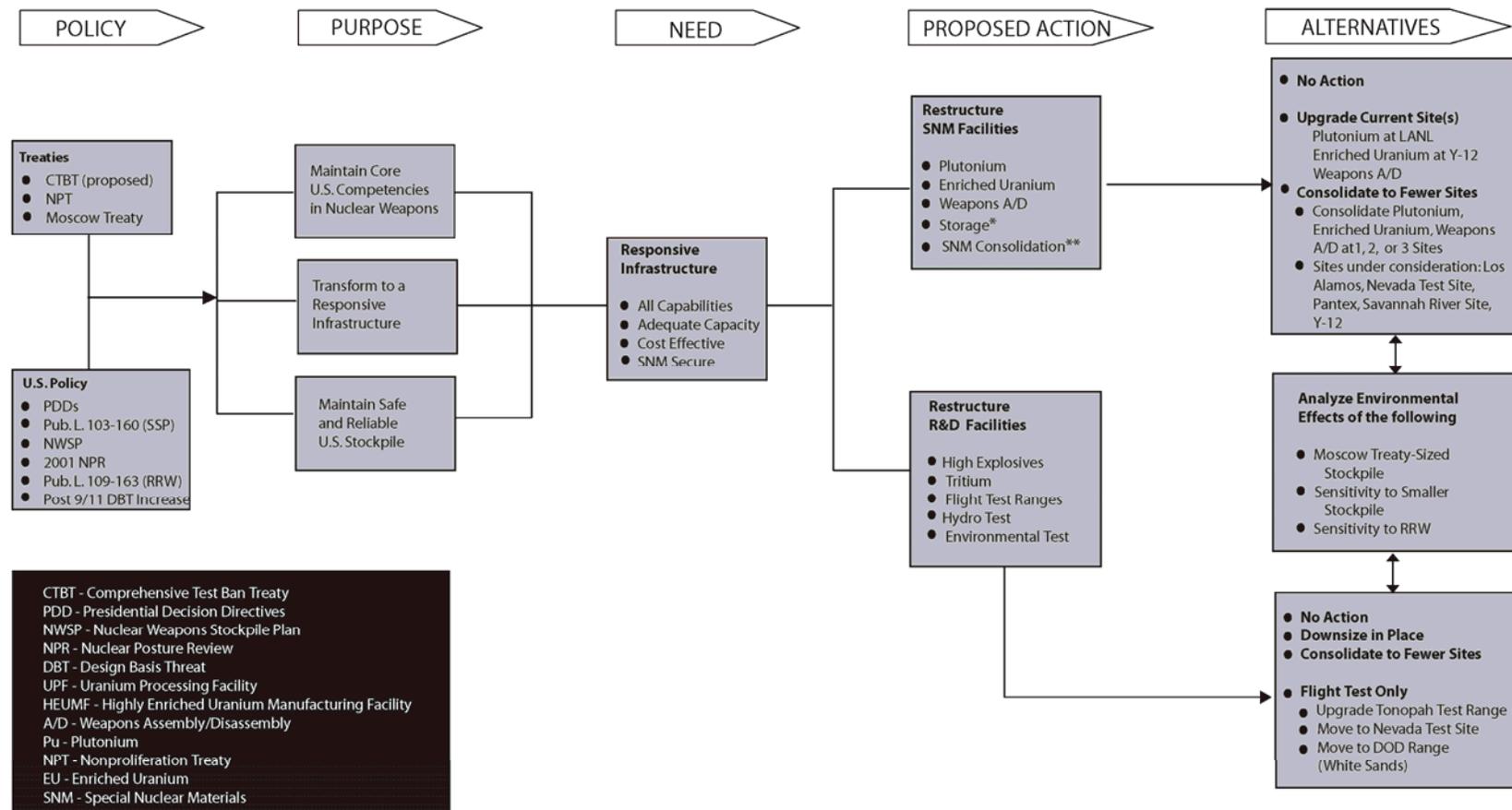
The following is a summary of the important features of Presidential Directives in effect through 1996 and Public Law 103-160; those formed the foundation of the SSP and established the purpose and need for the alternatives analyzed in the 1996 SSM PEIS.

- The continued maintenance of a safe and reliable nuclear weapons stockpile will remain a cornerstone of the U.S. nuclear deterrent for the foreseeable future.
- The core intellectual and technical competencies of the U.S. in nuclear weapons will be maintained. This includes competencies in research, design, development, and testing (including the ability to conduct nuclear testing); reliability assessment; certification; manufacturing; and surveillance capabilities.
- The U.S. will develop new ways to maintain a high level of confidence in the safety, reliability, and performance of its nuclear weapons stockpile without nuclear testing. The strategy for this objective is structured around the use of past nuclear test data in combination with enhanced computational modeling, experimental facilities, and simulators to further comprehensive understanding of the behavior of nuclear weapons and the effects of radiation on military systems.
- The continued vitality of all three NNSA national security laboratories is essential in addressing the challenges of maintaining a safe and reliable nuclear weapons stockpile without nuclear testing.

2.1.2 Nuclear Posture Reviews (NPR)

Beginning in 1991, several Presidential policy decisions, some unilateral and some made in conjunction with international treaties, resulted in the Department of Defense (DoD) conducting a comprehensive NPR that was approved by President Clinton in 1994. The 1994 NPR defined and integrated past and present U.S. policies for nuclear deterrence, arms control, and nonproliferation objectives. At the time of the 1994 NPR, it was anticipated that the START II Treaty would enter into force in 2004. Based on this anticipation, the 1996 SSM PEIS analyzed the potential effects of reasonable alternatives over a 10-year period.

In 2001, another NPR was conducted; it concluded that a strategic posture that relies solely on offensive nuclear forces is inappropriate for deterring potential future adversaries. A classified summary of the 2001 NPR was submitted to Congress in February 2002. A "new triad" was defined consisting of nuclear and non-nuclear strike capabilities, defenses, and a robust, responsive nuclear weapons infrastructure supported by enhanced intelligence and adaptive



CTBT - Comprehensive Test Ban Treaty
PDD - Presidential Decision Directives
NWSP - Nuclear Weapons Stockpile Plan
NPR - Nuclear Posture Review
DBT - Design Basis Threat
UPF - Uranium Processing Facility
HEUMF - Highly Enriched Uranium Manufacturing Facility
A/D - Weapons Assembly/Disassembly
Pu - Plutonium
NPT - Nonproliferation Treaty
EU - Enriched Uranium
SNM - Special Nuclear Materials

* All Category I/II SNM as a minimum

** The programmatic alternatives (restructuring SNM facilities) include an assessment of consolidating category I/II SNM currently stocked at LLNL and Pantex.

Figure 2-1 — Policy Perspective of the Stockpile Stewardship Program and Complex Transformation

planning capabilities. Prior to the 2001 NPR, the term “triad” generally referred to strategic land, sea, and air nuclear forces. The 2001 NPR was the foundation for the Moscow Treaty with Russia in 2002 (ratified in 2003). The relevance of this treaty to this SPEIS is discussed in the section on the Moscow Treaty.

2.1.3 Proposed Comprehensive Test Ban Treaty (CTBT)

The U.S. Senate has not ratified the CTBT; however, the U.S. has been observing a moratorium on nuclear testing that was first directed by President Clinton in 1992. Assessment and certification of the safety and reliability of the stockpile without nuclear testing will remain a significant technical challenge for the SSP as weapons in the stockpile age beyond the range of relevant historical technical data.

It has been almost 15 years since the last U.S. nuclear test and more than 15 years since the last new nuclear weapon entered the stockpile. While no issues have yet developed in maintaining legacy weapons that would require a return to nuclear testing in the reasonably foreseeable future, there is concern that the current weapon “life extension” approach to maintaining a safe and reliable stockpile will not ultimately, over the longer term, allow a continued moratorium on testing as weapons continue to age.

2.1.4 Treaty on the Nonproliferation of Nuclear Weapons (NPT)

Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." However, the NPT does not establish a time frame for achieving these goals and the President and the Congress have not set a schedule for these goals. Actions by the U.S., including its moratorium on nuclear testing accompanied by significant reductions in its strategic force structure, nuclear weapons stockpile, and production infrastructure, constitute significant progress toward these goals. However, unless and until there are significant changes in national security policy, NNSA is required to design, produce, and maintain the nuclear weapons stockpile pursuant to requirements established by the President and Congress. In conjunction with the 2001 NPR, President Bush set an objective of “achieving a credible nuclear deterrent with the lowest-possible number of nuclear warheads consistent with our national security needs.” In recognition of this objective and the reduction in the U.S. stockpile since the end of the Cold War, this SPEIS qualitatively evaluates changes in the alternatives that would be appropriate if the stockpile is reduced below the level set by the Moscow Treaty. Accordingly, this SPEIS analyzes alternatives that satisfy requirements of the existing national security policy framework, as well as a capability-based alternative that, while not capable of meeting current requirements, could meet those requirements if the stockpile were reduced below the level called for by the Moscow Treaty.

2.1.5 Moscow Treaty

This treaty does not limit the total number of nuclear weapons possessed by each party — it limits the strategic nuclear warheads that are operationally deployed. The provisions of the

START I Treaty, which is scheduled to expire in 2009, are still being implemented. The START II Treaty, while ratified, never entered into force. Both parties ratified the Moscow Treaty in 2003 and it further reduced the number of deployed strategic offensive nuclear warheads below the proposed START II levels.

For comparative purposes, 6,000 operationally deployed warheads were allowed under START I, 3,500 operationally deployed strategic warheads would have been allowed under START II and a range of 1,700-2,200 operationally deployed warheads is allowed under the Moscow Treaty. The U.S. plans to achieve a stockpile in this range by the end of 2012.

2.1.6 Nuclear Weapons Stockpile Plans (NWSPs)

NWSPs are normally issued each year by the President and define the actual stockpile size and composition in the near-term (usually for a six-year period). A joint DoD/DOE requirements and planning document is also developed annually that provides long-term planning for up to several decades. The NWSP creates the requirements for nuclear weapons that NNSA is required to meet. The NWSP is a classified document and contains details about the stockpile size and composition that is not part of treaties or unclassified government sources. However, the following unclassified information explains the latest NWSP and its effects on planning assumptions for weapon production capabilities and capacities.

Stockpile composition refers to the number of different weapon types scheduled to remain in the stockpile; currently there are seven types. This number has not changed significantly after the Cold War from START I to the Moscow Treaty. These weapons types contain the same general types of components and subsystems. They differ in technical and manufacturing detail, but these details have little effect on the basic technical and industrial “capabilities” required by NNSA to support the overall stockpile.

Stockpile size refers to the total number of weapons expected to remain in the stockpile for the foreseeable future of the seven major types. The total number includes both the treaty-accountable, operationally deployed strategic nuclear warheads and additional warheads retained for a number of reasons, such as support of routine maintenance cycles, repairs and attrition due to destructive testing. Beyond these requirements, a decision to dismantle any excess weapons in inventory, i.e., weapons not considered part of the stockpile, is considered carefully. An excess weapon can become a valuable asset if exchanged for deployed weapons of the same type in the event a problem is discovered that affects only part of the inventory of that type – for example, one bad manufacturing lot out of ten lots. Also, some of the weapon types were produced over a number of years. If an aging problem is discovered, perhaps a younger weapon could be exchanged for one that may be older. This could allow more time to investigate and find a solution to the problem. Excess weapons also provide some insurance against the need to return to nuclear testing to confirm or fix a problem.

Weapon reliability is assessed annually based in part on laboratory and surveillance tests on a relatively small number of each weapon type. There can be no “end-to-end” functional test of a complete nuclear weapon in its “stockpile-to-target” environments. In lieu of this, laboratory and flight surveillance tests are conducted at the component and subsystem levels and the data

are combined and analyzed to produce a reliability estimate for the weapon. While this methodology is adequate for estimating the current reliability of a weapon, it does not provide high-confidence predictions of the future behavior of an aging weapon. Because of these uncertainties, NNSA needs to plan some excess capacity beyond known requirements to be able to respond to unknown policy and technical issues that may arise over the next decades.

2.1.7 Presidential Directives after 1996 and Public Law (109-163)

Beginning in 2001, additional national security policies for the SSP began to develop. The 2001 NPR mandated a smaller U.S. nuclear weapons stockpile, but also a more robust and responsive infrastructure as part of the deterrence strategy. Starting in 2005 with Section 3111 of the National Defense Authorization Act for FY2006 (Public Law 109-163), the Congress established the Reliable Replacement Warhead program (RRW program) with the following objectives:

- (1) To increase the reliability, safety, and security of the United States nuclear weapons stockpile.*
- (2) To further reduce the likelihood of the resumption of underground nuclear weapons testing.*
- (3) To remain consistent with basic design parameters by including, to the maximum extent feasible and consistent with the objective specified in paragraph (2), components that are well understood or are certifiable without the need to resume underground nuclear weapons testing.*
- (4) To ensure that the nuclear weapons infrastructure can respond to unforeseen problems, to include the ability to produce replacement warheads that are safer to manufacture, more cost-effective to produce, and less costly to maintain than existing warheads.*
- (5) To achieve reductions in the future size of the nuclear weapons stockpile based on increased reliability of the reliable replacement warheads.*
- (6) To use the design, certification, and production expertise resident in the nuclear complex to develop reliable replacement components to fulfill current mission requirements of the existing stockpile.*
- (7) To serve as a complement to, and potentially a more cost-effective and reliable long-term replacement for, the current Stockpile Life Extension Programs.*

Section 3111 mandates the study of a different technical approach to the production and maintenance of the safety, security and reliability of the nuclear weapons stockpile without nuclear testing.

2.2 SAFETY, SECURITY AND RELIABILITY OF THE U.S. STOCKPILE

This section focuses on the technical effects of national security policies in shaping the purpose, need, proposed actions, and alternatives of the SSP and this SPEIS.

2.2.1 Stockpile History

1945 to 1990: Following World War II, the U.S maintained a nuclear deterrent force as safe and reliable as the evolution of military requirements and technology development would permit. The size of the nuclear weapons stockpile peaked in the 1960s. In the 1970s, it was significantly reduced due to the easing of Cold War tensions with the former Soviet Union. In the late 1970s and through most of the 1980s, Cold War tensions with the former Soviet Union significantly increased and the U.S. nuclear deterrent force was modernized in response. However, the size of the U.S. nuclear weapons stockpile remained stable during the 1980s with the production of new-design weapons replacing dismantled weapons on a nearly one-for-one basis.

1990 to 2000: The beginning of the 1990s brought the collapse of the Warsaw Pact and the Soviet Union and the end of the Cold War. Changes in U.S. policy in the early 1990s led to dramatic reductions in the size and diversity of the nuclear weapons stockpile. Many thousands of weapons have been dismantled and there have been significant reductions in the size and capabilities of the U.S. weapon production infrastructure.

2000 to the Present: The beginning of the new century brought a new strategy for nuclear deterrence. The 2001 NPR establishes the framework of the new strategy, in which a responsive infrastructure replaces a large standing stockpile as a hedge against future uncertainties. Operationally deployed strategic nuclear warheads will be reduced to between 1,700 and 2,200 warheads by 2012 under this framework.

2.2.2 Historical Stockpile Data and the Smaller, Aging Stockpile

Before the early 1990's, the stockpile's reliability was maintained by a robust nuclear testing program, production of new weapons types, and a continuous cycle of modernization and replacement of existing types to meet evolving safety, security and military requirements. During this period, these practices resulted in the rapid turnover of the stockpile, keeping the average age of weapons in it at approximately 12 years, or about half their typical design-life goal of 20-25 years. The last generation of weapons produced, now referred to as the legacy stockpile, was built in the 1970s and 1980s, with more than half the weapons produced before 1985.

A nuclear weapon has several thousand individual parts grouped into a dozen or more hermetically sealed subsystems, each of which contain some combination of organic, inorganic, radiological and hazardous materials. Each of these major subsystems can age or otherwise deteriorate independent of the others even though they are subjected to the same environment. The 1996 SSM PEIS included a lengthy discussion on historical stockpile data. It explained the role that nuclear testing played in finding and correcting defects in the stockpile. It also summarized the results of more than 35 years of data from stockpile surveillance and environmental testing programs and NNSA's requirements for making modifications to these

programs to assure the continued safety and reliability of the stockpile in the absence of nuclear testing.

The overall conclusion, drawn in 1996, was that there would be needs, over the next ten ensuing years (1995- 2005) for “certified repairs and replacements” within the stockpile due to its aging. This has, in fact, been the case. NNSA has completed or is conducting major retrofits on three of the seven weapon types currently scheduled to remain in the stockpile to correct certain defects. Some but not all of the defects were due to aging. Also, some, but not all, of the major retrofits have been accomplished as part of a life extension program (LEP). An LEP is a systematic approach by weapon type that consists of a coordinated effort by the design laboratories and production facilities to: (1) determine which components will need refurbishing to extend each weapon’s life; (2) design and produce the necessary refurbished components; (3) install the components in the weapons; and (4) certify that the changes do not adversely affect the safety and reliability of the weapon. There have been, during this same period, a number of retrofits of the seven weapon types performed outside the nuclear explosive package that have not been part of the LEP for that type.

It is important to note that predictions of major findings and actionable defects made in 1996 were for the following ten years. Now, more than ten years later, the weapons themselves, and also many of their individual components and subcomponents are beginning to enter an age where there may be far less relevant data available to base performance and reliability predictions. NNSA is responding by adjusting surveillance and environmental testing requirements and developing new computer codes and simulation tools to extend its predictive capabilities. This is no small task and collecting the types and amounts of data required to make credible assessments and predictions can take a considerable amount of time. It should not be assumed that the infrastructure of NNSA’s aging facilities will always be able to support the operating environment required for some of the tools and processes for these evolving test programs or to support the weapons modifications that they may indicate will be needed in the future. Similarly, it is becoming increasingly difficult to predict whether it will always be possible for these programs to detect and correct whatever problems may develop as the stockpile continues to age with the same level of confidence as we have in the past.

At the end of FY 2006 the nuclear physics laboratories (LANL and LLNL) completed the first ever assessment of the effects of the aging of plutonium on the lifetimes of pits in nuclear weapons. This study was reviewed by JASON. The unclassified version of the JASON report, which substantially agreed with the NNSA laboratory results, has received significant attention. This overall study is an example of the excellent stockpile stewardship work on the part of the technical community that supports the U.S. stockpile. The results, however, can not be extrapolated to a general prediction of the remaining life of legacy stockpile weapons. While this study revealed important information, it was only the first such estimate for pits, and only addressed the known and measurable aging mechanisms for the plutonium components in the pits. There are thousands of components in modern nuclear weapons, many of which are subject to aging, and, as pointed out by the JASON review, there is still additional work to do on plutonium and the other materials in primaries. The import of this study on the planning assumptions for the SSP is that it is unlikely that legacy pits will need to be replaced in the near future. There cannot be an absolute certainty established even in this regard since some aspects

of the performance of modern nuclear weapons are not experimentally accessible without underground testing. There is always the potential for the emergence of issues affecting pit lifetime of which we are currently unaware. Therefore NNSA will continue to investigate the aging of plutonium and all the other materials of concern to nuclear weapons, while monitoring the aging of weapons through stockpile surveillance.

2.3 PURPOSE AND NEED FOR NNSA ACTION

In accordance with the national security policies developed after 1996, this SPEIS focuses on the present need for a more responsive NNSA Complex that will:

- Maintain core competencies in nuclear weapons;
- Maintain a safe and reliable nuclear weapons stockpile; and
- Create a responsive nuclear weapons infrastructure that is cost-effective, has adequate capacity to meet reasonably foreseeable national security requirements, and consolidate Category I/II special nuclear materials (SNM) at fewer sites and locations within sites to reduce the risk and safeguards costs.

The Complex must be transformed independent of whether an RRW proceeds or life-extension of legacy weapons remains the authorized approach to sustain the stockpile. Likewise, the potential environmental effects associated with the infrastructure to support a smaller stockpile than established by the Moscow Treaty are evaluated to the extent practical.

2.3.1 Responsiveness of the Nuclear Weapons Complex Infrastructure

The current production infrastructure is not sufficiently responsive or cost-effective. Responsiveness means the ability to successfully meet national security requirements on schedule and react to new developments. Lack of responsiveness has been evidenced by difficulties in executing weapon production schedules in support of maintenance, retrofit, and Life Extension Programs, and by the lack of a sufficient pit production capability.

A reliable and responsive infrastructure is a cornerstone of the new triad discussed in the 2001 Nuclear Posture Review (Figure 2-2) and in section 3111 of the National Defense Authorization Act for FY 2006 (Public Law 109-163). The purpose of a reliable and responsive infrastructure is to deter adversaries from trying to seek advantage – an attempt to seek advantage would be detected and negated by a quick response. A more responsive infrastructure is expected to permit further reductions in the weapons stockpile. In the context of the SSP, this responsiveness could permit deeper reductions in the total weapons stockpile that supports the deployed stockpile.

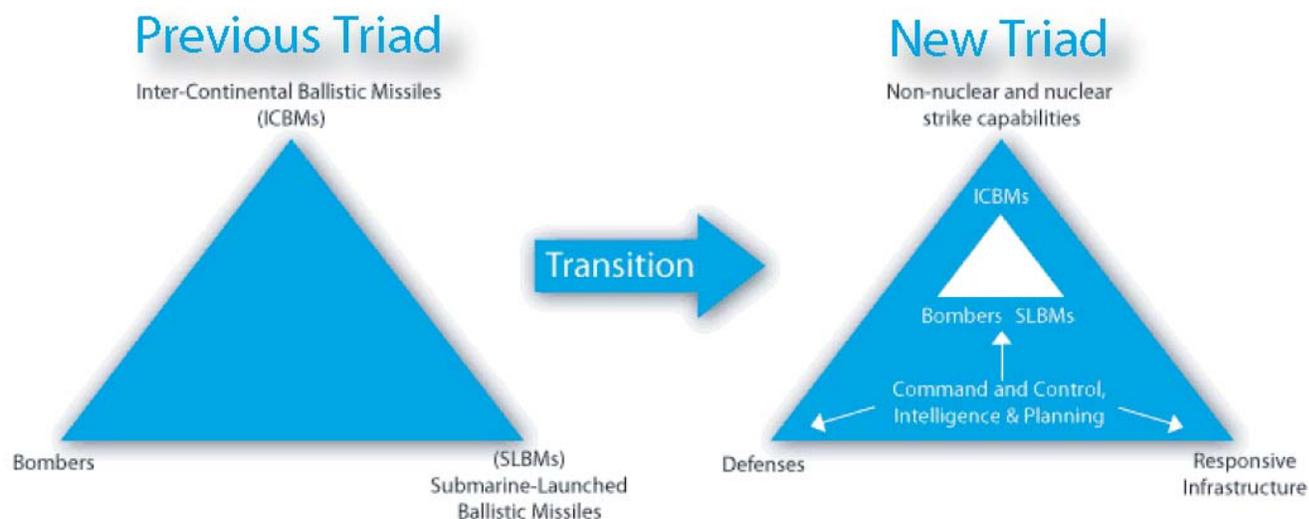


Figure 2-2 — Transition to the New Triad

2.3.2 Laboratory Technical and Industrial Base Capabilities

The underlying purpose and need for the technical and industrial capabilities of the SSP remain unchanged from that described in the 1996 SSM PEIS. National security policies still require the core competencies and capabilities of NNSA and its national laboratories, production plants, and test site. They are basic needs that must be maintained for the foreseeable future in order for NNSA to meet its national security obligations.

2.3.3 Adequate Production Capacity for a Smaller Stockpile

The Complex must retain a reasonable capability to produce required weapons and components. Production capacity, therefore, is established based on NNSA's judgment as to what might be reasonably required. There is presently no validated model that can predict with absolute certainty when major components or subsystems will develop a condition that would require their repair or replacement. Only a few component types are known to have a specific limited life, such as those that are determined by the half-life of the tritium they contain. Technical judgments on the relevance of available data, and the implications of other factors for potential production needs, must be used to arrive at the planning assumptions for future production. A capacity to produce components does not mean that those quantities of components will actually be produced. National security requirements and the authorization and appropriation of funds by the Congress will determine actual production.

A responsive production infrastructure needs to fix problems in a timely way, and therefore it is appropriate to introduce some conservatism into the planning assumptions. A number of other factors also call for conservatism in consolidation and downsizing or "rightsizing" the complex and its facilities. One such factor is the potential for common failure modes among weapon types that use similar components or materials. Certain types of problems could affect several weapon

types at the same time. Another factor is the difficulty in determining the level of responsiveness needed to feel confident about reducing the total stockpile size to the minimum required to support the deployed weapons.

2.3.3.1 *Production Capacity Planning Assumptions*

For the nuclear production alternatives, this SPEIS assumes, as a base case, a manufacturing capacity operated in single shift, five days per week that produces 50-125 weapons per year. The bounding case of producing approximately 200 weapons per year assumes operations in multiple shifts and extended workweeks. The SPEIS also analyzes infrastructure needs for a production rate as low as 50 weapons per year.

Due to the significant investment that may be required for new or modified plutonium and uranium component production facilities, more discussion follows on the technical details that could affect decision-making in this regard. The pit and the secondary assembly component (canned subassemblies [CSA]) are the two main weapon components that use plutonium and uranium.

2.3.3.2 *Technical Considerations for Pit Production Capacity Planning*

A particular need addressed by the alternatives analyzed in this SPEIS is the requirement for adequate production capacity for plutonium pits. The ROD for the 1996 SSM PEIS stated: “DOE’s decision is to reestablish the pit fabrication capability at a small capacity at Los Alamos National Laboratory (LANL)...Should a larger pit fabrication capacity be required in the future, appropriate environmental and siting analysis would be performed at that time.”

In 1996, the interim production capacity case was 50 pits per year (ppy) with a single shift and 80 ppy with multiple shifts at LANL. While this SPEIS analyzes a bounding pit production capacity (200 ppy in multiple shifts and extended workweeks), the lower rates previously analyzed in the SSM PEIS may provide adequate pit production capacity. One of the reasons is that pit reuse, discussed in the SSM PEIS, while still potentially viable for selective weapon applications, has numerous limitations as discussed below and no weapon has entered the stockpile with an intrusively modified pit. The following description of pit reuse is taken from the SSM PEIS Summary document (page S-20):

Intrusive pit modification reuse requires handling and processing of the plutonium internal to the pit. Non-intrusive pit modification reuse involves the external features of the pit and does not require an extensive plutonium infrastructure; the risk of contamination and generation of radioactive waste is very low for non-intrusive modification activities.

Because the pit reuse option could be seen as a substitute for new pit production capacity, more discussion is provided here on the limitations of pit reuse in weapon design and its effect on facility alternatives.

- Pit reuse can limit the ability to improve the performance margin of the primary, which contributes to longer-term reliability. Lower primary performance margins reduce confidence in performance because the weapon is more sensitive to changes that may cause it to fail, such as undesirable changes due to aging or other environmental factors.
- Pit reuse can limit the ability to upgrade the intrinsic safety and security features of a weapon. This is especially true for the nuclear package in a DoD re-entry vehicle (RV) that sits atop a strategic land- or submarine-based ballistic missile. DoD has no plans to modify existing RV aero-shells or significantly change the mass properties (weight, center of gravity, etc.) limitations placed on the nuclear package since modifying the DoD missile delivery system is very expensive. For example, as to nuclear packages containing Conventional High Explosive (CHE), pit reuse may not allow use of Insensitive High Explosive (IHE) to improve detonation safety in accidents or incorporation of enhanced fire safety features. In addition, certain types of enhanced surety features would be technically precluded if CHE is retained. The greatest gains in weapon safety and security could come from improving features in the primary (pit and high explosive subassembly). Evaluation of the technical trade-offs (reliability, safety, security, etc.) and pit reuse in a specific weapon application is not a simple matter. Pit reuse may make sense for certain weapon applications but not others.
- Reuse in the form of non-intrusive pit modification can range from no external modification of the old pit to the addition of significant new external features to it. Concepts with new external features were studied and prototyped and a few nuclear tests were conducted just prior to the U.S. moratorium on nuclear testing began in 1992. The current weapon assembly/disassembly (A/D) facilities may be able to perform such operations.
- Reuse in the form of intrusive pit modification has not been tested and it would be speculative to predict how such reuse might affect production capacity requirements for a pit facility. Conservatively, intrusive pit modification reuse is assumed to require the same basic capabilities as new pit production and require operations not suitable for current weapon A/D facilities.

Current surveillance data on pits in enduring stockpile weapons indicate that they are holding up well with age. However, should their hermetic seal be broken (due to latent manufacturing defects, corrosion, or long term environmental stresses such as temperature and vibration), their reliability could be compromised in a short time. Consequently, judgments about new pit production capabilities and capacities are complex and warrant careful consideration.

2.3.3.3 *Technical Considerations for Secondary Assembly Component (i.e. Canned Subassembly) Production Capacity Planning*

Internally, both the pit and the canned subassembly (CSA) have complex radioactive and chemical characteristics. CSA production capacity may not be equal to planned pit production

capacity due to the difference in their expected lifetimes. For these reasons, CSA production capacity may remain in the same range as the bounding pit production capacity planning assumption (single shift: 125 per year; multiple shifts: 200 per year). Further, there is a very large CSA dismantlement backlog from previously dismantled weapons that needs to be worked off. Higher CSA production capacity, if not used for new production or rebuild, could be used to work off the substantial dismantlement backlog.

2.3.4 A Smaller Infrastructure Footprint for More Cost-Effective Operations

In 2005, a Secretary of Energy Advisory Board (SEAB) task force recommended that NNSA consider a smaller, modernized infrastructure footprint to improve responsiveness, cost effectiveness, and security for high-risk special nuclear materials (SEAB 2005).

2.3.5 Enhanced Security for Special Nuclear Materials

The attacks of September 11, 2001, altered security requirements in the NNSA Complex. As a result, security costs have increased significantly. Most of the effects on NNSA infrastructure are a result of changes to the Design Basis Threat (DBT). The DBT is a profile of the type, composition, and capabilities of a potential adversary. The DBT is used to design safeguards systems to protect against acts of sabotage and to prevent theft of SNM. The details of the DBT, which DOE uses to establish and evaluate its security systems, are classified. However, the effect of changes in the DBT has stimulated proposed actions and an examination of alternatives for consolidating Category I/II SNM at fewer sites and locations within sites to improve security and reduce costs.

2.4 PROPOSED ACTIONS

NNSA's proposed action is to restructure the nuclear weapons complex to make it smaller and more responsive, efficient and secure, while meeting national security requirements. Two basic types of proposed actions result from the needs identified for a more responsive NNSA Complex infrastructure:

- Restructure SNM Facilities (Programmatic Alternatives)
- Restructure R&D and Testing Facilities (Project-Specific Alternatives)

The basic proposed actions appear simple; the alternatives for accomplishing them are complex. It is important to note that "Restructure SNM Facilities" includes evaluation of alternatives having a higher pit production capacity than currently exists at LANL. The details of the alternatives are provided in Chapter 3.

2.4.1 Restructure SNM Facilities

The following functional capabilities are included in this proposed action:

- Plutonium operations, including pit manufacturing, Category I/II SNM storage, and related R&D;
- Enriched uranium operations, including canned subassembly³ manufacturing, assembly, and disassembly; Category I/II SNM storage; and related R&D; and
- Weapons assembly and disassembly (A/D) and high explosives (HE) production.

To consolidate SNM facilities, which would be a long-term process carried out over a decade or more, the SPEIS alternatives address broad issues such as where to locate those facilities and whether to construct new or renovate existing facilities for these functions. As such, this SPEIS analysis is “programmatic” for the proposed action to restructure SNM facilities, meaning that tiered, project-specific NEPA documents could be needed to inform decisions on these facilities if existing site-wide EISs or other NEPA documents were insufficient.

An understanding of some of the existing conditions at the NNSA sites is useful in providing perspective on the complexity of the evaluation task for alternatives.

- There are operational safety issues at some existing facilities that use Category I/II SNM that call into question their viability for use beyond the next five to ten years. One is the Chemistry and Metallurgy Research (CMR) facility at LANL and another is the CSA production facility, Building 9212, at the Y-12 Plant (Y-12). The need to resolve these safety issues will be an important factor in the development of a preferred alternative for this proposed action.
- There are tens of metric tons of Category I/II plutonium and hundreds of metric tons of Category I/II enriched uranium at various sites under the control of three programs within the NNSA – Defense Programs (DP), Fissile Materials Disposition (FMD) and Naval Reactors (NR). This SPEIS concerns the SSP and the SNM managed by DP; however, the plans for management and ultimate disposition of SNM under the jurisdiction of multiple NNSA programs are also considered.

Of the eight NNSA sites involved in the SSP mission, seven currently have Category I/II SNM. The Kansas City Plant (KCP) does not have Category I/II SNM, and Sandia National Laboratories/New Mexico (SNL/NM) will not have any Category I/II SNM after 2008 based on existing plans and NEPA analyses. Of the eight sites involved in the SSP mission, three are national laboratories, four are manufacturing facilities, and one is a test facility. Two of the national laboratories, Lawrence Livermore National Laboratory (LLNL) and LANL, will have Category I/II SNM after 2008. LANL has extensive plutonium facilities, including the capability to manufacture plutonium weapons components. LLNL has Category I/II material but does not have extensive plutonium facilities as does LANL, nor does it have the capability to manufacture

³ Canned subassembly – The component of a nuclear weapon which contains the secondary uranium and lithium elements.

plutonium weapons components. If Category I/II SNM is retained at a single NNSA national laboratory site, it would be at LANL because of the nature and size of its current plutonium facilities; neither SNL nor the LLNL are considered reasonable alternatives for plutonium missions over the long term. This SPEIS evaluates the five remaining sites as alternatives for the proposed action to restructure SNM facilities- Los Alamos, Nevada Test Site (NTS), Pantex, Savannah River Site (SRS), and Y-12.

The current NNSA mission at SRS involves tritium processing and not SNM, but there is considerable former weapon plutonium under the jurisdiction of the Fissile Materials Disposition Program (FMD) at the site. Much of it came from the Rocky Flats Plant after it was closed in 1992 and there is much more plutonium waiting to be sent there in the form of pits coming from weapon dismantlements at Pantex. The current two-step disposition path for the NNSA pits and plutonium is to build two new facilities at the SRS. The Pit Disassembly and Conversion Facility (PDCF) will disassemble the pits and convert them into plutonium-oxide. It is expected to be completed in 2019. A mixed-oxide (MOX) fuel facility to fabricate MOX fuel for use in commercial nuclear power plants from the plutonium oxide is expected to be completed in 2017. These plans are considered in the evaluation of SRS as the site for future plutonium operations.

The general approach in this SPEIS analysis is to evaluate the three functional capabilities-- plutonium operations, uranium operations, and weapons assembly/disassembly in “building block” fashion so that the blocks can be arranged in any combination among the five alternative sites. Both new facilities and upgrades of existing facilities are considered and the building block approach is intended to allow phasing of construction. For example, to constitute a CNPC, a Consolidated Plutonium Center (pit production facility), a Consolidated Uranium Center (production facility for secondaries and cases), and an A/D/HE Center would be built in separate buildings set in a campus-like arrangement, but all would generally be within the same high-security perimeter.

Production rates to support a stockpile, including pit production, are evaluated for the proposed action. In addition, the environmental effects of smaller stockpiles are evaluated.

2.4.2 Restructure R&D and Testing Facilities

The 1996 SSM PEIS did not include any proposed actions to restructure the laboratory technical base other than adding new facilities for enhanced experimental capability. That PEIS concluded, “The continued vitality of all three NNSA national security laboratories will be essential in addressing the challenges of maintaining a safe and reliable nuclear weapons stockpile without nuclear testing.”

In pursuit of a more responsive and cost-effective Complex, a restructuring of the R&D facilities within the laboratory and production complex is being considered. For the proposed action to restructure R&D and testing facilities, the alternatives focus on shorter-term issues to consolidate, relocate, or eliminate duplicative facilities and programs and improve operating efficiencies. The following functional R&D and testing capabilities and capacities are evaluated as part of this proposed action:

- High Explosives R&D
- Tritium R&D
- Flight Test Operations
- Major Hydrodynamic Testing
- Major Environmental Testing

The detailed technical description of these functional capabilities and capacities is provided in Chapter 3.0.

In general, with the exception of flight test operations, the alternatives for these functions are:

- No Action
- Downsize-in-Place
- Consolidate at Fewer Sites

For flight testing, an alternative to the SNL-operated Tonopah Test Range (TTR) is being evaluated. Today, TTR is operated mainly to conduct a small number of surveillance flight tests of air-delivered gravity bombs. With only two gravity bomb weapon types remaining in the stockpile, it may be possible to cease testing at TTR and use the NTS or negotiate with the DoD to use the White Sands Missile Range (WSMR) for this flight testing.

The sites being considered for each of these functions are:

- High Explosives R&D – LLNL, LANL, SNL, Pantex, NTS
- Tritium R&D - LLNL, LANL, SRS
- Flight Test Operations – TTR, NTS, DoD (WSMR)
- Major Hydrodynamic Test Facilities – LLNL, LANL, NTS
- Major Environmental Test Facilities – LLNL, LANL, SNL, NTS, and Pantex

The 1996 SSM PEIS evaluated a proposed action of “enhanced experimental capability” that focused on facilities for high energy density physics (HEDP), such as the National Ignition Facility (NIF) and Atlas, and hydrodynamic test facilities, such as the Contained Firing Facility (CFF). In this SPEIS, only consolidation of existing major hydrodynamic test facilities is being considered. No further consolidations or new HEDP facilities are proposed.

The three national security laboratories, LANL, LLNL, and SNL, are multi-function, multi-disciplinary laboratories that perform R&D work for other NNSA missions, as well as for other programs within DOE, the DoD, and other government agencies. NNSA expects that the nuclear weapon program at the laboratories will change over time, and that other missions arising from 21st century challenges, such as nuclear energy security, will become increasingly paramount. The R&D restructuring alternatives under consideration would retain the unique science, technology, and engineering capabilities at the laboratories for the broader NNSA missions relating to national security. As a result, NNSA does not currently consider it reasonable to propose closure of any of the NNSA laboratories (see also Section 3.1.4). However, such consolidation could be proposed in the future depending upon future national security requirements.

2.5 RELIABLE REPLACEMENT WARHEAD

Even though the RRW is only in the design feasibility study phase, due to high congressional and public interest, this section explains the RRW's possible impact on the nuclear weapons stockpile.

2.5.1 RRW Status

The current status of RRW is that a feasibility study has been completed, a design competition has been concluded, and the Nuclear Weapons Council has selected a design concept. If authorized and funded by the Congress, the design concept would undergo further study and refinement over the coming years and cost estimates would be prepared by the DoD and NNSA. The first RRW being considered is a possible replacement for the Navy's W76 Trident warhead starting as early as 2014. The RRW would not have a different military requirement than the W76 warhead it would replace.

2.5.2 RRW and the Proposed Actions

The RRW would not affect the proposed action related to restructuring SNM facilities, nor the proposed action to restructure R&D facilities.

- **Restructure SNM Facilities:** The proposed action is based on the current site configuration that houses a very large inventory of SNM that needs to be consolidated in more modern facilities independent of whether an RRW is developed.
- **Restructure R&D and Testing Facilities:** R&D, hydrodynamic, environmental, and flight test facilities are needed to support the maintenance of the safety, security, and reliability of the existing stockpile as well as RRW warheads. The R&D and flight test facilities retained will be those necessary to support the future legacy stockpile or an RRW.

The potential effects of an RRW on other aspects of the transformation of the Complex, including pit production capacity, are discussed in the sections that follow.

2.5.3 RRW and Nuclear Testing

It is important to note what was said in the 1996 SSM PEIS Summary on the issues of new weapon design and testing (page S-46) and consider what has changed since that time.

New Weapon Design... Commentors have suggested that the proposal for enhanced experimental capabilities is directed more at the capability to design new weapons in the absence of nuclear testing than at maintaining the safety and reliability of the existing stockpile and that stewardship alternatives could be different if the facilities were directed only at maintaining the existing stockpile. This PEIS explains why these capabilities are needed to maintain the safety and reliability of a smaller, aging stockpile in the absence of nuclear testing (section S.2). The existing U.S. stockpile of nuclear weapons is highly engineered and

technically sophisticated in its design for safety, reliability, and performance. The stewardship capabilities required to make technical judgments about the existing stockpile are likewise technically sophisticated; therefore, it would be unreasonable to say that these stewardship capabilities could not be applied to the design of new weapons, albeit with less confidence than if new weapons could be nuclear tested.

However, the development of new weapon designs requires integrated nuclear testing such as occurs in nuclear explosive tests. Short of nuclear testing, no single stockpile stewardship activity, nor any combination of activities, could confirm that a new-design weapon would work. In fact, a key effect of a "zero-yield" CTBT would be to prevent the confident development of new-design weapons. National security policy requires DOE to maintain the capability to design and develop new weapons, and it will be a national security policy decision to use or not use that capability. Choosing not to use enhanced experimental capability for new weapons designs would not change the technical issues for the existing stockpile and, therefore, the stewardship alternatives would not change.

In 1996, the prevailing technical judgment in the DoD and DOE was that the U.S. should not design and field a new weapon design without nuclear testing, at least equal in sophistication to the testing of weapons already in the stockpile. The judgment was that the technical risk was too high and the confidence too low with the experimental, computational and simulation tools available at the time. Today, more than a decade later, the judgment has changed because of the age of the legacy stockpile, the new experimental, computational, and simulation tools available and new security threats. With either a legacy weapon or an RRW, NNSA does not currently see a need to resume nuclear testing to certify the safety, security, and reliability of the U.S. nuclear deterrent.

2.5.4 Potential Effects of the RRW on the Stockpile

Legacy stockpile weapons were designed to optimize the "yield-to-weight" ratio - that is, the maximum explosive force for the weight and volume of the nuclear warhead specified for the DoD delivery system. This resulted in highly sophisticated, finely tuned warhead designs that optimized yield-to-weight while trying to meet all other competing design requirements for safety, security, reliability, survivability (ability of the weapon to remain fully functional in hostile environments), etc. The RRW design concept allows more weight and volume to be used, which would enable larger margins of safety, security, and reliability to be designed into the warhead. Higher design margins imply higher confidence in meeting the requirements under unanticipated and undesirable conditions over a longer term. For example:

- **Warhead Safety and Security...** The use of Insensitive High Explosive (IHE) in a warhead requires more weight and volume than conventional high explosives (CHE) to perform the same function reliably, but it significantly reduces the probability of detonation in accidents, such as a fire. Thus, the use of IHE can provide a higher safety margin for the warhead, but, because a larger weight and

volume of explosive is required, it occupies a higher fraction of the total weight and volume available for the nuclear package in a DoD delivery system.

- Warhead Reliability... The reliability requirement for legacy stockpile warheads is quite high. However, an RRW would have designed-in higher performance margins. This results in increased confidence that the warhead would remain very reliable over a longer period of time - because it would be less sensitive to internal changes that might cause it to fail due to aging or environmental effects. The ability to improve the performance margins of legacy weapons is limited by the constraints on the original designs developed many years ago.

2.5.5 RRW and Complex Transformation

One of the objectives of the RRW is to simplify component and subassembly fabrication and warhead assembly/disassembly processes. In general, simplifying the design to one with fewer, less complex parts would reduce costly production operations in the Complex. Coordination and cooperation between the design laboratories and production plants to achieve this objective were encouraged by NNSA in the design competition for RRW. Some of the benefits accrue simply by fostering a closer working relationship between the laboratories and plants. However, the main benefit would be achieved by the fact that more weight and volume are available, which permits flexibility in the manufacture, assembly, disassembly, and maintenance of weapons. Some specific examples of improvements that emerged in the design competition were:

- Engineering of structural features that would permit safer and more efficient warhead assembly and disassembly operations.
- Avoiding the use of non-nuclear materials in the design where stockpile surveillance data indicated potential life-limiting concerns.
- Eliminating toxic and hazardous materials if technically acceptable substitutes were available.
- Substituting lower cost commercially available materials and components for higher cost specialty manufactured materials and components when feasible.

Some promising examples of efficiency improvements in manufacturing processes include pits and the cases surrounding the nuclear package. For example, a new pit manufacturing process is estimated to reduce the manufacturing time by about 33 percent.

A detailed cost study on an RRW design is in progress. When completed, it should provide the basis for quantifying the cost and efficiency benefits of the RRW approach.

2.5.6 RRW and the Evaluation of Pit Production Capacity

The current rate of pit production at LANL is about 10 pits per year. For comparison purposes 20 pits per year is currently authorized at LANL under the 1999 LANL SWEIS ROD; the 1996 SSM PEIS evaluated rates of 50-80 pits per year at LANL and SRS; and this SPEIS evaluates bounding rates of 125-200 pits per year at five candidate sites. Sections 2.3.3 and 2.4.1 provide more detail on pit production rate and capacity issues and facility siting alternatives. Regardless

of location, a new pit facility is estimated to take approximately 10 years from the time funding is authorized by Congress to when it becomes fully operational. In other words, while a RRW might affect actual production rates for pits, it would not significantly increase pit production capacity because in either case— legacy or a RRW— NNSA might need to produce pits.

2.5.7 RRWs and Use of Radioactive and Hazardous Materials

The environmental impacts of the proposed action alternatives in this SPEIS are based on the manufacturing materials and processes needed to support legacy stockpile weapons with life extension programs. An RRW is only in the feasibility study stage. However, the RRW design objectives are directed at reducing the use of radioactive and hazardous materials when compared to legacy weapons. Because the environmental impacts in this SPEIS are based on legacy weapons, these impacts should be larger than the potential impacts of an RRW if it were to go into production.

For example, the current RRW design eliminates the use of a toxic metal by substituting a non-toxic metal. If material substitution is not feasible, another way to reduce environmental impacts is to change manufacturing processes so that less radioactive or hazardous waste is created. For example, a RRW pit design has the potential to reduce the amount of plutonium scrap by as much as 90 percent when compared to the manufacture of the pit in the legacy type weapon it replaces.

2.5.8 RRW Summary

The ultimate fate of the RRW has no effect on the proposed actions in this SPEIS, alternatives, bounding production capacities studied, or the assessment of their environmental impacts. The RRW would enable NNSA to change how operations are conducted within the facilities studied in this SPEIS. While RRW would enable more cost-efficient and less hazardous operations, it would not eliminate the need for SNM operations or substantially reduce near-term production needs. Because the environmental impacts are based on the maintenance of the legacy weapons that are currently in the stockpile, a conservative estimate of the environmental impacts is provided by this SPEIS. A pit and CSA production capacity will be required for the foreseeable future with or without implementation of RRW.

2.6 PROGRAMMATIC IMPACTS OF SMALLER STOCKPILES

As discussed earlier in this chapter, the U.S. has steadily reduced its nuclear weapons stockpile since the end of the Cold War. The U.S. will reduce its stockpile to between 1,700-2,200 operationally deployed strategic warheads by 2012 in accordance with the Moscow Treaty. There are more than the 1,700-2,200 treaty-accountable warheads in the current total stockpile, and, based on the Nuclear Weapons Stockpile Plan, this will remain true in 2012. Section 2.1.6 explains the reasons for extra weapons in support of an operationally deployed stockpile and it also explains the indirect relationship of stockpile size to planning assumptions for the industrial capacities that may be needed to repair or replace weapons. This section discusses the sensitivity of the proposed actions and alternatives in this SPEIS to the possibility of a stockpile smaller than the one set by the Moscow Treaty.

2.6.1 Defining a Smaller Stockpile

In regard to smaller stockpiles, the 1996 SSM PEIS examined a hypothetical smaller stockpile of about 1000 weapons. This stockpile level required retaining a capacity to produce about 50 weapons per year. Prior discussions in this chapter explain the technical reasons why this is a judgment and not a mathematical calculation. This was defined as the low case for the production analyses. This is still a reasonable assumption for a production capacity; only it appears somewhat more likely than it did more than a decade ago. In this SPEIS, the 50 weapons per year rate is referred to as “capability-based capacity.”

2.6.2 Capability-Based Capacity

A factory-style layout of the process equipment needed to produce just one stockpile quality component is inherently capable of producing many more components per year if operated throughout the year. The production and maintenance of nuclear components within a weapon are the main determinants for infrastructure size and environmental impacts. A reasonable judgment of the inherent capacity of a production line for nuclear components exceeds 50 per year. A modern factory-style layout could result in a minimum inherent capacity in the range of 125 components per year. At these levels, a further decrease in the annual production rate, based on a reduction in stockpile size, would not significantly change the amount of process equipment, factory floor space, or qualified personnel needed. It would, however, affect the environmental impacts of actual operations.

2.6.3 Potential Effects on the Proposed Actions and Alternatives

For the reasons explained in the preceding paragraph and those that follow, the proposed actions and alternatives in this SPEIS have been scoped to meet a projected smaller stockpile size and annual production rates that are lower than already evaluated (i.e. the No Action Alternative, which includes 20 pits per year).

- Restructure SNM Facilities – A smaller stockpile would not change the intent of the proposed action to consolidate SNM. In addition, the alternatives already evaluate a maximum consolidation alternative at a single production site.
- Restructure R&D and Testing Facilities – In general, a smaller stockpile does not eliminate the need for the basic R&D facilities evaluated in the proposed action in that all legacy weapon types use the same basic materials (tritium, etc.) and require the same type of test capabilities.

Chapter 3
ALTERNATIVES

Chapter 3 ALTERNATIVES

Chapter 3 describes the alternatives assessed in this Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS). Chapter 3 begins with an overview of the alternatives and a description of the process utilized to develop the reasonable alternatives for this SPEIS. The majority of Chapter 3 is a summarized description of the programmatic and project-specific alternatives. Chapter 3 also discusses alternatives that were considered and subsequently eliminated from detailed evaluation. The chapter concludes with a summary comparison of the environmental impacts associated with the alternatives and identifies the National Nuclear Security Administration's (NNSA) preferred alternative. A more detailed description of the alternatives is contained in Appendix A.

3.0 OVERVIEW

This Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) evaluates alternatives for establishing a smaller, more efficient nuclear weapons complex (Complex) that is able to respond to changing national security challenges. A more responsive Complex would help ensure the long-term safety, security, and reliability of the nuclear weapons stockpile while reducing the possibility that the United States (U.S.) would need to resume underground testing.

3.1 DEVELOPMENT OF REASONABLE ALTERNATIVES

NNSA has been considering how to continue the transformation of the Complex since the Nuclear Posture Review was transmitted to Congress in early 2002. The Stockpile Stewardship Conference in 2003 (DoD 2003), the Department of Defense Strategic Capabilities Assessment in 2004 (DoD 2004), the recommendations of the Secretary of Energy Advisory Board Task Force on the Nuclear Weapons Complex Infrastructure in 2005 (SEAB 2005), and the Defense Science Board Task Force on Nuclear Capabilities in 2006 (DoD 2006) were considered by NNSA in this regard.

In 2006, NNSA developed a planning scenario for the future of the Complex (NNSA 2006). This was a continuation of NNSA's effort to establish a Complex that is more responsive to changing national security requirements, as determined by the President and Congress, and that is operated as efficiently as possible. Accordingly, NNSA developed the planning scenario after evaluating how significant economic and security benefits could be realized if the Complex were reduced in size, capacity, number of sites with Category I/II SNM (and locations of Category I/II SNM within sites), and redundant activities at facilities eliminated - in other words, whether and how the Complex could be made more secure and efficient.

Planning for Complex Transformation includes evaluation of alternatives for the next decade, as well as decisions NNSA has already made based on the evaluations in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM PEIS), Tritium Supply and Recycling PEIS, and other *National Environmental Policy Act* (NEPA) documents (see Section 1.5). NNSA developed the proposed actions and alternatives (described in Sections 3.3 through 3.13) that are analyzed in this SPEIS based on this planning and comments received

during scoping. In addition to the environmental reviews of these alternatives, NNSA has completed detailed economic studies of the alternatives (TechSource 2007a, 2007b, 2007c, 2007d) which are available to the public.

Any new facilities will, pursuant to DOE Order 413.3A, meet the requirements for High Performance and Sustainable Buildings that promote buildings that are environmentally responsible and healthy places to work and, where appropriate, utilize the consensus-based national standard for developing high-performance, sustainable buildings under the Leadership in Energy and Environmental Design developed by the U.S. Green Buildings Council.

3.1.1 Restructure SNM Facilities

The following functional capabilities are considered in this proposed action:

- Plutonium operations, including pit manufacturing; Category I/II SNM storage; and related R&D;
- Enriched uranium operations, including canned subassembly manufacturing, assembly, and disassembly; Category I/II SNM storage; and related R&D; and
- Weapons assembly and disassembly (A/D) and high explosives (HE) production.

To consolidate SNM facilities, which would be a long-term process carried out over a decade or more, the SPEIS alternatives address broad issues such as where to locate those facilities and whether to construct new or renovate existing facilities for these functions. As such, this SPEIS analysis is “programmatically” for the proposed action to restructure SNM facilities, meaning that tiered, project-specific NEPA documents could be needed to inform decisions on these facilities if existing site-wide EISs or other NEPA documents were insufficient.

As shown on Figure 3.1-1, these “programmatically alternatives” are:

- **No Action Alternative.** NNSA is considering a No Action Alternative, which represents continuation of the status quo including implementation of past decisions. Under the No Action Alternative, NNSA would not make additional major changes to the SNM missions now assigned to NNSA sites.
- **Programmatic Alternative 1: Distributed Centers of Excellence (DCE).** As described in Section 3.5, the DCE Alternative retains the three major SNM functional capabilities (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM at two or three separate sites. This alternative would create a consolidated plutonium center (CPC) for R&D, storage, processing, and manufacture of plutonium parts (pits) for the nuclear weapons stockpile. Production rates of 125 pits per year for single shift operations and 200 pits per year for multiple shifts and extended work weeks are assessed for a CPC.¹ A CPC could consist of new facilities, or

¹ See Section 3.15 for a discussion of a new CPC with a smaller capacity.

modifications to existing facilities at one of the following sites: Los Alamos,² NTS, Pantex, SRS, and Y-12. This SPEIS also considers an upgrade of facilities at Los Alamos to produce up to 80 pits per year. Highly-enriched uranium storage and uranium operations would continue at Y-12. As part of this alternative, a new Uranium Processing Facility (UPF) and an upgrade to existing facilities at Y-12 are analyzed. The weapons Assembly/Disassembly/High Explosives (A/D/HE) mission would remain at Pantex.

- **Programmatic Alternative 2: Consolidated Centers of Excellence (CCE).** As described in Section 3.5, the CCE Alternative would consolidate the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM at one or two sites. Two options are assessed: (1) the single site option (referred to as the consolidated nuclear production center [CNPC] option); and (2) the two-site option (referred to as the consolidated nuclear centers [CNC] option). The CCE alternative assesses three major facilities: (1) a CPC; (2) a consolidated uranium center (CUC), which would be similar to the UPF but would also include HEU storage and non-nuclear support functions; and (3) an A/D/HE Center, which would assemble and disassemble nuclear weapons and fabricate high explosives. Under the CNPC option, a new CNPC could be established at Los Alamos, NTS, Pantex, SRS, or Y-12. The SPEIS analyzes the impacts of each of these facilities separately and in combination with one another. If Pantex or Y-12 were not selected for this option, weapons operations at Pantex, Y-12, or both sites would cease. Under the CNC option, the plutonium and uranium component manufacturing missions could be separate from the A/D/HE mission. The A/D/HE functions could remain at Pantex or be transferred to the NTS, while the plutonium and uranium missions could be located at sites different than the A/D/HE function. The CCE Alternative assesses production rates of 125 weapons per year for single shift operations and 200 weapons per year for multiple shifts and extended work weeks.³
- **Programmatic Alternative 3: Capability-Based Alternative.** As described in Section 3.6, under this alternative, NNSA would maintain a basic capability for manufacturing components for all stockpile weapons, as well as laboratory and experimental capabilities to support stockpile decisions, but would reduce production facilities in-place to a capability to manufacture replacement components at a nominal level (approximately 50 per year). Under this alternative, pit production capacity at LANL would not be expanded beyond a capability to produce 50 pits per year. Production capacities at Pantex, Y-12, and the SRS would be reduced to a capability-based level.⁴

² In general, when referring to the Los Alamos National Laboratory, this SPEIS refers to this site as “LANL.” The term “Los Alamos” is used to describe this site as an alternative location for a CPC or Consolidated Nuclear Production Center (CNPC).

³ See Section 3.15 for a discussion of a new CNPC with a smaller capacity.

⁴ A capability-based capacity is defined as the capacity inherent in facilities and equipment required to manufacture up to 50 pits per year.. In the Notice of Intent for this SPEIS, this capacity was referred to as a “nominal capacity”.

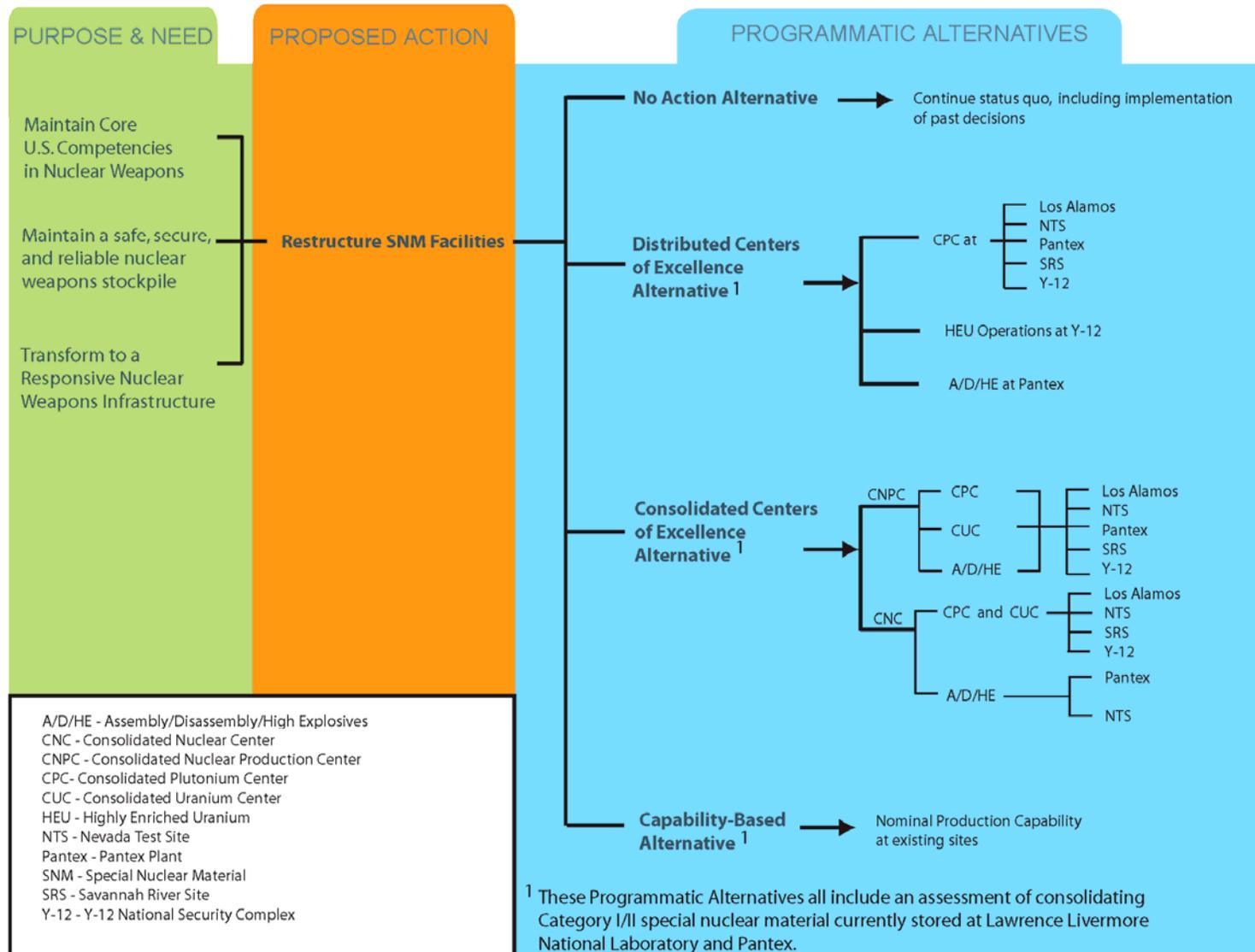


Figure 3.1-1 — Programmatic Alternatives

The DCE Alternative, CCE Alternative, and the Capability-Based Alternative all include proposals to reduce the amount of SNM currently stored at LLNL⁵ and Pantex. Those proposals are described in Section 3.7.

3.1.2 Restructure R&D and Testing Facilities

In pursuit of a more responsive and cost-effective Complex, NNSA is considering a restructuring of the R&D and testing facilities within the Complex. For the proposed action to restructure R&D and test facilities, the alternatives focus on near-term actions to consolidate, relocate, or eliminate facilities and programs and improve operating efficiencies. The following functional R&D capabilities and capacities are being evaluated:

- High Explosives R&D
- Tritium R&D
- Flight Test Operations
- Major Hydrodynamic Testing
- Major Environmental Testing

The analysis of alternatives for these capabilities is “project specific,” meaning that no further NEPA review would likely be needed to implement decisions consistent with the alternatives analyzed in this SPEIS. Restructuring of these facilities is expected to be pursued regardless of which programmatic alternative is selected for SNM facilities. The project-specific alternatives, shown on Figure 3.1-2, were developed to achieve significant benefits in making the Complex more secure and efficient. In addition to these project-specific alternatives for restructuring R&D and testing, this SPEIS also addresses alternatives related to non-nuclear component design and engineering work at SNL/California.

Project-Specific Analysis

A project-specific analysis is a detailed analysis of the environmental impacts of a proposed action and the reasonable alternatives. The project-specific analysis is intended to support actions that could be implemented after the ROD, without any additional NEPA analysis.

In order to identify and develop these alternatives, NNSA created Integrated Project Teams (IPT). The charter of the IPTs was to identify actions that could be taken to achieve downsizing, consolidate activities, eliminate duplicative and excess facilities, or otherwise make an activity more efficient and cost effective. The membership of each IPT consisted of experts in relevant operations around the Complex.

The IPTs evaluated the functional capabilities identified above. These potential alternatives were identified as those that offered the greatest potential to significantly improve the security or efficiency of the Complex to allow NNSA to better accomplish its mission. The IPTs developed

⁵ The LLNL SWEIS (DOE 2005a) assesses the environmental impacts of transporting SNM to and from LLNL and other NNSA sites, SRS, and WIPP. That analysis includes consideration of transportation actions involving greater quantities of SNM and more shipments than are identified in this SPEIS. As such, the transportation activities associated with consolidating SNM from LLNL are included in the existing No Action Alternative and can proceed without additional NEPA analysis. For completeness, however, this SPEIS includes the environmental impacts associated with such actions.

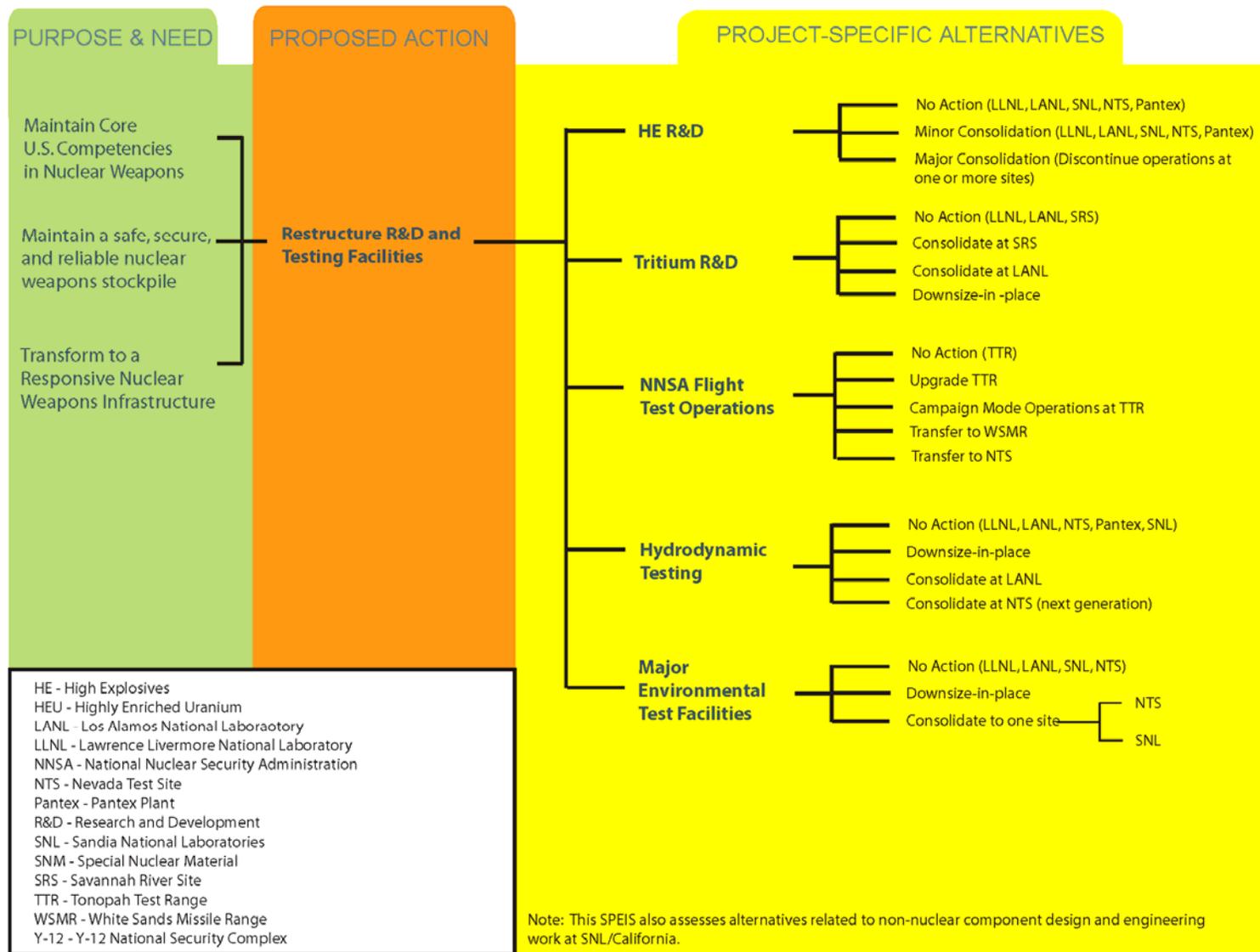


Figure 3.1-2 — Alternatives to Restructure R&D and Testing Facilities

an assessment of the programmatic requirements for each mission area, conceptualized ways to meet those mission requirements while making the Complex more secure and efficient. The IPTs developed the proposals and the alternatives that would restructure R&D and testing facilities. Those alternatives are described in Section 3.8 through Section 3.13.

3.2 OVERVIEW OF POTENTIALLY AFFECTED SITES AND EXISTING MISSIONS

3.2.1 Los Alamos National Laboratory

LANL was established as a nuclear weapons design laboratory in 1943. Its facilities are located on approximately 28,000 acres about 25 miles northwest of Santa Fe, New Mexico. LANL is a multidisciplinary research facility engaged in a variety of programs for NNSA, DOE, other government agencies, and the private sector. Its primary mission is the Stockpile Stewardship Program, emergency response to nuclear incidents, arms control, nuclear nonproliferation, and environmental clean-up. LANL conducts research and development in the basic sciences, mathematics, and computing applicable to its NNSA missions and to a broad range of other activities including: non-nuclear defense; nuclear and non-nuclear energy; material science; atmospheric, space, and earth sciences; bioscience and biotechnology; and the environment. Table 3.2.1-1 lists the current missions at LANL.

With regard to nuclear weapons, LANL is responsible for the design of the nuclear explosive package in certain U.S. weapons (LLNL has this responsibility for the other weapons).⁶ LANL performs research, design, development, testing, surveillance, assessment, and maintains certification capabilities in support of the SSP. In addition, LANL produces plutonium pits within its existing capacity of nominally 20 pits per year, as announced in the Record of Decision for the 1999 LANL Site-Wide EIS (64 FR 50797, September 20, 1999). LANL also conducts surveillance of pits and manufactures some non-nuclear components (e.g., detonators).

Table 3.2.1-1 — Current Major Missions at LANL

Mission	Description	Sponsor
Nuclear Weapons	Stockpile stewardship; nuclear design and engineering; pit production and surveillance; limited non-nuclear component production; HE R&D; hydrodynamic testing; tritium R&D	NNSA's Office of Defense Programs
Arms Control and Nonproliferation	Intelligence analysis; technology R&D; treaty verification; fissile material control; nonproliferation analysis	NNSA's Office of Defense Nuclear Nonproliferation

⁶ The general responsibilities assigned to LLNL and LANL for nuclear explosive packages are complementary. LANL and LLNL compete for assignment of responsibility for design and development of the nuclear explosive package for a nuclear weapons system. In the early design definition phase, both laboratories perform systems studies, preliminary development work, and initial design definition. NNSA, in consultation with the DoD and the cognizant military service, then selects either LANL or LLNL to work with SNL to design, and develop the new weapon system. LANL or LLNL designs and develops the nuclear physics package and associated support hardware; SNL designs and develops the arming, fuzing, and firing system; other warhead electronics; and external cases and mounts. SNL also performs systems integration to develop the complete system. There are nuclear explosive packages in the current legacy stockpile that have been designed and developed by both LANL and LLNL.

Table 3.2.1-1 — Current Major Missions at LANL (continued)

Mission	Description	Sponsor
Energy Research, Science and Technology	Neutron science; scientific computing; fusion energy; health and environmental research; high energy and nuclear physics; basic energy sciences; modeling and simulation	DOE’s Office of Science; DOE’s Office of Nuclear Energy (NE)
Energy Technology	Solar Cells; Fuel Cells; Shale Oil Detection;	DOE’s Office of Energy Efficiency and Renewable Energy (EE)
Environmental	Environmental restoration; waste analysis, management, and treatment	DOE’s Office of Environmental Management (EM) and NNSA ⁷
Work for Others	Conventional weapons; computing, modeling, and simulation	DoD, Department of Homeland Security (DHS), and various other agencies
Bioscience and technology	Biothreat reduction through Biodetection and Bioforensics R&D	DHS; CDC (Center for Disease Control)

3.2.2 Lawrence Livermore National Laboratory

LLNL was established as a nuclear weapons design laboratory in 1952. LLNL’s main site is located on approximately 821 acres in Livermore, California. LLNL also operates a 7,000 acre “Experimental Test Site” known as Site 300, which is located approximately 12 miles east of the main laboratory. Site 300 is used primarily for high explosives testing, hydrodynamic testing, and other experimentation, such as particle beam research.

LLNL is a multidisciplinary research facility engaged in a variety of programs for DOE, NNSA, other government agencies, and the private sector. Its primary mission is the SSP; emergency response to nuclear incidents, arms control, and nuclear nonproliferation activities. LLNL conducts research and development activities in the basic sciences, mathematics, and computing, applicable to its NNSA mission areas, and to a broad range of other programs including: non-nuclear defense; nuclear and non-nuclear energy; high-energy density physics; atmospheric, space, and earth sciences; bioscience and biotechnology; and the environment. Table 3.2.2-1 lists the current missions at LLNL. With respect to nuclear weapons, LLNL is responsible for the design of the nuclear explosive package in certain weapons (LANL has this responsibility for the other weapons). LLNL maintains research, design, development, testing, surveillance, assessment, and certification capabilities in support of Stockpile Stewardship.

Table 3.2.2-1 — Current Major Missions at LLNL

Mission	Description	Sponsor
Nuclear Weapons	Stockpile stewardship; nuclear design and engineering; HE R&D; hydrodynamic testing; tritium R&D; stockpile surveillance	NNSA’s Office of Defense Programs
Arms Control and Nonproliferation	Intelligence analysis; treaty verification; counter proliferation analysis; fissile material control	NNSA's Office of Defense Nuclear Nonproliferation

⁷ NNSA has responsibility for managing newly generated wastes.

Table 3.2.2-1 — Current Major Missions at LLNL (continued)

Mission	Description	Sponsor
Energy, Research, Science and Technology	Scientific computing; fusion energy; health and environmental research; high energy and nuclear physics; basic energy sciences; nuclear safety	DOE’s Office of Science; NE
Environmental	Environmental restoration; waste management and treatment	EM and NNSA ⁸
Work for Others	Conventional weapons; computing, modeling, and simulation; astrophysics and space science; microelectronics and optoelectronics	DoD and various other agencies
Radioactive Waste	Repository Studies	DOE’s Office of Civilian and Radioactive Waste Management (RW)
Bioscience and Biotechnology	Biothreat reduction through microbiological and genome studies	NNSA; DHS; EPA; CDC

3.2.3 Nevada Test Site

NTS occupies approximately 867,000 acres in the southeastern part of Nye County in southern Nevada. It is located about 65 miles northwest of Las Vegas. It is a remote, secure facility with restricted airspace that maintains the capability for conducting underground testing of nuclear weapons and evaluating the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials. The first nuclear test at NTS was conducted in 1951. Since the signing of the Threshold Test Ban Treaty in 1974, it has been the only U.S. site used for nuclear weapons testing. The last nuclear test was conducted in 1992. Approximately one-third of the land (located in the eastern and northwestern portions of the site) has been used for nuclear weapons testing; one-third (located in the western portion of the site) has been reserved for future missions, and one-third has been reserved for R&D, nuclear device assembly, diagnostic canister assembly, and radioactive waste management. In addition, DOE is preparing an application seeking Nuclear Regulatory Commission authorization to construct and operate a repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain, an area on the southwestern boundary of the site.

A primary NNSA mission at NTS is the nuclear weapons SSP, and includes maintaining the readiness and capability to conduct underground nuclear weapons tests within 24-36 months, (if so directed by the President). Other aspects of stockpile stewardship at NTS include conventional HE tests, dynamic experiments, and hydrodynamic testing. The Nuclear Emergency Search Team based at NTS maintains the readiness to respond to any type of nuclear emergency, including search and recovery for lost or stolen weapons, and conducts training exercises related to nuclear weapons and radiation dispersal threats. The Device Assembly Facility houses criticality machines and stores SNM in support of a range of NNSA missions. The current missions and functions of NTS are shown in Table 3.2.3-1.

⁸ NNSA has responsibility for managing newly generated wastes.

Table 3.2.3-1 — Current Major Missions at Nevada Test Site

Mission	Description	Sponsor
Nuclear Weapons Program	Stockpile stewardship activities, including maintenance of readiness to conduct underground nuclear tests, if directed	NNSA's Office of Defense Programs
Waste Management	Safe and permanent disposal of waste through disposal on NTS or to offsite commercial waste treatment or disposal facilities	EM, RW, and NNSA ⁹
Environmental Restoration	Identification, reduction, and cleanup of contaminated areas	EM
Nondefense Research and Development	Original research efforts by DOE, other Federal agencies, and universities	DOE's Office of Science; EM and others
Work for Others	Provides for the use of NTS areas and facilities by other groups and agencies for activities such as military training exercises	DoD and various other agencies

3.2.4 Tonopah Test Range

The Tonopah Test Range (TTR), managed and operated by SNL, is a 179,200-acre site located at the very northern end of the Nevada Test and Training Range, about 32 miles southeast of Tonopah, Nevada. TTR is used for NNSA flight testing of gravity-delivered nuclear weapons (bombs). The actual flight tests are conducted with one or more denuclearized warheads, called joint test assemblies, which are dropped from DoD aircraft or simply flown over the test range. The primary purpose of evaluation activities is the timely detection and correction of problems in the hardware interfaces for gravity weapons, and to ensure that components conform to design and reliability requirements throughout their life. DoD also currently uses TTR for exercises and as an emergency divert base for aircraft.

3.2.5 Pantex Plant

Pantex is located approximately 17 miles northeast of Amarillo, Texas, on 15,977 acres. Its missions are research and development on chemical high explosives for nuclear weapons; fabrication of high-explosive components essential to nuclear weapon function; assembly, disassembly, maintenance, and surveillance of nuclear weapons in the stockpile; dismantlement of nuclear weapons retired from the stockpile; and interim storage of plutonium components from dismantled weapons. Weapons activities involve the handling (but not processing) of uranium, plutonium, and tritium components, as well as a variety of non-radioactive hazardous or toxic chemicals. The current Pantex missions and functions are listed in Table 3.2.5-1.

Pantex is authorized to assemble, disassemble, and modify weapons in accordance with the ROD for the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components* (62 FR 3880, January 27, 1997). Although the specifics of nuclear weapons operations at Pantex are classified, approximately one-half of the current and future Pantex workload involves dismantling nuclear weapons. Under all alternatives, dismantlement operations would continue and there are no proposals in this SPEIS to increase activity levels

⁹ NNSA has responsibility for managing newly generated wastes.

beyond those previously evaluated.¹⁰ The current Pantex missions and functions are listed in Table 3.2.5-1.

Table 3.2.5-1 — Current Major Missions at Pantex

Mission	Description	Sponsor
Weapons Assembly and Maintenance	Initial production, repairs, modifications and safety/technology updates of nuclear weapons	NNSA
Weapons Disassembly and Dismantlement	Disassembly and disposal of nuclear weapons and their materials in a manner to protect worker, public, and environmental safety.	NNSA
Evaluation of Weapons	Surveillance testing and evaluation of active system weapons to maintain reliability of the nation's stockpile.	NNSA
High Explosive Fabrication and Research and Development	Develop, fabricate, and research high explosives that surround the nuclear components of weapons.	NNSA
Interim Plutonium Pit Storage	Provide environmentally controlled, safe, and secure interim storage for plutonium pits.	NNSA
Waste Management	Provide waste management and decontamination and decommissioning activities	EM and NNSA ¹¹

3.2.6 Sandia National Laboratories

SNL was established as a non-nuclear design and engineering laboratory separate from LANL in 1949. The principal laboratory is located in Albuquerque, New Mexico (SNL/NM); a division of the laboratory (SNL/CA) is located in Livermore, California, near LLNL. Sandia Corporation (the contractor that operates SNL under contract with NNSA) also operates the TTR in Nevada.

SNL is engaged in a variety of programs for NNSA, DOE, other government agencies, and the private sector. Its primary mission is implementation of the SSP and related systems engineering and non-nuclear component design and engineering. Other missions involve arms control and nonproliferation activities. In addition, SNL conducts R&D activities in advanced manufacturing, electronics, information, pulsed power, energy, environment, transportation, and biomedical technologies.

In regard to nuclear weapons, SNL is responsible for cradle-to-grave oversight of the non-nuclear components as well as being the system integrator for assuring the safety and reliability of the entire weapons system. SNL maintains research, design, development, testing, surveillance, assessment, and certification capabilities in support of the SSP. In addition, SNL performs some non-nuclear manufacturing functions, including the fabrication of neutron generators and production of limited quantities of microelectronic parts. Table 3.2.6-1 lists current missions at SNL.

¹⁰ In the Notice of Intent for this SPEIS, NNSA stated that the proposed action would accelerate nuclear weapons dismantlement activities; these activities are already occurring. For example, during fiscal year 2007, NNSA increased its rate of dismantling nuclear weapons by 146 percent over the previous year's rate.

¹¹ NNSA has responsibility for managing newly generated wastes.

Table 3.2.6-1 — Current Major Missions at SNL

Mission	Description	Sponsor
Defense Programs and Nuclear Weapons	Stockpile stewardship; non-nuclear design and engineering; R&D; modeling and simulation; maintenance of national security readiness; limited non-nuclear component production	NNSA's Office of Defense Programs
Arms Control and Nonproliferation	Intelligence support; treaty verification; nonproliferation technology; reduce threat of nuclear accidents	NNSA's Office of Defense Nuclear Nonproliferation
Energy, Research, Science and Technology	Energy infrastructure enhancements, including electric, geothermal, solar, wind and photovoltaic; coal, gas and petroleum; fusion; basic energy sciences	EE; DOE's Office of Fossil Energy (FE); and DOE's Office of Science
Environmental	Environmental restoration; waste management; hazardous material transport systems engineering	EM and NNSA ¹²
Work for Others	Conventional weapons; computing, modeling, and simulation; satellites; arming, fusing, and firing systems; probabilistic risk assessment; transport packaging	DoD and various other agencies

3.2.7 White Sands Missile Range¹³

The White Sands Missile Range (WSMR), located in south-central New Mexico, is the largest installation in the DoD. WSMR is a Major Range and Test Facility Base under the Department of the Army Test and Evaluation Command, Developmental Test Command, providing test and evaluation services to the Army, Air Force, Navy, other government agencies, and industry. The range covers more than 3,000 square miles of land and 10,026 square miles of contiguous restricted airspace fully managed, scheduled, and controlled by the WSMR. Holloman Air Force Base is located adjacent to the range's east boundary, and has capabilities for aircraft support and staging. WSMR has a full suite of flight test instrumentation including radar, telemetry, and optical equipment that would allow for complete coverage of a NNSA gravity weapons flight test. WSMR has extensive experience conducting flight tests with requirements and flight test scenarios similar to the NNSA flight test program, including requirements concerning penetrating weapons, weapons recovery, and test materials.

3.2.8 Savannah River Site

SRS is located in south-central South Carolina and occupies approximately 198,420 acres in Aiken, Barnwell, and Allendale counties. The site was established in 1950 and is approximately 15 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina. The major nuclear facilities at SRS have included fuel and target fabrication facilities, nuclear material production reactors, chemical separation plants used for recovery of plutonium and uranium isotopes, a uranium fuel processing area, and the Savannah River National Laboratory, which provides technical expertise. The initial mission at SRS was production of heavy water and

¹² NNSA has responsibility for managing newly generated wastes.

¹³ WSMR is not currently part of the NNSA nuclear weapons complex. However, WSMR is being considered as a location for NNSA Flight Testing.

strategic radioactive isotopes (plutonium-239 and tritium) in support of national defense. Today, the main weapons mission at SRS is tritium supply management and R&D.

Tritium, an important component of nuclear weapons, decays and must be replaced periodically to meet weapons specifications. Tritium recycling facilities empty tritium from weapons reservoirs, purify it to eliminate the helium decay product, and fill replacement reservoirs with specification tritium for nuclear stockpile weapons. Filled reservoirs are delivered to Pantex for weapons assembly and to the DoD as replacements for weapons reservoirs. The Tritium Extraction Facility takes rods, which have been irradiated in a commercial light water reactor, and extracts tritium for use in the nation’s nuclear weapons. As an NNSA mission that is separate from weapons activities, a mixed oxide fuel fabrication facility is under construction and a pit disassembly and conversion facility is planned to be built at SRS to disposition excess plutonium. The current missions at SRS are shown in Table 3.2.8-1.

Table 3.2.8-1— Current Major Missions at Savannah River Site

Mission	Description	Sponsor
Tritium Supply Management and R&D Support	Operate H-Area tritium facilities and Tritium Extraction Facility; conduct tritium R&D; evaluate reservoir components returned from the stockpile	NNSA
Research and Development	Savannah River National Laboratory; technical support for NNSA, EM, and NE	NNSA; EM; and NE
Waste Management	Operate waste processing facilities	EM and NNSA ¹⁴
Environmental Monitoring and Restoration	Operate remediation facilities	EM
Energy Technology	R&D of hydrogen (production, separation, and storage) as an energy source	EE
Stabilize Targets, Spent Nuclear Fuels, and Other Nuclear Materials	Operate F- and H- Canyons	EM
SNM Disposition	Build and operate facilities for SNM disposition	NNSA’s Office of Defense Nuclear Nonproliferation

3.2.9 Y-12

Y-12 is one of three primary installations on the DOE Oak Ridge Reservation (ORR), which covers a total of approximately 35,000 acres in Oak Ridge, Tennessee. The other installations are the Oak Ridge National Laboratory (ORNL) and the East Tennessee Technology Park (formerly the Oak Ridge K-25 Site). Construction of Y-12 started in 1943 as part of the World War II Manhattan Project. Y-12 consists of approximately 800 acres. The early missions of the site included the separation of uranium-235 from natural uranium by the electromagnetic separation and the manufacture of weapons components from uranium and lithium. Today, as one of the NNSA major production facilities, Y-12 is the primary site for enriched uranium processing and storage, and one of the primary manufacturing

Secondaries and Cases

Secondaries are components of nuclear weapons that contain elements needed to initiate the fusion reaction in a thermonuclear explosion. Cases confine the nuclear package.

¹⁴ NNSA has responsibility for managing newly generated wastes from NNSA activities.

facilities for maintaining the U.S. nuclear weapons stockpile. Y-12 is the only source of secondaries, cases, and certain other weapons components within the Complex. Y-12 also dismantles weapons components, safely and securely stores and manages SNM, supplies SNM to naval and research reactors, and dispositions surplus materials. The current missions and functions are listed in Table 3.2.9-1.

Table 3.2.9-1 — Current Major Missions at Y-12

Mission	Description	Sponsor
Weapons Components	Fabricate uranium and lithium components and parts for nuclear weapons and test hardware	NNSA
Stockpile Surveillance	Evaluate components and subsystems returned from the stockpile	NNSA
Uranium and Lithium Storage	Store enriched uranium, depleted uranium, and lithium materials and parts	NNSA
Dismantlement	Dismantle nuclear weapon secondaries returned from the stockpile	NNSA
Environmental Restoration and Waste Management	Waste management and decontamination activities	ER; EH; NE; EM; and NNSA ¹⁵
Work for Others	Provide specialized medical emergency, security technology, and protection strategy expertise to other federal agencies	DoD and various other agencies
Arms control and Nonproliferation	Conduct security technology R&D; technical support for material disposition; global threat reduction; fissile material control; nonproliferation analysis	NNSA's Office of Defense Nuclear Nonproliferation
Naval Reactors	Supply HEU for use as fuel in naval reactors	NNSA

¹⁵ NNSA has responsibility for managing newly generated wastes.

PROGRAMMATIC ALTERNATIVES

3.3 PROGRAMMATIC NO ACTION ALTERNATIVE

Under the programmatic No Action Alternative, NNSA would continue operations to support national security requirements using the existing Complex. As shown on Figure 1.1-1, the current complex consists of multiple sites located in seven states (alternative for the activities conducted at KCP, which manufactures and procures non-nuclear weapons components, are being evaluated separately from this SPEIS, as discussed in Section 3.2.10). The Complex enables NNSA to design and manufacture nuclear weapons; conduct surveillance on weapons in the stockpile; and dismantle retired weapons. Under the No Action Alternative, NNSA sites would continue to perform the weapons functions identified in Section 3.2. A summary of the functions, and the sites where these functions are performed, follows.

Weapon Design and Certification. Nuclear weapons are designed at three NNSA national laboratories; these laboratories also certify the weapons safety and reliability. LLNL and LANL design and engineer the nuclear physics package for nuclear weapons. SNL designs and engineers non-nuclear components and is responsible for systems engineering of nuclear weapons. The laboratories provide the science and technology foundation for the SSP and rely on facilities across the Complex to support essential plutonium, uranium, non-nuclear materials, tritium, and high explosives research and development, as well as, hydrodynamic, environmental, and flight testing. NNSA would not close any of the three laboratories under this alternative (Section 3.14), but could consolidate some research and development and testing facilities to achieve a more integrated, interdependent, and cost-effective Complex.

Plutonium Operations and Pit Manufacture. Pits are the central nuclear core of the primary of a nuclear weapon, and typically contain Pu-239 or HEU. Subsequent to the 1996 SSM PEIS ROD, an interim pit manufacturing capability was established at LANL. In the 1999 LANL SWEIS ROD, DOE decided that LANL would produce nominally 20 pits per year. NNSA is currently preparing a LANL SWEIS that evaluates an alternative to produce up to 80 pits per year in order to obtain 50 certified pits per year. LANL manufactures pits in the Plutonium Facility Complex, consisting of six primary buildings located in Technical Area-55 (TA-55). This activity is supported by numerous laboratories, storage facilities, administrative offices and waste management facilities, located elsewhere at LANL. Both LANL and LLNL currently perform R&D on Category I/II quantities of plutonium.

Uranium Operations and Secondary and Case Fabrication. The energy released by the primary explosion activates the secondary assembly. Secondary assemblies may contain HEU, lithium deuteride, and other materials. Implosion of the secondary assembly creates the thermonuclear explosion. Heavy metal cases surround the secondary assemblies. Uranium operations and secondary and case fabrication are generally performed at Y-12, where most highly enriched uranium materials reserved for weapons are retained. NNSA is currently constructing a new Highly-Enriched Uranium Materials Facility (HEUMF) at Y-12 to consolidate highly-enriched uranium storage. LANL, LLNL, and NTS currently retain smaller Category I/II quantities of highly enriched uranium for R&D. This activity requires high security facilities as well as support, laboratory, waste management, and administrative facilities.

Weapons Assembly/Disassembly and High Explosives Production. Weapons assembly and disassembly refers to the assembly, dismantlement, and reassembly of complete nuclear weapons. This activity is primarily conducted at Pantex, which is the principal facility in the Complex that handles complete nuclear weapons. Facilities include heavily fortified work areas, storage facilities, administrative buildings and support laboratories. Waste management facilities are also required. Pantex also produces and machines the high explosives that surround the nuclear components of nuclear weapons. In the ROD for the EIS for the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components* (62 FR 3880, January 27, 1997), Pantex is authorized to assemble, disassemble, and modify weapons. Although the specifics of nuclear weapons operations at Pantex are classified, approximately one-half of its current and future workload is associated with dismantling nuclear weapons.

Category I/II SNM Storage. Quantities of SNM are categorized into security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. Category I/II SNM are the most attractive materials and require the most extensive and expensive security protection. These facilities consist of heavily fortified storage or processing buildings surrounded by security fences with highly trained, heavily armed security personnel. Category I/II SNM storage facilities are currently located at LANL, LLNL, Pantex, SRS, Y-12, SNL/NM, and NTS. NNSA intends to remove all Category I/II quantities of SNM from SNL/NM by the end of 2008.

Tritium Production and R&D. Tritium is a short-lived radioactive isotope of hydrogen used to increase yield in nuclear weapons. The production of tritium is carried out in a Tennessee Valley Authority reactor. Tritium extraction, purification, and reservoir loading (which are collectively referred to as the "tritium supply management" missions) are carried out at SRS in the Tritium Extraction Facility, which became operational in late 2006, and the H-Area New Manufacturing Facility, which became operational in 1994. Tritium research and development is performed at SRS and LANL (in the Weapons Engineering Tritium Facility). Very limited tritium operations are performed at LLNL in the Tritium Facility within Superblock, primarily to support preparation of tritium targets for the National Ignition Facility, and at SNL/NM in the Neutron Generator Production Facility for neutron generator production. Tritium operations require supporting laboratory facilities and administrative office buildings.

High Explosives Research and Development. High explosives are used in the primary assembly of nuclear weapons. The development of safer, more stable, and more energetic forms of this material are referred to as high explosives research and development. The research and development work includes confined and unconfined detonation of experimental quantities of high explosives. High explosives research and development are conducted at LANL, LLNL, SNL/NM, Pantex, and NTS. This activity entails development laboratories, chemical sotrates, radiography facilities, environmental test facilities, administrative buildings and test fire facilities. Waste management facilities are also required.

Flight Test Operations. Flight test operations assess how weapon systems function in realistic delivery conditions. Denuclearized test weapons are assembled at Pantex. These denuclearized weapons are then subjected to realistic aircraft flight and release conditions. This program is conducted at the TTR for gravity weapons (bombs). Facilities include a drop zone, target

facilities, observation and test equipment, and administrative buildings. Flight testing for ballistic and cruise missiles is conducted at existing DoD test ranges.

Hydrodynamic Test Facilities. Hydrodynamic testing refers to experiments that use high explosives to study the physics of weapons and to assess their performance and safety. These activities are principally conducted at LLNL and LANL, with smaller supporting activities at NTS, SNL/NM and Pantex. High energy radiographic facilities support the hydrodynamic testing capabilities with dynamic radiography. This activity also entails laboratory and administrative office space.

Major Environmental Test Facilities. Environmental test facilities are used to assess the safety, reliability and performance of the nation's nuclear weapons systems through subjecting weapons to differing environmental conditions (shock, vibration, high temperatures, etc.). These facilities test complete (denuclearized) weapons or major weapons subsystems. Major environmental test facilities are located at SNL/NM, LLNL, LANL, and NTS. These facilities are supported by storage, support laboratory, and administrative office buildings. Small environmental test laboratories and capabilities also exist at Pantex and SRS. These smaller test laboratories support component R&D and production, and are an integral part of the production/certification process.

3.3.1 Limitations of the Existing Complex

The existing Complex is aging, too big, and maintains redundant capabilities that were required for the Cold War stockpile. Many of the facilities are being operated beyond their anticipated life. In fact, parts of the Complex were built during the Manhattan Project of the 1940s. It is expensive to maintain these facilities. Reliance on aging facilities increases operating costs and in some instances subjects workers to unnecessary risks. The history of facility construction within the Complex is shown in Figure 3.3.1-1.

The chart shows that there were two periods of significant construction in the 1950s and the 1980s. Construction during these periods was primarily the result of expanding the production capacity as the nuclear weapons stockpile grew rapidly during the Cold War. There are several thousand buildings in the Complex today, covering more than 35 million square feet of floor space, that support weapons activities. Maintaining this much space requires the expenditure of extensive resources for maintenance, safety, and security. As shown on Figure 3.3.1-2, the Complex has undergone significant footprint reductions (approximately 50 percent) since the Cold War ended in 1991. NNSA is continuing to consolidate operations and reduce floor space and ongoing efforts in this regard would continue under the No Action Alternative.

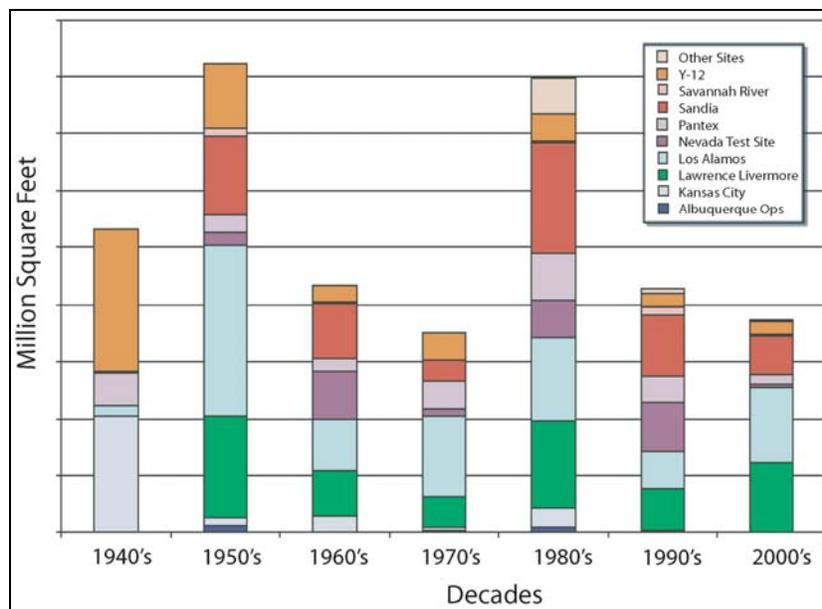


Figure 3.3.1-1 — Facility Construction History within the Current Complex

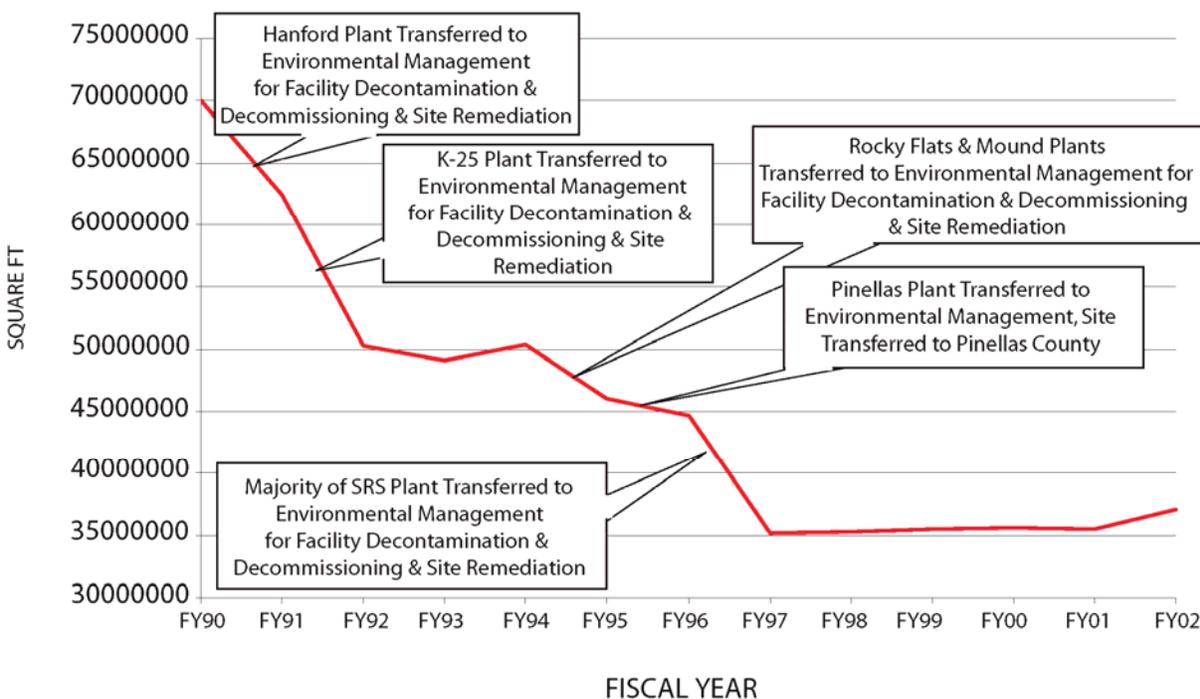


Figure 3.3.1-2 — Footprint Reductions in the Complex Due to Mission Changes

While the functions required to sustain the U.S. nuclear deterrent are understood, the actual facilities that will be used in the future will depend on a number of factors. NNSA anticipates the footprint of the current Complex could be reduced by 20-30 percent in the future. This would result in a footprint of less than 26 million square feet. Figure 3.3.1-3 presents possible

reductions in the footprint of the Complex due to mission changes. As can be seen from the figure, nuclear facilities, office space, laboratory space, and indirect support would be significantly reduced. In 2006, approximately 27,000 management and operating contractor personnel were employed at major NNSA sites to support weapons activities. NNSA is continuing to consolidate operations and reduce floor space, on a site-by-site basis, and these efforts would continue under the No Action Alternative.

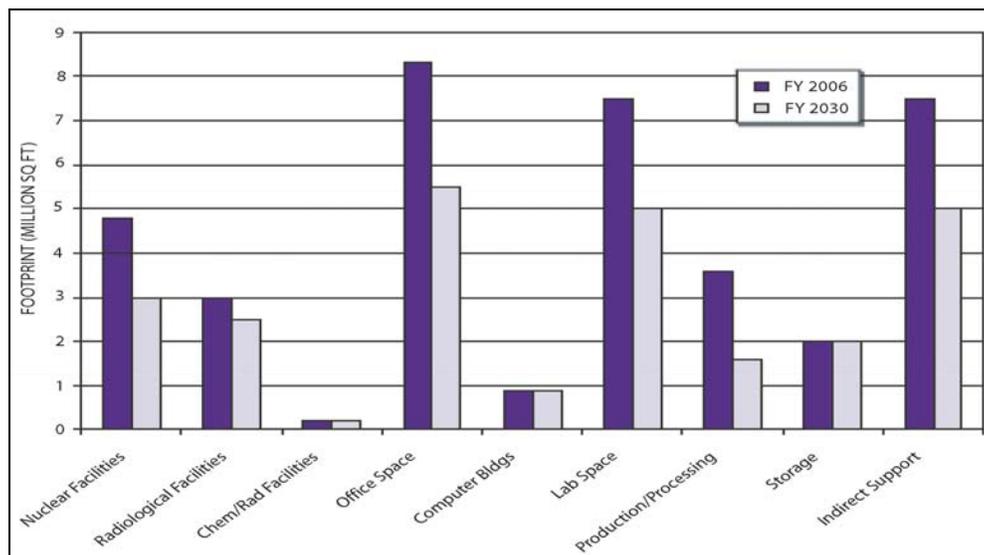


Figure 3.3.1-3 — Possible Footprint Reductions in the Complex Due to Mission Changes

Another requirement of a geographically dispersed Complex and military bases is the need for a safe and reliable transportation system to move weapons components and other items. This function is provided by the Department's Office of Secure Transportation (OST) which transports nuclear weapons, components and special nuclear materials, and conducts other missions supporting national security. Since 1974, OST has operated a system for the safe and secure transportation of all government-owned, DOE controlled special nuclear materials in "strategic" or "significant" quantities. Shipments are transported in specially designed equipment, monitored closely with highly sophisticated satellite telemetry, and escorted by armed Federal Agents (Nuclear Material Couriers). Section 5.10.1 describes the existing transportation system (No Action Alternative) for the Complex.

3.4 PROGRAMMATIC ALTERNATIVE 1: DISTRIBUTED CENTERS OF EXCELLENCE

Under this alternative, NNSA would transform the Complex by consolidating major functions required to support the nuclear weapons stockpile at distributed centers of excellence (DCE). This alternative would locate the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM at two or three separate sites. This alternative would create a consolidated plutonium center (CPC) for the R&D, storage, processing, and manufacture of plutonium parts (pits) for the nuclear weapons stockpile. Production rates of 125 pits per year for single shift operations and 200 pits per year for multiple shifts and extended work weeks are assessed.¹⁶ A CPC could either be a completely new configuration of buildings at Los Alamos, NTS, Pantex, SRS, or Y-12, or an upgrade of existing and planned facilities at Los Alamos (two alternatives, referred to as the “50/80” and “Upgrade”) or planned facilities at SRS. Highly Enriched Uranium (HEU) storage and uranium operations would continue at Y-12. As part of this alternative, a new Uranium Processing Facility (UPF) and an upgrade to existing facilities at Y-12 are analyzed. The weapons Assembly/Disassembly/High Explosives (A/D/HE) mission would remain at Pantex.

3.4.1 Consolidated Plutonium Center

The inception of the Cold War in the early 1950s led to the large-scale production of nuclear weapons. During this time, many facilities were constructed across the country to build nuclear weapons. One of these was the Rocky Flats Plant in Colorado. It commenced production of plutonium components for nuclear weapons, including pits, in 1952. From 1952 until 1989, the principal mission of Rocky Flats was the processing of plutonium and the fabrication of pits that went into the nuclear weapons stockpile.

In 1969 there was a major fire in one of the buildings at Rocky Flats and its cleanup took approximately two years. To prevent similar fires, the Department made many changes to both the equipment and processes used in the manufacture of pits. During the mid 1970s and the 1980s a series of events occurred that altered operations in the Complex: the enactment of major environmental legislation (including the *Resource Conservation and Recovery Act* [RCRA] and the *Comprehensive Environmental Response, Compensation and Liability Act* [CERCLA]); issuance of a Department of Energy Report (DOE 1988) recommending the phase-out of plutonium operations at Rocky Flats due to encroaching population as well as emerging information about the environmental contamination at the site.

In 1989, agents from the Federal Bureau of Investigation (FBI) and U.S. Environmental Protection Agency (EPA) secured the plant to investigate allegations of environmental crimes. Following this event, the production of pits ceased, never again to resume. In 1992, Rocky Flats was officially closed. The reasons for its closure were: encroaching communities; the requirement to conduct extensive environmental remediation; and the recognition that the nation did not need a facility the size of Rocky Flats to maintain the nuclear weapons stockpile.

In 1996, DOE issued a ROD following issuance of the SSM PEIS. The ROD announced DOE’s decision to “reestablish the capability, with an attendant small, interim capacity, for pit

¹⁶ See Section 3.15 for a discussion of a new CPC with a smaller capacity.

fabrication at Los Alamos National Laboratory” (61 FR 68014). Also in that ROD, DOE stated that it would, at a later date, consider a larger capacity for the fabrication of pits than could be achieved in the facilities at LANL. In 2002, NNSA issued a notice of intent to prepare an EIS for a Modern Pit Facility (MPF) (67 FR 59577). While NNSA published a MPF Draft EIS it never issued a final EIS. The analysis of proposed pit production is contained in this Complex Transformation SPEIS.

Only recently has NNSA regained the capability to manufacture pits for the stockpile, however, it is limited to a single pit type (W88) at the LANL plutonium facility within TA-55. In the LANL SWEIS currently in preparation (see Section 1.7), NNSA is assessing an alternative that would increase this interim capacity. A CPC could be new construction or construction and modification of existing facilities (if LANL is the selected site). This section of this SPEIS describes the alternatives for a CPC. This section also discusses the pit production process, and lists the facility requirements necessary to this process. A new seismic study in the LANL SWEIS indicates that the seismic hazard at LANL is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the Design Basis Earthquake (DBE) ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet and whether capacity could be increased in existing facilities.

CPC Requirements and Assumptions

- A CPC would provide the facilities and equipment to perform pit manufacturing, pit surveillance, and plutonium research and development.
- Stockpile requirements are based on national security requirements established by the President and funded by the Congress based on joint recommendations from DOE and DoD. CPC capacity and production output would be designed to meet national security requirements, which could include production of new pits for maintenance of the legacy stockpile or replacement weapons (e.g., Reliable Replacement Warheads [RRW]).
- As described in Chapter 2, this SPEIS assumes that a CPC would provide a manufacturing capacity of 125 pits per year using a single shift, with a contingency of 200 pits per year through multiple shifts and extended work weeks. A CPC would be capable of supporting the surveillance program at a rate of one pit being destructively evaluated per pit type in the stockpile per year. For Los Alamos, this SPEIS also assesses an alternative that would result in a smaller pit production capacity (up to 80 pits per year), based on the use of the existing and planned infrastructure at that site.
- A new CPC would be built and started up over a six year period, and would be fully operational by approximately 2022. A CPC would be designed for a service life of at least 50 years.
- The sites being considered as potential locations for a CPC and consolidation of Category I/II quantities of SNM are Los Alamos, NTS, Pantex, SRS, and Y-12.

- A newly constructed CPC would consist of a central core area surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS), which would enclose all operations involving Category I/II quantities of SNM. The enclosed area would be approximately 40 acres. A buffer area would provide unobstructed view of the area surrounding the PIDAS. All administrative and non-SNM support buildings would be located outside of the buffer area. Once operational, approximate 110 acres would be required for a new CPC (Table 3.4-1). As shown in Table 3.4-1, two CPC alternatives at Los Alamos (Upgrade Alternative and 50/80 Alternative) could reduce land area requirements by the use of existing and planned facilities and infrastructure.

Table 3.4-1 – Land Requirements for CPC Alternatives

	Construction (acres)	Operation (acres)	
		140	110*
Greenfield Alternative (Los Alamos, NTS, Pantex, SRS, Y-12)		PIDAS	Non-PIDAS
		40	70
Upgrade Alternative (Los Alamos)	13	6.5 (All within PIDAS)	
50/80 Alternative (Los Alamos)	6.5	2.5 (All within PIDAS)	

* Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

- It is assumed that CPC facilities would be constructed above ground. During design activities, studies would be performed on worker safety, security enhancements, and costs. For example, whether to locate the CPC facilities above or below-ground would be examined. All 5 sites are assumed to be able to support a buried or partially buried CPC. This SPEIS includes a discussion of the potential differences among the sites in supporting a buried or bermed facility (see Appendix A).
- If Los Alamos is not selected for the CPC mission, it is assumed that plutonium facilities at that site would be reduced to Category III or IV nuclear facilities for R&D purposes, or closed, after the CPC begins operations. Any residual non-Defense Program (DP) missions (i.e. Pu-238) that might use these plutonium facilities after NNSA’s mission in those facilities ends will be responsible for the operation and maintenance of these facilities. However, as explained in Section 3.4.1.6, facilities at Los Alamos are also being considered for an upgrade to meet CPC requirements.
- SNM storage at the CPC would be based on the need to support a 3-month production period. Approximately 3 metric tons of storage is anticipated.
- Any transuranic (TRU) waste from a CPC is assumed to be disposed of at the Waste Isolation Pilot Plant (WIPP) (see Section 10.5.5).

3.4.1.1 *CPC Operations*

The following section discusses CPC operations. It begins with a summary of the pit production process. The overall process would involve three main areas: (1) Material Receipt, Unpacking, and Storage; (2) Feed Preparation; and (3) Manufacturing. In addition, a CPC would perform plutonium R&D and surveillance, as described below.

Material Receipt, Unpacking, and Storage — Plutonium feedstock material would be delivered from offsite sources in DOE/Department of Transportation (DOT) approved shipping containers. The shipping containers would be held in Cargo Restraint Transporters (CRT) and hauled by Safeguards Transporters (SGTs). The bulk of the feedstock material would come from Pantex, in the form of pits from retired weapons. Additionally, small amounts of plutonium metal from LANL and SRS could be used.

Feed Preparation — The containers would then be transferred through a secure transfer corridor to an adjacent Feed Preparation Area where plutonium metal is prepared for manufacturing. For pits that would be recycled, the pit is first cut in half and all non-plutonium components are removed. Notable among these components is EU, which would be decontaminated and then shipped to Y-12 for recycling. All of the other disassembled components would be decontaminated, to the maximum extent possible, and then disposed of as either low-level waste (LLW) or transuranic (TRU) waste, as appropriate.

There are two processes currently being evaluated for the purification of the plutonium metal. One process relies more heavily on aqueous chemistry (aqueous process) and the other on pyrochemical reactions (pyrochemical process). The primary difference between the two is that the aqueous process does not employ chloride, which means conventional stainless steels can be used to contain all of its reactions. On the other hand, the pyrochemical process requires specialized materials to contain the corrosive chloride-bearing solutions that it employs.

The pyrochemical process has the potential to be environmentally more benign than the aqueous process. As the design of a CPC develops and a final purification process is proposed, a site-specific EIS would evaluate in more detail the impacts of the process proposed for use. Additionally, for a CPC that might be constructed at SRS, this SPEIS considers using facilities and infrastructure that are to be constructed in support of the Materials Disposition Program. The Pit Disassembly and Conversion Facility (PDCF) would provide the capability to disassemble nuclear weapons pits and could be modified in the future to convert plutonium to a form suitable for producing new pits. The use of the PDCF and MOX would be consistent with the requirements of September 2000 *Agreement Between the Government of the United States and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation* and any future modifications to this Agreement. The PDCF would include a hardened plutonium processing building, conventional buildings and structures housing support personnel, systems, and equipment (see Section 3.4.1.2).

Manufacturing — Pit manufacturing work includes fabrication of plutonium components for pits and the assembly of pits. Typically, non-plutonium parts would be fabricated elsewhere. These non-plutonium components would be shipped to the CPC to be assembled with the plutonium components into pits. The CPC would require the capability to perform SNM shipping, receiving, and storage; pit disassembly and feedstock sampling; metal preparation, recovery, and refining; product forming, machining, welding, cleaning, and assembly; and product inspection (including radiography), process qualification, production surveillance, and analytical chemistry support. Support and ancillary functions (waste handling, security operations, training, maintenance, administration, process development, and testing) required to perform pit manufacturing are also included in the CPC.

Plutonium R&D — A CPC would conduct plutonium R&D that would investigate the properties and performance characteristics of plutonium. Understanding the properties and performance characteristics allows better modeling of weapon performance and provides assurance of stockpile reliability. This R&D would also assess activities required for pit processing in order to develop more efficient and environmentally benign methods.

Plutonium Pit Surveillance — Pit surveillance is the periodic disassembly and inspection of pits from the active stockpile to identify any defects or degradation, and to assure that nuclear weapons are safe and reliable. Evaluations include leak tests, weighing, dimensional inspection, dye penetration inspection, ultrasonic inspection, radiographic inspection, metallographic analysis, chemical analysis, pressure tests, and mechanical testing.

3.4.1.2 *CPC Facility Requirements*

In order to allow for the pit production processes described above, a CPC would require a number of facilities. Although the specific requirements of these facilities are still being developed, the general requirements are:

Process and R&D Buildings — An approach being evaluated for a CPC would divide the major plant components into four separate buildings identified as Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D to perform the functions described in Section 3.4.1.1. The process buildings would be two-story reinforced concrete structures located aboveground. The exterior walls and roofs would be designed to resist all credible man-made and natural phenomena and comply with all security requirements. The first story of each building would include plutonium processing areas, manufacturing support areas, waste handling, control rooms, and support facilities for operations personnel. The second story of each of the three process buildings would include the heating, ventilating, and air conditioning (HVAC) supply fans, exhaust fans and high-efficiency particulate air (HEPA) filters, breathing/plant/instrument air compressor rooms, electrical rooms, process support equipment rooms, and miscellaneous support space. The buildings would be connected by secure transfer corridors.

Support Buildings within the PIDAS — The major support structures located within the PIDAS would include an Analytical Support Building and a Production Support Building. The Analytical Support Building would contain the laboratory equipment and instrumentation required to provide analytical chemistry and metallurgical support for the CPC processes, including radiological analyses. The Production Support Building would provide the capability for performing classified work related to the development, testing, staging and troubleshooting of CPC processes and equipment. A number of other smaller structures also supporting a CPC would include standby generator buildings, fuel and liquid gas storage tanks, an HVAC chiller building, cooling towers, and an HVAC exhaust stack.

Support Buildings outside the PIDAS — The major structures located outside the PIDAS would include an Engineering Support Building, a Commodities Warehouse, and a Waste Staging/TRU Packaging Building. This Waste Staging/TRU Packaging Building would be used for characterizing and certifying TRU waste prior to packaging and short-term storage prior to

shipment to the waste disposal facility. Parking areas and storm water retention basins would also be located outside the PIDAS. In addition, a temporary concrete batch plant and construction laydown area would be required during construction. A generic layout showing the major buildings and their relationship to each other is shown in Figure 3.4.1-1. Table 3.4.1-1 shows the dimension estimates. The overall plant layout in this generic representation is a greenfield campus layout and would be adapted to each site as necessary. The actual footprint of all of the buildings, as shown in the table, should be less than the “developed” area from the generic layout. Thus, the actual developed site layout could be less than that shown in Table 3.4.1-2, and could fit any site with enough space for buildings footprint and adequate security standoff distances.

Table 3.4.1-1 — Dimensions for the CPC

	Dimension
Processing Facilities Footprint (ft ²)	308,000
Support Facilities Footprint (ft ²)	280,000
Research and Development (ft ²)	57,000
Total Facilities Footprint (ft ²)	645,000
Area Developed during Construction (acres)	140
Post Construction Developed Area (acres)	110

Source: NNSA 2007.

CPC Construction, Operational Materials and Wastes — Tables 3.4.1-2 through 3.4.1-4 identify the construction and operational requirements for a CPC. As shown in Table 3.4.1-2, CPC construction requirements and wastes at LANL and SRS could be less than at all other sites because the existing plutonium infrastructure could be used. For Los Alamos, this SPEIS assumes that a CPC would not require additional construction in support of an R&D mission, as that mission currently exists at LANL. Additionally, the CMRR, a new planned facility for LANL, if built, could provide support to the CPC. For SRS, this SPEIS includes an analysis of both a stand-alone CPC and a CPC that would use the mixed-oxide (MOX) facilities and infrastructure that are to be constructed in support of the Fissile Materials Disposition (FMD) Program (see Section 3.4.1.5 for more details). As shown in Table 3.4.1-2, NNSA has estimated that using these facilities/infrastructure could reduce construction requirements by approximately 25 percent.

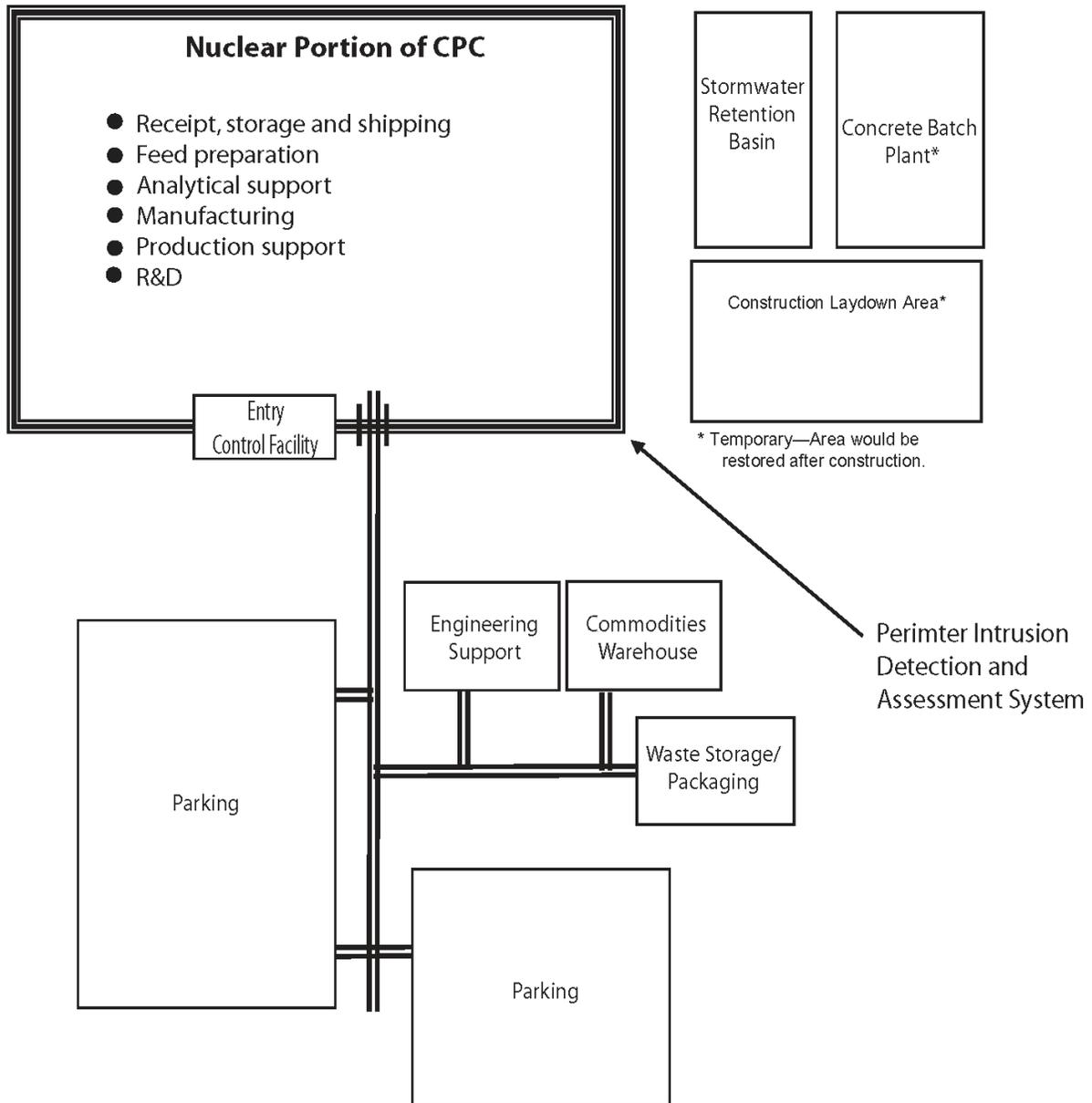


Figure 3.4.1-1 — Generic Layout of a CPC

Table 3.4.1–2 — CPC Construction Requirements

Requirement	Stand-alone CPC at SRS, Y-12, Pantex, NTS	CPC at Los Alamos^a	CPC at SRS Using MOX Facilities^a
Electrical Energy (MWh)	13,000	12,000	12,000
Peak Electricity (MWe)	3.3	3.0	3.0
Concrete (yd³)			
Total	308,000	280,000	280,000
Peak Yearly	107,000	97,000	97,000
Aggregate (yd³)			
Total	288,000	262,000	262,000
Peak Yearly	79,000	72,000	72,000
Steel (tons)			
Total	44,000	40,000	40,000
Peak Yearly	11,900	10,800	10,800
Liquid Fuels (million gallons)			
Total	4.8	4.4	4.4
Peak Yearly	0.8	0.7	0.7
Gases (yd³)			
Total	19,800	18,000	18,000
Peak Yearly	5,700	5,200	5,200
Water (million gallons)			
Total	20.9	20.9	20.9
Peak Yearly	5.6	5.6	5.6
Total Employment (Worker Years)	2900	2,650	2,650
Peak Employment (Workers)	850	770	770
Construction Period (years)	6	6	6
Hazardous Liquid Wastes (tons)	7.0	6.5	6.5
Nonhazardous Solid Wastes (yd ³)	10,900	9,800	9,800
Nonhazardous Liquid Wastes (gallons)	56,000	50,700	50,700

^a Data in this table reflects the fact that CPC construction requirements at Los Alamos and SRS would be lower than at NTS, Pantex, and Y-12 due to the potential use of existing or planned plutonium infrastructure at those two sites.

Source: NNSA 2007

Table 3.4.1-3 — CPC Operations Annual Requirements

Resources	CPC at LANL [200 pits per year (ppy) (surge)] ^f	CPC at SRS, Y-12, Pantex, NTS [200 ppy (surge) plus R&D]
Electrical Consumption ^a (MWh)	48,000	48,000
Peak Electrical (MWe)	11.0	11.0
Diesel Fuel ^b (gallons)	21,000	23,000
Nitrogen ^c (yd ³)	81,000	89,000
Argon ^c (yd ³)	2,000	2,200
Domestic Water ^d (gallons)	14,000,000	15,500,000
Cooling Tower Make-up (gallons)	66,000,000	73,000,000
Steam ^e (million pounds)	227	250
Total workers	1,170	1,780
Radiation workers	675	1,150

^a Electrical: Based on 24 hrs/day, 365 days/yr.

^b Diesel Fuel: Based on diesel generator testing 1 hr/week.

^c Nitrogen and Argon: Annual consumption is based on 1 percent make-up.

^d Domestic Water: Calculations for the annual consumption were based on 189 L/day/person, 240 days/year.

^e Steam would require an energy source for generation. If coal were used, it would require 4,000 tons/yr. If natural gas were used, it would require 5,500,000 yd³/yr.

^f Los Alamos operational requirements for a CPC are less than the other four sites due to the fact that the plutonium R&D activities are part of the existing No Action Alternative at Los Alamos.

Source: NNSA 2007.

Table 3.4.1-4 — CPC Operations Annual Waste Volumes

Annual Operating Waste Type	CPC at Los Alamos [200 ppy (surge)] ^a	CPC at SRS, Y-12, Pantex, NTS [200 ppy (surge) plus R&D]
TRU Solid (including Mixed TRU) (yd ³)	850	950
Mixed TRU Solid (included in TRU solid above) (yd ³)	310	340
LLW Solid (yd ³)	3,500	3,900
Mixed LLW Solid (yd ³)	2.3	2.5
Mixed LLW Liquid (yd ³)	0.4	0.4
Hazardous Solid (tons)	3.6	4.0
Hazardous Liquid (tons)	0.5	0.6
Nonhazardous Solid (yd ³)	7,400	8,100
Nonhazardous Liquid (gallons)	69,500	75,000

^a Los Alamos operational wastes are less than the other four sites due to the fact that the plutonium R&D activities are part of the existing No Action Alternative at Los Alamos.

Source: NNSA 2007.

3.4.1.3 CPC Transportation Requirements

A CPC would require transportation activities as described in this section. Plutonium pit assemblies used as material feedstock would be shipped from Pantex to the CPC. EU parts would be disassembled from the pit assemblies and shipped to Y-12. Y-12 would recondition these parts and they would then be returned to the CPC, where they would be assembled with the plutonium components to produce weapons-ready pits for shipment to Pantex. During startup, and potentially at other infrequent times, additional plutonium metal could be required. This additional plutonium could be shipped to the CPC from SRS. Additionally, as discussed in Section 3.4.1.4, once a CPC becomes operational, Los Alamos would transfer its Category I/II SNM to the CPC if Los Alamos were not selected as the CPC site.

Both TRU waste and LLW would be generated at a CPC. DOE’s Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, would be the destination for TRU waste from all CPC alternative sites. Three candidate sites (LANL, NTS, and SRS) have LLW disposal facilities and would dispose of LLW on-site. Although Y-12 has some LLW disposal capability, it currently ships its LLW to NTS for disposal. Pantex does not have any LLW disposal capacity and would have to ship LLW to the NTS, if Pantex were selected as the CPC site. A matrix depicting the origins, destinations, and materials shipped is provided in Table 3.4.1-5.

Table 3.4.1-5 — Origins, Destinations, and Material Shipped to Support the CPC

Shipment Type	CPC at SRS	CPC at Pantex	CPC at Los Alamos	CPC at NTS	CPC at Y-12
Los Alamos Plutonium into CPC	LANL ⇒ SRS	LANL ⇒ Pantex	LANL ⇒ Los Alamos (intra-site transfer)	LANL ⇒ NTS	LANL ⇒ Y-12
Existing Pits from Pantex into CPC	Pantex ⇒ SRS	None	Pantex ⇒ Los Alamos	Pantex ⇒ NTS	Pantex ⇒ Y-12
EU from Y-12 into CPC	Y-12 ⇒ SRS	Y-12 ⇒ Pantex	Y-12 ⇒ Los Alamos	Y-12 ⇒ NTS	None
EU from CPC to Y-12	SRS ⇒ Y-12	Pantex ⇒ Y-12	Los Alamos ⇒ Y-12	NTS ⇒ Y-12	None
Pits from CPC to Pantex	SRS ⇒ Pantex	None	Los Alamos ⇒ Pantex	NTS ⇒ Pantex	Y-12 ⇒ Pantex
TRU waste out of CPC to WIPP or WIPP-like facility	SRS ⇒ WIPP	Pantex ⇒ WIPP	Los Alamos ⇒ WIPP	NTS ⇒ WIPP	Y-12 ⇒ WIPP
LLW out of CPC	Onsite disposal	Pantex ⇒ NTS	Onsite disposal	Onsite disposal	Y-12 ⇒ NTS

3.4.1.4 Phase-out NNSA Plutonium Operations and Remove Category I/II SNM from LANL

If Los Alamos is not selected as a site for a CPC, NNSA proposes to phase-out plutonium operations and remove Category I/II SNM from Los Alamos by approximately 2022. Although the exact quantities of Category I/II SNM are classified, NNSA’s Category I/II SNM at Los Alamos can be divided up into three basic categories: (1) programmatic material essential to NNSA; (2) surplus material not needed by NNSA; and (3) excess material with no certain future disposition plan.

Programmatic Material — Category I/II inventories of nuclear material essential to the weapons program would be transferred to the eventual CPC or CNPC. This would involve four shipments of material. Shipments to the candidate sites (NTS, Pantex, SRS, and Y-12) were modeled and analyzed.

Surplus Material — Surplus materials held at LANL would be assigned to the Fissile Material Disposition (FMD) Program. This material may be sent to SRS. In 2007, DOE prepared a Supplement Analysis (SA), which determined that the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium from Hanford, LLNL and LANL would not be a significant change from the potential environmental impacts associated with the alternatives analyzed in previous NEPA analyses (DOE 2007). As a result, DOE decided to consolidate storage of surplus, non-pit, weapons-usable plutonium from

Hanford, LLNL, and LANL to SRS, pending disposition (72 FR 51807). Nonetheless, for completeness, this SPEIS includes an analysis of the transportation impact associated with disposition of all surplus plutonium from LANL to SRS. Another proposal, which is not addressed by the SA, is to transport surplus HEU to Y-12. This SPEIS assesses these impacts.

Excess Material — Two scenarios have been analyzed for transporting materials at LANL designated as excess: (1) shipping excess HEU to Y-12 and excess plutonium to SRS; and (2) shipping all excess materials to SRS.

This SPEIS assesses the environmental impacts associated with:

- Packaging and Unpackaging Category I/II SNM
- Transporting Category I/II SNM from LANL to Receiver Sites
- Phasing out Category I/II SNM Operations from LANL

Table 3.4.1-6 — Phase-out of NNSA Plutonium Operations at LANL

Socioeconomics	610 jobs could be affected 483 jobs would be radiation workers.	
Waste	50 pits/year	20 pits/year
	LLW decrease by 1,400 yd ³ annually. MLLW decrease by 20yd ³ annually. TRU decrease by 690yd ³ annually.	LLW: decrease by 990 yd ³ annually. MLLW: decrease by 20 yd ³ annually TRU: decrease by 690 yd ³ annually.
Radiation Dose to Workers	No Action (20 pit/year) dose to workers would decrease by 90 person-rem. For the 50 pit/year to the stockpile scenario analyzed in the LANL SWEIS currently being prepared: dose to workers would decrease by 220 person-rem.	
50-mile Population Dose	No Action (20 pits/year): TA-55 contributes 0.19 person-rem/yr to dose. For the 50 pit/year to the stockpile scenario analyzed in the LANL SWEIS currently being prepared: TA-55 would contribute 0.20 person-rem/yr to dose.	
Air Emissions	TA-55 emits approximately 0.00082 Curies of plutonium annually.	

Source: NNSA 2007.

3.4.1.5 Candidate Sites for a CPC

Figures 3.4.1-2 thru 3.4.1-6 identify the reference locations for a CPC at the five candidate sites. Reference locations were identified at each site, consistent with the environmental analysis in this SPEIS, to evaluate the potential environmental impacts of a CPC. These reference locations were designated by the site offices so as to not conflict or interfere with existing or planned operations. The characterization of the affected environment in Chapter 4 of this SPEIS addresses the entire candidate site and the affected region surrounding the site. Each region varies by resource, but generally extends to a 50-mile radius from the center of each site.

Two of the sites under consideration for pit production function (Los Alamos and SRS) have existing and/or planned facilities that could be used to support production activities. The facilities could influence the location of any new facilities. This SPEIS analyzes options that would use these facilities. Section 3.4.1.6 discusses the Los Alamos option. The SRS option is discussed below.

At SRS, the reference location was selected to provide proximity to the PDCF and MOX facilities. This location would support either a greenfield CPC or use of the infrastructure associated with the PDCF and MOX facilities. The project scope for the PDCF includes the following capabilities and modules: pit receipt, storage, and preparation; pit disassembly; plutonium recovery and oxide conversion; tritium capture and recovery or disposal; oxide blending and sampling; non-destructive assay; product canning and storage; product inspection and sampling for international inspection; product shipping; declassification of parts not made from special nuclear materials; HEU decontamination, oxide conversion, packaging, storage and shipping; and waste packaging, sampling and certification. Support areas within the main building include: an analytical laboratory; mechanical equipment rooms; maintenance shops; ventilation exhaust rooms; waste storage; truck bay; and office areas. The following functions could likely be shared between a CPC and the PDCF: pit receipt, storage, and preparation; pit disassembly; some portions of plutonium recovery and oxide conversion; analytical laboratory; packaging, storage, and shipping; and waste management packaging, sampling and certification. For all practical purposes, the shared functions could be consolidated if these were not separated facilities. The PDCF capability is sized for a higher capacity than the CPC capability. Combining shared functions of the PDCF and the CPC could yield a floor space savings of approximately 27,000 square feet of hardened floor space; thus, a smaller CPC could be built at SRS (NNSA 2007b).

3.4.1.6 *Los Alamos CPC Alternatives*

For purposes of assessing a CPC at Los Alamos, this SPEIS evaluates three approaches: (1) a greenfield CPC alternative (previously discussed in Section 3.4.1.1), in which new nuclear facilities would be constructed; (2) an upgraded alternative in which existing and planned facilities at Los Alamos are upgraded and augmented with new facilities to achieve a baseline of 125 pits per year for single shift operations (Upgrade Alternative); and (3) an upgrade of existing and planned facilities that would provide up to 80 pits per year (50/80 Alternative¹⁷). These latter two approaches are described in this section.

¹⁷ The name “50/80 Alternative” reflects the fact that this alternative would expand pit production capacity up to 80 pits per year.

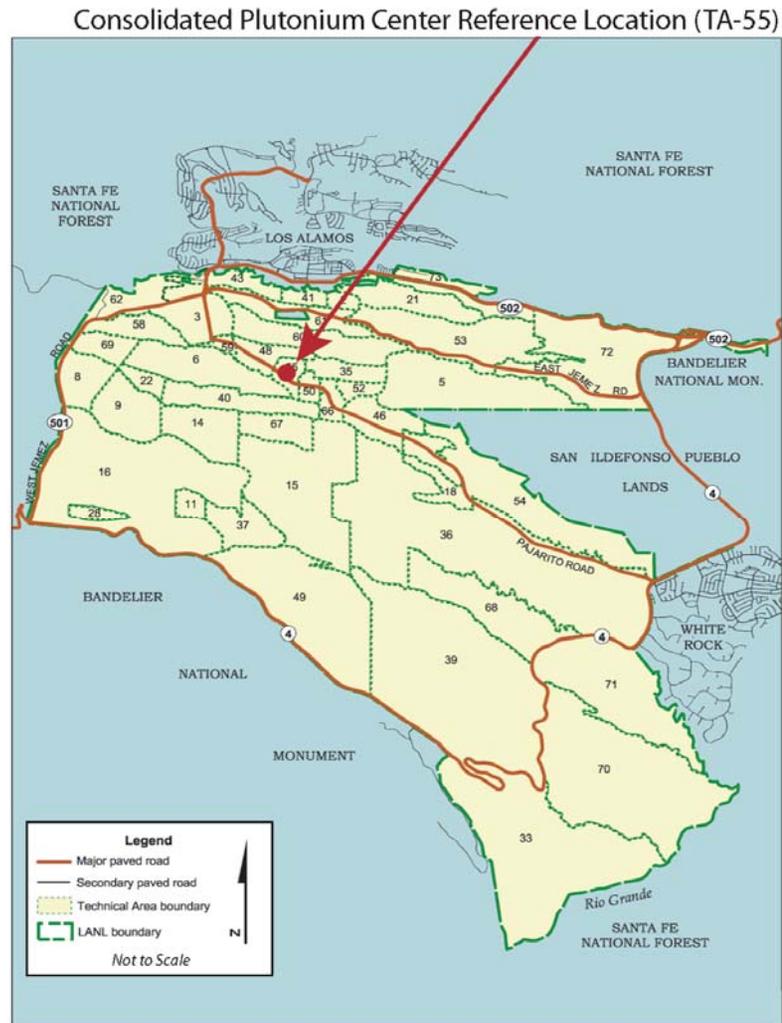


Figure 3.4.1-2 — Los Alamos CPC Reference Location

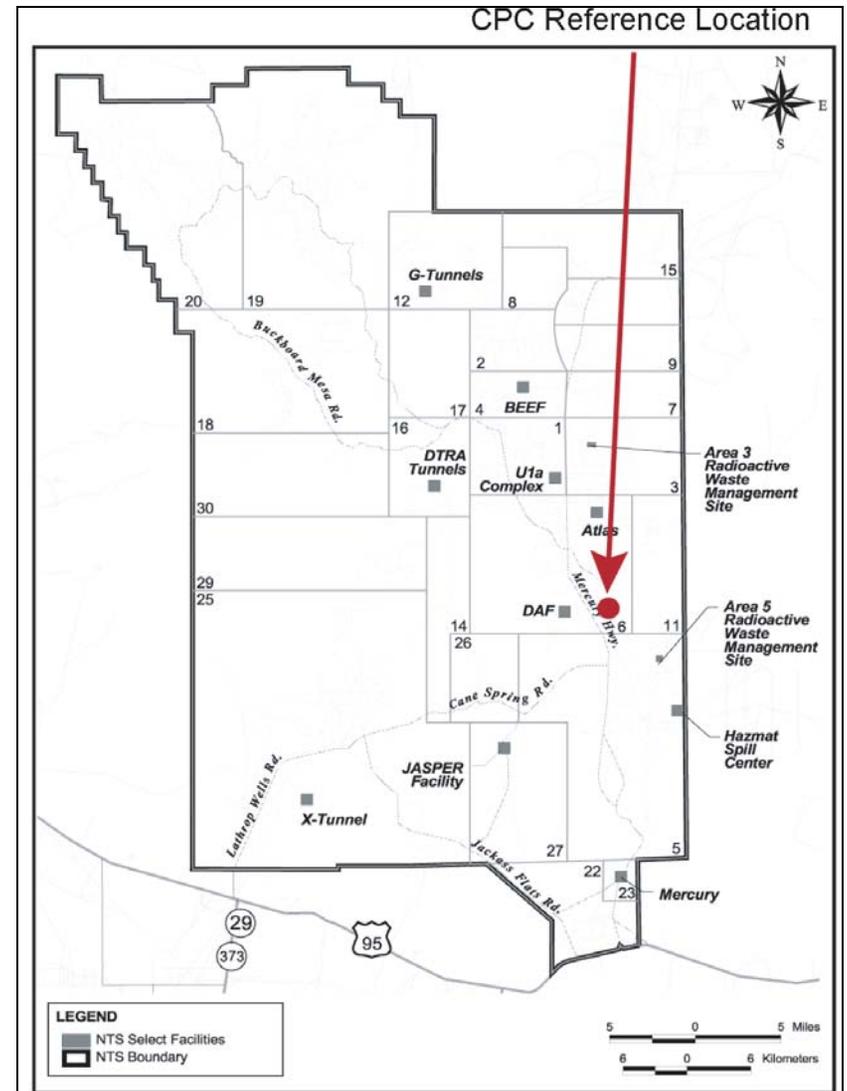


Figure 3.4.1-3 — NTS CPC Reference Location

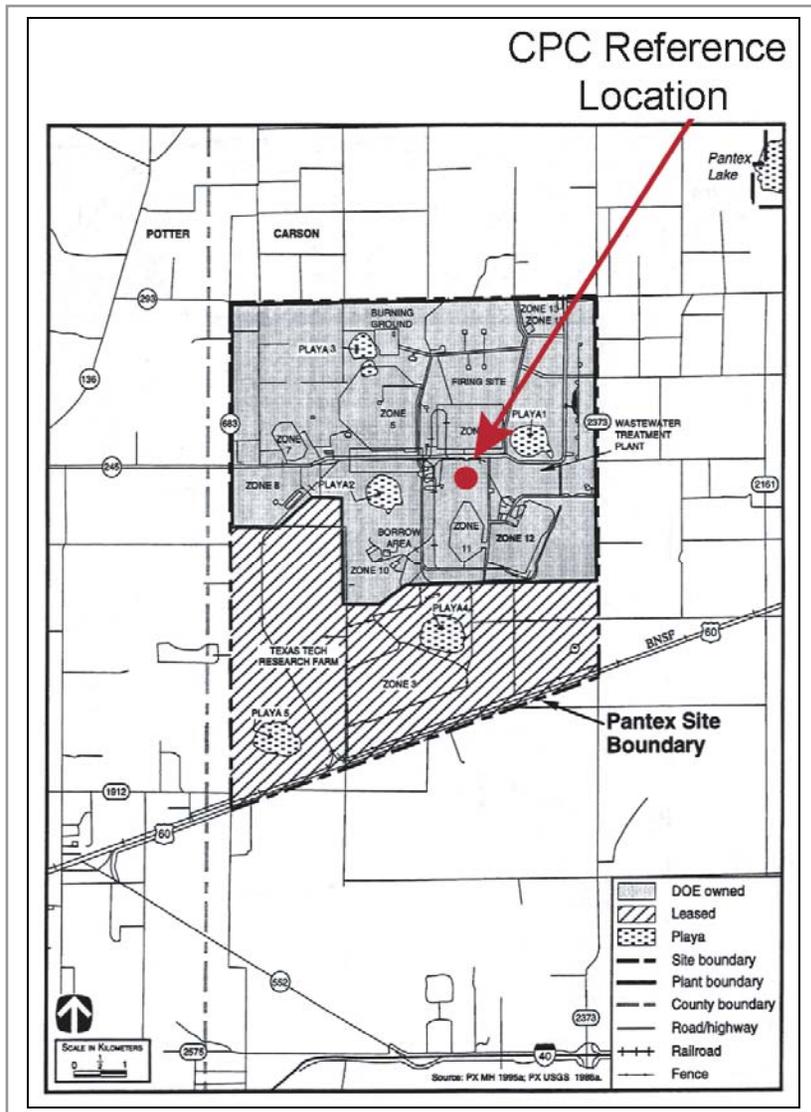


Figure 3.4.1-4 — Pantex CPC Reference Location

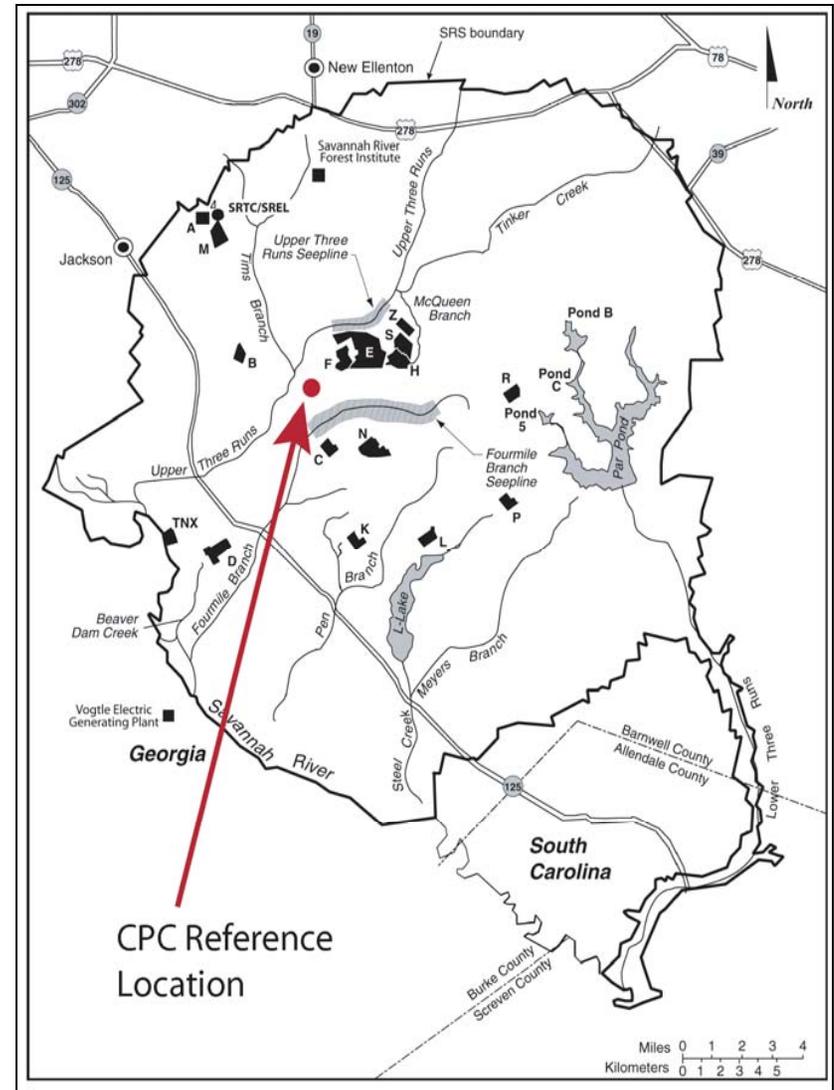


Figure 3.4.1-5 — SRS CPC Reference Location

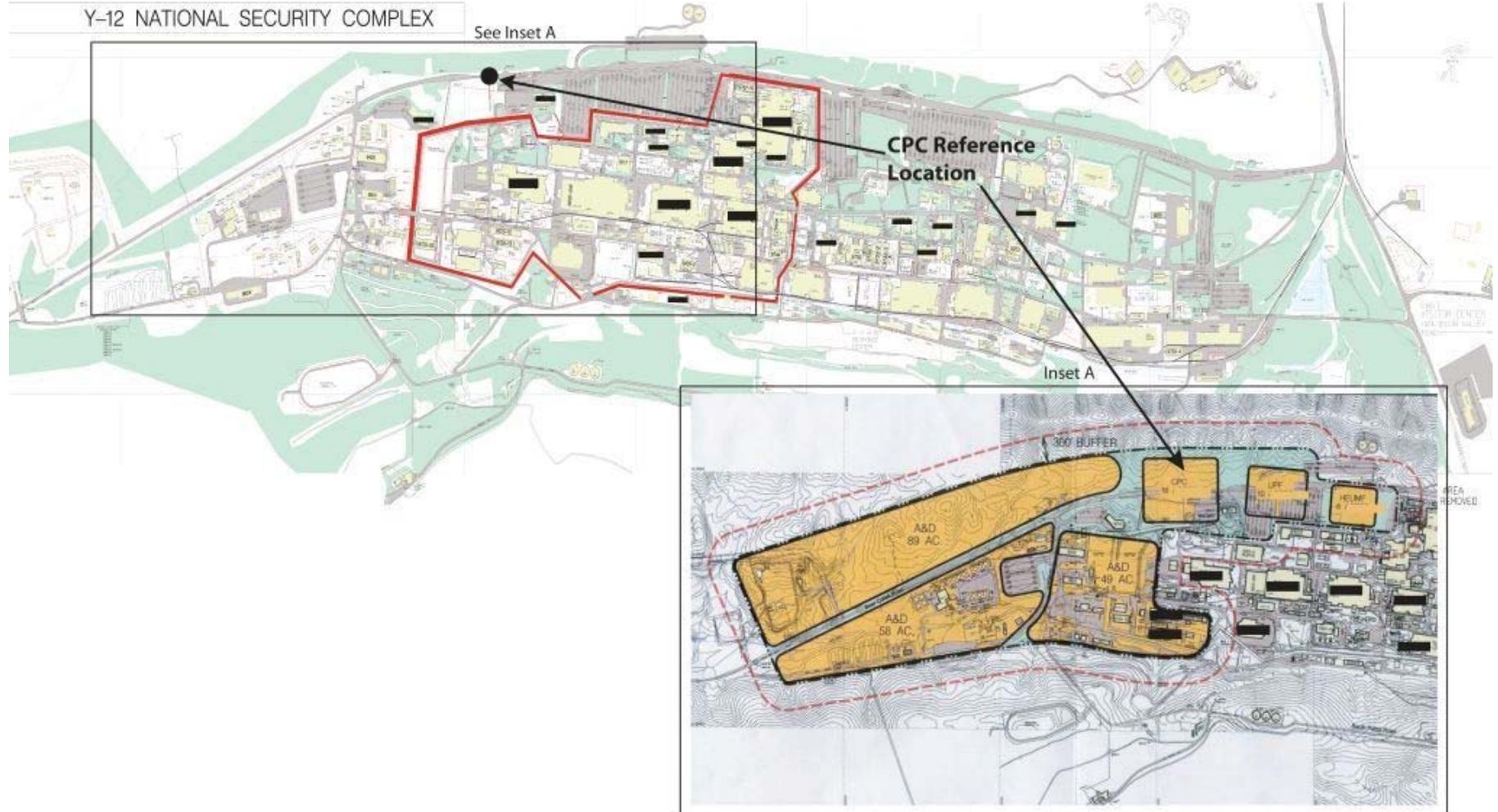


Figure 3.4.1-6 — Y-12 CPC Reference Location

3.4.1.6.1 Los Alamos Upgrade Alternative

Los Alamos could support pit production requirements using existing and new facilities at TA-55, which is the current site of the Plutonium Facility (PF-4) and future site of the Chemistry and Metallurgy Research Building Replacement (CMRR) Facility. The programmatic operations at TA-55 are supported by several facilities, including:

- The Radioactive Liquid Waste Treatment Facility (RLWTF);
- The solid waste characterization and disposal site (TA-54);
- The Chemistry and Metallurgy Research (CMR) Building (TA-03-29);
- The Sigma Building (TA-03-66); and
- The Radiochemistry Facility (TA-48, RC-1).

In addition, previously planned facilities that would support plutonium operations include:

- The CMRR Facility;
- A new radiography facility; and
- A new solid-waste staging facility.

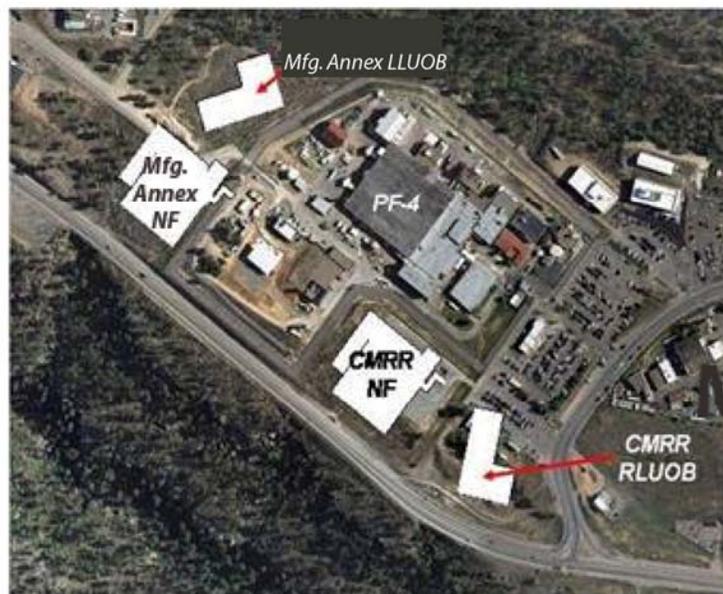
Estimated Modifications to Support the Los Alamos Upgrade Alternative

Using the existing TA-55, the pit production capacity could be enhanced from the current capacity to approximately 125 pits per year for single shift operations by the following:

1. Expanding the scope and the size of the planned CMRR Facility; and/or
2. Constructing a new facility (known as the “Manufacturing Annex”) to augment existing pit-manufacturing capacity, the planned CMRR Facility, and related infrastructure capacity.

Both approaches would result in the addition of up to 400,000 square feet of space at TA-55, either as one or more stand-alone facilities (e.g., the Manufacturing Annex, which would be comprised of a Manufacturing Annex Nuclear Facility and a light laboratory/utility/office building [LLUOB]) or as an addition to the CMRR. As such, the environmental impacts are not expected to differ significantly. This SPEIS analyzes the environmental impacts of the addition of a Manufacturing Annex to provide the additional pit manufacturing, supply/recovery, and/or analytical chemistry support.

Based on prior planning information (NNSA 2007), the new Manufacturing Annex would be approximately the same size as the buildings in the current CMRR project (which would consist of the Chemistry and Metallurgy Research Replacement Nuclear Facility and a radiological laboratory/utility/office building [RLUOB]). This annex would be located near the existing PF-4 structure to minimize the logistics of material and personnel movements between the facilities, which would take place through hardened tunnels. An overhead conceptual view of this configuration is shown in Figure 3.4.1-7.



RLUOB = Radiological Laboratory/Utility/Office Building
 CMRR NF = Chemistry and Metallurgy Research Replacement Nuclear Facility
 LLUOB = Light Laboratory/Utility/Office Building

Figure 3.4.1-7 — TA-55 site plan showing the Proposed CMRR and Manufacturing Annex Facilities

The impacts of construction requirements of the Manufacturing Annex would be approximately the same as those for the CMRR project with selected additions to accommodate possible remodeling of PF-4. These data are shown in Table 3.4.1-7. The Los Alamos Upgrade Alternative would be expected to operate similar to the greenfield CPC at Los Alamos. As such, the operational data in Tables 3.4.1-3 and 3.4.1-4 would be applicable to this alternative.

Table 3.4.1-7 — Construction Requirements for the Los Alamos Upgrade Alternative

Requirements	Consumption/Use
Peak Electrical energy (MWe)	2.0
Diesel Generators (Yes or No)	Yes
Concrete (yd ³)	3,715
Steel (tons)	401
Water (gal)	2,111,800
Land (acre)	
Laydown Area Size	2
Parking Lots	5
Total Square Footage (ft ²)	400,000
Post-Construction Footprint	6.5
Employment	
Total employment (worker years)	1,100
Peak employment (workers)	300
Construction period (years)	3.6
Waste Generated	
Transuranic Waste Contact Handled (yd ³)	200
Low level (yd ³)	200
Nonhazardous (Sanitary and Other) tons	578

Source: NNSA 2007.

3.4.1.6.2 Los Alamos Upgrade Alternative to Produce Up to 80 Pits per Year (“50/80 Alternative”)

The 50/80 Alternative is evaluated to provide NNSA with an alternative that has a pit production capacity of less than 125 pits per year. The 50/80 Alternative would involve expanding the current pit production capabilities in Building PF-4 and completing the CMRR Facility, with the potential addition of approximately 9,000 square feet, to support production of up to 80 pits per year. To add space within TA-55/PF-4 to support an increase in pit manufacturing capacity to 80 pits per year, LANL would remodel existing space, consolidate some missions where space is not being fully utilized, and perhaps move some activities to locations where similar activities are conducted. For the period evaluated in this SPEIS, it is assumed that the Plutonium-238 mission would remain within TA-55 and PF-4.

The 50/80 Alternative is evaluated to identify impacts from reductions in pit production needs. PF-4 at TA-55 is the only existing plutonium facility capable of being upgraded to support this level of pit production without major construction. Implementation of the 50/80 Alternative (if selected) would be timed to minimize disruption of LANL’s interim small-scale pit production activities, which are needed to meet current requirements.

The 50/80 Alternative differs from a greenfield CPC in several important aspects. First, this alternative assumes that NNSA would produce up to 80 pits per year; a CPC would produce 125 pits per year for single shift operations and is assessed at a bounding rate of 200 pits per year multiple shifts and extended work weeks. Next, the upgraded facility may not have a design life of 50 years (the design life for a CPC) without additional upgrades because the existing facility would have already operated for 40 years by approximately 2022.

Modifications would include major upgrades to the residue recovery/metal feed facilities in the 400 Area of PF-4. Many of the gloveboxes in this part of the facility would have to be replaced. Replacement of these older gloveboxes would be required to ensure that the recovery/feed process operations are adequate to supply plutonium metal to the manufacturing operations. There would also be significant glovebox decontamination, decommissioning, and disposal operations as new process development and certification operations are moved into other areas of PF-4. In addition, various manufacturing equipment would be added or replaced in the fabrication areas of PF-4 to increase capacity and reliability. Other upgrades at TA-55 would include heating, ventilation, and air conditioning systems; PF-4 roof replacement; confinement doors in PF-4; criticality alarm system; fire sprinkler piping; fire alarm system; replacement of cooling towers; seismic upgrades; and others.

The 50/80 Alternative includes completing the previously analyzed CMRR facility, and could require expansion of it by up to 9,000 additional square feet to accommodate pit manufacturing operations. Modifications to existing facilities at TA-55 could be required to accommodate additional workers employed in pit manufacturing. The construction of CMRR would disturb 6.5 acres during construction and add approximately 2.5 acres to the permanent TA-55 footprint.

The Radioactive Liquid Waste Treatment Facility (TA-50) and the Solid Waste Management Facility (TA-54) would be capable of processing waste streams even with an enhanced fabrication mission of 80 pits per year. Tables 3.4.1-8 through 3.4.1-10 list the construction and

operational material requirements and waste volumes for the 50/80 Alternative.

Table 3.4.1-8 — Los Alamos 50/80 Alternative Construction Requirements

Requirement	Consumption/Use
Electrical Energy (MW-hr)	1.0
Concrete (yd ³)	32,750
Aggregate (yd ³)	In Concrete
Steel (tons) including rebar	3,850
Gases (yd ³)	4,000
Water (gal)	550,000
Employment	
Total (Worker Years)	430
Peak (Workers)	190
Radiation Workers	0
Construction Period (yrs)	4

Source: NNSA 2007.

Table 3.4.1-9 — Los Alamos 50/80 Alternative Annual Operating Requirements

Requirement	Consumption/Use
Electrical Energy (MW-hr)	44,000
Peak Electricity (MWe)	10
Domestic Water (gal)	10,000,000 + 33,000,000 (cooling water)
Employment	
Total Workers	680
Radiation Workers	458

Source: NNSA 2007

Table 3.4.1-10 — Los Alamos 50/80 Alternative Waste Volumes

Waste	Annual Operating	Construction
TRU Waste		
Solid (includes Mixed TRU Solid) (yd ³)	575 ^a	0
Liquid (yd ³)	6.5	0
Mixed TRU Waste		
Solid (included in TRU Solid) (yd ³)	2.6	0
Liquid	0	0
LLW		
Solid (yd ³)	1850	0
Liquid (yd ³)	19.5	0
Mixed LLW		
Solid (yd ³)	65	0
Liquid (yd ³)	0	0
Hazardous		
Solid (tons)	265	0
Liquid (tons)	2.6	4
Nonhazardous		
Solid (yd ³)	700	9,750
Liquid (gallons)	16,000	7,800

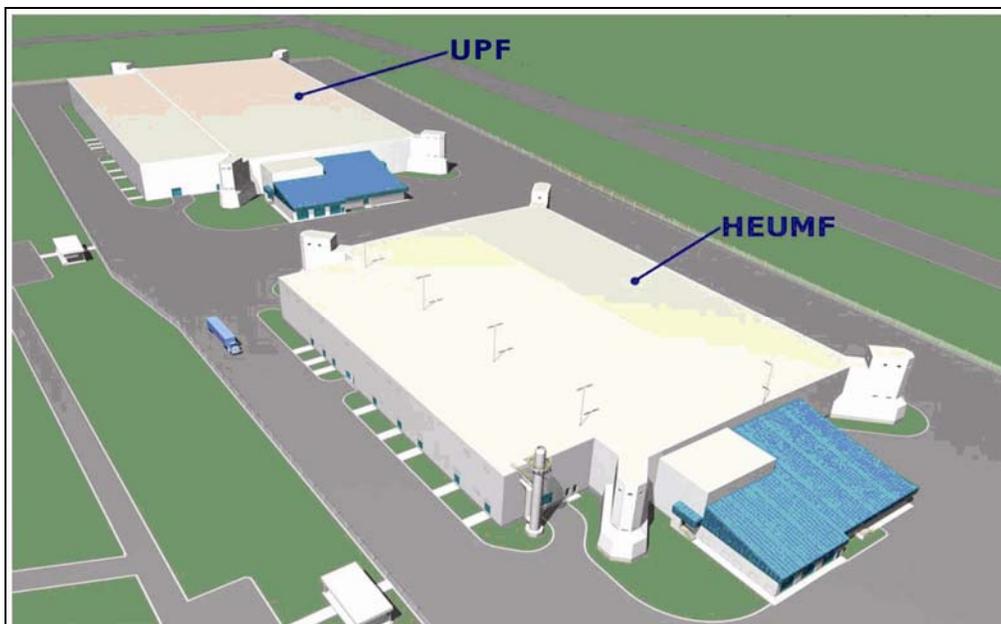
Source: NNSA 2007.

^a Includes 75 yd³/yr over a 10-year period to replace gloveboxes in PF-4.

3.4.2 Uranium Processing Facility at Y-12

As discussed in Section 3.3, Y-12 manufactures nuclear weapons secondaries, cases, and other weapons components; evaluates and performs testing of these weapon components; maintains Category I/II quantities of HEU; conducts dismantlement, storage, and disposition of nuclear weapons materials; and supplies HEU for use in naval reactors. The UPF would consolidate many of these operations into an integrated manufacturing operation sized to satisfy all identified programmatic needs. The UPF would be sited adjacent to the Highly Enriched Uranium Materials Facility (HEUMF) (currently under construction) to allow the two facilities to function as an integrated operation. A site-wide EIS for Y-12 is currently being prepared and is assessing alternatives, including a UPF at Y-12 (70 FR 71270) (see Section 1.5.2.2). Transition of Y-12 operations to this configuration would enable the high security area to be reduced by 90 percent. As described below, would significantly improve physical protection; optimize material accountability; enhance worker, public, and environmental protections; and reduce operational costs.

The UPF would replace multiple existing enriched uranium (EU) and other processing facilities. The current operating and support areas occupy approximately 633,000 square feet in multiple buildings, while a UPF would result in approximately a 33 percent reduction, to approximately 400,000 square feet in one building. Once a UPF were operational, some existing facilities would be available for decontamination and decommissioning (D&D), while other facilities could be used for non-EU processes. Figure 3.4.2-1 shows an artist's rendering of the proposed UPF. Figure 3.4.2-2 shows the location of a UPF relative to other buildings at Y-12.



Source: NNSA 2005c.

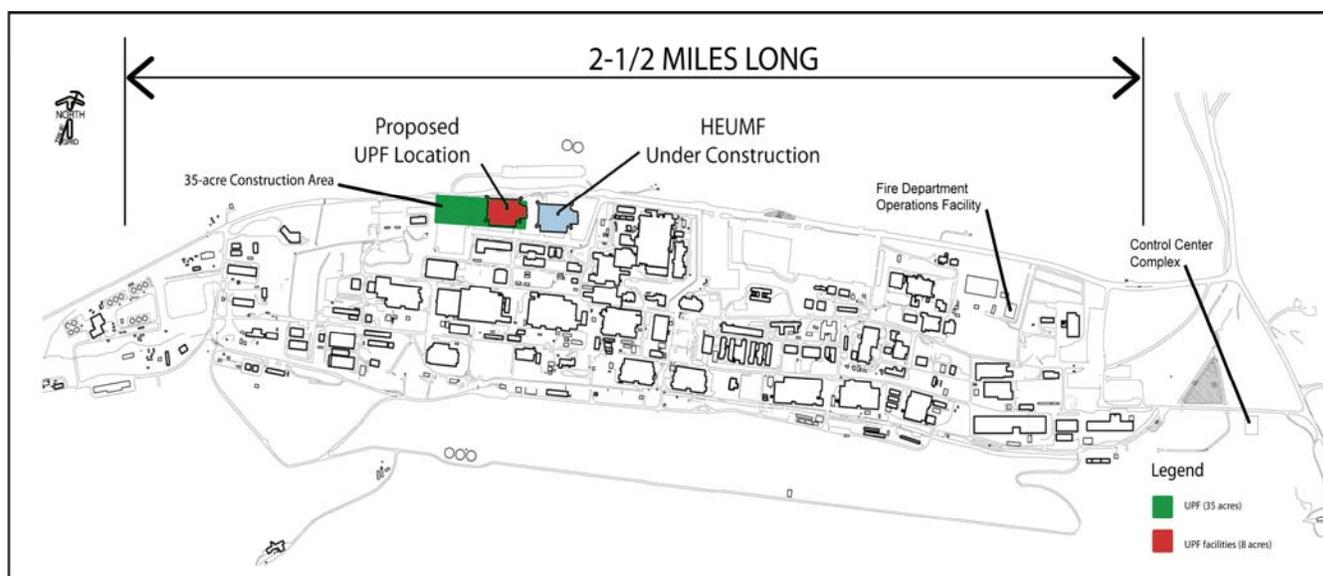
Figure 3.4.2-1 — Artist's Rendering of a UPF Adjacent to the HEUMF

3.4.2.1 UPF Construction

The new structures and support facilities that would constitute a UPF complex include:

- UPF building;
- UPF electrical switching center;
- chiller building and chiller building switch center;
- cooling tower;
- aboveground water tank for a seismic-qualified firewater system with a firewater pumping facility;
- electrical generators; and
- modified PIDAS to encompass the UPF complex.

The design life of a UPF would be 50 years. It would be equipped with safety support systems to protect workers, the public, and the environment, and would be housed in a multistory, reinforced concrete building designed for safety and security. The main building would be a concrete structure with reinforced exterior walls, floor slabs, and roof. The preliminary schedule for the project calls for site preparation beginning in approximately 2010, with completion by approximately 2016, and operations beginning by approximately 2018. As shown on Figure 3.4.2-2, construction of a UPF would require approximately 35 acres of land, which includes land for a construction laydown area and temporary parking. Once constructed, the UPF facilities would occupy approximately 8 acres.



Source: NNSA 2007.

Figure 3.4.2-2 — Proposed Location of the UPF Relative to other Buildings at Y-12

Table 3.4.2-1 lists the construction material requirements and wastes for the UPF.

Table 3.4.2-1 — UPF (based on a HEUMF) Construction Requirements and Estimated Waste Volumes

Requirements	Consumption
Materials/Resource	
Peak Electrical energy (MWe)	2.2
Concrete (yd ³)	200,000
Steel (tons)	27,500
Liquid fuel and lube oil (gallons)	250,000
Water (gal)	4,000,000
Aggregate (yd ³)	5,000
Land (acres)	35
Employment	
Total employment (worker years)	2,900
Peak employment (workers)	900
Requirements	Consumption
Construction period (years)	6
Low-level Waste	
Liquid (gallons)	0
Solid (yd ³)	70
Hazardous (tons)	4
Nonhazardous (Sanitary) (tons)	800

Source: BWXT 2006a.

3.4.2.2 *UPF Operations*

The core operations of a new UPF would be assembly, disassembly, quality evaluation, specialized chemical and metallurgical operations of EU processing, and product certification and inspection. The material processing areas within a UPF would use gloveboxes, inert atmosphere, negative air pressure, and other engineered controls, supported by administrative controls, to protect workers and the public from exposure to radiological and hazardous materials. Exhaust emissions for the facility would comply with applicable Federal and state requirements. In conjunction with other engineered containment measures, the ventilation system barriers would provide a layered system of protection.

Other systems in a UPF for facility operation and Environment, Safety and Health (ES&H) protection include:

- Criticality Accident Alarm System
- Emergency Notification System
- Alarm System
- Fire Suppression Alarm Systems
- Telephone and public address system
- Classified and unclassified computer network

- Personnel Monitoring System
- Security-related sensors
- Automated inventory system with continuous real-time monitoring

Table 3.4.2-2 lists the operations requirements the UPF.

Table 3.4.2-2 — UPF Annual Operation Requirements and Estimated Waste Volumes

Requirements	Consumption
Materials/Resource	
Electrical energy (MWh/yr)	168,000
Peak electrical demand (MWe)	18.4
Natural gas (yd ³)	894,000
Water (gallons)	105,000,000
Plant footprint (acres)	8
Employment	
Total Workers	600
Requirements	Consumption
Radiation Workers	315
Waste Generated	
Low-level	
Liquid (gallons)	3,515
Solid (yd ³)	7,800
Mixed Low-level	
Liquid (gallons)	3,616
Solid (yd ³)	21
Hazardous (tons)	14
Non-hazardous (Sanitary) (tons)	7,125
Non-hazardous liquid (gallons)	50,000

Source: BWXT 2006a.

3.4.3 Upgrade Existing Enriched Uranium Facilities at Y-12

NNSA could upgrade the existing EU facilities. In that case, there would be no UPF and the current high-security area would not be reduced. The upgrade projects would be internal modifications to existing facilities and would improve protection for worker health and safety and extend the life of existing facilities. For continued operations in existing facilities, major investments would be required for roof replacements; structural upgrades; heating, ventilating, and air conditioning (HVAC) replacements; and fire protection system replacement/upgrades (see Appendix A for a detailed discussion of the specific upgrades). The projects would improve airflow controls between clean, buffer, and contamination zones; upgrade internal electrical distribution systems; and reinforce a number of structures to comply with current natural phenomena criteria (DOE-STD-1023-95).

For the purpose of this analysis, it is assumed that the upgrades would be performed over a 10-year period following issuance of a SPEIS ROD. This would enable NNSA to spread out the capital costs associated with the upgrades, and minimize disruption of operations. Conventional construction techniques would be used for upgrade projects. Table 3.4.3-1 lists the construction

requirements associated with the upgrades. In terms of operations, there would be no change from the No Action Alternative.

Table 3.4.3-1 — Construction Data for Upgrading Existing Uranium Facilities

Requirements	Consumption
Materials/Resource	
Electrical energy use (MWh)	No significant change compared to current site use
Concrete (yd ³)	No significant change compared to current site use
Steel (tons)	No significant change compared to current site use
Water (gallons/year)	4.2 million
Aggregate (yd ³)	No significant change compared to current site use
Land (Laydown Area)	<7 acres
Employment	
Total employment (worker years)	1,000
Peak employment (workers)	300
Construction period (years)	10
Wastes	
Hazardous	
Liquid (gallons)	No significant change compared to current site use
Solid (tons)	14

Note: “No change from current” represents estimated 2006 usage.
 Source: BWXT 2006a.

3.5 PROGRAMMATIC ALTERNATIVE 2: CONSOLIDATED CENTERS OF EXCELLENCE

An alternative under consideration in this SPEIS is consolidated centers of excellence (CCE). The CCE Alternative would consolidate the three major SNM functions (plutonium, uranium, and weapon assembly/disassembly) involving Category I/II quantities of SNM into a consolidated nuclear production center (CNPC) at one site or into consolidated nuclear centers (CNC) at two sites. Depending upon the CCE option selected, this alternative could result in the end of all nuclear weapons operations at up to two sites (e.g., Y-12 and Pantex). The program, capability, and facility requirements for the CCE alternative are described below. More details are in Appendix A.

Requirements and Assumptions

- A CCE alternative would be sized and configured to support the nuclear weapons stockpile after full implementation of the Moscow Treaty. The upper bound of the capacities would be sized to support delivery of 125 weapon assemblies per year to the stockpile in five-day, single-shift operations. Multiple shift operation and extended work weeks would yield up to 200 weapon assemblies per year.
- Fabrication, inspection, and assembly equipment would support the fabrication of new replacement weapons (such as RRWs), legacy weapons or a combination of both. In general, the ability to produce legacy weapons would also provide the capability to produce new replacement weapons. NNSA expects that replacement weapons such as RRWs would use fewer hazardous materials than found in most legacy weapons and require production tolerances within the range of those required for legacy weapons.
- The CCE alternatives include three major facilities: a consolidated plutonium center (CPC), consolidated uranium center (CUC), and the A/D/HE Center. As explained in Section 3.5.2, there is an option to separate the weapon A/D/HE mission to allow NNSA to consider an alternative that locates nuclear production facilities at a different site than the A/D/HE mission.
- All Category I/II SNM required by NNSA would be stored at the CCE facilities.
- CCE facilities would have a useful service life of at least 50 years without major renovation beyond normal maintenance.
- CCE facilities would be located at the following sites: Los Alamos, Pantex, NTS, SRS, and Y-12.
- A modular arrangement of facilities (campus) is assumed for the CCE options rather than separate operational wings of a single large facility under one roof. The facilities making up the CCE campus would be configured so that they can be constructed sequentially. Building a single building to house CCE functions was not considered reasonable due to the need to bring facilities on-line in sequence and the fundamental differences in

uranium, plutonium, and assembly/disassembly operations.¹⁸ The assumed schedule for the CCE facilities is:

Facility	Start Detailed Facility Design	Begin Operations
CUC	2009	2018
CPC	2012	2022
A/D/HE Center	2015	2025

- It is assumed that facilities at Y-12 and Pantex, whose missions would be included in the CCE alternative, would be brought to a safe shutdown condition as soon as possible if these sites were not selected for a CCE.
- A CNPC or CNC would consist of a central area that includes all operations involving Category I/II quantities of SNM that would be surrounded by a PIDAS. A buffer area would provide unobstructed view of the area surrounding the PIDAS. Support facilities requiring lower levels of security protection would be outside the PIDAS. The land requirements for operation of a CNPC and CNC are shown in Tables 3.5-1 and 3.5-2.

Table 3.5-1 – Land Requirements to Operate a CNPC*

Operation (acres)	Total Area: 545*	
	PIDAS	Non-PIDAS
Total: 235 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	Total: 310 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100 	

*Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities, including the HEUMF.

Table 3.5-2 – Land Requirements to Operate a CNC*

Operation (acres)	Total Area: 195*	
	PIDAS	Non-PIDAS
Total: 55 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	Total: 140 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50 	

*Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities, including the HEUMF.

¹⁸ The facilities that would constitute a CCE would be separate buildings in a campus because they have different and unique safety and operational requirements, and it would not be technically feasible to make them part of a single large facility without having separate systems for the operation of the three facilities and other physical features (blast wall separation, etc.) to keep them separate. They would be built in sequence because they are very complex facilities and the potential realities of construction logistics, cash flow, and start-up management would not support a single facility. Building them in sequence reduces the construction management risk and allows lessons learned from one to benefit the others. The CUC would be first because the existing uranium facilities at Y-12 (except the HEUMF) are aging. The CPC would be built second because the LANL facilities can handle the immediate need for pits. The weapons A/D/HE facilities would be built last because there is less programmatic urgency than for the CUC and CPC.

3.5.1 Consolidated Nuclear Production Center Option

This option would consolidate the three major SNM functions (plutonium, uranium, and A/D/HE) involving Category I/II quantities of SNM into a consolidated nuclear production center (CNPC) at one site. Depending upon the site selected for a CNPC, this option could result in the cessation of NNSA weapons operations at up to two sites (e.g., Y-12 and Pantex). Under this option, NNSA would construct and operate a CNPC, as described in Section 3.5, at SRS, Y-12, Pantex, NTS, or Los Alamos. The CNPC would combine three major facilities: CPC, CUC, and the A/D/HE Center. The description of the CPC is in Section 3.4.1 and is not repeated below. The sections below describe the other major CNPC facilities: the CUC (Section 3.5.1.1) and the A/D/HE Center (Section 3.5.1.2). In addition, Section 3.5.1.3 describes the transport of plutonium and HEU to the CNPC to support future NNSA needs. Finally, Section 3.5.1.4 discusses site-specific characteristics of the alternative sites that could affect the manner in which a CNPC might be implemented. For example, a CNPC located at Pantex would not require the construction of the A/D/HE Center, as Pantex currently performs that mission in existing facilities that would not require major renovations to continue operations for years. Section 3.5.1.4 also identifies the reference locations for the CNPC at each site alternative. A generic layout of the CNPC is shown in Figure 3.5.1-1.

3.5.1.1 Consolidated Uranium Center

A CUC would have a nuclear facility located within a heavily protected area (PIDAS), and non-nuclear support facilities outside the PIDAS. The nuclear facility would consist of a UPF, which is described in Section 3.4.2, and a storage facility for HEU.¹⁹ The nuclear facility would process HEU, produce nuclear weapon secondary components, provide the capability to perform HEU R&D in support of LANL and LLNL, and store HEU. The non-nuclear facilities would contain the non-nuclear production equipment, and support functions. The facility would also contain the chemical processes, fabrication operations, support functions associated with the production of lithium-hydride and lithium-deuteride components, and general manufacturing capabilities. For this analysis, it is assumed that a CUC could be built at any of the sites on approximately the same timeframe that a UPF could be built at Y-12. A CUC would be constructed over a six year period, beginning in approximately 2010, with completion by approximately 2016, and operations beginning by approximately 2018.

The land requirements for a CUC are shown in Table 3.5-3.

Table 3.5-3 – Land Requirements for CUC*

Construction (acres)	50	
Operation (acres)	Total Area: 35**	
	PIDAS	Non-PIDAS
	15	20

* At Y-12, a UPF would be constructed (see Section 3.4.2). The UPF would require a total of 8 acres rather than the 35 acres required for a CUC.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

¹⁹ A CUC at Y-12 would not require construction of a new HEU storage facility, as a modern storage facility (the HEUMF) is under construction at that site.

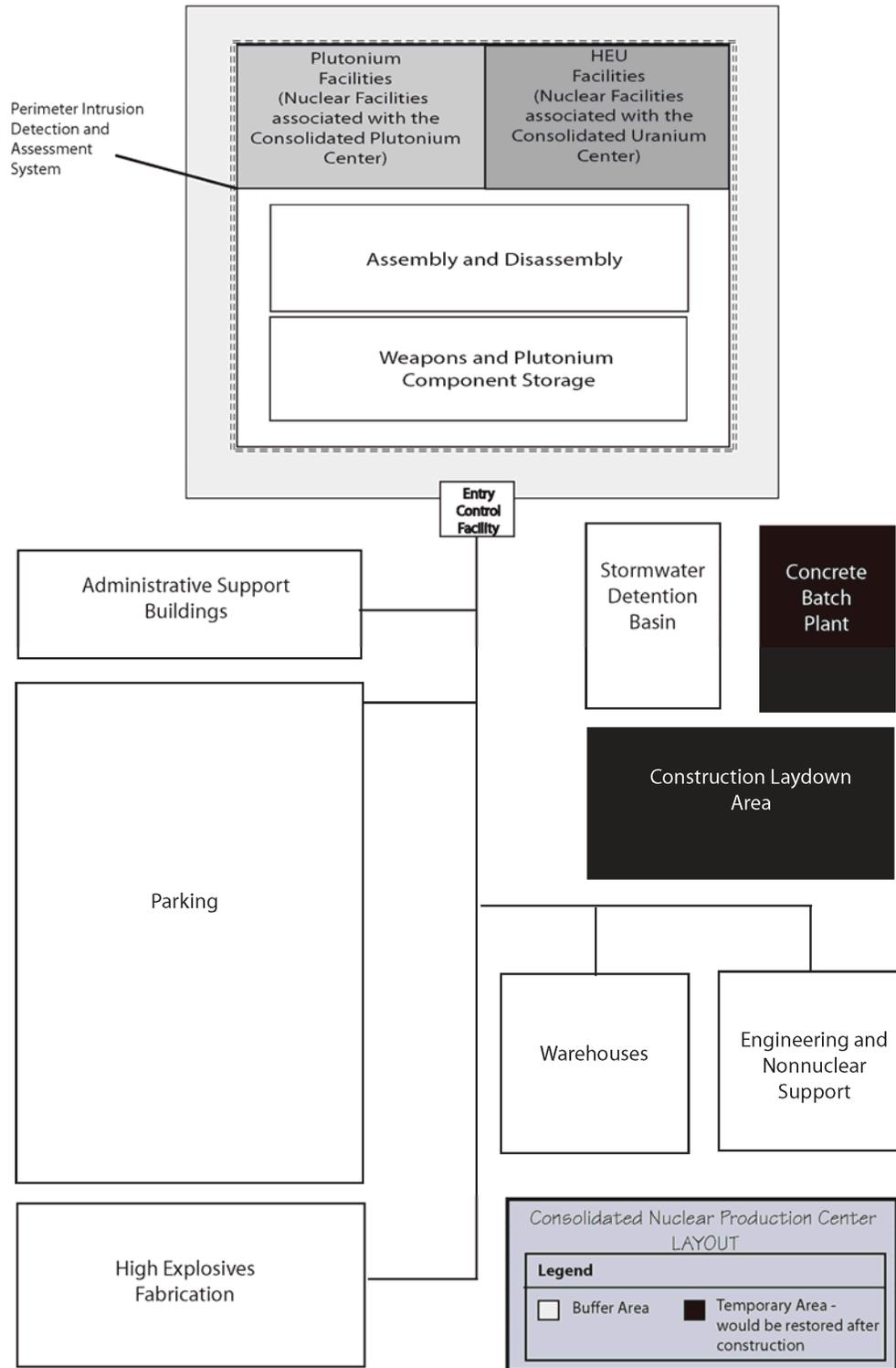


Figure 3.5.1-1 — Generic Layout of the CNPC

3.5.1.1.1 CUC Construction

The construction discussion contained in Section 3.4.2 pertains to a UPF constructed at Y-12, and is relevant to a portion of a CUC that could be built at sites other than Y-12. As such, that discussion is not repeated here. This section presents the requirements for a CUC that could be built at sites other than Y-12. The major difference involves the addition of HEU storage and the non-nuclear support facilities outside the PIDAS. Construction of a CUC at sites other than Y-12 would require approximately 50 acres of land, which includes land for a construction laydown area and temporary parking. Once constructed, a CUC would occupy approximately 35 acres. Table 3.5.1-1 lists the construction requirements for a CUC, along with the associated waste volumes.

Table 3.5.1-1 — CUC Construction Requirements and Estimated Waste Volumes²⁰

Requirements	Consumption
Materials/Resource	
Peak Electrical energy (MWe)	2.5
Concrete (yd ³)	230,000
Steel (tons)	29,500
Liquid fuel and lube oil (gallons)	325,000
Water (gallons)	5,200,000
Aggregate (yd ³)	6,000
Land (acre)/Laydown Area	50/22
Employment	
Total employment (worker-years)	4,000
Peak employment (workers)	1,300
Construction period (years)	6
Waste Category	
Low-level	
Liquid (gallons)	0
Solid (yd ³)	70
Mixed Low-level	
Liquid (gallons)	0
Solid (yd ³)	0
Hazardous (tons)	6
Nonhazardous (Sanitary) (tons)	1000

Source: NNSA 2007

The nuclear portion of a CUC would require approximately 500,000 square feet in one building. Of this, long-term storage of Category I/II HEU would account for approximately 100,000 square feet. The non-nuclear support facilities outside the PIDAS would require approximately 150,000 square feet.

²⁰ Numbers in Table 3.5.1-1 reflect a CUC comprised of both nuclear and non-nuclear facilities. At Y-12, only a UPF would be required. Section 3.4.2 identifies UPF construction requirements and estimated waste volumes for Y-12.

3.5.1.1.2 CUC Operation

A CUC would provide secure docking for Safeguards Transporters (SGTs) to ensure the secure, transfer of secondaries and other materials containing HEU. The shipping and receiving docks at a CUC would accommodate the simultaneous loading and unloading of three SGTs. The main operational steps that would be involved in handling containers with HEU materials are presented below:

- SGT arrives at the loading dock;
- Shipping containers are offloaded and moved to the nondestructive assay (NDA) and re-containerization area;
- A transfer check is performed;
- Containers undergo NDA;
- HEU materials are placed in new containers if required;
- Each container is entered into the computerized tracking system and is assigned a rack location;
- Each container is moved by forklift to its assigned location in the storage area; and
- Each container is connected to the automated inventory system.

The core operations of a CUC would be similar to the UPF operations described in Section 3.4.2, and are not repeated here. Table 3.5.1-2 lists the operations requirement, number of workers, and the expected waste generation for a CUC.

Table 3.5.1-2 — CUC Annual Operation Requirements and Estimated Waste Volumes

Requirements	Consumption/Use
Materials/Resource	
Electrical energy (MWhr/yr)	168,000
Peak electrical demand (MWe)	18.4
Natural gas (yd ³)	894,000
Water (gallons)	105,000,000
Plant footprint (acres)	35
Employment	
Workers	935
Radiation Workers	490
Average Annual Dose	22.4 mrem/yr
Uranium Releases to Air (Curies)	0.01
Uranium Releases to Water (Curies)	0.20
NAAQS emissions (tons/yr)	71.64 ton/yr
Low-level Waste	
Liquid (gallons)	3,515
Solid (yd ³)	8,100
Mixed Low-level	
Liquid (gallons)	3,616
Solid (yd ³)	70
Hazardous (tons)	15
Non-hazardous Solid(Sanitary) (tons)	7,500
Non-hazardous Liquid (gallons)	50,000

Source: NNSA 2007.

3.5.1.2 *Assembly/Disassembly/High Explosives Center*

The A/D/HE Center would carry out the following major missions:

- Assemble warheads;
- Dismantle weapons that are surplus to the strategic stockpile and sanitize²¹, store, or dispose of components from dismantled weapons;
- Develop and fabricate explosive components; and
- Conduct surveillance related to certifying weapon safety and reliability.

An A/D/HE Center would consist of nuclear facilities located within the PIDAS, and non-nuclear facilities outside the PIDAS. The nuclear facilities would contain the cells and bays in which maintenance, modification, disassembly, and assembly operations are conducted. The facilities would be designed to mitigate the effects of the unlikely accidental detonation of the weapon’s explosive components. Bays differ from cells in that bays are designed to vent an explosion to the atmosphere while protecting adjacent facilities from the blast, while cells are designed to filter the explosion products, while also protecting the adjacent facilities from the blast. Appendix A contains a more detailed description of a bay and a cell.

As shown in Table 3.5.1-3, an area of 180 acres would be provided in the PIDAS for weapons assembly and disassembly facilities, and for weapons and component storage. Located outside the PIDAS would be a buffer zone and non-nuclear facilities for HE fabrication, administrative support, and disposal of explosive materials. This area would be approximately 120 acres. An A/D/HE Center would be constructed over a six-year period beginning in approximately 2020, with completion by approximately 2025, and operations beginning by approximately 2025. The design service life of an A/D/HE Center would be 50 years. Table 3.5.1-4 lists the construction requirements for an A/D/HE Center, along with the associated waste values.

Table 3.5.1-3 – Land Requirements for A/D/HE Center*

Construction (acres)	300	
Operation (acres)	Total Area: 300**	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120

* At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

²¹ The process of sanitization involves the obliteration and demilitarization of classified weapons parts.

Table 3.5.1-4 — A/D/HE Construction Requirements

Requirements	Consumption / Use
Peak Electrical energy (MWe)	12.7
Diesel Generators (Yes/No)	Yes
Concrete (yd ³)	324,500
Steel (tons)	18,050
Liquid fuel and lube oil (gallons)	21,350,000
Water (gallons)	2,022,000
Land (acre)	300
Total Square Footage added (ft ²)	2,392,400
Employment	
Total employment (worker-years)	6,850
Peak employment (workers)	3,820
Construction period (years)	6
Waste Generated	Volume (yd³)
Low Level Waste (yd ³)	9,900
Hazardous Waste (yd ³)	0
Non-Hazardous (Sanitary and Other) (tons)	7,100
Non-Hazardous Liquid Waste (gallons)	45,000

Source: NNSA 2007.

3.5.1.2.1 Operations Conducted at an A/D/HE Center

Assembly

Weapons assembly requires written, prescribed steps to combine separate parts to form a new weapon. Complete weapons assembly would be accomplished in the following stages:

- Physics Package assembly;
- Mechanical and Electronic Components assembly; and
- Final Package or Ultimate User Package assembly.

The physics package is a subassembly combining HE components (produced at an A/D/HE Center) and nuclear components (to be manufactured at a CPC and CUC) within a protective shell. Physics package assembly entails bonding or mating the main charge subassemblies to a nuclear pit and then inserting this subassembly into a case along with other components. Mechanical and electronic components assembly entails placing the physics package in a warhead case and then installing the components for the arming, fusing, and firing systems; the neutron generator; and the gas transfer system. The final package assembly involves installing additional components and packaging the weapon for shipment.

Dismantlement

Dismantlement consists of disassembly and disposal of weapon components. The dismantlement process begins with the arrival of the weapon at the A/D/HE Center. Disassembly would include the following activities:

- Weapons staging, including inspection and verification after receipt from DOE;
- A variety of specialty operations (e.g., X-ray examinations, leak testing, coding,

- packaging, painting, verification, etc.) in special purpose bays;
- Mechanical disassembly operations in bays;
- Nuclear disassembly operations in cells;
- Demilitarization and sanitization of non-nuclear weapons components, for final disposition and disposal;
- Packaging and shipping or transfer of HEU to the CUC and tritium components to the SRS;
- Packaging and shipping or transfer of pits to the CPC; and
- Segregating waste into non-hazardous, hazardous, LLW, and mixed LLW categories and appropriate storage pending disposal.

High Explosives Fabrication

The A/D/HE Center would manufacture the main charge HE and other small explosive components. The fabrication process for explosives involves synthesizing energetic materials (explosives) and then formulating the energetic materials with other materials as appropriate. Some of the energetic materials are manufactured at the plant, while others are procured commercially. The explosive powder is then pressed into the configurations needed and machined for use in nuclear weapons.

Surveillance

To maintain the reliability of the nation’s nuclear weapons, a statistical sample of randomly selected weapons from all active systems would be annually removed from the stockpile and returned to the A/D/HE Center. The weapons are disassembled, tested, and evaluated to ensure the operability of the weapons components. Most testing is done onsite, but some tests associated with component aging are performed at other laboratories and production facilities. Some weapons are configured as Joint Test Assemblies (JTAs) and used for flight-testing.

Table 3.5.1-5 lists the operations requirement for an A/D/HE Center.

Table 3.5.1-5 — A/D/HE Operation Requirements and Estimated Waste Volumes

Requirements	Consumption / Use
Annual Electrical energy (MWh)	52,000
Peak Electrical energy (MWe)	11.9
Fuel Usage (gallons)	367
Other Process Gas (N, Ar, etc.)	
Water (million gallons/year)	130
Plant footprint (acres)	350
Employment (workers)	1,785
Number of Radiation Workers	400
Average annual dose (mrem)	103
Maximum annual worker dose (mrem)	750
Radionuclide emissions and effluents-nuclides and Curies	

**Table 3.5.1-5 — A/D/HE Operation Requirements and Estimated Waste Volumes
(continued)**

Requirements	Consumption / Use
Tritium (Ci)	1.41×10^{-12}
Total Uranium (Ci)	7.50×10^{-5}
Total Other Actinides (Ci)	2.17×10^{-15}
NAAQS emissions (tons/year)	
Oxides of Nitrogen (tons/year)	91
Carbon Monoxide (tons/year)	31
Volatile Organic Compounds (tons/year)	31
Particulate Matter (tons/year)	18
Sulfur Dioxide (tons/year)	5
Hazardous Air Pollutants and Effluents (tons/yr)	22
Chemical Use	
Liquid (gallons)	40,000
Solid (pounds)	294,000
Waste Generated	Volume (yd ³)
Low Level Waste	
Liquid (gallons)	5,410.00
Solid (yd ³)	40
Mixed Low-Level	
Liquid (gallons)	6.00
Solid (yd ³)	<1
TRU	
Liquid (gallons)	0
Solid (yd ³)	0
Hazardous Waste	
Liquid (gallons)	5,900
Solid (yd ³)	900
Non-Hazardous (Sanitary)	
Liquid (gallons)	0
Solid (yd ³)	15,000
Non-Hazardous (Other)	
Liquid (gallons)	46,000
Solid (yd ³)	12,000

Source: NNSA 2007.

3.5.1.3 *Transport of Plutonium and HEU to a CNPC*

If NNSA were to construct and operate a CNPC, Category I/II plutonium and HEU would be consolidated at it. This would entail three potential movements of materials: (1) transfer of LANL's Category I/II plutonium to a CNPC, if LANL is not selected as the host site for a CNPC; (2) transfer of Pantex's non-excess Category I/II plutonium to the CNPC, if Pantex is not selected as the site for a CNPC; and (3) transfer of Y-12's Category I/II HEU to the CNPC, if Y-12 is not selected as the host site for the CNPC. Each of these movements is discussed below.

- Transfer of LANL's Category I/II is discussed in Section 3.4.1.4 regarding a CPC. Transport of LANL's Category I/II plutonium to a CNPC would be the same as the transfer of the material to a CPC.

- Transfer of Pantex’s non-excess Category I/II plutonium to a CNPC would occur as follows:
 - Up to 60 metric tons of plutonium, mostly in pit form, would be shipped;
 - Approximately 470 shipments would be required, beginning in approximately 2025 and lasting 5 years.
- Transfer of Y-12’s Category I/II HEU to a CNPC would occur as follows:
 - Up to 252 metric tons of HEU would be shipped;
 - Approximately 540 shipments would be required, beginning after approximately 2023 and lasting 5 years.

Table 3.5.1-6 lists the origins, destinations, and materials that would be shipped to support a CNPC. The transfer of LANL, Pantex, and Y-12 Category I/II SNM would be a one-time move. Any transportation of TRU waste and LLW (for a CNPC at Pantex and Y-12) would occur on an annual basis as part of CNPC operations.

Table 3.5.1-6 — Origins, Destinations, and Material Shipped to Support the CNPC

Material Transported	CNPC at SRS	CNPC at Pantex	CNPC at Los Alamos	CNPC at NTS	CNPC at Y-12
Los Alamos Plutonium	Los Alamos ⇒ SRS	Los Alamos ⇒ Pantex	LANL ⇒ Los Alamos (intra-site transfer)None	Los Alamos ⇒ NTS	Los Alamos ⇒ Y-12
Pantex Plutonium	Pantex ⇒ SRS	None	Pantex ⇒ Los Alamos	Pantex ⇒ NTS	Pantex ⇒ Y-12
Y-12 HEU	Y-12 ⇒ SRS	Y-12 ⇒ Pantex	Y-12 ⇒ Los Alamos	Y-12 ⇒ NTS	None
TRU waste out	SRS ⇒ WIPP	Pantex ⇒ WIPP	Los Alamos ⇒ WIPP	NTS ⇒ WIPP	Y-12 ⇒ WIPP
LLW out	Onsite disposal	Pantex ⇒ NTS	Onsite disposal	Onsite disposal	Y-12 ⇒ NTS

3.5.1.4 *Site-Specific Features Relevant to a CNPC*

This section describes a CNPC at each candidate site alternative. While CNPC requirements would be the same at each site, the means of achieving them would vary depending upon the existing facilities and infrastructure at each candidate site. This section also identifies the reference location for a CNPC at each site.

3.5.1.4.1 **Los Alamos**

A CNPC located at Los Alamos would require the construction of a CPC (which could either be a “Greenfield CPC” [see Section 3.4.1.1] or an upgrade to existing LANL facilities [see Section 3.4.1.3]), a CUC (as described in Section 3.5.1.1), and an A/D/HE Center (as described in Section 3.5.1.2). There would not be enough acreage at TA-55 to locate an entire CNPC. Thus, a CNPC at LANL would be split between two TAs (TA-55 [which could be the site for a CPC and a CUC], and TA-16 [A/D/HE Center]) or completely located in its entirety at TA-16. Figure 3.5.1-2 shows the reference locations for a CPC, CUC, and an A/D/HE Center at LANL.

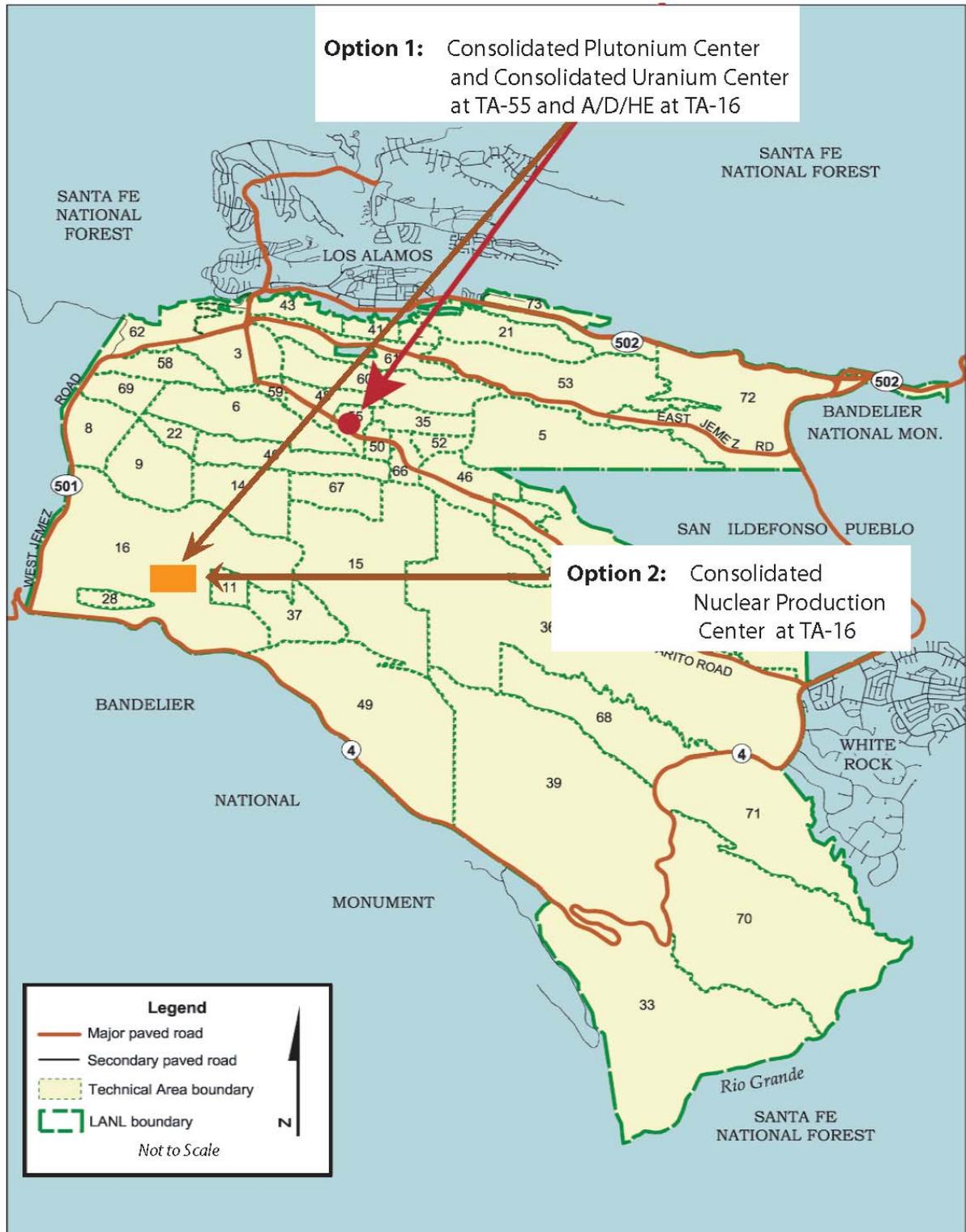


Figure 3.5.1-2 — Los Alamos CNPC Reference Locations

Because a CPC, CUC, and A/D/HE Center would be constructed sequentially, construction requirements for these three facilities would not create “parallel impacts in time” and are analyzed as sequential actions in this SPEIS. The construction data are summarized in Tables 3.4.1-2, 3.4.1-7, and 3.4.1-8 (CPC), 3.5.1-1 (CUC), and 3.5.1-3 (A/D/HE Center).

3.5.1.4.2 NTS

A CNPC located at NTS would require the construction of a CPC (as described in Section 3.4.1.1), a CUC (as described in Section 3.5.1.1), and an A/D/HE Center (which would be an upgrade to the existing DAF, as described in this section). Figure 3.5.1-3 identifies the reference locations for a CPC, CUC, and an A/D/HE Center at NTS.

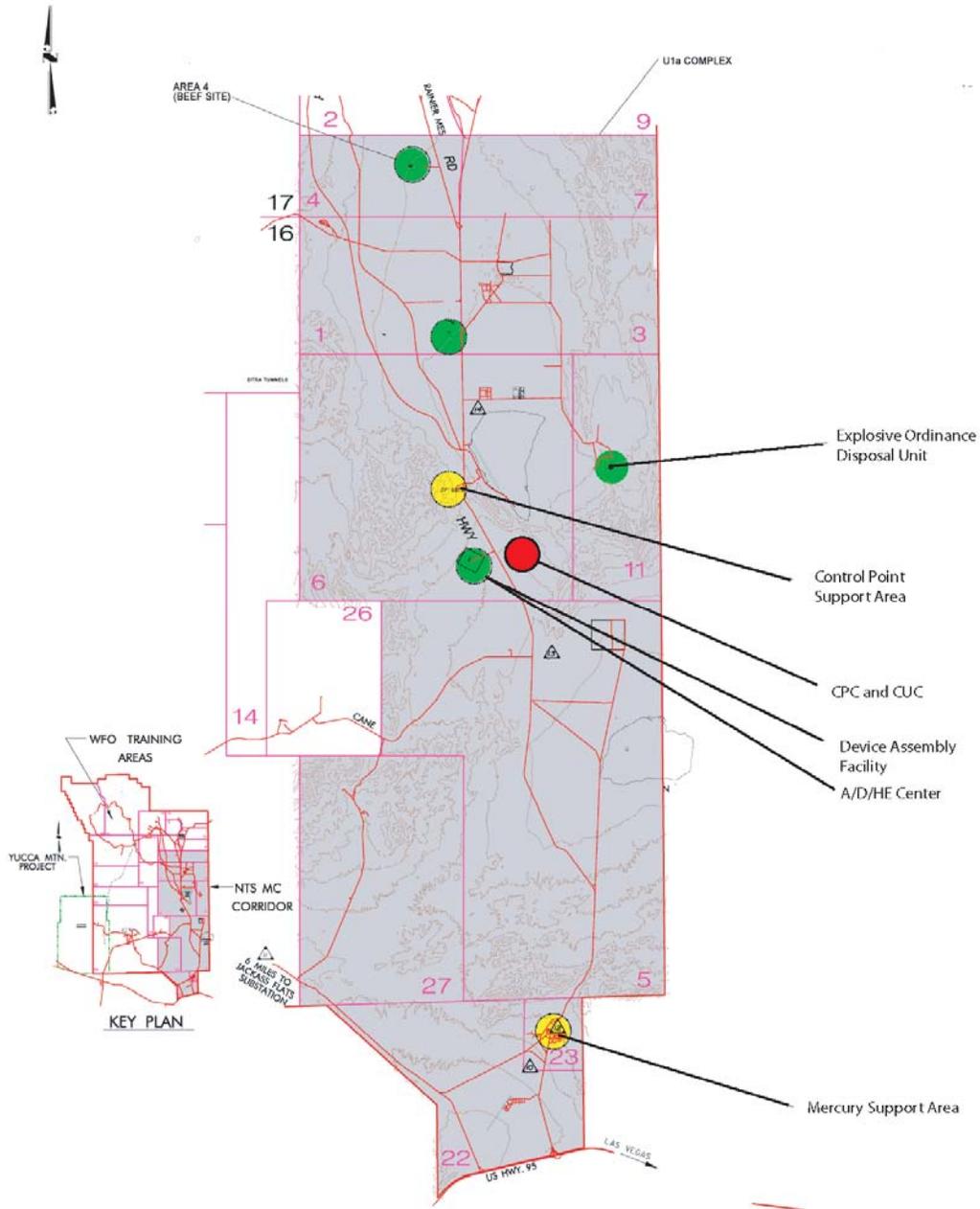


Figure 3.5.1-3 — NTS CNPC Reference Locations

The construction data are summarized in Tables 3.4.1-2 (CPC), 3.5.1-1 (CUC), and 3.5.1-4 (A/D/HE Center). Once steady-state operations are achieved in approximately 2025, the operational impacts of a CPC, CUC, and an A/D/HE Center are summarized in Tables 3.4.1-3 (CPC), 3.5.1-2 (CUC), and 3.5.1-5 (A/D/HE).

At NTS, an A/D/HE Center could make use of the existing capabilities at NTS such that construction requirements would be reduced compared to a generic A/D/HE Center described above. An A/D/HE Center at NTS could use existing facilities such as the Device Assembly Facility (DAF); the underground complex of tunnels at U1a; the Big Explosive Experimental Facility (BEEF); the Explosives Ordnance Disposal Unit; and existing NTS site infrastructure and support areas at Mercury, the Control Point, and Area 6 Construction (Figure 3.5.1-3). By using these existing assets, the need for additional construction would be minimized.

The NTS alternative would use the DAF for disassembly operations. DAF could fully support disassembly operations and continue to support the existing criticality experiments that recently began in the DAF. Disassembly operations in the DAF would not require additional construction within the PIDAS or additions to the existing PIDAS. In the non-PIDAS area of the DAF and outside the buffer zones, an administrative facility and parking area would be constructed to support the increased personnel processing requirements for disassembly.

The remaining operations of assembly, longer-term storage for nuclear and non-nuclear components that are generated by disassembly activities, weapon surveillance, and strategic reserve storage of plutonium would be located 900 feet underground in the tunnel complex at U1a. This alternative would include construction of new tunnels and alcoves in accordance with nuclear explosive requirements for assembly and storage operations. At U1a, access to the tunnel network is limited to two (2) vertical access/egress shafts that would require construction of a small PIDAS around the surface footprint of each shaft. Table 3.5.1-7 lists the construction requirements for the A/D/HE Center.

Table 3.5.1-7 — A/D/HE Center Construction Requirements at NTS

Requirements	Consumption/Use²²
Peak Electrical energy (MWe)	250
Diesel Generators (Yes/No)	Yes
Concrete (yd ³)	10,000
Steel (tons)	635
Liquid fuel and lube oil (gallons)	19,100,000
Water (gallons)	1,800,000
Land (acre)	200
Laydown Area Size (acre)	5
Parking lots	30
Footprint of New Construction (ft ²)	330,000
Total Square Footage added (ft ²)	330,000
Employment	
Total employment (worker years)	915

²² Construction requirements for employment-related data are based on 85 percent reduction (330,000 square feet versus 2,100,000 square feet for generic A/D/HE Center) due to existing DAF capabilities.

Table 3.5.1-7 — A/D/HE Center Construction Requirements at NTS (continued)

Requirements	Consumption/Use
Peak employment (workers)	525
Construction period (years)	2
Waste Generated	Volume (yd ³)
Low Level Waste	9,000
Hazardous Waste	0
Non-Hazardous (Sanitary and Other)	6,400

Source: NNSA 2007.

Operations of an A/D/HE Center at NTS would be the same as operations of an A/D/HE Center at other sites.

3.5.1.4.3 Pantex

A CNPC located at Pantex would not require the construction of an A/D/HE Center, as Pantex currently performs these missions in existing facilities. As such, a CNPC at Pantex would entail the construction of a CPC (as described in Section 3.4.1.1) and a CUC (as described in Section 3.5.1.1). Figure 3.5.1-4 identifies the reference location for a CPC and CUC at Pantex (CNPC).

The construction data are summarized in Tables 3.4.1-2 (CPC) and 3.5.1-1 (CUC). Once steady-state operations are achieved in approximately 2022, the operational impacts of both the CPC and CUC are summarized in Tables 3.4.1-3 (CPC) and 3.5.1-2 (CUC).

3.5.1.4.4 SRS

A CNPC located at SRS would require the construction of a CPC (as described in Section 3.4.1.1), a CUC (as described in Section 3.5.1.1), and an A/D/HE Center (as described in Section 3.5.1.2). Figure 3.5.1-5 identifies the reference location for the CNPC at SRS.

Because a CPC, CUC, and A/D/HE Center would be constructed in series, construction requirements for these three facilities would not create simultaneous impacts and are analyzed as sequential actions in this SPEIS. As such, the construction data in Tables 3.4.1-2 (CPC), 3.5.1-1 (CUC), and 3.5.1-3 (A/D/HE Center) form the basis for the impact analysis in this SPEIS. Once steady-state operations are achieved in approximately 2025, the operational impacts of the CPC, CUC, and the A/D/HE Center are summarized in Tables 3.4.1-3 (CPC), 3.5.1-2 (CUC), and 3.5.1-5 (A/D/HE Center).

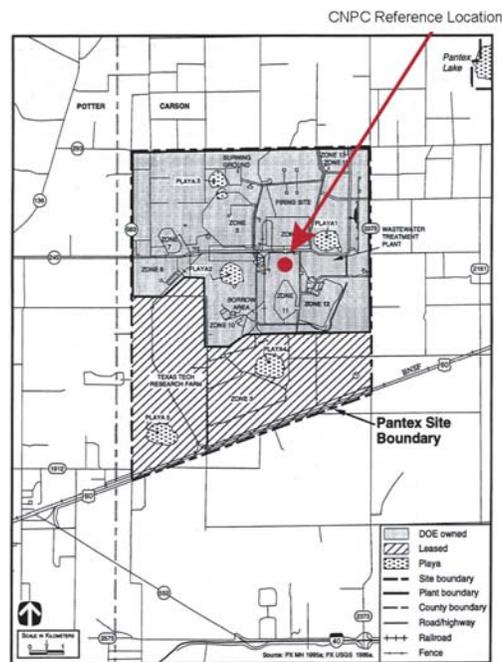


Figure 3.5.1-4 — Pantex CNPC Reference Location

3.5.1.4.5 Y-12

A CNPC located at Y-12 would require the construction of a CPC (as described in Section 3.4.1.1), a UPF (as described in Section 3.4.2), and an A/D/HE Center (as described in Section 3.5.1.2). A CUC at Y-12 would not require construction of a new HEU storage facility because NNSA is already building a modern storage facility. Figure 3.5.1-6 identifies the reference locations for these facilities at Y-12. The HE component of the A/D/HE mission would be located on the ORR approximately 4.5 miles west of Y-12 site due to buffer and acreage requirements.

Because a CPC, UPF, and A/D/HE Center would be constructed in series, construction requirements for these three facilities would not create simultaneous impact and are analyzed as sequential actions in this SPEIS. As such, the construction data in Tables 3.4.1-2 (CPC), 3.4.2-1 (UPF), and 3.5.1-3 (A/D/HE Center) form the basis for the impact analysis in this SPEIS. Once steady-state operations are achieved in approximately 2025, the operational impacts of the CPC, UPF, and the A/D/HE Center are summarized in Tables 3.4.1-3 (CPC), 3.4.2-2 (UPF), and 3.5.1-5 (A/D/HE Center).

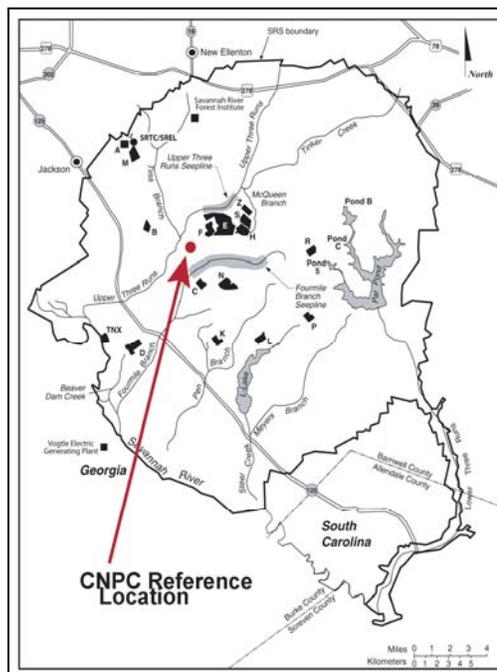


Figure 3.5.1-5 — SRS CNPC Reference Location

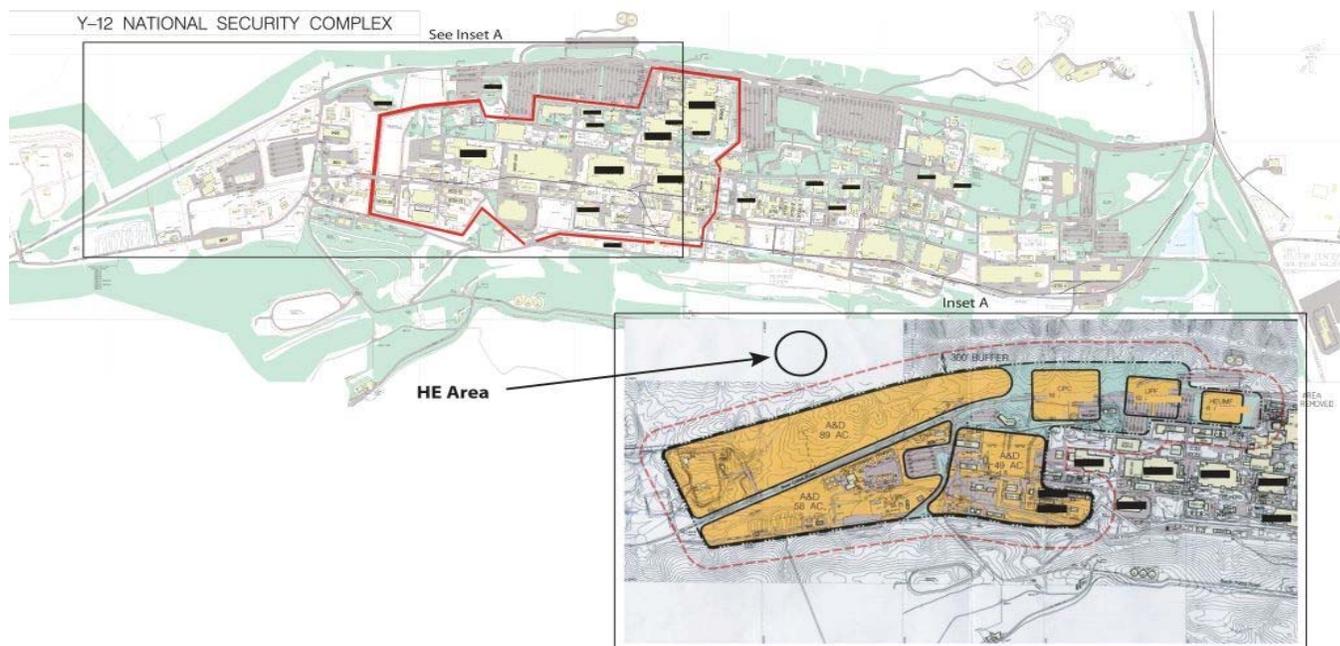


Figure 3.5.1-6 — Y-12 CNPC Reference Location

3.5.2 Consolidated Nuclear Center Option

This option would separate the A/D/HE mission to allow NNSA to consider an option that locates the production facilities of a CNPC at a different site than the weapons A/D mission. Under this option, NNSA would construct and operate a CPC and CUC at one site and an A/D/HE facility at either Pantex or NTS. For purposes of this SPEIS, this option is referred to as the CNC. A generic layout of a CNC is shown in Figure 3.5.2-1.

The descriptions of the facilities, along with the representative site locations that constitute a CNC, are contained in Section 3.5.1. Operationally, the major difference between a CNPC and a CNC involves transportation impacts between the nuclear production facilities and the A/D/HE facility. For example, once steady-state operations are achieved in a CNPC, all nuclear missions would occur at a single site and there would be virtually no radiological transportation (with the exception of waste shipments and nuclear weapons shipments between DoD and NNSA). Under the CNC Alternative, radiological transportation would be required between the production facilities and the A/D/HE facility. As such, this SPEIS assesses the radiological transportation impacts per the matrix of alternative configurations shown in Table 3.5.2-1

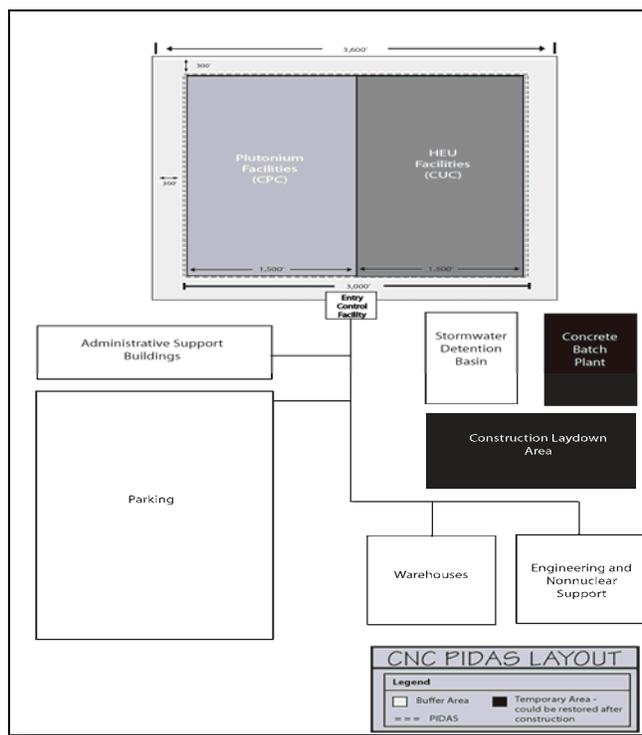


Figure 3.5.2-1 — Generic Layout of the CNC

Table 3.5.2-1 – Alternative Configurations of the CNC

If A/D/HE is at:	Then CNC would be located at one of the following locations:			
	SRS	NTS	Los Alamos	Y-12
Pantex	X	X	X	X
NTS	X		X	X

3.6 PROGRAMMATIC ALTERNATIVE 3: CAPABILITY-BASED ALTERNATIVE

In the 2001 Nuclear Posture Review (NPR), the President established the objective of achieving a credible nuclear deterrent with the lowest possible number of nuclear warheads consistent with our national security needs. NNSA developed a programmatic alternative, referred to as the “Capability-Based Alternative,” to analyze the potential environmental impacts associated with operation of a Complex that would support stockpiles smaller than required to meet anticipated future national security needs.

The objective of this analysis is to identify the potential environmental impacts (if any) that are particularly sensitive to assumptions about the size of the future stockpile. In addition, analysis of this alternative enhances NNSA’s understanding of the infrastructure that might be appropriate if the U.S. continues to reduce stockpile levels. In this alternative, NNSA would maintain a basic manufacturing capability to produce nuclear weapons, as well as laboratory and experimental capabilities to support the stockpile. It would reduce the operational capacity of production facilities to a throughput of approximately 50 weapons per year. This alternative involves:

- Pit production at LANL of 50 pits per year; and
- Reductions of production capacities at Pantex, Y-12, and SRS.

This SPEIS also assesses stockpile reductions beyond those that are the basis for the Capability-Based Alternative (see Section 3.6.2).

3.6.1 Capability-Based Alternative for Production Facilities

For purposes of this alternative, the nuclear weapons *production* sites are:

- LANL— producing pits;
- Y-12— producing secondaries and cases;
- SRS— processing tritium and other tritium activities; and
- Pantex— producing HE components and performing weapons assembly/ disassembly.

This section discusses how each of these sites would operate in the Capability-Based Alternative. Because LANL does not have adequate capacity to support stockpile requirements expected in the future, as do the other production facilities, LANL would proceed with replacing the CMR with a CMRR to achieve a pit production capability that could produce as many as 50 pits per year. At other production sites, capacity could be reduced.²³

The following sections provide specific information about each of the four production facilities.

²³ For this alternative, the SPEIS analyzes options that would maintain missions within existing facilities by reductions in place. NNSA acknowledges that new facilities such as a CPC, CNPC, or a CNC, with smaller capacities, could be built in support of a capability based alternative. However, the SPEIS already analyzes reasonably-sized new facilities that could be operated with smaller throughputs. Section 3.15 discusses why new facilities, of smaller capacities, are not analyzed in detail in this SPEIS.

3.6.1.1 *Capability-Based Alternative for LANL*

The LANL SWEIS (DOE/EIS-0380D) assesses an alternative to establish an interim pit fabrication capacity of up to 50 pits per year. Under the Capability-Based Alternative, that would not change. The LANL SWEIS contains a description of the specific actions that would be required to produce up to 50 pits per year to the stockpile. For a description and analysis of the specific actions, the reader is directed to the draft LANL SWEIS (LANL 2006a). A summary of the major actions follows:

- CMRR — NNSA is continuing design of the CMRR nuclear facility, but has not begun construction. NNSA will decide whether to construct the CMRR nuclear facility after completion of this SPEIS. Should another site be selected for pit production, the full CMRR could still be constructed at LANL in order to produce an interim production capability pending the availability of a new pit production facility. In any case, NNSA has determined that preliminary design of the CMRR nuclear facility would be applicable to any future pit production facility at any site analyzed in this SPEIS.
- Other Upgrades at TA-55 — a series of upgrades would be made at TA-55, including: heating, ventilation, and air conditioning systems; PF-4 roof replacement; confinement doors in PF-4; criticality alarm system; fire sprinkler piping; fire alarm system; replacement of cooling towers; any necessary seismic upgrades; and others.

3.6.1.2 *Capability-Based Alternative for Pantex*

Pantex is responsible for the production of HE and the assembly/disassembly of weapons. Approximately one-half of its current and future workload is associated with weapons dismantlements. Under the Capability-Based Alternative, NNSA would continue dismantlement activities at Pantex. If future stockpile requirements decreased significantly, this would result in an increased need for dismantlements at Pantex. For purposes of this analysis, it is assumed that dismantlement activities would continue at current rates for an even longer period of time compared to the No Action Alternative. As such, this alternative assumes that approximately one-half of the operations at Pantex would not change for the foreseeable future. With respect to other operations (most notably weapons assembly and HE fabrication), this alternative assumes a 50 percent reduction in these activities.

The reduction in weapons assembly and HE fabrication would reduce the number of employees, reduce waste generation, infrastructure needs, and overall worker doses. Estimates of these reductions are in Table 3.6.1-1. Safeguard and security expenditures would remain at current levels, and other operations conducted at Pantex, such as the storage of pits, dismantlement of retired weapons, and stockpile surveillance activities, would remain at current levels, consistent with the levels described for the No Action Alternative in Section 3.3.

Table 3.6.1-1 — Annual Operation Requirements and Estimated Waste Volumes for the Capability-Based Alternative at Pantex Compared to the No Action Alternative

Requirements	No Action Alternative	Capability Based Alternative ^a
Electrical Energy Use (MWh)	81,850	61,000
Water Use (gallons)	130,000,000	97,500,000
Site Employment (workers)	1,644	1230
Number of Radiation Workers	334	250
Average Worker Dose (mrem)	132	132
Total Worker Dose (person-rem)	44.1	33.0
Waste Category		
Low-level Waste (yd ³)	96.8	73
Mixed Low-level Waste (yd ³)	1.8	1.4

^a For a 50% reduction in production, this alternative estimated a 25% reduction in infrastructure requirements, personnel requirements, emissions, and waste generation. Average worker dose would remain approximately the same, but a reduced workforce would reduce total worker dose. Source: NNSA 2007.

3.6.1.3 *Capability-Based Alternative for Y-12*

Y-12 is responsible for producing secondaries and cases, dismantling secondaries from weapons disassembly operations, and storage of HEU. Less than one-quarter of the current and future Y-12 workload is associated with weapons dismantlements. Under the Capability-Based Alternative, NNSA would continue to dismantle secondaries at Y-12. If the future stockpile decreased significantly, dismantlements would need to increase. This alternative assumes that dismantlement activities would continue at current rates for an even longer period of time compared to the No Action Alternative. As such, this alternative assumes that less than one-quarter of the operations at Y-12 would change for the foreseeable future. With respect to other operations (most notably the production of secondaries), this alternative assumes a 50 percent reduction in these activities. With respect to producing secondaries and cases, which accounts for the majority of the Y-12 nuclear workload, this alternative assumes a 50 percent reduction in these activities.

The reduction in workload would reduce employees, waste generation, infrastructure needs, and the total worker dose. Estimates of these levels appear in Table 3.6.1-2. Safeguard and security expenditures would remain at current levels, and other operations conducted at Y-12, such as the storage of HEU and dismantlement of secondaries, would remain at current levels, consistent with the expected levels described in the No Action Alternative in Section 3.3.

Table 3.6.1-2 — Annual Operation Requirements and Estimated Waste Volumes for the Capability-Based Alternative at Y-12 Compared to the No Action Alternative

Requirements	No Action Alternative	Capability Based Alternative ^a
Electrical Energy Use (MW)	360-480	220-290
Water Use (million gallons/year)	2,000	1,200
Y-12 Site Employment (workers)	6,500	3,900
Steam Plant Generation (billion pounds)	1.5	0.9
Normal Radiological/Uranium Air Emissions (Curie)	0.01	0.006
Number of EU Radiation Workers	839	500
Average worker-dose for EU Worker (mrem)	38.1	38.1
Total dose to EU Radiation Workers (person- rem)	32.0	19.1
Waste Category		
Low-level Waste		
Liquid (yd ³)	17.4	10.4
Solid (yd ³)	7,800	4,700
Mixed Low-level Waste		
Liquid (yd ³)	17.9	10.7
Solid (yd ³)	21.1	12.7

^a For a 50% reduction in production, this alternative estimated a 40% reduction in infrastructure requirements, personnel requirements, emissions, and waste generation. Average worker dose would remain approximately the same, but a reduced workforce would reduce total worker dose
 Source: NNSA 2007.

3.6.1.4 Capability-Based Alternative for SRS

SRS is responsible for extracting tritium (from tritium producing burnable absorber rods irradiated in a TVA reactor) and filling tritium reservoirs for nuclear weapons. Under the Capability Based Alternative, tritium activities at SRS would be reduced significantly, as NNSA could likely meet its tritium requirements through a combination of tritium recycle and limited extraction. As such, it is conceivable that tritium operations could be reduced to approximately 50 percent compared to the No Action Alternative. This reduction would require fewer employees, reduce waste generation, reduce infrastructure needs, and lower the total worker-dose. Estimates of these reductions appear in Table 3.6.1-3. Safeguards and security would remain at current levels, and other non-tritium operations conducted at SRS, such as the MOX program, would not change. Table 3.6.1-3 presents relevant operational reductions from the higher stockpile levels of the 1990s to the No Action Alternative to the Capability Based Alternative.

Table 3.6.1-3 — Annual Operation Requirements and Waste Volumes for the Capability Based Operations Alternative at SRS Compared to Other Tritium Activity Levels

Requirements	Tritium Activities to Support 1990's Stockpile ^a	No Action Alternative	Capability Based Alternative
Electrical Energy Use at Tritium Facilities (MWh)	32,400	27,500	22,500
Water Use at Tritium Facilities (gallons)	43,000	36,550	30,100
Normal Tritium Air Emissions (Curies)	21,700	10,350	2,500

Table 3.6.1-3 — Annual Operation Requirements and Waste Volumes for the Capability Based Operations Alternative at SRS Compared to Other Tritium Activity Levels (continued)

Requirements	Tritium Activities to Support 1990's Stockpile ^a	No Action Alternative	Capability Based Alternative
Number of Tritium Workers ^b	148	110	85 ^a
Average worker-dose for Tritium Worker ^c (mrem)	37	37	37
Total worker-dose (person-rem)	5.5	4.1	3.1
Waste Category			
Low-level Waste Solid (yd ³)	275	138	69
Mixed Low-level Waste and Hazardous Waste Solid (yd ³)	12	6	3
Nonhazardous (Sanitary) Waste (gallons/year)	27,500	23,375	19,250

^a Based on TEF EIS [DOE/EIS-0271D] and the EA for the Tritium Facility Modernization and Consolidation Project at SRS [DOE/EA- 1222].

^b Reductions in workforce would not be directly proportional to throughput reduction due to support personnel. A 50 percent reduction in throughput would reduce worker requirements by approximately 25 percent.

^c Average worker dose would remain constant, but total workforce would be reduced for reduced throughput.

Source: NNSA 2007.

3.6.2 Further Stockpile Reductions

The nuclear weapons stockpile and the Complex have undergone profound changes since the end of the Cold War. Since that time, more than 14,000 U.S. nuclear weapons have been dismantled, no new-design weapons have been produced, three former nuclear weapons plants (Mound, Pinellas, and Rocky Flats) have been closed, nuclear material production plants (Hanford, K-25 at ORR, most of SRS, and Fernald) have stopped production, and the U.S. is observing a nuclear test moratorium. In the midst of these changes, one of NNSA's main challenges has been to maintain a safe and reliable stockpile.

NNSA acknowledges that any decision to eliminate nuclear weapons or significantly reduce the stockpile size would change NNSA's operational requirements. In response to such a decision, NNSA would initiate planning, including any required NEPA analyses, to determine how to meet its new operational requirements such as continuing dismantlements, disposition of SNM, and cleaning up unneeded facilities. In this SPEIS, NNSA has based its analysis on current national policy regarding stockpile size (approximately 1,700-2,200 operationally deployed strategic nuclear warheads) with flexibility to respond to future Presidential direction to change the stockpile size while assuming a continued requirement to maintain a nuclear arsenal. Because there is, inevitably, uncertainty about stockpile requirements in the future, this SPEIS analyzes alternatives to meet reasonably foreseeable requirements as the President and Congress may determine.

If stockpile size were reduced even further, at some point, even a capability-based Complex may not be the optimum configuration. Indeed, in such a situation, it is likely that NNSA would make major changes to the Complex beyond those described in Section 3.6.1. For example, at some point on a path of denuclearization, closure of production sites would become reasonable,

rather than reducing facilities in-place. In such a case, NNSA current thinking is that the Complex could be reconfigured as follows:

- LLNL, LANL, and SNL would become smaller as research and development laboratories;
- LANL or NTS would likely become locations for all Category I/II SNM component production;
- NTS would become the site for A/D/HE operations and any high-hazard testing;
- SRS would remain the tritium production site; and
- Pantex and Y-12 would close.

This SPEIS discusses, at a qualitative level, the sensitivity of the potential environmental impacts of the programmatic alternatives to smaller stockpiles. That analysis is intended to describe various approaches for transitioning the Complex if the stockpile were very small or eliminated. With respect to maintaining the core competencies of the U.S. in nuclear weapons, and the technical problems of maintaining the safety and reliability of a smaller, aging stockpile in the absence of nuclear testing, NNSA does not believe that stockpile size alone would change the need for the nuclear weapons *laboratory* facilities unless the nation were to abandon the option of returning to a nuclear weapons state. On a gradual path to a very small stockpile, size alone could change the need for nuclear weapons *production* facilities. At some point on this path, further reduction of existing industrial plants or consolidating production missions at laboratories could become more attractive as manufacturing capacity becomes less important. Consequently, NNSA expects that it would undertake further NEPA review in the event of Presidential direction to reduce the stockpile to very low levels or to eliminate it.

3.7 CATEGORY I/II SNM CONSOLIDATION ALTERNATIVES

Category I/II quantities of SNM are stored at seven NNSA sites: LLNL, LANL, NTS, Pantex, SNL/NM, SRS, and Y-12. NNSA is seeking to reduce security costs and increase safety through SNM consolidation. As a result, the future complex is expected to have fewer sites and fewer locations within sites with Category I/II quantities of SNM. This section describes proposals related to Category I/II SNM consolidation alternatives.

As defined in section 11 of the Atomic Energy Act of 1954, SNM are: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which DOE or the U.S. Nuclear Regulatory Commission determines to be SNM; or (2) any material artificially enriched by plutonium or uranium 233 or 235. Quantities of SNM are grouped into security Categories I, II, III, and IV based on the type, attractiveness level, and quantity of material. This enables DOE to use a cost-effective, graded approach to providing safeguards and security.

SNL/NM is currently removing its Category I/II SNM, and by the end of 2008 should no longer maintain any Category I/II SNM quantities (see Section 3.7.1.3). NNSA is planning and scheduling the removal of Category I/II SNM from LLNL, which could begin shortly and be accomplished by 2012. Additionally, as described in Section 3.4.1.4, NNSA would remove Category I/II SNM from LANL if LANL were not selected as a site for either plutonium consolidation or a CNPC/CNC. Removal of Category I/II SNM from LANL would be

accomplished by approximately 2022 if plutonium operations are not consolidated at Los Alamos. Additionally, this SPEIS analyzes an alternative that would consolidate Category I/II SNM currently stored in Zone 4 at Pantex at Zone 12.

The alternatives for consolidating Category I/II SNM are described in the sections below. The No Action Alternative (Section 3.7.1) focuses on the Category I/II SNM stored at LLNL and Pantex, as those materials are being considered for transfer (in the case of LLNL) and to a new location within the site (in the case of Pantex). The No Action Alternative also describes Category I/II SNM storage at LANL, because LANL would receive the LLNL Category I/II SNM that is still required for NNSA missions. Lastly, for completeness, the No Action Alternative describes ongoing actions to remove Category I/II SNM from SNL/NM. Because there are no *project-specific* proposals or alternatives to consolidate Category I/II SNM from Y-12, NTS, and SRS, those sites are not addressed in this section.

As part of the programmatic analysis to decide whether and where to construct a CPC, this SPEIS also assesses the impacts of consolidating Category I/II plutonium from LANL to the CPC site, if Los Alamos is not chosen as the host site for a CPC. That assessment is described in Section 3.4.1.4. Additionally, as part of the programmatic analysis to decide whether and where to construct a CNPC, this SPEIS also assesses the impacts of consolidating Category I/II SNM from LANL, Pantex, and Y-12 to the CNPC site, if any of those sites are not chosen as the host site for the CNPC. That assessment is described in Section 3.5.1.3.

Section 3.7.2 describes the alternative of removing the LLNL Category I/II SNM. Section 3.7.3 describes the alternative of consolidating Category I/II SNM currently stored in Zone 4 at Pantex to Zone 12 at Pantex. The analysis of the environmental impacts of these alternatives is contained in Section 5.12.

3.7.1 No Action Alternative

3.7.1.1 *Lawrence Livermore National Laboratory*

LLNL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, and research on the properties of materials. Based on facility design and operation, LLNL establishes administrative limits for fissile, special use, radioactive, and sealed materials. An administrative limit establishes the maximum amount of a particular material that is allowed at a facility. Actual inventories are classified.

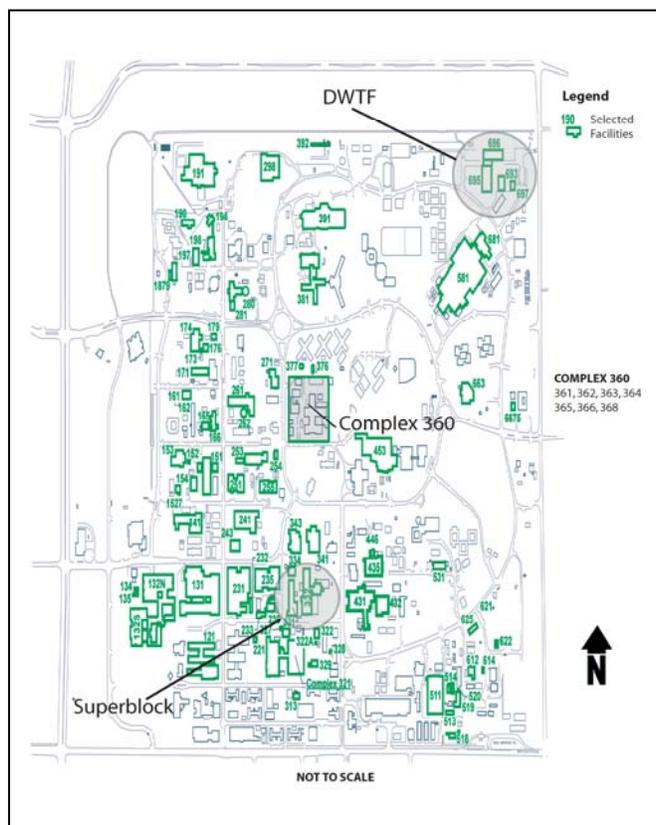


Figure 3.7-1 — Location of Building 332 and the DWTF at LLNL

Non-waste management facilities at LLNL authorized to have Category I/II SNM quantities are Building 332, Building 334, and Building 239. However, only Building 332 stores this material. As such, only Building 332 is discussed below.

The Building 332 Plutonium Facility is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site (see Figure 3.7-1). This building has a total area of 104,687 square feet, including radioactive materials laboratories, mechanical shops, change rooms, storage vaults, a fan loft, basement, equipment rooms, and offices. There are currently 24 laboratories in which radioactive materials can be handled within the radioactive material areas (RMAs) of the facility (DOE 2005a). The mission of Building 332 includes R&D on the physical, chemical, and metallurgical properties of plutonium and uranium isotopes, compounds and alloys. Although the quantities of Category I/II SNM in Building 332 are classified, the administrative limits are as follows:

Plutonium	1,400 kg
Enriched uranium	500 kg

With respect to waste management facilities with Category I/II SNM, the Decontamination and Waste Treatment Facility (DWTF) and Building B625 manage TRU waste that would be shipped to WIPP.

As described in Section 1.5.2.1, DOE has analyzed the transfer of surplus non-pit weapons-usable plutonium materials from LLNL to SRS for consolidated storage. Those transfers can be accomplished under the No Action Alternative.

3.7.1.2 *Pantex*

As shown on Figure 3.7-2, after removal from nuclear weapons, pits are stored at Pantex. The majority of pits are stored in magazines, commonly referred to as “igloos,” in Zone 4. Zone 4 operations include weapon and SNM staging. These storage operations require access control, security, and electricity. The storage area in Zone 4 is approximately 74,200 square feet. In general, these facilities were built in 1949.

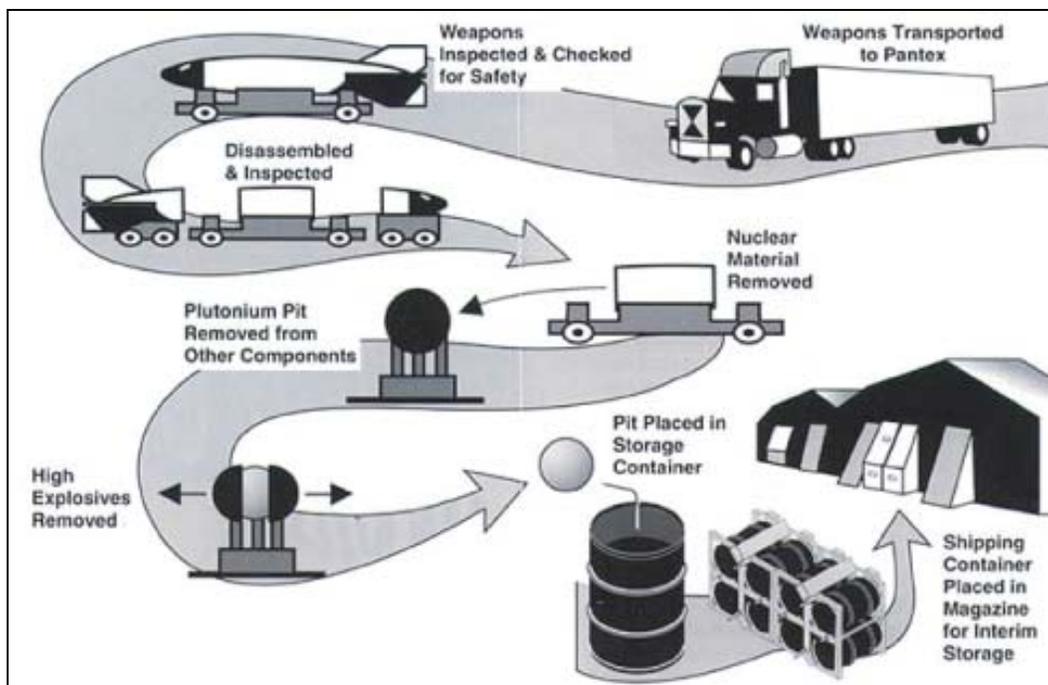


Figure 3.7-2 — Pit Storage at Pantex

There are two types of igloos used for pit storage: Modified Richmond and Steel Arch Construction (SAC). Both types are 39 feet deep, 25 feet wide, and a maximum of 15 feet high. Figure 3.7-3 shows a typical igloo. There are more than 10,000 pits in storage at Pantex, the majority of which are destined for processing at the Pit Disassembly and Conversion Facility (PDCF) at the Savannah River Site. PDCF is currently projected to be operational in 2019.



Figure 3.7-3 — Typical Storage Igloos at Pantex

Pits are stored and packaged inside cylindrical containers. The packaging also thermally insulates the pits and makes the problem of cooling more difficult. Currently, pit storage magazines are cooled by natural convection. A draft is created by the heat generated inside the magazine which results in air circulation through intake vents, and out through a ventilation stack. In 1999, Pantex began repackaging pits from AL-R8 containers into AL-R8 Sealed Insert containers to improve storage conditions (see Figure 3.7-4). The repackaging effort started in 1999 is complete. Pit packaging into sealed inserts is a continuing process as pits are yielded from current and future weapon dismantlement activities.

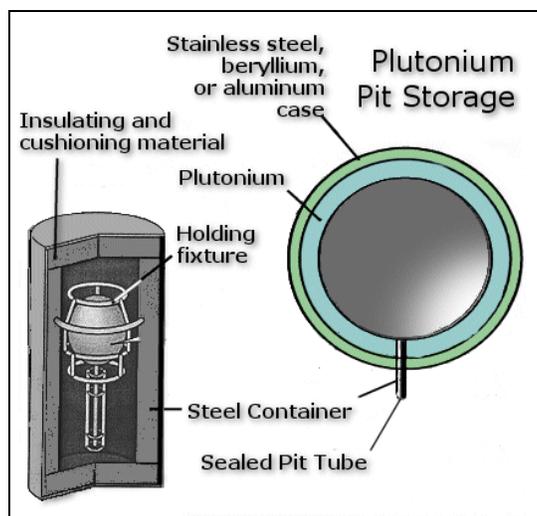


Figure 3.7-4 — Simplified illustration of a pit with AL-R8 storage container

3.7.1.3 *Los Alamos National Laboratory*

LANL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and plutonium pit production. The TA-55 Plutonium Facility Complex (TA-55 Complex) encompasses about 40 acres and is located about 1 mile southeast of TA-3 (Figure 3.7-5). Most of TA-55 is situated inside a restricted area surrounded by a double security fence. The main complex has five connected buildings: the Administration Building, Support Office Building, Support Building, Plutonium Facility, and Warehouse.

The Plutonium Facility, a two-story laboratory of approximately 151,000 square feet, is the major plutonium R&D facility in the complex (see Figure 3.4.1-7). The Plutonium Facility provides storage, shipping, and receiving activities for the majority of the LANL SNM inventory (up to approximately 7.3 tons), mainly plutonium.

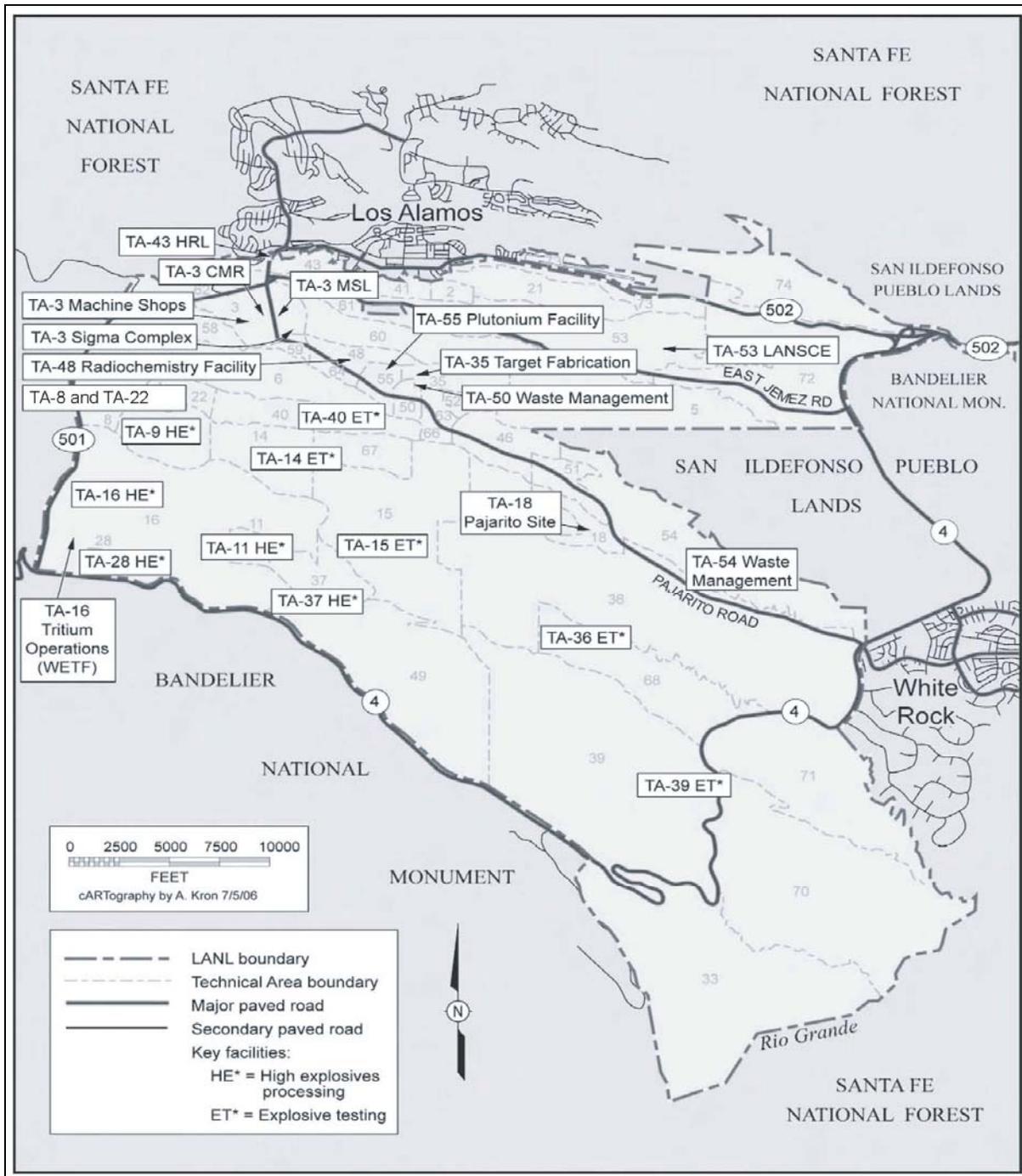


Figure 3.7-5 — Major Technical Areas (TAs) at LANL, including TA-55

3.7.1.4 Sandia National Laboratories/NM

Under the No Action Alternative, SNL/NM is currently removing its Category I/II SNM, and by the end of 2008 should no longer maintain any Category I/II SNM quantities. Three phases, distinguished by the destinations and schedules for shipping the material, are involved, as described in Table 3.7-1.

Table 3.7-1 — SNL/NM Shipping Phases

Phase	Description
Phase One	Material removal in this Phase would include the Moly-99 Targets and the HEU Calibrations Standards which would be moved from storage to a vault-type room at the Radioactive and Mixed Waste Management Facilities (RMWMF). At the RMWMF, the material would be repackaged for exclusive use transport by commercial carrier, to Y-12. The Moly-99 Targets were moved in 2005. The HEU Calibrations Standards were partially moved in 2006.
Phase Two	Material removal in this phase would include the Molten Pool Experiment Materials and the MP-1 and MP-2 Packages that Sandia proposes to move to the RMWMF, where Sandia would characterize the material, and seek opportunities within the DOE complex for reapplication of the materials. Failing to identify appropriate reapplication opportunities, the material would be characterized for potential staging or interim storage at the NTS DAF. The MP-1 and Mp-2 Packages were moved in April 2007 and July 2007, respectively.
Phase Three	Material removal in this Phase would include the Pu-239 Source Plates, the Sodium Debris Bed Experiment Packages, and the SPR Fuel, which Sandia proposes to transport to the NTS DAF for interim storage or staging, until a final destination for each material group is secured.

3.7.2 Transfer Category I/II SNM from LLNL to Other Sites and Phase-out Operations Involving Category I/II quantities of SNM at Superblock

NNSA is considering the removal of Category I/II SNM from LLNL by approximately 2012, and the phase-out of operations at the Superblock involving Category I/II quantities of SNM. Although the exact quantities of Category I/II SNM are classified, the Category I/II SNM at LLNL can be divided up into three basic categories, in the percentages indicated, along with the receiver site for this material, and the number of trips required (see Table 3.7-2).

Table 3.7-2 – Category I/II SNM at LLNL

Category I/II SNM Category	Percentage	Receiver Site	# Trips
SNM Excess to Programmatic Missions ²⁴	49	SRS	10
SNM Required for Programmatic Missions	47	LANL ²⁵	9
Waste	4	WIPP	1

Source: NNSA 2007.

²⁴ In 2007, DOE prepared a Supplement Analysis (SA) that evaluated the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium from Hanford, LLNL and LANL. The SA concluded that this consolidation would not be a significant change to the potential environmental impacts associated with the alternatives analyzed in previous NEPA reviews (DOE/EIS-0229-SA-4). As a result of this SA, DOE determined that no additional NEPA review is required prior to transferring surplus non-pit weapons-usable plutonium from LLNL to SRS for consolidated storage. Nonetheless, for completeness, this SPEIS includes an analysis of the transportation risk associated with disposition of all surplus plutonium from LLNL to SRS.

²⁵ This analysis also evaluates NTS as an interim storage location for the LLNL Category I/II SNM required for programmatic missions. Under this option, the material would be transferred to NTS for interim storage in the DAF until eventual transfer to LANL, or site of a CPC or CNPC.

The LLNL SWEIS (DOE 2005a) assesses the environmental impacts of transporting SNM to and from LLNL and other NNSA sites, SRS, and the WIPP. That analysis includes consideration of transportation actions involving greater quantities of SNM and more shipments than are identified in Table 3.7-2. As such, the transportation activities identified in Table 3.7-2 are included in the existing No Action Alternative. For completeness, however, this SPEIS assesses the environmental impacts associated with:

- Packaging and Unpackaging Category I/II SNM
- Transporting Category I/II SNM from LLNL to Receiver Sites

This SPEIS also assesses phasing out Category I/II SNM Operations from LLNL Superblock.

With respect to shipments, the maximum number of containers per shipment would be 75, the maximum number of shipments per year would be approximately 4, and all shipment would be made by truck. Shipping is expected to commence soon and be complete in 2012.

- All oxide and non-weapon component metal would be packaged to meet the DOT 9975 Type B shipping container.
- All weapon components would be packaged to meet DPP-1 Type B Shipping Container Requirements. Mass in containers is dependent on weapon type.
- All Enriched Uranium oxide would be packaged to meet Type B Shipping Container Requirements.
- Enriched Uranium excess metal would be packaged to meet DOT 6M, ES3100, or DPP-2 Type B Shipping Container Requirements.
- All TRU would be packaged to meet the WIPP WAC and shipped in TRUPAC-II.

After phase-out of Category I/II SNM the Superblock facilities would continue to operate with Category III quantities of SNM. During Complex Transformation the Superblock facilities would continue to perform machining, foundry operations, analytical chemistry, and materials characterization on SNM originating from LANL facilities. These activities involving Category III quantities of SNM are well within the bounds of impacts analyzed for Superblock facilities in LLNL SWEIS (DOE 2005a).

3.7.3 Transfer Category I/II SNM from Pantex Zone 4 to Zone 12

Under this alternative, NNSA would transfer more than 10,000 pits currently stored at Pantex in Zone 4 to Zone 12. Because there is insufficient storage space in existing Zone 12 facilities, a new storage facility would be required. Table 3.7-3 describes the construction requirements for a new underground reinforced storage facility. Transfer of the pits from Zone 4 to Zone 12 would enable all Category I/II SNM at Pantex to be consolidated into a central location, close to the assembly, modification, and disassembly operations. This would reduce the area at Pantex requiring a high level of security. If pits are transferred from Zone 4 to Zone 12, Zone 4 would undergo D&D (Section 3.5).

Table 3.7-3 — Construction Requirements for New Zone 12 Pit Storage Facility

CONSTRUCTION REQUIREMENTS	
Data Required	Consumption/Use
Land	
Total Square Footage of New Construction	456,600
Total Area Disturbed (Facility Footprint) (acres)	57
Laydown Area Size (acres)	2.6
Parking Lots (acres)	1.5
Water requirement (total construction) (in gallons)	2,950,000
Employment	
Total construction employment (worker years)	480
Peak construction employment (workers)	120
Construction period (years)	5

ALTERNATIVES TO RESTRUCTURE R&D AND TESTING FACILITIES

3.8 HIGH EXPLOSIVES R&D

Introduction

Energetic materials (high explosives [HE], propellant, and pyrotechnic powders) provide the specific quantities of energy needed for a nuclear weapon to function. Stewardship of the current stockpile and modernization of the weapons in the future require a broad spectrum of energetic material R&D. In the nuclear portion of a weapon system, HE is used for the main charge and associated triggering systems. More specifically, HE R&D is required to assure stability and dependability of HE in nuclear weapons.

Section 3.8.1 describes the No Action Alternative for HE R&D. As described in that section, HE R&D is currently conducted at five sites within the weapons complex. LLNL and LANL are where most of the R&D related to main charge explosives is performed. SNL has responsibility for the cradle-to-grave of the non-nuclear explosive components such as gas generators, ignitors, actuators, and timer-drivers. In addition to extensive manufacturing operations, HE R&D is conducted at the Pantex Plant, principally for safety and quality control purposes and manufacturing process development and improvement. Pantex also partners with the National Labs in conducting HE R&D activities to meet stockpile and other national defense needs. NTS is used for testing of larger quantities of high explosives.

Section 3.8.2 describes the alternatives being considered for HE R&D. Within Section 3.8.2, there are two types of alternatives: Section 3.8.2.1 describes the “Minor”²⁶ Downsizing/Consolidation Alternatives and Section 3.8.2.2 describes the “Major”²⁷ Downsizing/Consolidation Alternatives. The analysis of the environmental impacts of these alternatives is contained in Section 5.13.

High Explosives R&D Alternatives

- **No Action** — continue operations at LLNL, LANL, SNL/NM, NTS, and Pantex
- **Minor Consolidation** — multiple options to consolidate or transfer some operations, but operations would continue at all sites
- **Major Consolidation** — multiple options to consolidate or transfer operations to fewer sites, and discontinue operations at sites that transfer missions

3.8.1 Alternative 1 -- No Action Alternative

This section describes the HE R&D facilities and missions currently conducted at weapons complex sites.

²⁶ “Minor” alternatives would not completely transfer the HE R&D experimentation and fabrication activities from a site.

²⁷ “Major” alternatives could completely transfer the HE R&D experimentation and fabrication activities from a site.

3.8.1.1 *Lawrence Livermore National Laboratory*

HE R&D at LLNL is carried out primarily in two facilities – the High Explosives Application Facility (HEAF) at the main Livermore site, and the Chemistry, Materials and Life Sciences Facility at Site 300. The HEAF is an R&D facility which performs the following missions:

- explosive characterization and lab-scale development;
- performance and safety testing; and
- modeling and simulation of explosive properties and reactions.

The HEAF includes laboratory areas approved for handling explosives in quantities up to 10 kilograms, and office space for the research and support staff. The net usable area of the facility is approximately 65,000 square feet. An aerial view of the HEAF is shown in Figure 3.8-1.

The Chemistry, Materials and Life Sciences Facility at Site 300 provides the capability for larger scale synthesis and formulation, HE R&D part fabrication (e.g. pressing, radiography, machining and assembly), and explosives waste packaging, storage and treatment. These capabilities are provided by the Chemistry Area, the Process Area, the Explosive Waste Storage Facility, and the Explosive Waste Treatment Facility. There are approximately 175 scientists, engineers, and technicians associated with the HE R&D mission at LLNL.

The Chemistry Area is made up of the following buildings:

- B825 – 1- and 2-inch mechanical presses;
- B826 – small deaerator/loader;
- B827 Complex – 50-pound deaerator/loader; heating ovens; 2-gallon to 5-gallon mixers; melt cast kettles, synthesis pilot plant, slurry kettles, grinders, reaction vessels; and
- HE storage magazines – long term and temporary storage.

The Process Area is made up of the following buildings:

- B809 Complex – 25-inch isostatic press, drying ovens;
- B817 Complex – 14- and 18-inch isostatic presses, drying oven;
- B823 Complex – 9-Mev, 2-Mev, 120-kev radiography of HE R&D parts;
- B806 Complex, B807 – machining of HE R&D parts;



Figure 3.8-1 — The LLNL HEAF

Note: The facility section at the bottom of the image is the office area; the area behind that houses the laboratory areas including firing tanks

- B855 Complex – large HE part machining;
- B810 Complex – assembly of HE R&D parts;
- B805 – general machine shop, explosives waste packaging; and
- HE storage magazines – long term and temporary storage.

The Explosives Waste Storage Facility contains 5 HE storage magazines. The Explosives Waste Treatment Facility has a State of California permit for Open Burn/Open Detonation of explosives waste.

3.8.1.2 *Los Alamos National Laboratory*

LANL conducts HE R&D activities in nine technical areas (TAs), as discussed below. While the LANL HE R&D facilities share some common spaces with the hydrodynamic program, this SPEIS focuses on current HE R&D activities at LANL in three areas (HE Science, HE Fabrication, and HE Firing Sites), with 31 buildings (each >1000 square feet), which includes magazines and firing points. The major TAs with HE R&D facilities are discussed below and shown on Figure 3.7-5.

- TA-9** This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this site, and new organic compounds are investigated for possible use as explosives. Storage and stability problems are also studied.
- TA-14** Located in the northwestern part of LANL, this TA is one of fourteen firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning. This site is currently permitted to treat waste through open detonation or open burning under the RCRA.
- TA-16** Fabrication of precision explosive assemblies, from powder pressing to machining and inspection, occurs at TA-16 to support HE R&D experimentation.
- TA-22** This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. Research, development, and fabrication of high-energy detonators and related devices are conducted at this facility.
- TA-36** TA-36 is in a remotely located area in the eastern portion of LANL that is fenced and patrolled. It has two active firing sites that support the HE R&D mission (it has two other firing sites that support the hydrotesting mission). The sites are used for a wide variety of non-nuclear ordnance tests.
- TA-39** TA-39 is located at the bottom of Ancho Canyon. The behavior of non-nuclear weapons is studied here, primarily by photographic techniques.
- TA-40** TA-40, centrally located within LANL, is used for studies of explosive initiation, detonation, and shock wave response of other materials related to weapon

systems. In addition, surveillance and qualification studies of War Reserve (WR) detonators are conducted.

TA-46 TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL’s basic research sites. Current operations include studies of the response of small quantities of explosive to thermal and mechanical stimuli.

TA 53 At TA-53, LANL has developed Proton Radiography, which has the ability to capture a sequence of images, creating a movie of an explosive event (up to 33 frames, currently). Proton radiography shots are currently limited to 10 pounds TNT equivalent in a containment vessel.

Reductions in HE activities have been previously analyzed at LANL in the *Environmental Assessment for the Proposed Consolidation of Certain Dynamic Experimentation (DX) Division Activities at the Two Mile Mesa Complex of LANL* (hereafter, LANL DX Consolidation Plan) (LANL 2003). Based on that Environmental Assessment and FONSI, LANL is reducing the footprint of HE and is transforming from open-air to contained firing for most experiments under 10 kg TNT equivalent. LANL consolidation is underway, as exhibited by closure of Buildings TA-16-340, TA-16-430 with consolidation into TA-16-260, closure of the TA-40-4 firing site, D&D of TA-9-35 and TA-9-42, and the transfer of TA-39-2 to Threat Reduction Directorate.

3.8.1.3 Pantex Plant

Research at Pantex includes studying the use of insensitive HE for increased safety as well as refinement of HE manufacturing methods and safety procedures. Pantex performs HE synthesis, formulation, machining, extrusion, testing, process development, and analytical operations in performing its HE research and development and production missions. These operations are performed in Zone 11 or Zone 12 using HE materials stored in Zone 4 East remote firing sites (see Figure 3.8-2). HE R&D activities and HE production mission work at Pantex both occur in common facilities and work areas.

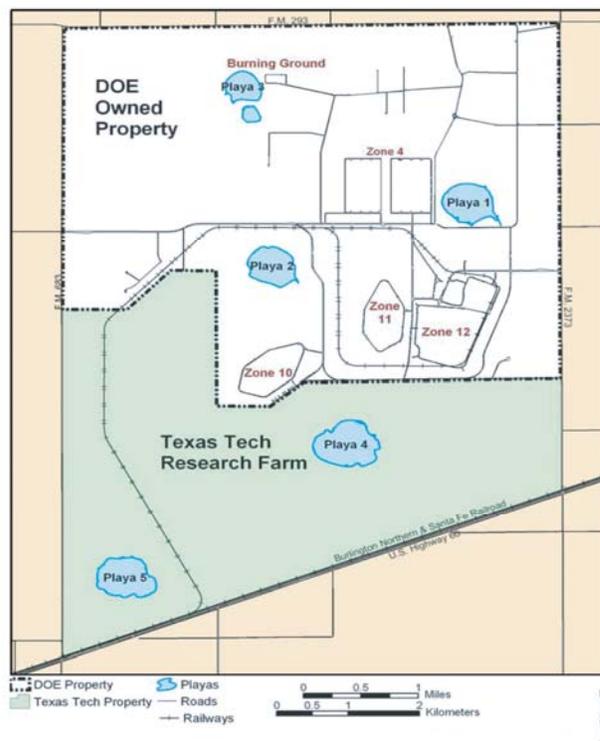


Figure 3.8-2 — Relevant Zones at Pantex for HE R&D

3.8.1.4 *Sandia National Laboratories/NM*

The major SNL/NM facilities and laboratories involved in NNSA activities that conduct HE R&D are described below. The Explosive Component Facility (ECF), shown in Figure 3.8-3, was built specifically to conduct the SNL/NM work on explosive components. The ECF includes over 100,000 square feet of laboratories, diagnostic centers and performance facilities for the research and development of advanced explosive technology and sits on 22 acres in Tech Area II (see Figure 3.8-4). Unique facility features include explosives labs qualified for all types of explosives, HE chambers and firing pads, explosive component disassembly area, explosives receiving area, and explosives storage. The ECF includes the ability to handle, store, test and model all types of explosive materials, conduct performance testing and material compatibility studies, and surety assessments related to safety and reliability. Approximately 80 people work at the ECF.



Figure 3.8-3 — Explosive Component Facility (ECF); SNL/NM Bldg 905

The Terminal Ballistics Facility (TBF), located in TA-III, includes a 1,000 square-foot indoor and a 100-acre outdoor firing range that accommodate testing and firing of guns ranging in size from 0.17 caliber to 8-inch. The facility retains the world's fastest launch capability for masses of 300 to 2,000 grams. The site also conducts static firings of solid fuel rocket motors of up to 100,000 pounds thrust. The firing site can accommodate explosive detonation tests up to the equivalent of 50 pounds of TNT. As many as 12 people work at the TBF, depending upon the test being conducted.

Currently there are two facilities used for explosive storage: the “6000 Igloos” and Manzano. They are owned by Kirtland AFB. The 6000 Igloo storage area has a total of 21,000 square feet in 21 facilities (10 of 21 are for classified storage). The Manzano storage area includes 43 facilities, of which 13 are used for explosive storage. Approximately 18 people maintain the storage facilities.

The Explosives Applications Department utilizes facilities in Sites 9930, 9939, 9920 in Coyote Canyon to conduct research, design, development, manufacture and testing of explosive

components, explosive systems, and arming and firing system hardware. The department also operates laboratories in Tech Area IV and the Explosives Applications Laboratory (Site 9930) in Coyote Canyon. Approximately 36 people support this mission.

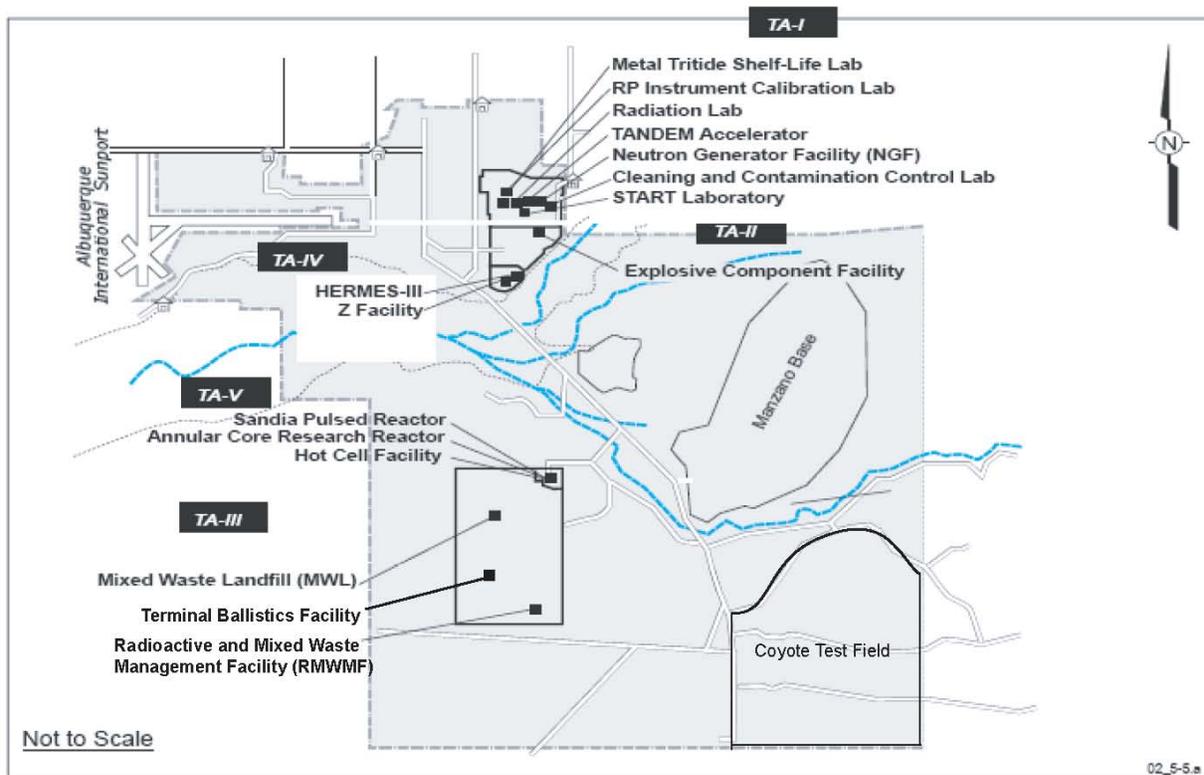


Figure 3.8-4 — SNL/NM Technical Areas

3.8.1.5 *NTS*

NTS facilities for HE R&D also support hydrotesting. Section 3.11.1.3 discusses these facilities.

3.8.2 **HE R&D SPEIS Alternatives**

As explained in Section 3.8.1, HE R&D activity is currently distributed among five primary sites within the nuclear weapons complex based on their respective roles in support of the nuclear weapons stockpile. This SPEIS analyzes a full spectrum of alternatives associated with HE R&D as shown on Table 3.8-1. Each of these alternatives is described in this section.

3.8.2.1 *HE R&D Minor Reduction/Consolidation Alternatives*

Alternatives 2a – 2e would reduce or consolidate various functions related to HE R&D, but not transfer the entire HE R&D mission from one site to another site. Each alternative is described below:

Table 3.8-1 — HE R&D Alternatives

Downsize/Consolidate Alternatives		Donor Site	Receiver Site
1	No Action Alternative	N/A	N/A
2a	Downsize in Place	N/A	N/A
2b	Relocate HE Processing & Fabrication from Site 300	LLNL	Pantex, LANL
2b'	LLNL HEAF Annex for local part fabrication	LLNL	Pantex, HEAF, LANL, Private industry
2c	Consolidate open-air 1-10 kg HE R&D experiments from LANL and SNL/NM to HEAF; and over 10 kg-100 kg HE R&D experiments at LANL or NTS	<u>1-10 kg HE R&D</u> LANL, SNL/NM, Pantex <u>10-100 kg HE R&D</u> LLNL, SNL/NM	<u>1-10 kg HE R&D</u> LLNL, NTS <u>10-100 kg HE R&D</u> LANL or NTS
2d	Consolidate unconfined firing to one or no sites	ALL	ALL
2e	Consolidate Maincharge HE R&D Experiments and Testing to one or both nuclear labs	SNL/NM	LANL, LLNL
3a	Consolidate HE R&D Experimentation and Fabrication Activities to LANL	SNL/NM, LLNL, Pantex	LANL
3b	Consolidate HE R&D Experimentation and Fabrication Activities to LLNL	SNL/NM, LANL, Pantex	LLNL
3c	Consolidate HE R&D Experimentation and Fabrication Activities to Pantex	SNL/NM, LANL, LLNL	Pantex
3d	Consolidate HE R&D Experimentation and Fabrication Activities to SNL/NM	LANL, LLNL, Pantex	SNL/NM
3e	Consolidate HE R&D Experimentation and Fabrication Activities from LANL to LLNL or Pantex or NTS	LANL	LLNL, Pantex, NTS
3f	Consolidate HE R&D Experimentation and Fabrication Activities from LLNL to LANL or Pantex or NTS	LLNL	LANL, Pantex, NTS
3g	Consolidate HE R&D Experimentation and Fabrication Activities from LANL and LLNL to Pantex or NTS	LANL, LLNL	Pantex, NTS
3h	Consolidate HE R&D Experimentation and Fabrication Activities to NTS	LANL, LLNL, SNL/NM, Pantex	NTS

3.8.2.1.1 Alternative 2a — Downsize in place

Under this alternative, the following actions would take place:

At LLNL, B825/B826, B817, and some machining bays in B806/B807 would close. No construction would be required for this alternative, however, B825 and B826 would be decommissioned. There would be no staffing change for this alternative (175 scientists, engineers, and technicians) and no significant change in effluents, emissions, or waste compared to the No Action Alternative. As some buildings close, work would transfer to existing buildings.

As discussed in Section 3.8.1.2, LANL is reducing the footprint of HE and is transforming from open-air to contained firing for most experiments under 10 kg TNT equivalent. However, under option 2a, additional reductions at LANL would occur to the HE R&D capability as part of Complex Transformation. This reduction could include establishing a smaller footprint with fewer contained firing chambers, than identified in the LANL DX Consolidation Plan. These actions, however, would be bounded by previous plans and would have no different environmental impacts.

At SNL/NM, the DP-related explosives R&D work substantially decreased its footprint in 1995 when the ECF (Bldg 905) was built. The footprint for the DOE explosive work decreased from 210 to 22 acres in this consolidation event, and the lab and office space decreased from a total of 110,000 square feet, over a dozen buildings (offices, labs and storage) to approximately 100,000 square feet now located one building – the ECF. Currently all the facilities that house explosives-related R&D are functioning close to full capacity or are unique to the function that they perform. SNL/NM's 9920, 9930, 9939, 9940 sites and Thunder Range are being used to full capacity. As such, no additional reductions are proposed under this alternative. No changes would occur at Pantex or NTS.

3.8.2.1.2 Alternative 2b — Relocate HE processing & fabrication from Site 300

Under this alternative, NNSA would discontinue HE processing and fabrication at Site 300. The activities and configuration of the HEAF, as described in the No Action Alternative, would remain unchanged. However, the HE R&D facilities at Site 300 would be closed, and HE R&D parts that are currently fabricated at Pantex or LANL would be shipped to LLNL for testing in HEAF.²⁸ The facilities at Site 300 that would close under this alternative are: B825, B826, B827 Complex, HE storage magazines, B809 Complex, B817 Complex, B823 Complex, B806 Complex, B807, B855 Complex, B810 Complex, B805, and the B845 Complex. No construction at LLNL, LANL, or Pantex would be required for this alternative.

3.8.2.1.3 Alternative 2b' — Construct HEAF Annex at LLNL for local part fabrication

Under this alternative, NNSA would implement alternative 2b, construct an annex to HEAF for local fabrication of HE R&D parts. The annex would be constructed adjacent to HEAF's explosive processing cells and support areas (e.g. control room, explosive storage) to provide fabrication capability that is currently provided at Site 300. Construction information for this annex is presented in Section 5.13.1.3.

3.8.2.1.4 Alternative 2c — Move open-air experiments using 1-10 kg HE from LANL and SNL/NM to LLNL HEAF and experiments using 10 kg -100 kg HE to LANL or NTS

Under this alternative, NNSA would consolidate open-air 1-10 kilograms HE from LANL and SNL/NM to LLNL HEAF and consolidate experiments using more than 10 kilograms up to 100 kilograms at LANL or NTS. There would be no new construction at LANL.

At LLNL, available office space near HEAF would provide temporary office/work space for LANL or SNL/NM staff while they are at LLNL. To accommodate the higher firing load at HEAF, more LLNL staff would be required in addition to the staff that LANL and SNL/NM would rotate in for their experiments. It is assumed in this alternative that alternatives 2b and 2b'

²⁸ This alternative can only be implemented if other activities at Site 300 that require a HE processing and fabrication infrastructure, specifically hydrotesting at the Contained Firing Facility (see Section 3.11.2.2) and system environmental testing at the Environmental Test Facility (see Section 3.12.3), have been transferred to new facilities which would enable this testing to occur.

are not adopted.²⁹ No new facilities would be required for this alternative.

At SNL/NM, the maximum shot size at the ECF is 1 kilogram of TNT equivalence. As a result, this alternative would not eliminate HE R&D experiments and testing that are conducted at the ECF, nor would it decrease the laboratory space required to do this work. The work at the TBF is also not likely to experience major impacts in this alternative. The SNL/NM firing sites most likely affected by this alternative would be 9920, 9930, 9939, 9940 and Thunder Range, which are mostly used and funded by work for other agencies.

At LANL, consolidation of open-air 1-10 kilograms shots at HEAF with simultaneous consolidation of 10-100 kg shots at LANL would be expected to have no significant net effect on operations. Consolidation of 1-10 kilograms shots to HEAF would result in the transfer of the firing and assembly of approximately 200-250 shots per year. At LANL, conducting the 10-100 kilogram shots would impact the planned reductions/closure of LANL's firing points in order to perform these additional tests. This would include receiving shots from LLNL's 850 and 851, SNL/NM's 9920, 9930, 9939, 9940, Thunder Range, and surveillance and destructive testing from Pantex. This is in contrast to the LANL downsizing that is occurring under the No Action Alternative, as firing points are being replaced with containment vessels. However, given LANL's current permitted status, this work could be accepted without additional environmental impacts.

NTS does not currently have an independent HE R&D program, but utilizes specific capabilities at various facilities to conduct high explosive activities. These facilities include the BEEF, Baker site, U1a Complex, and the tunnels U12P and U25X, as well as the Nonproliferation Test and Evaluation Complex (NPTEC). Each site is suitable and has the capabilities necessary to conduct HE R&D experiments up to 100 kilograms using hazardous materials.

NTS's primary open air firing site is the BEEF complex. The facility contains one instrumented shot table, a control/diagnostic bunker, and a high speed camera bunker. Surrounding the 60 ft x 60 feet shot table are three steel diagnostic blast enclosures. A shot rate of greater than one shot per day could likely be accommodated in existing firing tables.

3.8.2.1.5 Alternative 2d — Consolidate unconfined firing to one site or eliminate it

Under this alternative, all unconfined firing operations would be consolidated at one site or eliminated. In any case, unconfined firing operations would be eliminated at LLNL. Currently, HE R&D unconfined firing at LLNL is limited to destruction of excess explosive parts and explosives waste, through open burn or open detonation (OB/OD) at the Explosives Waste Treatment Facility located at Site 300. No new facilities are required in this alternative. At LLNL, Building 845 would be decommissioned.

LANL currently operates an Emergency Management and Response (EM&R) site that includes open detonation of suspect/terrorist threat devices for the Laboratory and the County of Los Alamos. This site is a destruct site that will always require some outdoor capability (for example destruction of a "car bomb"; this could be characterized as an emergency). In addition, LANL

²⁹ This alternative is not possible if either alternative 2b or 2b' is implemented.

uses the existing OB/OD permit to eliminate “Class L” explosives and to sanitize classified remains of hydrodynamic experiments. OB/OD is a separately permitted function that does not allow dual use of facilities. For example, a contained firing vessel for programmatic testing may not also be used as a waste treatment facility, unless permitted. Replacement of all OB/OD requires either additional construction or modification of an existing facility to develop a separately permitted contained destruct capability (e.g. incineration, super critical water oxidation, base hydrolysis or molten salt reactors). Construction of a 2000-square foot facility would be worst case, and would fall within the bounding condition set by the DX Consolidation Plan which is covered under the No Action Alternative.

Receiving all unconfined firing would force limited closure of LANL’s firing points in order to meet the needs of these demands. This would include receiving shots from LLNL’s 850 and 851, SNL/NM’s 9920, 9930, 9939, 9940, Thunder Range, and surveillance and destructive testing from Pantex.

The NTS Area 11 Explosive Ordinance Disposal Unit (EODU) is used to conduct open detonations for the destruction of excess explosive materials. An area near tunnel U25X has a firing site that was used for HE experiments containing beryllium. No additional facilities are required.

3.8.2.1.6 Alternative 2e — Consolidate main charge HE R&D experiments and testing at one or both nuclear labs

In this alternative, main charge HE R&D experiments at SNL/NM would be transferred to LANL and/or LLNL. Pantex main charge experiments are considered part of production plant support, or surveillance, and not HE R&D, and are therefore not in the scope of this alternative.

If the SNL/NM experiments were transferred to LLNL, they could be accommodated in existing laboratories in HEAF. The main charge HE R&D effort is small at SNL/NM, so there is a negligible impact on current HEAF activities. No construction or new facilities are required for this alternative.

If the SNL/NM experiments were transferred to LANL, LANL has the current infrastructure to absorb main charge HE R&D experiments and testing that SNL/NM is currently conducting at its site, with minimal or no impact. No new facilities are required in this alternative.

If SNL/NM had LLNL or LANL conduct its experiments instead, this would not decrease the need for supporting work at SNL/NM. SNL/NM would design components and experiments up to the point of HE assembly at SNL/NM. SNL/NM also has components that utilize secondary HE, which is the same family of explosives as the main charge explosives. SNL uses these same capabilities for the explosive materials in the non-nuclear components. If work on the main charge explosives ceased at SNL/NM, work would continue on the other explosive materials that are in the non-nuclear components. No change in personnel would occur and there would be no net reduction in facility footprints. Consolidation to one or both nuclear laboratories would reduce costs associated with maintenance of duplicative facilities.

3.8.2.2 HE R&D Major Reduction/Consolidation Alternatives

Alternatives 3a – 3g would transfer the entire HE R&D experimental and fabrication activities from one site to one or more other sites. It is noted that the R&D *mission* that has been assigned to each laboratory and plant would continue to be conducted by the scientists and engineers at those sites, although they may have to travel to a “user facility” at the consolidation site. It is the *capability*; i.e. facilities, machines, and equipment, that would be consolidated at a single site or smaller number of sites. Some personnel (facility operating staff and technicians) might move with the capability to the consolidation site. Each alternative is described below.

3.8.2.2.1 Alternative 3a — Consolidate HE R&D experimentation and fabrication activities at LANL

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated at LANL. The following actions at the potentially affected sites would occur:

LANL. Consolidating HE R&D at LANL would involve an increase of capacity for the types of experiments and capabilities that currently exist at LANL. LANL would need approximately 170,000 square feet of office and laboratory space to absorb the LLNL and SNL/NM experimental and fabrication activities. Figure 3.8-5 shows the proposed location for this new facility. No additional construction would be needed to absorb the Pantex HE R&D experimentation and fabrication activities.

LLNL. Under this alternative, LLNL would cease HE R&D experimentation and fabrication.

SNL/NM. Under this alternative, SNL/NM would cease HE R&D experimentation and fabrication.

Pantex. Under this alternative, Pantex would cease HE R&D experimentation and fabrication. However, because there are currently no Pantex facilities or personnel dedicated entirely to HE R&D experimentation and fabrication, no major changes in facility operations would result.

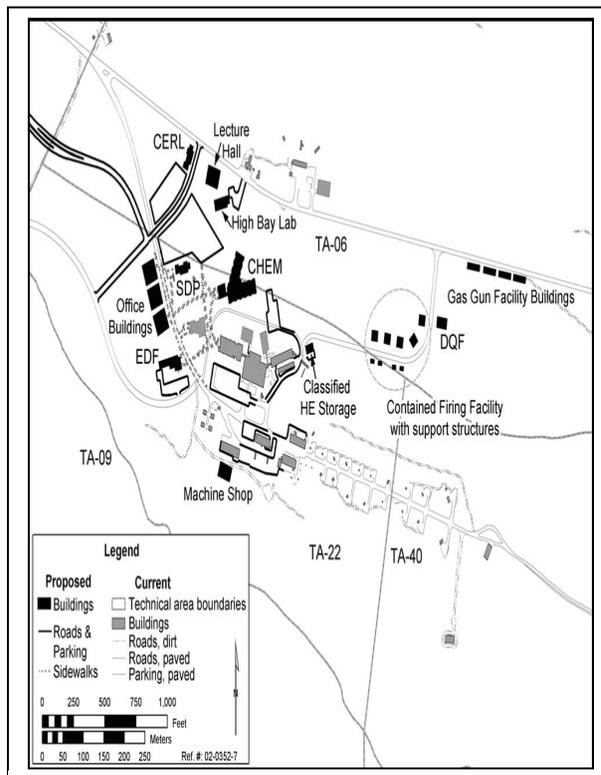


Figure 3.8-5 — New Construction Location for LANL Consolidation Alternative

3.8.2.2.2 Alternative 3b — Consolidate HE R&D experimentation and fabrication activities at LLNL

Under this alternative, HE R&D experimentation and fabrication would be consolidated at LLNL. The following actions would occur:

LLNL. Construction of a new facility at LLNL would be necessary to provide capacity.³⁰ A new experimental facility with about 400,000 square feet and 300 offices is projected. The new facility would be located near HEAF, as shown below in Figure 3.8-6.

LANL. Under this alternative, LANL would cease HE R&D experimentation and fabrication.

SNL/NM. Under this alternative, SNL/NM would cease HE R&D experimentation and fabrication.

Pantex. Under this alternative, Pantex would cease HE R&D experimentation and fabrication. However, because there are currently no facilities or personnel dedicated entirely to HE R&D experimentation and fabrication at Pantex, no major changes in facility operations would result.

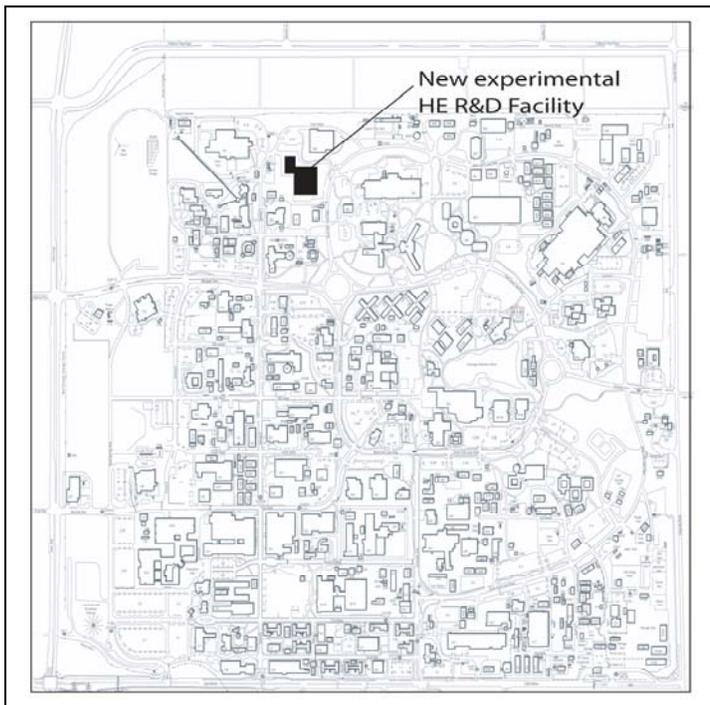


Figure 3.8-6 — Location for New HE R&D Facility at LLNL

3.8.2.2.3 Alternative 3c — Consolidate HE R&D experimentation and fabrication activities at Pantex

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated at Pantex. The following actions would occur:

Pantex. Consolidating HE R&D experimentation and fabrication activities at Pantex would result in the need for both new construction and modifications to existing facilities. Pantex would need approximately 100,000 square feet of office and laboratory space to absorb the LLNL, LANL, and SNL/NM HE R&D experimental and fabrication activities.

LANL. Under this alternative, LANL would cease HE R&D experimentation and fabrication.

LLNL. Under this alternative, LLNL would cease HE R&D experimentation and fabrication.

³⁰ For this alternative, HE R&D at Site 300 would have to continue – alternatives 2b or 2b' could also be adopted.

SNL/NM. Under this alternative, SNL/NM would cease HE R&D experimentation and fabrication.

3.8.2.2.4 Alternative 3d — Consolidate HE R&D experimentation and fabrication activities at SNL/NM

Under this alternative, HE R&D experimentation and fabrication would be consolidated to SNL/NM. The following actions would occur:

SNL/NM. SNL/NM could conduct the HE R&D experimentation and fabrication activities currently performed at Pantex and activities from LANL and LLNL conducted at outdoor firing sites without additional construction. In order to transfer operations from the LLNL HEAF, Site 300, and LANL, an additional 480,000 square feet of office and laboratory space would be required. The construction would likely be located in TA-2, near the ECF shown on Figure 3.8-4.

No construction would be required to accommodate the work that is currently conducted at Pantex. New firing sites would not be required. About half of the new construction represents office space for traveling scientists and engineers, and the remainder as laboratory space.

LANL. Under this alternative, LANL would cease HE R&D experimentation and fabrication.

LLNL. Under this alternative, LLNL would cease HE R&D experimentation and fabrication.

Pantex. Under this alternative, Pantex would cease HE R&D experimentation and fabrication. However, because there are currently no facilities or personnel dedicated entirely to HE R&D experimentation and fabrication, no major changes in facility operation would result.

3.8.2.2.5 Alternative 3e — Move HE R&D experimentation and fabrication Activities from LANL to LLNL, Pantex or NTS (for NTS, see Section 3.8.2.2.8)

Under this alternative, HE R&D experimentation and fabrication activities would be transferred from LANL to either LLNL or Pantex. The following actions would occur:

LANL. Under this alternative, LANL would cease HE R&D experimentation and fabrication.

LLNL (if receiver). Construction of a new facility at LLNL would be necessary to provide capacity. The facility would be similar to the facility identified under alternative 3b.

Pantex (if receiver). Construction of a new facility and modifications to existing facilities would be necessary to support the HE R&D capacity from LANL. The facility would be similar to the facility identified under alternative 3c.

3.8.2.2.6 Alternative 3f — Move HE R&D experimentation and fabrication Activities at LLNL to LANL, Pantex, or NTS (for NTS, see Section 3.8.2.2.8)

Under this alternative, HE R&D experimentation and fabrication would be transferred from LLNL to either LANL or Pantex. The following actions would occur:

LANL. Consolidating the LLNL HE R&D experimentation and fabrication at LANL would involve an increase of capacity for the types of experiments and capabilities that currently exist at LANL. LANL would need approximately 65,000 square feet of office and laboratory space to absorb the LLNL experimentation and fabrication activities.

LLNL. Under this alternative, LLNL would cease HE R&D experimentation and fabrication.

Pantex (if receiver). Construction of a new facility and modifications to existing facilities at Pantex (similar to those identified under Alternative 3c) would be necessary to support the HE R&D experimentation and fabrication capacity from LLNL.

3.8.2.2.7 Alternative 3g — Move HE R&D experimentation and fabrication activities from LANL and LLNL to Pantex or NTS (for NTS, see Section 3.8.2.2.8)

Under this alternative, HE R&D experimentation and fabrication activities would be transferred from LLNL and LANL to Pantex. The following actions would occur:

Pantex (if receiver). Consolidating HE R&D experimentation and fabrication at Pantex would result in the need for both new construction and modifications to existing facilities. The facility and modifications would be similar to those identified under alternative 3c.

LANL. Under this alternative, LANL would cease HE R&D experimentation and fabrication.

LLNL. Under this alternative, LLNL would cease HE R&D experimentation and fabrication.

3.8.2.2.8 Alternative 3h — Move HE R&D experimentation and fabrication Activities to NTS

Under the major HE R&D consolidation alternatives, NTS is being considered for the following: (1) consolidation of LANL HE R&D experimentation and fabrication to NTS; (2) consolidation of LLNL HE R&D experimentation and fabrication to NTS; (3) consolidation of LANL and LLNL HE R&D experimentation and fabrication to NTS; and (4) consolidation of all HE R&D experimentation and fabrication at NTS.

To consolidate HE R&D experimentation and fabrication activities to the NTS would require a 100,000 square feet Explosive Components type facility to conduct SNL/NM activities. An additional 200,000 square feet of mix use space would be required for HE R&D activities currently being conducted at LANL, LLNL, and Pantex.

3.9 TRITIUM R&D

Introduction

Tritium, a radioactive isotope of hydrogen, is an essential component of every warhead in the nuclear weapons stockpile. Tritium is used to boost the yield of warheads. Tritium has a half-life of about 12 years, so replacement tritium must be produced in reactors, purified, and put into storage vessels (reservoirs). Because warheads depend on tritium to perform as designed, there is a need for tritium R&D. Tritium R&D involves activities such as: storage, purification, separation, engineering and physics performance, aging, analysis of surveillance data, diagnostics, enhanced surveillance, modeling and simulation, and compatibility testing.

Over the past fifteen years there has been substantial consolidation of tritium activities. Today, the NNSA tritium mission includes several basic elements: irradiation of tritium targets, tritium extraction, tritium recycle and reservoir fill, Gas Transfer System (GTS) surveillance, design support, and R&D. For ease of discussion, the irradiation of tritium targets, tritium extraction, recycle and reservoir fill, and GTS surveillance are referred to as “Tritium Production”, and the design support and tritium R&D as “Tritium R&D.” With the exception of the irradiation of tritium targets (which occurs at the TVA Watts Bar commercial nuclear reactor), all other elements of “Tritium Production” are currently conducted at SRS. The “Tritium R&D” missions are largely performed at LANL, with lesser amounts performed at both LLNL and SRS.

Section 3.9.1 describes the facilities for the Tritium R&D No Action Alternative, Section 3.9.2 describes an alternative of consolidating Tritium R&D at SRS, Section 3.9.3 describes an alternative of consolidating Tritium R&D at LANL, and Section 3.9.4 describes the alternative of reducing Tritium R&D in place. The analysis of the environmental impacts of the reasonable alternatives is contained in Section 5.14.

Tritium R&D Alternatives

- **No Action** — continue operations at LLNL, LANL, SRS, and SNL/NM¹
- **Consolidate Tritium R&D at SRS** — move gas transfer system R&D support from LLNL² and LANL to SRS
- **Consolidate Tritium R&D at LANL** — move gas transfer system R&D support from LLNL to LANL
- **Reduce Tritium R&D In Place** — LLNL, LANL, and SRS would reduce operations

¹Tritium Operations at SNL/NM are primarily associated with the Neutron Generator Production Facility, which is unaffected under all alternatives.

² Does not include National Ignition Facility (NIF) target R&D and NIF production target filling. Those operations would remain at LLNL under all alternatives.

3.9.1 Tritium R&D No Action Alternative

Under the No Action Alternative, NNSA would continue ongoing tritium activities at current sites. This would entail the following tritium operations.

3.9.1.1 *Lawrence Livermore National Laboratory*

The LLNL Tritium Facility is located within the Superblock (see Figure 3.9-1) at the main Livermore site. The facility has an administrative limit of 35 grams of tritium, and a material-at-risk limit of 30 grams. The primary tritium mission of the Tritium Facility is NIF target R&D with target filling to be added in support of the NIF Ignition Campaign beginning in 2009. Under



Figure 3.9-1 — LLNL Tritium Facility

all alternatives, the NIF target R&D and target filling would remain at LLNL. The facility also hosts limited GTS R&D experiments conducted by SNL/CA researchers, which are engaged in neutron generator development and provide maintenance and recertification services for the UC-609 Type B tritium shipping package. These R&D activities, which occur in one glove box and involve less than 10 people, could be affected by the alternatives in this SPEIS.

3.9.1.2 *Los Alamos National Laboratory*

The LANL Weapons Engineering Tritium Facility (WETF) is located at TA-16, a remote area with controlled access (that is, a limited security area) (Figure 3.9-2). The WETF performs tritium R&D in support of LANL's stockpile stewardship mission, primarily the gas transfer system (GTS) design mission for use in weapons. Support of the GTS mission requires flexibility to quickly react to issues that are discovered in the stockpile. The primary use of tritium in the stockpile is in GTSs which require large quantities of tritium. Typical WETF tritium processing activities include: (1) loading and unloading; (2) removing tritium decay products and other impurities from gaseous tritium; (3) mixing tritium with other gases; (4) analyzing tritium as mixtures; (5) loading tritium onto various metals and metal alloys; (6) repackaging tritium and other gases to user specifications; (7) environmental storage and conditioning of GTS components; (8) performing various user-defined experiments with tritium; (9) unloading (depressurizing) containers of tritium; and (10) functionally testing R&D GTSs.



Figure 3.9-2 — Aerial Photo of the WETF

All tritium R&D at LANL is supported by 25 people. The number of programmatic R&D researchers is approximately 10 FTEs, with portions of R&D support staff providing the remaining 15 FTEs (performing gas analysis, gas mixing, R&D material preparation, R&D apparatus construction/maintenance, etc.).

3.9.1.3 Savannah River Site

The SRS Tritium Facilities, shown in figure 3.9-3, support the NNSA Stockpile Stewardship missions for tritium target extraction; tritium unloading, purification and enrichment; tritium and non-tritium reservoir loading; reservoir reclamation; and GTS surveillance. These are collectively referred to as the "tritium production" missions, although the actual production of new tritium is carried out in a Tennessee Valley Authority reactor, with extraction taking place at SRS in the Tritium Extraction Facility (TEF), which became operational in late 2006. Final processing of new tritium gas from TEF, as well as all other tritium gas processing, is carried out in the H-Area New Manufacturing Facility (HANMF). This facility became operational in 1994 and was also designed for a 40 year service life. The Tritium Facility Modernization & Consolidation Project, completed in 2004, significantly expanded the tritium gas processing capabilities in the HANMF and added surveillance capabilities in a new 234-7H facility.



Figure 3.9-3 — Aerial Photo of SRS Tritium Facilities

The SRS Tritium Facilities, shown in Figure 3.9-3, are located adjacent to H-Area near the center of the site and about 7 miles from the nearest

site boundary. All tritium gas processing is done within secondary containment glove-boxes or modules which have either nitrogen or argon atmospheres. The glove-box and module atmospheres are continuously re-circulated through stripper systems to recover any tritium which may leak out of piping or components. All gas streams released to the environment are processed through a recovery system to reduce emission to as low as reasonable achievable. The tritium R&D at SRS is related to the process and is a very small segment of the overall Tritium R&D. It is conducted primarily to support the ongoing tritium extraction, loading and surveillance missions at SRS.

3.9.1.4 Sandia National Laboratories/NM

Tritium Operations at SNL/NM are primarily associated with the Neutron Generator Production Facility (NGPF). The primary responsibility of the NGPF is to produce and manufacture neutron generators, which fuse deuterium and tritium to produce neutrons used to initiate the fission reaction in nuclear weapons. The neutron generator is a “limited-life” component of a nuclear weapon that uses tritium and must be replaced periodically due to the relatively short half-life of tritium. SNL/NM also performs weapons research qualification and testing on neutron tube and generator materials, process and lot samples, sub-components, and post-mortem examinations on final product. The department also performs technical studies that characterize processes and products in collaboration with production and development and design organizations. Section 3.15 describes why no alternatives were studied in detail for changing the SNL/NM tritium missions.

3.9.2 Consolidate Tritium R&D at SRS Alternative

Under this alternative, tritium R&D currently conducted at LLNL³¹ and LANL would be consolidated at SRS into existing facilities (primarily in the TEF, HANMF, and the 234-7H facility, but may also include the H-Area Old Manufacturing Building and facilities at the Savannah River National Laboratory). No new construction would be necessary to consolidate these missions. With this option, an on-site office, staffed with approximately 25 personnel to perform tritium R&D, would be required. Office space exists at SRS to support these personnel. Personnel from LANL would travel to SRS to conduct experiments, as necessary. Approximately 25 personnel at LANL could be affected by the transfer of tritium R&D to SRS.

Transferring the LLNL tritium R&D (not NIF tritium work) to SRS would basically amount to adding one glove box, which could be accommodated in the HANMF without any significant changes. Phasing out tritium R&D operations at LLNL would have no significant effect on tritium emissions, wastes, and exposure to personnel. Personnel from LLNL would travel to SRS to conduct experiments, as necessary.

³¹ This does not include NIF target R&D and NIF production target filling. Those operations would remain at LLNL under all alternatives (see Section 3.9.5.4).

3.9.3 Consolidate Tritium R&D at LANL Alternative

Under this alternative, tritium R&D currently conducted at LLNL³² would be consolidated at LANL into the WETF. No new construction would be necessary to consolidate these missions. Transferring the LLNL tritium R&D to LANL would basically amount to one glove box system, which could be accommodated in the WETF without any significant changes. LANL already performs same type work within WETF.

3.9.4 Reduce Tritium R&D in Place Alternative

Under this alternative, no changes in assigned tritium R&D missions would result. Instead, LLNL, LANL, and SRS would reduce tritium operations in-place. This alternative would result in the least transition impacts in the Complex. All three sites would increase efficiencies in tritium operations by improving planning and scheduling of activities. Any reductions in tritium emissions, wastes, and exposure to personnel are expected to be small, as these are a function of the work requirements and would not be significantly affected by improved planning and scheduling.

³² This does not include NIF target R&D and NIF production target filling. Those operations would remain at LLNL under all alternatives (see Section 3.9.5.4).

3.10 NNSA FLIGHT TEST OPERATIONS FOR GRAVITY WEAPONS

Introduction

SNL manages Flight Test Operations for gravity weapons (bombs) to assure compatibility of the hardware necessary for the interface between weapons and the delivery system, and to assess weapon system functions in realistic delivery conditions. The actual flight tests are conducted with both the B83 and B61 weapons, which are pulled from the stockpile and converted into units called Joint Test Assemblies (JTAs). These flight tests are presently conducted at the Tonopah Test Range (TTR), a 280 square-mile site, located about 140 air-miles northwest of Las Vegas, Nevada. In addition, development tests of gravity bomb and short-range systems are conducted TTR. NNSA operates this facility under the terms of a land use agreement with the United States Air Force.

Conversion of nuclear weapons into JTAs is a multi-step operation. Pantex denuclearizes the weapons that become JTAs. The JTAs are not capable of producing nuclear yield. They may then be further modified at SNL. JTAs are then dropped from aircraft at various altitudes and velocities. Depleted uranium usually remains in JTAs, but because there is no explosive event, the uranium is contained within the weapon case and completely recovered after each test. There is no contamination of the soil as the result of a flight test. In some cases, JTAs are flown at velocities and altitudes of interest and not dropped. In this case, the aircraft returns to its base with the JTA on-board. In an average year, ten JTAs are tested at TTR. Historically, JTAs included SNM, but NNSA does not plan to use SNM in JTAs after 2008. Therefore, all alternatives assume that SNM would not be present in future JTAs.

In addition to analyzing the impacts associated with the No Action Alternative, four additional alternatives for conducting NNSA flight test operations are evaluated in this SPEIS . These alternatives are as follows: (1) upgrade the existing program at TTR; (2) operate the Flight Test Program at TTR in a “campaign” mode; (3) transfer NNSA’s program to the WSMR in New Mexico; and (4) transfer NNSA’s program to NTS. Specific locations within WSMR and NTS are being evaluated to assure that the required geological conditions exist to successfully support all flight testing requirements. NNSA has conducted flight tests at facilities other than TTR, on occasion, when specific test requirements cannot be met by TTR assets. Under any alternative, NNSA may continue to conduct one or more flight tests at a different facility, consistent with environmental reviews for that site.

Section 3.10.1 describes the No Action Alternative, Section 3.10.2 describes the alternative to upgrade TTR, Section 3.10.3 describes the alternative to operate TTR in a campaign mode, Section 3.10.4 describes the alternative to transfer NNSA’s flight testing mission to WSMR, and Section 3.10.5 describes the alternative to transfer the mission to NTS. Analysis of the environmental impacts of the alternatives is contained in Section 5.15. The analysis of alternatives does not affect NNSA’s responsibilities at TTR relating to post-weapons testing by the Atomic Energy Commission at DOE. Any remediation is independent of decisions to be made as a result of this SPEIS.

NNSA Flight Test Operations Alternatives

- **No Action** — continue operations at TTR
- **Upgrade Alternative** — continue operations at TTR and upgrade equipment with state-of-the-art mobile technology
- **Campaign Mode Operations** — continue operations at TTR but reduce permanent staff and conduct tests with DOE employees from other sites
- **Transfer to WSMR** — move NNSA Flight Testing from TTR to WSMR
- **Transfer to NTS** — move NNSA Flight Testing from TTR to NTS

3.10.1 No Action Alternative

Under the No Action Alternative, NNSA would continue to conduct the flight test mission at TTR. This section describes the NNSA test program currently being conducted at TTR. Figure 3.10–1 shows the location of TTR. There would be no construction required at the TTR for this alternative. The current facilities would remain serviceable. Minimal investments in equipment would be required for the No Action Alternative, as described below:

Radar — This would include a replacement of one radar with a modern unit, maintenance of a second radar; and the acquisition of an Identification, Friend or Foe (IFF) system. The acquisition of this IFF system would allow elimination of 2 existing maintenance-intensive radar systems.

Optics — Three distinct functional upgrades would include: (1) addition of a Time-Space Positioning Information (TSPI) section to collect precise positional data; (2) addition of an Event Optics section using telescope tracking mounts to record event data; and (3) addition of a Photometrics section using both high speed fixed camera arrays to augment the existing still photography capability.

Facilities — TTR would continue to use the existing facilities and maintain them within the normal budget process. A new HVAC system for the control facility and a roof and siding repair on one building would be required under this alternative. Repair to the electrical grid and road surfaces would also be required.

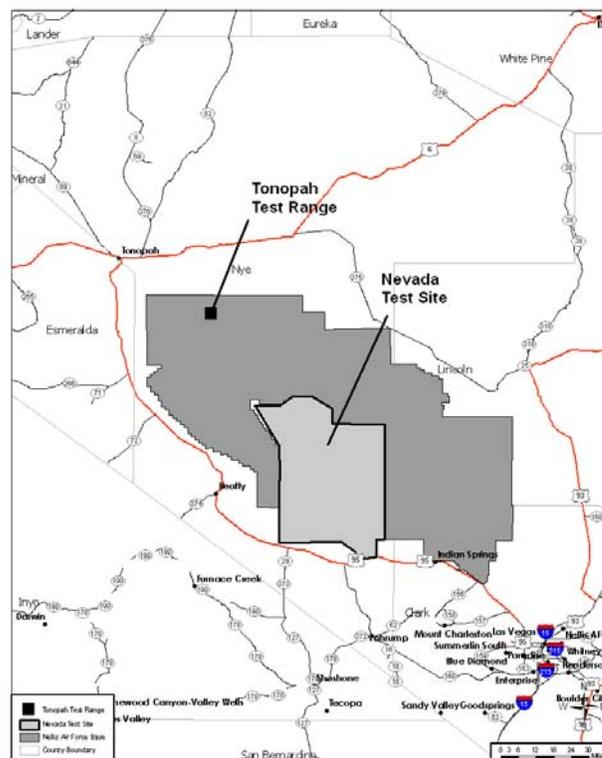


Figure 3.10–1 — Location of TTR and NTS

3.10.2 Upgrade of Tonopah Test Range Alternative

This alternative, referred to as the High-Tech Mobile (HTM) Upgrade Alternative, would reduce the operational costs at TTR through the introduction of newer, more efficient, and more technologically advanced equipment. This alternative would lower work force requirement and keep test equipment highly reliable and operational between test dates, thereby reducing recalibration and start-up costs. Under this alternative, additional range campaign activities could be considered and conduct with minimal additional costs.

A vision of a HTM Upgrade Alternative is shown in Figure 3.10-2. It would include the acquisition of modern digital equipment that is compatible with other national test range standards. The emphasis is on highly mobile command, telemetry, communications, and radar units which could be readily moved to the different testing locations at TTR. This would not only eliminate duplicative permanent structures, but would also eliminate costly start-up calibration.

The actions required for the HTM Upgrade Alternative are as follows:

Documentary/Time-Space-Position Information (TSPI) Optics — This action would include an additional five combined mount [TSPI and documentary telescopes] units with a separate optics Control Trailer for remote control operations. Encryption capability would be included.

Radar — The proposal is equivalent to that described for the No Action Alternative.

Telemetry — New trailers, fully equipped with telemetry equipment and antennas, would be purchased and all trailers would be DOT certified. This would allow the telemetry equipment and the antennas to be fully mobile.

Operations Control Equipment — Two operational control trailers, fully equipped, would be acquired to replace the operations that currently take place in the operational control tower at TTR. Test coordination, communications, and safety would all be housed in these trailers. Operation displays would provide continuous coverage of the test in progress.

Facilities — The proposal is identical to that described for the No Action Alternative.

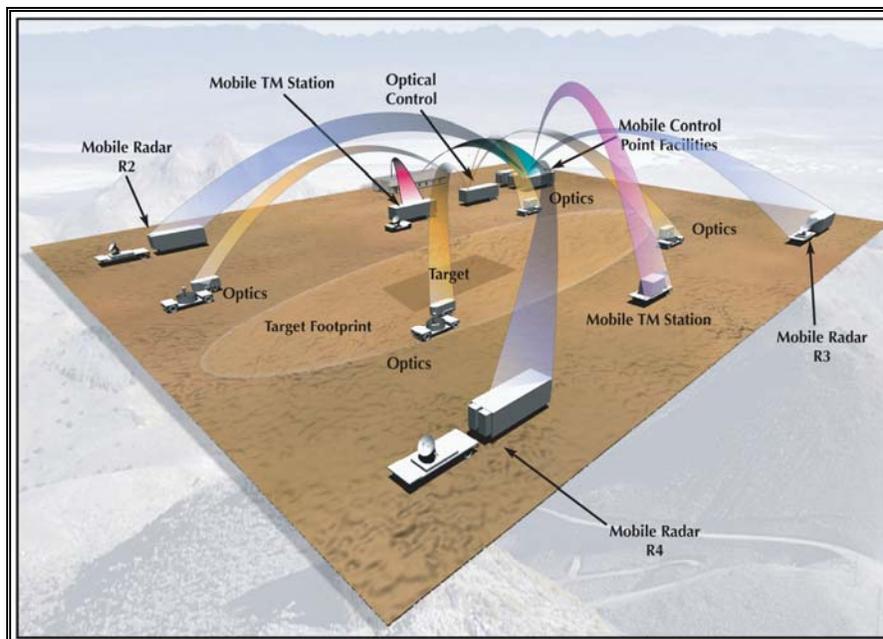


Figure 3.10-2 — HTM Upgrade Alternative

There would be no construction required for the HTM Upgrade Alternative. It would use existing infrastructure and personnel, without any increases in the number or intensity of tests, the operational resources would be the same as for the No Action Alternative.

3.10.3 Campaign Mode Operation of TTR

An alternative to relocating NNSA's flight test operations from TTR to another site would be to conduct the JTA tests at TTR on a campaign basis, bringing in employees from other NNSA sites to conduct tests. SNL would continue to be the program manager, and National Security Technologies (NSTec) would be the management and operations (M&O) contractor.

A limited permanent staff at TTR would be required to continuously maintain the facilities and equipment. For a drop test, this permanent staff at TTR would be augmented by technical staff from NTS. By the end of 2015 a decision could be made to:

1. Discontinue NNSA Flight Testing at TTR in approximately 2019 and use the interim period to transition equipment and establish needed infrastructure at NTS or WSMR; or
2. Renew the USAF – DOE permit at TTR (which expires in 2019) and continue work at that site, managed by the Nevada Site Office and SNL.

The capabilities at TTR under this alternative would remain the same. After 2019, the capabilities would be upgraded with the HTM improvements presented in Section 3.10.2. Under this Alternative, there would be no construction required. Annual operations would be conducted with a lower employment level. This employment level would be supplemented with campaign workers from other DOE sites during tests.

3.10.4 Transfer to WSMR Alternative

This alternative involves transferring NNSA flight test operations conducted at the TTR to the WSMR, near White Sands, New Mexico. Figure 3.10-3 shows the location of WSMR. WSMR is the largest installation in the DoD, and is a major range and test facility base (MRTFB) under the Department of the Army Test and Evaluation Command, Developmental Test Command. It provides test and evaluation services to the Army, Air Force, Navy, other government agencies and industry. The range covers 3,420 square miles on the ground and 10,026 square miles of contiguous restricted airspace managed, scheduled and controlled by the WSMR. Holloman Air Force Base is adjacent to the range's east boundary and has capabilities for aircraft support and staging.

WSMR has a full suite of flight test instrumentation including radar, telemetry and optical equipment, which would allow complete coverage of NNSA gravity weapons flight testing. As an MRTFB, the range's infrastructure and instrumentation are funded by DoD. WSMR has extensive experience conducting flight tests with requirements and flight scenarios similar to the NNSA program, including penetrating weapons, weapons recovery and handling of classified material and special nuclear materials.

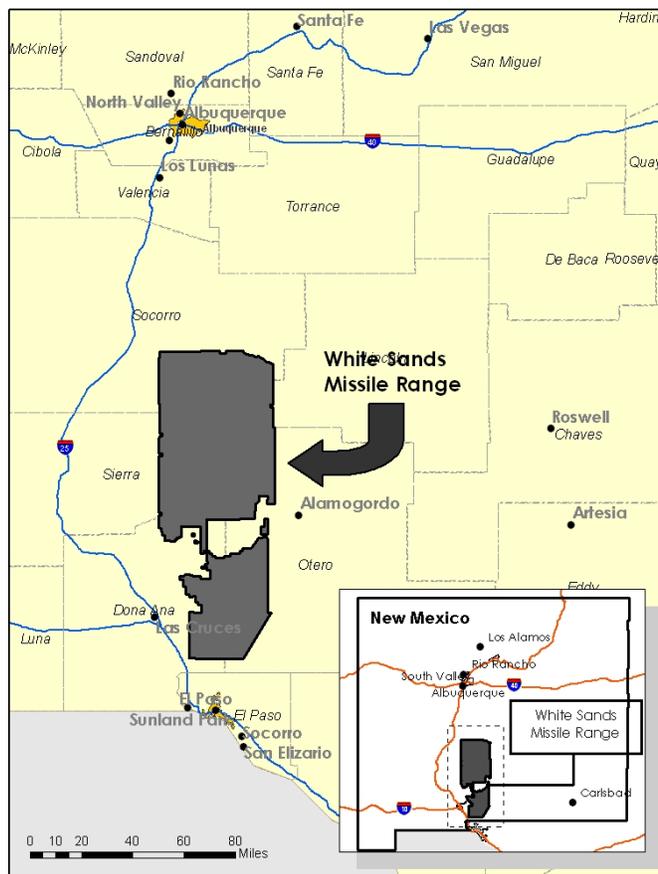


Figure 3.10-3 — Location of WSMR

3.10.4.1 Siting Locations

The northwest area of the WSMR would provide several sites suitable for flight testing. An EA is currently being prepared to support core sampling that is required to assess the geologic suitability of specific target site areas. Pending completion of that EA and soil sampling, it is anticipated that one or more locations in this area would meet the requirements for NNSA flight test operations. A review of the preliminary data indicates that this area of the WSMR could accommodate the safety footprints of all current flight test scenarios. If this alternative were to be selected, transition from TTR to WSMR could occur as early as the latter part of 2009 and the beginning of 2010. NNSA would need to construct pads and targets. Flight Test Program

system upgrades would only begin after completion of construction and the completion of transition.

The only construction that would be required to support the JTA flight test operations at the WSMR would be the installation of a circular concrete target. The target aids in recovery of the JTAs used in flight test drops. The concrete target would be constructed of non-reinforced concrete, 500 feet in diameter, with a depth of 12 inches.

Under this alternative, NNSA Flight Testing at TTR would be discontinued. The environmental impacts of discontinuing flight testing at TTR are addressed in Section 5.15.4.

3.10.5 Transfer to NTS Alternative

This alternative involves transferring NNSA Flight Test Operations to NTS (Figure 3.10-4). A review of three possible sites at NTS was conducted (see Figure 3.10-4). An EA is currently being prepared to support core sampling that is required to assess the geologic suitability of each of the three target areas. Pending completion of that EA and the additional core sampling, it is expected that one or more of the identified locations would meet the requirements for testing. Although the isolation of the NTS is a benefit, these site locations would require an investment in infrastructure due to their remoteness. These sites meet the necessary safety criteria to permit the program to use these areas of NTS. Other sites are also available at NTS.

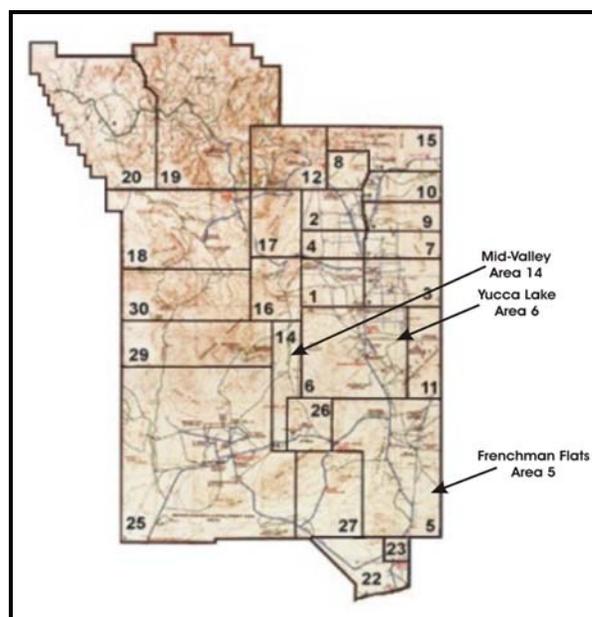


Figure 3.10-4 — NTS

If this alternative were to be selected, transition from TTR to NTS could occur as early as the latter part of 2009 and the beginning of 2010. Upgrades would only begin after the construction of the needed facilities was completed and transition completed. The JTA Flight Test Program staff would be housed in CP-40, an existing NTS facility that includes an available high-bay area and office space. Minor building preparation would be required. In addition, the installation of roads and utilities, and the construction of a circular concrete target, similar to the existing one at TTR, would be required for the NTS Alternative. The target would be used to aid in recovery efforts. The concrete target would be constructed of non-reinforced concrete, 500 feet in diameter with a depth of 12 inches.

Under this alternative, NNSA Flight Testing at TTR would be discontinued. The environmental impacts of discontinuing this testing are addressed in Section 5.15.4.

3.11 HYDRODYNAMIC TESTING

Hydrodynamic testing (hydrotesting) use high-explosive experiments to assess the performance and safety of nuclear weapons. Data from hydrotesting and other experiments, combined with modeling and simulation using high performance computers, are used to certify the safety, reliability, and performance of the physics packages of nuclear weapons without underground testing.

The alternatives for hydrotesting are explained in the sections that follow. Section 3.11.1 discusses the No Action Alternative, which would continue operations at the existing facilities at LANL, LLNL, NTS, SNL/NM, and Pantex. Section 3.11.2 discusses an alternative which would reduce the number of existing hydrotesting facilities at LANL, LLNL, and NTS, and discontinue hydrotesting at SNL/NM and Pantex. Section 3.11.3 discusses an alternative that would consolidate non-fissile hydrotesting activities at LANL (the Big Explosives Experimental facility [BEEF] at NTS would also still be required). Section 3.11.4 discusses a next generation alternative which would consolidate all hydrotesting activities at the NTS. The analysis of the environmental impacts of the alternatives is contained in Section 5.16.

Hydrodynamic Testing Alternatives	
<ul style="list-style-type: none"> • No Action – continue hydrotesting at LLNL, LANL, NTS, Pantex, and SNL/NM • Reduce in Place <ul style="list-style-type: none"> ➤ Consolidate LLNL hydrotesting to Contained Firing Facility (CFF) ➤ Consolidate LANL hydrotesting to Dual Axis Radiographic Hydrodynamic Test (DARHT) facility ➤ Consolidate NTS hydrotesting to single confined and single open-air sites ➤ Discontinue hydrotesting at Pantex and SNL/NM • Consolidate at LANL <ul style="list-style-type: none"> ➤ Integrate hydrotesting program at LANL ➤ Construct new CFF-like facility at LANL ➤ Discontinue hydrotesting at LLNL once CFF-like facility is operational ➤ Maintain BEEF at NTS ➤ Discontinue hydrotesting at Pantex and SNL/NM • Consolidate at NTS¹ <ul style="list-style-type: none"> ➤ Integrate hydrotesting program at NTS ➤ Construct new DARHT-like facility at NTS ➤ Construct new CFF-like facility at NTS ➤ Discontinue hydrotesting at LLNL, LANL, Pantex, and SNL/NM 	<p>¹The NTS Alternative is considered a “next generation” alternative because NNSA is not proposing these changes at this time.</p>

3.11.1 No Action Alternative

This section describes the hydrotesting facilities and missions currently conducted at NNSA sites. More details regarding hydrotesting requirements and existing facilities are contained in Appendix A.

3.11.1.1 *Hydrotesting Facilities at LLNL*

LLNL's Site 300 has been used since 1955 to perform experiments that measure variables important to nuclear weapons' behavior, safety, conventional ordnance, and accidents (such as fires) involving explosives. These experiments are conducted without fissile material. The facilities used for Site 300 activities include four firing point complexes and associated support facilities. The locations of the four firing complexes are indicated in Figure 3.11-1. The Building 801 Complex is comprised of Buildings 801A, 801B, and 801D, and encompasses approximately 51,000 square feet. The Building 801 Complex is in the northeast quadrant of the site, called the east firing area.

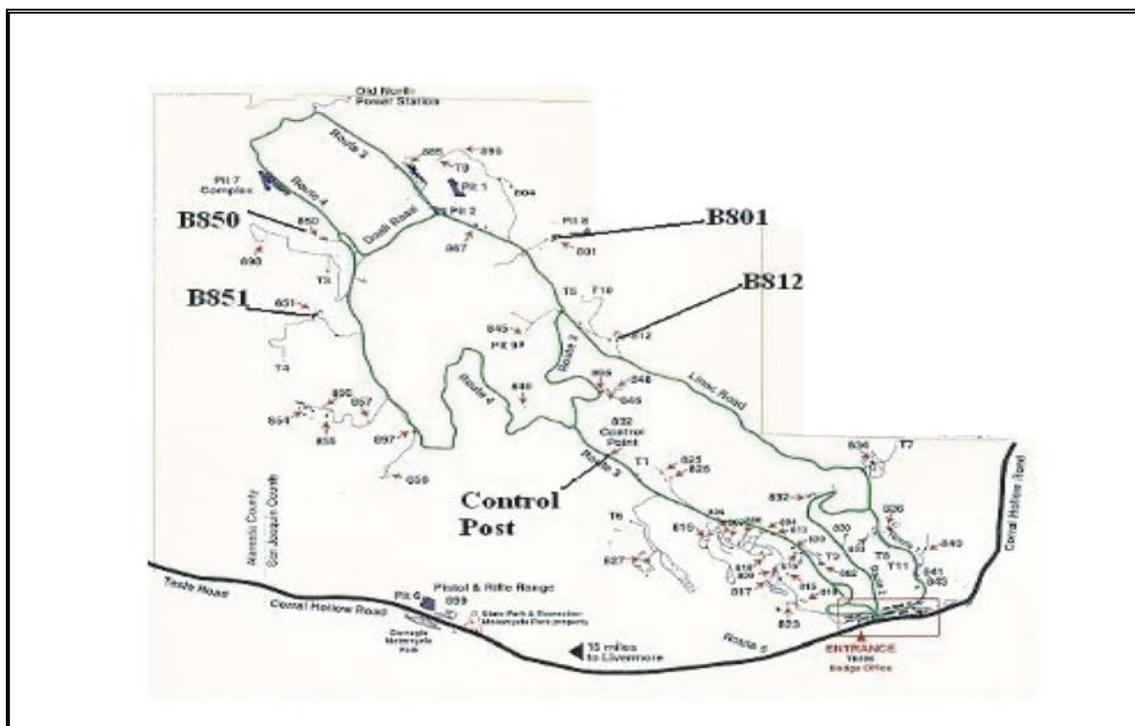


Figure 3.11-1 — Locations of B801, B812, B850, and B851 at Site 300

The Contained Firing Facility (CFF) is located at the Building 801 Complex and is one of the more important facilities in NNSA's science-based SSP, as it is capable of full-scale dynamic weapons radiography (Figure 3.11-2). The CFF drastically reduces emissions to the environment and minimize the generation of hazardous waste, noise, and blast pressures, although emissions from open air testing are well within current environmental standards. LLNL's Hydrodynamic Test Program employs 56 workers. Thirty of these employees are at the Building 801 Complex, of which 10 are at the CFF. Appendix A, Section A.9, provides additional information on the LLNL hydrotesting facilities.

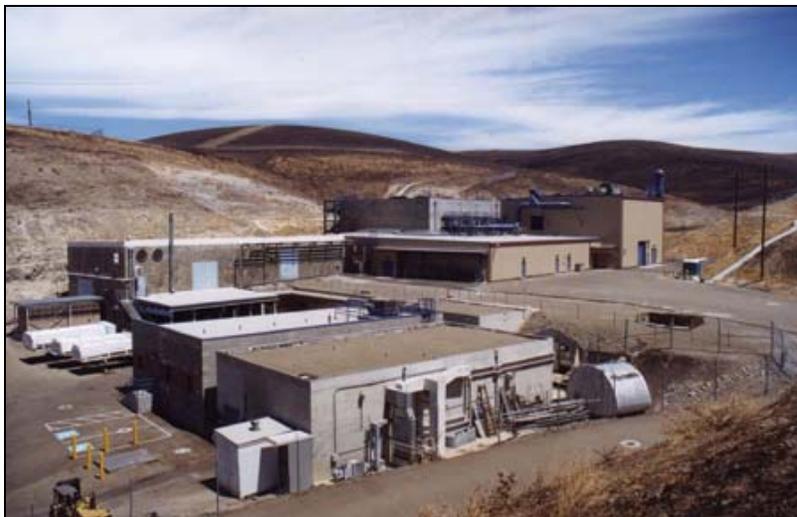


Figure 3.11-2 — The Contained Firing Facility at the LLNL Site 300 Building 801 Complex

3.11.1.2 *Hydrotesting Facilities at LANL*

The hydrotesting facilities at LANL are located within one of the TAs that contain HE R&D facilities. TA-15, located approximately 3 miles from the main administrative area, in the central portion of LANL, is the location of two firing sites: the DARHT, which has an intense high-resolution, dual-machine radiographic capability, and Building 306 (R306), a multipurpose facility where primary diagnostics are performed (see Figure 3.11-3). Currently, there exists no permanent radiographic capability at R306. Figure 3.11-3 shows the location of TA-15 at LANL. The Pulsed High Energy Radiation Machine Emitting XRays (PHERMEX) Facility, a multiple-cavity electron accelerator capable of producing a very large flux of x-rays, was disabled in 2004. D&D of this facility is ongoing and has not yet been completed. LANL conducts about 100 hydrotest experiments per year composed of both large scale and smaller scale “focused” experiments. LANL has a Hydrodynamic Test Program staff of 34 employees, of which 29 are at the DARHT.

DARHT is a state-of the-art, full scale radiography facility and is used to investigate weapons functioning and systems behavior in non-nuclear testing. DARHT is designed to include two high intensity x-ray machines whose beams cross at right angles. Each machine has been designed to generate radiographs of far higher resolution than anything previously obtainable--the resolution required for stockpile stewardship without underground nuclear testing. The first axis became operational in 1999 and the second axis was tested in late 2002. In 2003, LANL began refurbishing failing accelerator cells Facility Axis II in order to bring them up to design specifications.

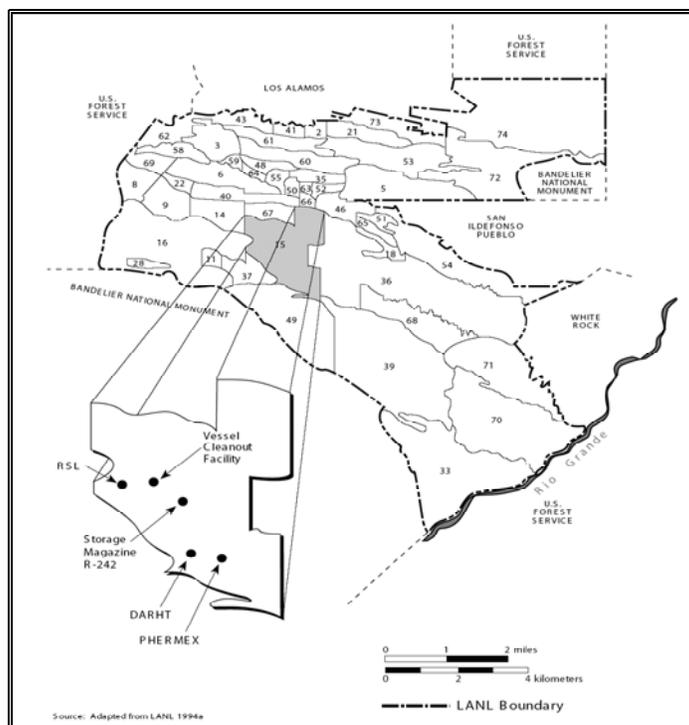


Figure 3.11-3 — TA-15 at LANL

The second axis is scheduled to begin operations in May 2008. When DARHT becomes fully operational, its multi-axis large scale hydrodynamic tests will allow researchers to obtain three-dimensional as well as time-resolved radiographic information. Figure 3.11-4 shows the DARHT facility.



Figure 3.11-4 — The DARHT at LANL

Additional facilities required to support hydrotesting are located in six other TAs at LANL. The Test Device Assembly is one such facility. The Test Device Assembly provides the capacity to assemble test devices ranging from full-scale nuclear-explosive-like assemblies (where fissile material has been replaced by inert material) to materials characterization tests. In addition, LANL has several idle hydrotesting facilities, such as the PHERMEX, awaiting closure. Appendix A, Section A.9, provides additional information on the LANL hydrotesting facilities.

3.11.1.3 *Hydrotesting Facilities at Pantex, SNL/NM, and NTS*

Smaller hydrotest facilities, which are not capable of dynamic weapons radiography, are also located at Pantex, SNL/NM, and NTS. Both Pantex and SNL/NM have several outside blasting table facilities which are primarily used for HE R&D activities and can only handle small hydrotesting experiments. NTS has several facilities which are utilized for very large explosion-type experiments. The BEEF is one such facility at NTS. It is the only NNSA facility where experiments requiring more than 2000 pounds of HE can be conducted. Similarly, the U1a is the only facility capable of subcritical experiments.

Several specialized NTS facilities are maintained and available to meet both hydrotesting and HE R&D requirements. LANL, LLNL, SNL/NM, DoD, and the Department of Homeland Security (DHS) sponsor experiments at these facilities. They feature an array of diagnostic equipment and expertise to support a variety of hydrotest and HE experiments, including flash x-ray systems, PDV, high-speed digitizers, fast-framing cameras, and high-speed digital video systems.

Hydrotest and HE capabilities and facilities at the NTS are as follows:

Big Explosives Experimental Facility (BEEF). Located on a 9-acre site in Area 4 of the NTS, BEEF is an open-air HE test bed for large hydrodynamic and weapons physics experiments, shaped-charge development, and render-safe experiments. BEEF is designed and certified with an operational HE limit of 70,000 pounds (TNT equivalent).

Baker Site. Located within Area 27 of the NTS, Baker Site serves as an inspection, storage, assembly (including hand-packing or forming uncased plastic explosives), and disassembly area for HE or HAZMAT and components.

U1a Complex. Located within Area 1 of the NTS, the U1a Complex is an underground laboratory for performing hazardous experiments with HE and SNM, primarily subcritical experiments. It consists of a series of horizontal drifts, each about one-half mile in length and mined at the base of three 965-foot-deep vertical shafts.

Other Explosives Storage. Located in Area 12 of the NTS, this storage includes four single-story metal explosives magazines. The total HE storage quantity is limited to 70,000 pounds (TNT equivalent). The magazines are generally used for the receipt of large orders of explosive materials and provide for bulk storage of high explosives, blasting agents, and detonators.

Explosive Ordinance Disposal Unit (EODU). Located in Area 11 of the NTS, EODU is an open burn or open detonation (OB/OD) site designed and constructed specifically for the storage and demolition of waste explosive materials. It consists of three explosives storage structures and an EOD pad on which to detonate explosives. Activities are limited to the receipt, storage, and detonation of explosives and explosive materials.

Three additional and similar facilities, at Pantex, conduct both HE R&D and hydrotesting

experiments. All three would require upgrades within the next several years. The upgrades would include two open-air firing sites with bunkers and one facility containing indoor firing chambers. SNL/NM has several small HE R&D firing sites and the Explosives Component Facility and ancillary facilities, which have been used for hydrodynamic tests. Because none of SNL/NM's facilities are used primarily for hydrotesting, they are described more completely in the No Action Option for HE R&D in Section 3.8. The Explosives Component Facility and its ancillary locations support the design, development, and life cycle management of all explosive components outside the nuclear package. There are no employees assigned to the Hydrodynamic Test Program at Pantex, SNL/NM, or NTS. Appendix A, Section A.9, provides additional information on the hydrotesting facilities at these sites.

3.11.2 Action Alternatives

3.11.2.1 *Reduce in Place Alternative*

This option would continue hydrotesting activities by consolidating LANL activities at the DARHT, consolidating LLNL activities at Building Complex 801 and the CFF, closing the smaller facilities at both of these sites, and moving tests requiring larger amounts of HE to the BEEF at NTS.

This alternative would entail the closure of a number of facilities at LLNL and LANL. It would also entail the closure of facilities at Pantex and SNL/NM. At LLNL, this would entail the closing of Building 812, the Building 850 Complex, and the Building 851 Complex, if they cannot be turned over to another user. The associated support facilities probably would not be impacted by this alternative, as they are smaller multi-purpose facilities which could be of use to other program activities. At LANL, this would entail the closing of all hydrotesting facilities at TA-15, except for DARHT, and TA-36. Closure of the idle PHERMEX would commence. At Pantex, at least six outdoor burn areas, primarily utilized for HE R&D, but sometimes used in conjunction with hydrodynamic test experiments, could be closed. Because none of the facilities at SNL/NM are used primarily for hydrotesting, options for downsizing are discussed in Section 3.8, High Explosives R&D. NTS would maintain BEEF operational to conduct large tests and continue operations at Cygnus U1a.

Closure of approximately a dozen facilities at the above sites would entail a substantial clean-up and D&D effort. Although not heavily contaminated, these facilities all have a substantial amount of reinforced concrete and steel structures designed to withstand sizeable HE explosions. It is estimated that at least 100,000 square feet of hardened concrete and steel structures would have to be dismantled and disposed of.

3.11.2.2 *Consolidation at LANL*

This alternative would integrate all large-scale hydrotesting at the single location of LANL. Since LLNL and NTS both have capabilities not presently at LANL, this alternative would entail the construction of a new facility at LANL that would have the capabilities of the CFF and

Building 801 Complex at LLNL.³³ For a description of what such a new facility would entail, see Section 3.11.1.1, Building 801 Complex. There are three potential sites at LANL where such a “CFF-like” facility could be constructed. Figure 3.11-5 displays these three locations at LANL.

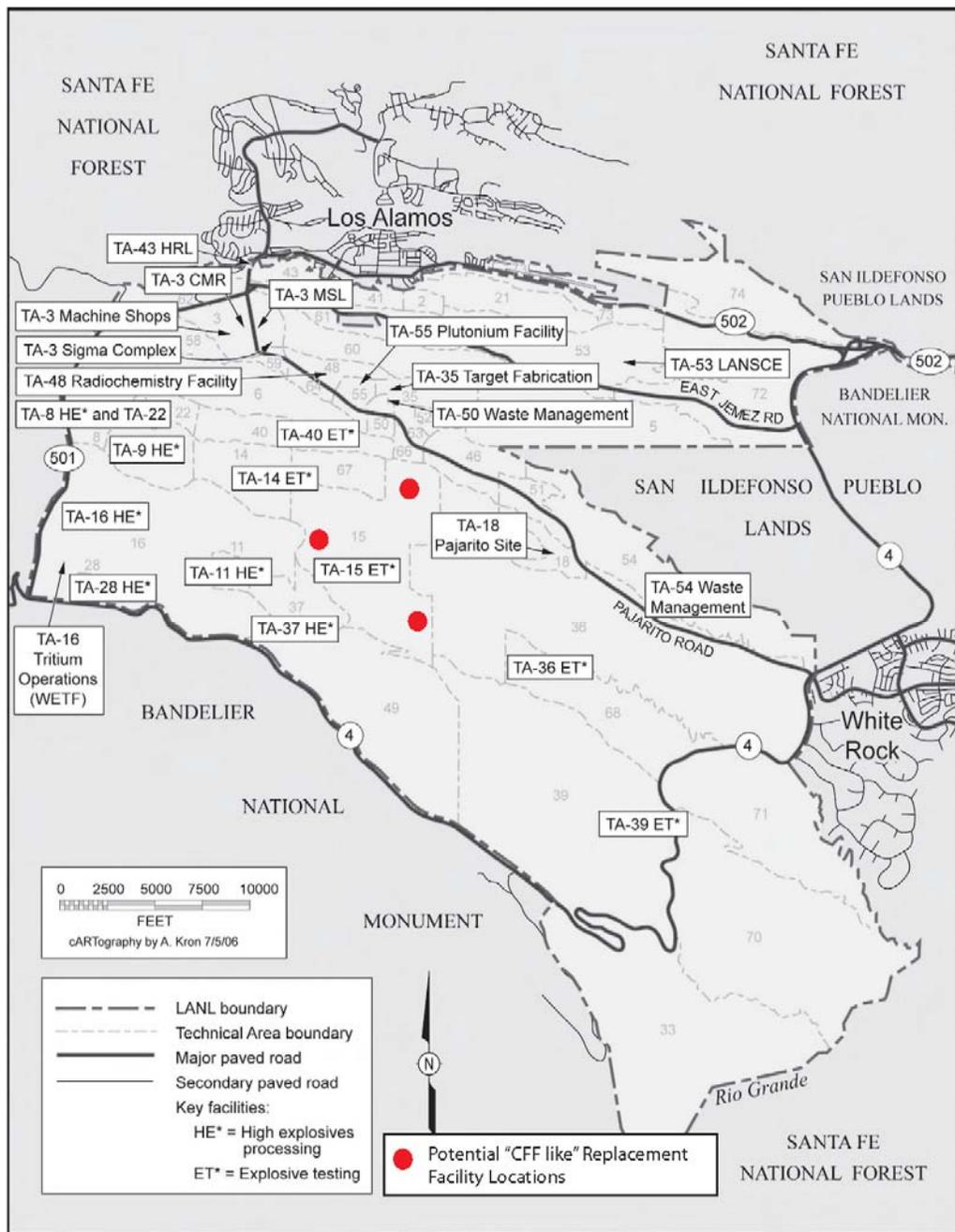


Figure 3.11-5 — Potential Locations of “CFF-Like” Replacement Facility at LANL

³³ This SPEIS addresses the closure of the CFF in Section 5.16.3.1. Closing the CFF at LLNL Site 300 could occur whether or not a new CFF-like facility is constructed at LANL.

Until such time as these capabilities could be established at LANL, the CFF capabilities at LLNL might have to remain in operation. In addition, it is not anticipated that it would be possible to transfer the capability to conduct experiments requiring very large amounts of HE, presently being conducted at NTS, to LANL. Accordingly, under this alternative, operations at the BEEF and the U1a at NTS would still be required. This alternative would entail a large amount of clean-up and D&D associated with the closure of all hydrodynamic test facilities at LLNL, SNL/NM (based on a joint agreement of the HE R&D Program and the Hydrotesting Program), and Pantex and a substantial number of smaller, idle facilities at LANL. Appendix A, Section A.9, provides additional information on these hydrotesting facilities. It is estimated that this alternative would entail the closure and clean-up of close to 170,000 gross square feet of hardened concrete and steel structures designed to withstand very large HE explosions.

3.11.2.3 *Consolidation at NTS – A Next Generation Alternative*

Moving hydrodynamic testing to NTS would consolidate the capabilities currently at LANL, LLNL, SNL/NM, and Pantex to the NTS and provide next generation capabilities required to maintain the nuclear deterrent in the 2020 to 2050 time frame. This alternative would require the construction of DARHT-2 and CFF-2 facilities at NTS. Both facilities would be more technically advanced than the existing DARHT and CFF. The design to provide the required capabilities would be addressed when a proposal for these next generation facilities is needed and developed. The discussion below provides reasonable and conservative estimates and options of how the NNSA might proceed.

Gas cavity radiography would require high energy (16 MeV) multi-time multi pulse radiography. Depending on requirements this capability may be provided with DARHT-like technology, proton radiography, or emerging accelerator and detector technology. The architecture of the facility would depend on specific requirements for dynamic SNM experiments. One option is a consolidated facility using large, flexible firing chambers and additional containment vessels for SNM experiments. This facility could be located above or below ground depending on operational and construction costs. Another option is two separate facilities because of the difference in operational requirements between SNM and surrogate experiments.

The complex experiment requirements could be met by utilizing two firing chambers optimized for wide angle, medium ($\geq 6\text{MeV}$) or high ($\geq 16\text{MeV}$) radiography, velocimetry, high-speed cameras, and pin diagnostics. Such an approach provides the capacity necessary to address focused experiments as well as integrated weapons experiments (IWE's), and still provide for risk mitigation in the event of a single point of failure in one of the firing chambers

Any next generation hydrodynamic experimental facility, either aboveground or underground, would require new building construction and considerable infrastructure (i.e., facilities, equipment, and personnel) in support of test events. Existing infrastructure at NTS might be used to the extent practical. In addition to the one-time construction costs, the operational requirements for a next generation hydrodynamic test facility might well be greater than that of the combination of the DARHT and CFF facilities. The impacts associated with construction and operation of facilities would depend on the technological approach needed to meet defined requirements. For example, the use of proton radiography could require an accelerator

comparable to other large accelerators operated by DOE.

It is estimated that over 250 additional workers would be required for construction and operation of a next generation hydrodynamic test facility. Construction and operation of a next generation hydrodynamic test facility is not anticipated to use large quantities of water. New construction activities would be expected to result in an increase in short-term air emissions. Operation of the next generation hydrodynamic test facility would be expected to have a minimal impact on the air quality considering the impacts projected for DARHT operations. A next generation hydrodynamic test facility would not be expected to impact existing community infrastructure or services in the area; however, depending on the specific design, a proton accelerator could require significant electrical power resources. Waste volumes would not be expected to increase substantially over existing operations at NTS, and waste management associated with dynamic experiments with plutonium at NTS could require additional infrastructure. A new CFF-like facility at NTS would be similar to the facility described in the LANL Consolidation Alternative (see Section 3.11.2.2).

3.12 MAJOR ENVIRONMENTAL TEST FACILITIES

Environmental testing helps NNSA maintain and demonstrate the safety, reliability and performance of the nation’s nuclear weapons. The environmental testing facilities (ETFs) are divided into two categories – base ETFs and system ETFs. The base ETFs are those facilities and laboratory scale (or “table-top”) items used to evaluate components or subassemblies in the environments defined by the Stockpile-to-Target Sequence (STS) and the Military Characteristics requirements for each nuclear weapon in the stockpile. Every laboratory within the NNSA complex has some base capability essential for day-to-day operations. The system ETFs are those facilities used to test full-scale weapons systems (with or without SNM or assembly/disassembly) or those unique major facilities that are used for development and certification of components, cases, accessories, subsystems and systems. This SPEIS analyses alternatives involving base and system environmental testing facilities, referred to as “major” ETFs, that are costly to maintain or have potentially significant environmental impacts. Major ETFs are located at LANL, SNL/NM, LLNL, and NTS.

Section 3.12.1 discusses the No Action Alternative, which would continue operations at the existing facilities at LANL, SNL/NM, LLNL, and NTS. Section 3.12.2 discusses an alternative which would downsize facilities in-place. Section 3.12.3 discusses an alternative that would consolidate major ETFs at one site (NTS or SNL/NM), with an option to move the LLNL Building 334 ETF capabilities to Pantex. The analysis of the environmental impacts of the alternatives is contained in Section 5.17.

Major ETF Alternatives
<ul style="list-style-type: none">• No Action — Maintain status quo at each site. All facilities would be maintained, or upgraded to meet safety and security standards.• Reduce-in-Place — No duplication of capability within a given site, but there may be duplication from site to site - phase out aging and unused facilities.• Consolidate ETF Capabilities at One Site (NTS or SNL/NM) — Entails construction of new facilities at consolidation site. This alternative also includes an option to move LLNL Building 334 ETF capabilities to Pantex.

3.12.1 No Action Alternative

Under the No-Action Alternative, NNSA would maintain the status quo at each existing site. Only those upgrades and maintenance required to meet safety and security standards would take place. ETFs are located at three national laboratories (SNL/NM, LANL, and LLNL) and NTS. It should be noted that ETF laboratories and capabilities also exist at Pantex and SRS. These facilities, however, are not involved in the R&D or weapons/component design process, but instead, utilizes ETF capabilities as an integral part of the production/certification process. Without these ETF capabilities, these sites could not complete their mission. Accordingly they have not been included in this analysis. Table 3.12.1-1 lists the existing ETF facilities at the three NNSA laboratories and the NTS.

Table 3.12-1 — ETFs at LANL, SNL/NM, LLNL, and NTS

Facility	Size (ft²)
LANL	
K Site Environmental Test Facility	8,452
Weapons Component Test Facility	22,075
Thermo-Conditioning Facility	6,795
PIXY with Sled Track	6,245
Total	43,567 ft²
SNL/NM	
Simulation Tech Lab (HERMES and RHEPP)	56,886
PBFA Saturn and Sphinx	42,052
ACRR and Sandia Pulsed Reactor Facility	13,793
Radiation Metrology Lab`	1,774
Gamma Irradiation Facility	12,514
Low Dose Rate Gamma Irradiation Facility	206
Auxiliary Hot Cell Facility	13,358
Outdoor Centrifuge Complex	12,671
25 Foot Centrifuge	135
Model Validation and System Cert Test Ctr	31,990
Complex Wave Test Facility	2,327
Light Initiated HE Test Facility	4,138
10,000 Foot Sled Track	8,900
Aerial Cable Facility and Control Building	5,022
Radiography Building and Nondestructive Test Facility	5,348
Mobile Guns Complex	2,400
Thermal Test Complex	15,712
Vibration Acoustics and Mass Properties Lab	8,434
Engineered Sciences Experimental Facility	19,416
Component Environmental Test & Advanced Diagnostic Facility	44,091
Electromagnetic/Environ./Light Strategic Def	103,185
SNL California Environmental Test Complex (a SNL program conducted at LLNL)	65,964
Total	470,316 ft²
LLNL	
Dynamic Testing Facility (836 Complex)	12,913
Thermal Test Facility (834 Complex)	4,289
Hardened Engineering Test Bldg (334 in Superblock)	6,300
Total	23,502 ft²
NTS	
Device Assembly Facility Area (ETF Portion only)	4,790
U1a (Above ground portion only)	2,100
Total	6,890 ft²
Complex Total	544,275 ft²

3.12.1.1 *Environmental Test Facilities at LANL*

LANL has four primary ETFs located within three different Tech Areas: (1) the K Site ETF; (2) the Weapons Component Test Facility, (3) the Thermo-conditioning Facility; and (4) the PIXY

X-Ray Building with Sled Track. The K Site is a large complex consisting of eleven major structures and is located at TA-11. The total size of all facilities at the K Site is 8,452 square feet. Both the Weapons Component Test Facility and the Thermo-Conditioning Rest House are located at TA-16. Together these two facilities total 28,870 square feet. The Pulsed Intense X-Ray (PIXY) facility is a 6,245 square feet facility located on 194 acres at TA-36. In all the ETF structures at LANL total 43,567 square feet and are operated by a staff of about 30. A description of these facilities is contained in Appendix A.

3.12.1.2 *Environmental Test Facilities at LLNL*

LLNLs ETF program is conducted in three separate facilities: (1) Building 334 (Hardened Engineering Test Building); (2) Building 834 Complex at Site 300; and (3) Building 836 Complex at Site 300. These three facilities consist of a total area of 23,502 square feet occupying a total site area of seventeen and three quarter acres. There is not a specific and dedicated crew of test technicians or engineers assigned to any of the individual test facilities at LLNL. The Weapons Test Group (WTG), which operates the ETF facilities, has stewardship to maintain all the facilities and provides support staff to the appropriate building in order to conduct and complete the necessary testing. The WTG has a total of 6 workers to support the three LLNL ETF facilities. A description of the LLNL ETF facilities is contained in Appendix A. Figure 3.12-1 shows some of the ETF capabilities in Building 334.



Figure 3.12-1 — Photos of Building 334, Hardened Engineering Test Building:
(a) view of environmental test facilities bay, (b) view of INRAD bay

3.12.1.3 *Environmental Test Facilities at SNL/NM*

SNL/NM has twenty-one major ETF complexes, each with multi-operational capability. In all, these facilities have a combined area of 404,352 square feet. These facilities consist of accelerator facilities, radiation testing facilities, a drop tower complex, and a number of other shake, bake, rattle, and roll type laboratories. SNL/NM has a mobile gun complex, an aerial drop tower complex, a rocket-sled, and a number of other facilities which can subject weapons, weapons components, and associated components to the entire spectrum of electric, radioactive, thermal and other such insults necessary to determine design, performance, and surveillance parameters. Approximately 224 employees are involved in the SNL/NM ETF effort. Besides testing nuclear weapons, SNL/NM has the added responsibility to provide assurance that all nuclear warhead use-control equipment, shipping containers, transportation vehicles and

handling equipment meet the performance requirements dictated by the Military Characteristics and can survive the normal, abnormal, and hostile environments described within the Stockpile-to-Target-Sequence requirements documents. Figure 3.12-2 shows a drop tower facility at SNL/NM. A description of the SNL/NM ETF facilities is contained in Appendix A.



Figure 3.12-2 — Drop Tower Facility at SNL/NM

3.12.1.4 Environmental Test Facilities at NTS

NTS has two environmental Test Facilities, the Device Assembly Facility (DAF) and the U1a Facility (Figure 3.12-3). Together, these two facilities occupy a floor-space of 6,890 square feet. It should be noted the U1a is an underground facility with only the small portion of the total facility size included in this number. Both DAF and U1a are considered “user facilities,” operated by LLNL and LANL, respectively, on behalf of the NNSA Nevada Site Office with the site Management and Operations (M&O) providing support, primarily in the area of facility maintenance. Under this concept, the facilities are maintained in a “warm standby” condition ready to accept programmatic work. The assigned personnel maintain the facility, its authorization basis, and ensure that programmatic work is properly authorized. The actual programmatic work is conducted by project teams that deploy to the facility to conduct their activities. Thus, staffing levels presented here, only reflect the personnel required to maintain the facility in a warm standby condition and not programmatic work. Fully staffed, both facilities would employ 170. Current employment to maintain warm stand-by is 107. A description of these two ETF facilities is contained in Appendix A.



Figure 3.12-3 — The U1a Environmental Test Facility at NTS

3.12.2 Consolidation in Place Alternative

Under the Consolidation in Place Alternative, facilities which are duplicative, in need of major upgrades to enable continued operations, or no longer used would be closed. The facilities that would close as a result of this Alternative are shown in Table 3.12-2.

Table 3.12-2 — ETF Closures for Consolidate in Place Alternative

LANL	LLNL	Sandia National Lab
PIXY with Sled Track	Thermal Test Facility (834 Complex)	Outdoor Centrifuge Complex (8 structures)
Thermo-Conditioning Facility (5 structures)	Building 836 Complex (7 structures)	Auxiliary Hot Cell Facility
	SNL/CA Environmental Test Complex* (4 structures)	Low Dose Gamma Irradiation Facility
		Sandia Pulsed Reactor

* A SNL facility, but impacts are considered at LLNL where the facility is physically located. These buildings would not be demolished and undergo D&D, but would be reused for other purposes.

Source: NNSA 2007.

3.12.3 Alternative to Consolidate ETF Capabilities at One Site (NTS or SNL/NM)

There are two options for an alternative to consolidate all major ETF capabilities to one site. One option would consolidate ETF capabilities to the NTS. This option would close ETFs at LANL, LLNL, and SNL/NM and require construction of new facilities at NTS to replace some of the capabilities lost through closures. The two ETFs at NTS at the DAF and U1a would remain in operation. The Engineered Test Bay (Building 334) at LLNL and three of the facilities at SNL/NM (considered to be capabilities critical to the continuance of the ETF Program) would remain open until the replacement facilities at NTS are operational. A listing of the facilities that would close as a result of this Alternative is shown in Table 3.12-3.

Table 3.12-3 — ETF Closures for the NTS Consolidation Alternative

LANL	LLNL	Sandia National Lab
K Site Environmental Test Facility	Thermal Test Facility (834 Complex) (5 Structures)	Outdoor Centrifuge Complex (8 structures)
Weapons Component Test Facility	Building 836 Complex (7 structures)	Auxiliary Hot Cell Facility
PIXY with Sled Track	Hardened Engineering Test Building (334 in Super Block)	Low Dose Gamma Irradiation Facility
Thermo-Conditioning Facility		Sandia Pulsed Reactor Facility Sandia Pulsed Reactor)
		Simulation Tech Lab (HERMES and RHEPP)
		PBFA ("Z"), Saturn and Sphinx
		Radiation Metrology Lab
		Gamma Irradiation Facility
		25 Foot Centrifuge
		Model Validation and System Cert Test Center
		Complex Wave Test Facility
		Light Initiated HE Test Facility
		10,000 Foot Sled Track
		Aerial Cable Facility and Control Building
		Radiography Building and Nondestructive Test
		Mobile Guns Complex
		Thermal Test Complex
		Vibration Acoustics and Mass Properties Lab
		Engineered Sciences Experimental Facility
		Component Environmental Test & Adv. Diagnostic Facility
		Electromagnetic/Environmental/Light Strategic Defense Facility
		SNL/CA Environmental Test Complex (4 structures)

Source: NNSA 2007.

The alternative to consolidate ETF capabilities at NTS would require the construction of four new facilities at NTS: (1) an ACRR-like facility (replacing capability lost at SNL); (2) an Engineering Test Bay (ETB) (replacing LLNL’s Bldg 334, a required capability); (3) an Aerial Cable Test Facility (replacing capability lost at SNL); and (4) a sled track (replacing a required capability lost at LANL and SNL), which could be constructed above or below ground. A description of these new facilities and assessment of the environmental impacts of constructing and operating these facilities is contained in Section 5.17.4.1.4.

A second option would consolidate ETF capabilities at SNL/NM. This alternative would close ETFs LANL and LLNL, but would continue operations of the two ETFs at NTS and some of the existing facilities at SNL/NM. Under this alternative, the ETF activities in Building 334 at LLNL would be transferred to either NTS (as discussed above) or to Pantex (see Section 3.12.4). A listing of the facilities that would close is found in Table 3.12-4.

Table 3.12-4 — ETF Closures for the SNL Consolidation Alternative

LANL	LLNL	Sandia National Lab
K Site Environmental Test Facility	Engineered Test Bay (834 Complex) (5 Structures)	Sandia Pulsed Reactor Facility (part of the Sandia Pulsed Reactor)
Weapons Component Test Facility	Building 836 Complex (7 structures)	Low Dose Gamma Irradiation Facility
PIXY with Sled Track	Hardened Engineering Test Building (334 in Super Block)	Auxiliary Hot Cell Facility
Thermo-Conditioning Facility		Outdoor Centrifuge Complex
		SNL/CA Environmental Test Complex (4 structures) ^a

^a SNL/CA Environmental Test Complex is a Sandia National Laboratory run program near LLNL in California. For environmental impacts, SNL/CA facilities are included in LLNL analysis since this is where the majority of the impacts are incurred.
Source: NNSA 2007.

3.12.4 ETF Pantex Option

As an option for the consolidation alternatives discussed in Section 3.12.3, this SPEIS considers the transfer of LLNL ETF activities to Pantex. As discussed in Section 3.12.3, consolidation to one site would require the construction of several new facilities. One such facility is a Building 334-like facility to allow for critical activities presently being conducted at Building 334 (also known as the Hardened Engineering Test Building) at LLNL. As an alternative to constructing this new Building 334-like facility at NTS, an additional option would be for equipment presently located at Building 334 to be relocated to Pantex.

Pantex presently conducts activities that are similar to those being conducted at Building 334, although not with SNM. As part of its ongoing modernization efforts, Pantex is currently planning the construction of a Weapons Surveillance Facility (WSF), which would replace the existing facility where these operations are conducted. Under this option, the ETF work presently being conducted at LLNL Building 334 would be transferred to the WSF. No new construction or additional security considerations would be required for this option.

3.13 SANDIA NATIONAL LABORATORIES, CALIFORNIA (SNL/CA), WEAPONS SUPPORT FUNCTIONS

In 1956, SNL established the SNL/CA facility to allow a closer cooperation with Lawrence Livermore National Laboratory (LLNL) design work. The SNL/CA facility evolved into an engineering research and development laboratory by the early 1960s and into a multi-program engineering and science laboratory during the 1970s. The SNL/CA facilities at Livermore, which include Weapon Systems Engineering, consist of 29 buildings. The majority of these buildings are small laboratories and office structures grouped together into seven “facilities”. The major facilities include the Combustion Research Facility (CRF), Building 910, Building 914, Building 916, Building 927, the Micro and Nano Technologies Laboratory (MANTL), and the Distributed Information Systems Laboratory (DISL). Section 3.13.1 discusses the No Action Alternative, which would continue operations at the existing facilities at SNL/CA. Section 3.13.2 discusses the alternative that would transfer the weapons support functions to SNL/NM. The analysis of the environmental impacts of the alternatives is contained in Section 5.18.

SNL/CA Weapons Support Functions
<ul style="list-style-type: none">• No Action — Maintain current non-nuclear component design and engineering work at SNL/CA with SNL personnel• Consolidate SNL/CA non-nuclear component design and engineering work to SNL/NM

3.13.1 No Action Alternative

Under the No Action Alternative, NNSA would continue to conduct the existing weapons non-nuclear component design and engineering work at the SNL/CA facilities as shown in Figure 3.13-1. A description of the major SNL/CA facilities is as follows:

Building 910

Building 910 is used to conduct weapons research and development (R&D) activities. The facility conducts science-based engineering and technology R&D in a wide variety of sciences including advanced electronics prototype and development, surface physics, neutron detector research, and telemetry systems. Building 910 is a low-hazard non-nuclear facility that consists of offices and space for weapons test assembly work. It is a multistory steel frame masonry structure of approximately 89,000 square feet, of which 48,000 square feet is laboratory and office space. The following spaces are located in the facility:

- Lobby;
- 128 offices;
- Loading dock (provides gas bottle storage area);
- Large liquid nitrogen tank; and
- 35 primary research and development light laboratories.

Generally, the activities are focused on electronics and microelectronics prototypes. Materials that are studied include ceramics, semiconductors, organic polymers, and metals. Specific

activities include:

- Advanced electronics prototype and development;
- Surface physics;
- Neutron detector research; and
- Telemetry systems research and development.

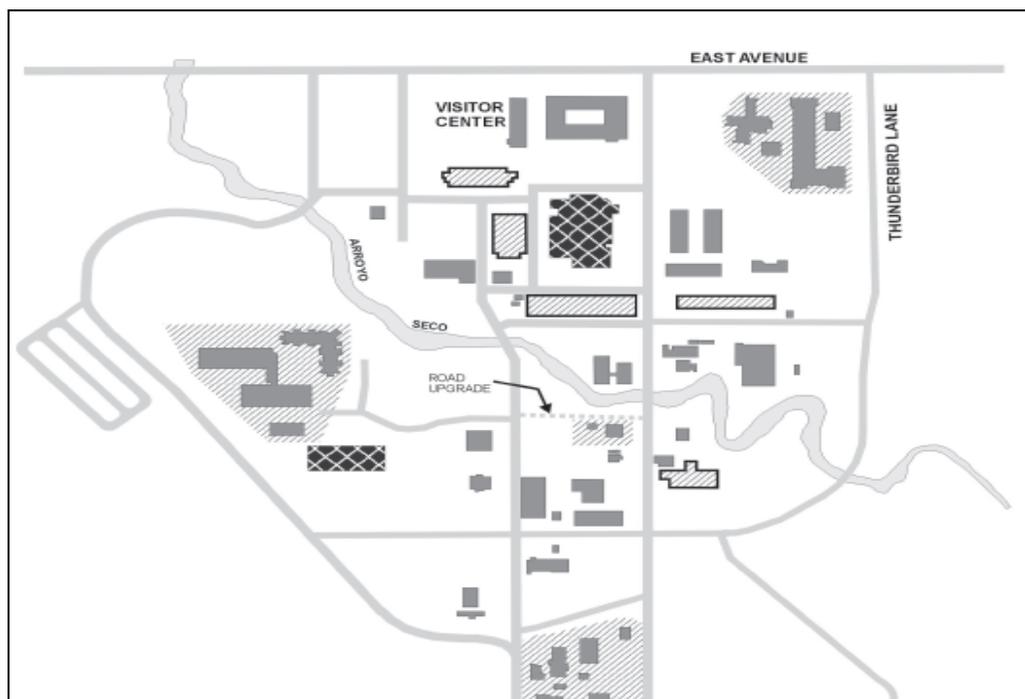


Figure 3.13-1 SNL/CA Weapons Support Facilities

Building 914

Building 914 is used to conduct weapons test assembly and machine shop activities. The facility supports SNL/CA's primary mission of ensuring that the U.S. nuclear weapons stockpile is safe, secure, and reliable. Building 914 is a low-hazard non-nuclear facility that consists of offices and laboratory space for weapons test assembly work. It is a single-story, steel frame masonry structure of approximately 25,000 square feet, of which 19,000 square feet is laboratory and office space. The following spaces are located in the facility:

- 17 offices;
- 4 electronic laboratories;
- 1 large machine shop;
- 1 high-bay test assembly; and
- Several small utility, vault, and storage rooms.

The operations conducted at Building 914 generally are focused on two distinct capabilities that support the mission of U.S. nuclear weapons stockpile maintenance: machine shop activities and test assembly operations.

Building 916

Building 916 is used to conduct materials chemistry R&D activities. Areas of research include thin film interface science, mechanics, ion implantation, gases in metals, hydrogen storage, plasma, annealing, detectors, science-based modeling, extreme ultraviolet lithography, microsystems, and fluidics. Building 916 is a low-hazard non-nuclear facility that consists of offices and laboratory space for primary research and development light labs. It is a single story building of approximately 42,000 square feet, of which 32,000 square feet is laboratory and office space. The following spaces are located in the facility:

- Lobby;
- Conference room;
- 53 offices;
- Loading dock (provides gas bottle storage area);
- Large liquid nitrogen tank; and
- 22 primary research and development light laboratories.

Generally, the activities are focused on materials studies including chemical and physical properties and characteristics (phases). Materials that are studied include ceramics, semiconductors, organic polymers, and metals. A wide variety of capabilities are employed in areas of material science, lithography, surface analysis, electronics, and microsystems engineering.

Building 927

Building 927 is used to store nuclear and classified materials, assemble subsystems, conduct system verification, and store equipment. The Explosive Destruction System (EDS) subsystems are assembled in the facility. No testing with explosives or other hazardous materials is conducted at this location. Building 927 is a low-hazard non-nuclear facility. It consists of a single story warehouse of approximately 22,000 square feet. The building provides a safeguard storage facility for special materials. Building 927 has four operations:

- Nuclear and Classified Material Control;
- Assembly test facility;
- Storage; and
- EDS assembly support.

Micro and Nanotechnologies Laboratory (MANTL)

The mission of the MANTL (Buildings 940, 941, 942, and 943) is to develop and integrate manufacturing technology to produce micro- and nano-products. MANTL is a low-hazard non-nuclear facility complex that consists of an administrative building and three separate laboratory buildings. All of the buildings are of steel-framed masonry construction, and total approximately 100,000 square feet. The following facilities are located in the complex:

- 22,778 square foot administrative building including lobby, offices, and a small auditorium;
- 30,218 square foot building with primary research and development light laboratories;
- 25,740 square foot building with primary research and development light laboratories; and
- 7,182 square foot building with primary research and development light laboratories.

MANTL activities include a wide variety of operations micro-machining, miniature component fabrication, fuel cell research and development, sensors and signal processing, and extreme ultraviolet lithography. Areas of materials research and development include characterization, chemistry, composite and lightweight components, engineered materials (welding, brazing, and joining), science-based modeling, and radiography. Specific operations include materials evaluation laboratories, materials synthesis and processing laboratories, microsystems processing laboratories, and nanolithography equipment development. MANTL has 11 areas of capabilities:

- Integrated Manufacturing;
- Microsystems;
- Fuel Cell Prototyping;
- Materials Characterization;
- Materials Chemistry;
- Lightweight Components;
- Engineered Materials;
- Science-Based Modeling;
- Sensors;
- Radiography; and
- Extreme Ultraviolet Lithography.

Distributed Information Systems Laboratory (DISL)

The DISL (Building 915) provides research and development in areas of distributed information systems. The new facility is a state-of-the-art, two-story structure containing approximately 70,400 square feet; housing offices, computer laboratory space, research and development space, and collaborative group areas. The space is divided into the following:

- 12,000 square feet of computer laboratory space;
- 17,650 square feet of research and development space;
- 4,730 square feet for collaborative group areas;
- 8,220 square feet for support areas;
- Ancillary laboratories; and
- Secure vault-type rooms.

DISL operations focus on the following technologies:

- Secure networking;
- High performance distributed computing;

- Visualization and collaboration technologies; and
- Design and manufacturing of productivity environments.

Laboratory activities consist primarily of connecting off-the-shelf hardware components into multimedia and network systems, computer model development, testing and validation, and distributed computing.

3.13.2 Move Activities to SNL/NM

This alternative would move some or all of the weapons non-nuclear component design and engineering work to SNL/NM where it would be consolidated with similar ongoing weapons activities presently being conducted there. The majority of the buildings at SNL/CA are in good repair, of a general office type design, and could easily be occupied by other programs. No new construction would be required at SNL/NM, as existing facilities could accept all personnel and equipment associated with this move to SNL/NM.

3.14 POTENTIAL CHANGES AT ALTERNATIVE SITES

This section presents a summary of the potential actions, displayed by site, which could occur based upon the alternatives presented in Sections 3.3 through 3.12. The purpose of this section is to provide a convenient format to understand the range of actions that could occur at each site potentially affected by the Complex Transformation SPEIS proposed action and alternatives.

3.14.1 Los Alamos National Laboratory

Programmatic Alternatives

- Continue current activities (Section 3.3.1)
- Be selected for a Greenfield CPC (Section 3.4.1) or Upgrade (Section 3.4.1.6.1) or 50/80 (Section 3.4.1.6.2)
- Be selected to receive the CNPC (Section 3.5.1) or CNC (Section 3.5.2) and Category I/II SNM from other sites (Section 3.5.1.3)
- Receive Category I/II SNM from LLNL (Section 3.7.2)
- If Los Alamos is not selected for CPC, phase-out plutonium manufacturing capability and transfer all Category I/II SNM to CPC site (Section 3.4.1.4)
- Establish a Capability Based pit production capacity (Section 3.6.1.1)

Project-Specific Alternatives

- Continue current activities related to Category I/II SNM storage (Section 3.7.1), HE R&D (Section 3.8.1), Tritium R&D (Section 3.9.1), Hydrotesting (Section 3.11.1), and ETFs (Section 3.12.1)
- Transfer HE R&D activities to other sites (Section 3.8.2)
- Receive HE R&D activities from other sites (Section 3.8.2)
- Transfer tritium R&D activities to SRS (Section 3.9.2)
- Receive tritium R&D activities from SRS and LLNL (Section 3.9.3)
- Reduce tritium R&D activities in place (Section 3.9.4)
- Reduce hydrotesting facilities in place (Section 3.11.2.1)
- Consolidate hydrotesting mission at LANL (Section 3.11.2.2)
- Consolidate ETFs in place (Section 3.12.2)
- Transfer ETFs to SNL/NM or NTS (Section 3.12.3)

3.14.2 Lawrence Livermore National Laboratory

Programmatic Alternatives

- Continue current activities related to Category I/II SNM storage (Section 3.7.1)
- Transfer Category I/II SNM to other sites (Section 3.7.2)

Project-Specific Alternatives

- Continue current activities related to HE R&D (Section 3.8.1), Tritium R&D (Section 3.9.1), Hydrotesting (Section 3.11.1), and ETFs (Section 3.12.1)
- Transfer HE R&D activities to other sites (Section 3.8.2)
- Receive HE R&D activities from other sites (Section 3.8.2)
- Transfer tritium R&D activities to SRS (Section 3.9.2)
- Transfer tritium R&D activities to LANL (Section 3.9.3)
- Reduce tritium R&D activities in place (Section 3.9.4)
- Reduce hydrotesting facilities in place (Section 3.11.2.1)
- Transfer hydrotesting mission to LANL (Section 3.11.2.2)
- Consolidate ETFs in place (Section 3.12.2)
- Transfer ETFs to SNL/NM or NTS (Section 3.12.3)
- Perform Category III SNM operations on material originating from LANL facilities (Section 3.7.2)

3.14.3 Nevada Test Site

Programmatic Alternatives

- Continue current activities (Section 3.3.1)
- Be selected for a Greenfield CPC (Section 3.4.1)
- Be selected to receive the CNPC (Section 3.5.1) or CNC (Section 3.5.2) and Category I/II SNM from other sites (Section 3.5.1.3)
- Receive Category I/II SNM from LLNL for interim storage (Section 3.7.2)

Project-Specific Alternatives

- Continue current activities related to HE R&D (Section 3.8.1), Hydrotesting (Section 3.11.1), and ETFs (Section 3.12.1)
- Receive HE R&D activities from other sites (Section 3.8.2)
- Receive NNSA flight test operations
- Be the M&O contractor for campaign mode flight test operations
- Reduce hydrotesting facilities in place (Section 3.11.2.1)
- Transfer hydrotesting mission to LANL (Section 3.11.2.2)
- Receive consolidated hydrotesting missions (next generation) (Section 3.11.2.3)
- Consolidate ETFs in place (Section 3.12.2)
- Consolidate ETFs to NTS (Section 3.12.3)

3.14.4 Pantex Plant

Programmatic Alternatives

- Continue current activities (Section 3.3.1)
- Be selected for a Greenfield CPC (Section 3.4.1)
- Be selected to receive the CNPC (Section 3.5.1) or CNC (Section 3.5.2) and Category I/II

- SNM from other sites (Section 3.5.1.3)
- Transfer Category I/II SNM storage from Zone 4 to Zone 12 (Section 3.7.2)
- Transfer A/D/HE activities to another site if a site other than Pantex is selected for CNPC/CNC; Pantex would close and undergo D&D (Section 3.5)
- Establish a Capability Based Assembly/Disassembly/HE Production (Section 3.6.1.2)

Project-Specific Alternatives

- Continue current activities related to HE R&D (Section 3.8.1), and Hydrotesting (Section 3.11.1)
- Transfer HE R&D activities to other sites (Section 3.8.2)
- Receive HE R&D activities from other sites (Section 3.8.2)
- Receive ETF Mission from LLNL Building 334 (Section 3.12.4)

3.14.5 Sandia National Laboratories/NM

Programmatic Alternatives

- None

Project-Specific Alternatives

- Continue current activities related to HE R&D (Section 3.8.1), Tritium R&D (Section 3.9.1), Hydrotesting (Section 3.11.1), and ETFs (Section 3.12.1)
- Transfer HE R&D activities to other sites (Section 3.8.2)
- Receive HE R&D activities from other sites (Section 3.8.2)
- Reduce hydrotesting facilities in place (Section 3.11.2.1)
- Consolidate ETFs in place (Section 3.12.2)
- Consolidate ETFs to SNL/NM or NTS (Section 3.12.3)
- Receive SNL/CA Weapons Support Functions (Section 3.13)

3.14.6 Savannah River Site

Programmatic Alternatives

- Continue current activities (Section 3.3.1)
- Be selected for a Greenfield CPC (Section 3.4.1)
- Be selected to receive the CNPC (Section 3.5.1) or CNC (Section 3.5.2) and Category I/II SNM from other sites (Section 3.5.1.3)
- Establish a Capability Based tritium production capacity (Section 3.6.1.4)

Project-Specific Alternatives

- Continue current activities Tritium R&D (Section 3.9.1)
- Receive tritium R&D activities from LLNL and LANL (Section 3.9.2)
- Transfer tritium R&D activities to LANL (Section 3.9.3)

- Reduce tritium R&D activities in place (Section 3.9.4)

3.14.7 Tonopah Test Range

Programmatic Alternatives

- None

Project-Specific Alternatives

- Continue current activities related to NNSA Flight testing (Section 3.10.1)
- Upgrade TTR (Section 3.10.2)
- Operate TTR in Campaign Mode (Section 3.10.3)
- Transfer NNSA Flight Testing to WSMR (Section 3.10.4)
- Transfer NNSA Flight Testing to NTS (Section 3.10.5)

3.14.8 Y-12

Programmatic Alternatives

- Continue current activities (Section 3.3.1)
- Be selected for a Greenfield CPC (Section 3.4.1)
- Be selected to receive the CNPC (Section 3.5.1) or CNC (Section 3.5.2) and Category I/II SNM from other sites (Section 3.5.1.3)
- Transfer Enriched Uranium operations to another site if a site other than Y-12 is selected for CNPC/CNC; Y-12 would close and undergo D&D (Section 3.5)
- Establish a Capability Based Enriched Uranium operations (Section 3.6.1.3)

Project-Specific Alternatives

- None

3.14.9 White Sands Missile Range

Programmatic Alternatives

- None

Project-Specific Alternatives

- Continue current activities (Section 3.2.7)
- Receive NNSA Flight Testing Mission (Section 3.10.4)

3.14.10 Sandia National Laboratories/CA

Programmatic Alternatives

- None

Project-Specific Alternatives

- Transfer Weapons Support Functions (Section 3.13)

3.15 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

NNSA identified no programmatic alternatives to the proposed action that were outside the range of the alternatives evaluated in this SPEIS. There were some specific alternatives suggested during the scoping process that NNSA has concluded do not merit further study for the reasons set forth below:

Consolidate the Three Nuclear Weapons Laboratories (LLNL, LANL and SNL). The three weapons laboratories possess most of the nation's core intellectual and technical competencies in nuclear weapons. The laboratories perform the basic research, design, engineering, testing, and certification of weapon performance. In 1995, President Clinton concluded that the continued vitality of all three laboratories (LANL, LLNL, and SNL) was essential to the nation's ability to fulfill the requirements of stockpile stewardship in the absence of underground testing (White House 1995). While this conclusion has not changed, NNSA continues to make the laboratories more efficient and effective, as indicated by the alternatives to consolidate, relocate, or eliminate duplicative facilities and programs.

Pursue Dismantlement and Refrain from Designing and Building New Nuclear Weapons. This SPEIS assesses reasonable alternatives for maintaining a safe, secure, and reliable nuclear weapons stockpile. This includes a Capability-Based Alternative that would support a stockpile much smaller than currently planned and a qualitative evaluation of alternatives that might be adapted if the President were to direct further reductions in the stockpile. Each of these alternatives that would maintain weapons design, R&D, and manufacturing capabilities, because these are necessary to maintain the nuclear weapons stockpile. These alternatives are consistent with the Nuclear Nonproliferation Treaty. With respect to not designing or building new nuclear weapons, this SPEIS does not propose to design or build new nuclear weapons. Decisions to design or build new weapons are made by the President and the Congress.

Curatorship Alternative. This programmatic alternative was proposed during the public scoping meetings for this SPEIS. The written comments submitted made reference to a document that provides a description of *curatorship* as a strategy for managing the Stockpile Stewardship Program (SSP) and the description that follows is excerpted from that report.³⁴

Curatorship

This option is based upon reliance on the surveillance and non-nuclear testing program to determine when repairs are necessary to nuclear weapons. Only if there is compelling evidence that components have degraded, or will soon degrade, and could cause a significant loss of safety or reliability, would DOE replace the affected parts with new ones that would be remanufactured as closely to their original design as possible. A core philosophy of this approach is that absent detectable changes, the well designed and thoroughly tested warheads in the stockpile will remain as safe and reliable as the laboratories have certified them to be today. No separate action would be taken to recertify each warhead

³⁴ Managing the U.S. Nuclear Weapons Stockpile – A Comparison of Five Strategies, A Report for Tri-Valley CAREs by Dr. Robert Civiak, July 2000

annually. This places a heavy responsibility on the surveillance and testing program to assure timely warning of any problem that could materially impair a significant fraction of the nuclear weapons stockpile.

Under the Curatorship Option, DOE would take a very cautious approach to making any changes to the weapons in the current stockpile. The approach is like that of a museum curator, whose first priority is to preserve the pieces under his charge and only restore them if they suffer unacceptable degradation. DOE would make the minimum number of changes to warheads in the stockpile that are believed necessary to maintain current levels of safety and reliability. Nuclear explosive components would be remanufactured and replaced only when there is compelling evidence from the surveillance and testing program that they have degraded, or will soon degrade, to a degree that will cause a significant loss of performance. Then, DOE would replace such components with others as close to the originals as possible, and always meeting the specifications previously associated with adequate nuclear performance. Non-nuclear components would be replaced only when detected degradation threatens to impair safety or weapon reliability. The burden of proof would be on those in the surveillance program to demonstrate that a component must be replaced to maintain historical levels of confidence in safety and reliability. No attempts at improving performance in either of these areas would be made.

DOE would support state-of-the-art testing and engineering capabilities to examine components. It would retain sufficient scientific and computing capabilities to apply current models and normal evolutionary improvements in analytical models to appraise potential problems with weapons systems. Weapons design and development capabilities would be allowed to atrophy, however, and most of DOE's weapons related research and experimentation programs would be suspended. Existing manufacturing capabilities would be retained and facilities would be refurbished only as needed to remanufacture components to previous designs. Changes in materials and production techniques would be limited to those dictated by environmental, health, and safety requirements, or by the unavailability at reasonable cost of products and processes used in a component's original manufacturing process. The production complex would be smaller than under the first two options, since components would be replaced less frequently. Functioning components would rarely be replaced with improved versions.

This definition of *curatorship* comprises many aspects of NNSA's current Stockpile Stewardship Program. One section of Dr. Civiak's report entitled "Assessment of the Options for Managing the U.S. Nuclear Weapons Stockpile" does identify two potential differences between the current SSP and curatorship.

- Unlike the current SSP, curatorship would involve NNSA giving up its capabilities to design and develop replacement nuclear weapons.
- Unlike the current SSP, curatorship would involve reduction of NNSA's manufacturing

capabilities, as NNSA would rely more on surveillance and remanufacturing and less on production of newly designed components.

The report states that “weapons design and development would be allowed to atrophy” in the suggested curatorship alternative. This statement assumes that there is a significant difference in the technical capabilities needed to maintain the weapons in the legacy stockpile from those required to design new weapons. The technical capabilities of the SSP, such as the experimental and computational capabilities, are largely defined by the technical characteristics of the aging U.S. stockpile and the prohibition on nuclear testing. The legacy nuclear weapons in the stockpile are not simple in that they were generally designed to provide the maximum nuclear yield within the weight and volume constraints of the delivery vehicles capabilities. The weapon’s nuclear yield, reliability, safety and security characteristics all compete for the same weight and volume capacities. Thus, weapon design is a result of complex “systems engineering” wherein design features affect one another and are traded-off against each other. When a stockpile problem is detected or suspected, laboratories must make technical judgments on the nature and extent of the problem and the proposed solution, because they are the ones most technically competent to do so. The concept of science-based stockpile stewardship was developed to enable a more fundamental scientific understanding of the legacy weapons for the purpose of making competent judgments about their safety and reliability in the absence of nuclear testing. The technical merit of any particular feature of the SSP, such as a specific experimental capability, will always be subject to uncertainty. Nonetheless, as a whole, the SSP is technically designed for proper care of the legacy stockpile. Allowing any aspects of this capability to atrophy would impair NNSA’s ability to assess and, if necessary, address concerns regarding the safety, security, and reliability of a nuclear weapon.

In regard to the second point on surveillance and remanufacture, this aspect of curatorship may not differ significantly from the existing SSP. In practice, the SSP is probably more cautious in making changes to legacy weapons than implied in the definition of curatorship. For example, a number of stockpile problems have been corrected by requesting changes to DoD maintenance, operating or management procedures, thus avoiding the need to return the weapons to NNSA for more complicated and expensive fixes. However, the ability of DoD to physically repair nuclear weapons is minimal and inherently limited by the weapon’s complex design and construction. The thousands of parts in weapons do not exist as individual items that can be individually changed out, like an electrical fuse in a home or car. Generally, the weapon has to be returned to Pantex for safe disassembly and replacement of components or subassemblies. In general, there is no practical, safe, or cost effective way to fix individual defects in isolation or just-in-time as implied by curatorship proposals. This is the main reason that legacy “life extension programs” are planned, so as to repair all known or potential problems at one time while the weapons are disassembled. In summary, a curatorship alternative does not define a programmatic alternative outside the range of alternatives evaluated in this SPEIS.

Smaller CUC/CNC/A/D/HE Center Alternative. Because this SPEIS includes an analysis of an alternative that would produce 50 to 80 pits per year (the 50/80 Alternative), NNSA also considered whether there should be an alternative at this production level for secondary components (CUC) and weapon assembly and disassembly (A/D/HE Center). In determining whether to assess a smaller CUC, CNC, or CNPC, NNSA considered three different factors –

programmatic risk, cost effectiveness and environmental impacts. These factors are discussed below.

Programmatic Risk. Section 2.3.3.2 describes the technical considerations for planning pit production capacity. In summary, current surveillance data and special studies indicate that pits in legacy weapons are aging without significant problems. Also, pit reuse may be a viable way to avoid some new pit production for some weapons, but it cannot be relied on as a complete substitute for new production due to the technical limitations described in Section 2.3.3.2. However, an advantage of pit reuse is that the work could possibly be done at the weapons A/D site in existing facilities. Thus, the increased programmatic risk of planning a lower-than-base-case production capacity for new pits might be judged acceptable. This same kind of judgment about programmatic risk was made for pits in the 1996 SSM PEIS.

Section 2.3.3.3 describes the technical considerations for planning secondary production capacity. In summary, current surveillance data and studies indicate that the secondary components in some legacy weapons are not holding up as well as they age beyond their intended design life. Further, there is no risk mitigating option for secondary components similar to the pit reuse. Secondary components have been disassembled and completely rebuilt in recent life extension programs. For planning purposes, rebuilding a secondary is not significantly different from building a completely new secondary.

Pit and secondary component installation and removal are done at the weapons A/D site, so its planning assumption for production capacity must be at least as high as the higher of the two components. In addition, because the weapons A/D site is the only location for safe disassembly of nuclear weapons, it is unlikely that the base case for this function would be reduced even if pit and secondary component production levels were reduced. It would not be prudent to overly limit this function in the event that weapons needed to be disassembled quickly for some unforeseen reason, not the least of which would be a nuclear safety problem.

Cost Effectiveness. If new nuclear production facilities were built for pit or secondary components, production capacities at levels less than 125 units per year are not likely to have a significant effect on the cost of these facilities. The number of pieces of unique equipment and factory floor space required will not change significantly at lower capacity levels. Pit and secondary components both contain SNM and these materials require a substantial factory infrastructure regardless of production rate – an infrastructure needed for compliance with environment, health and safety requirements and nuclear safeguards and security. In addition to facility requirements being similar because of the use of SNM, the uranium and plutonium components use many of the same manufacturing technologies (welding, machine tools, etc.). The lack of sensitivity of facility size and cost to lower production rates is illustrated by an SRS study on pit production capacity for the Modern Pit Facility (MPF). The study identified 84 pieces of equipment to produce 75 pits per year, but only 87 pieces of equipment to produce 125 pits per year. This translates into less than a 2 percent difference in the floor space needed for 75 pits per year versus 125 pits per year.

In regard to constructing new facilities for the weapon A/D function, the cost sensitivities are different based on the differences in facility design and utilization. Nuclear facilities for SNM

processing and component production are very complex and expensive. Weapon A/D facilities are not designed for SNM processing and all that entails. They are designed to mitigate the effects of an accidental detonation of a weapon's high explosive during operations. The construction cost for a weapon A/D type facilities is very much less than the cost of facilities for pit production and secondary component production. Cost would not play a significant role in relation to programmatic risk.

Environmental Impacts. Because the size of a new pit, secondary or weapon A/D facility is not very sensitive to changes in production rates between 50 and 125 units per year, the environmental impacts of construction are not expected to be significantly different than for the current alternatives. The environmental impacts of operations estimated in the draft SPEIS are proportional to production rates and bounded on the low side by the impact of the Capability-Based Alternative.

In conclusion, lower pit production rates may be an acceptable programmatic risk in view of the pit surveillance data, and the existence of a potential pit reuse option and cost. The same is not true for secondary components and weapon A/D functions since recent history on the secondary components indicates there is a higher programmatic risk associated with secondary longevity resulting in a need to work on weapons under the life extension program. The environmental impacts for the secondary component and weapon A/D functions would not change significantly by creating a new alternative based on a planning assumption of 50/80 units per year. Based on this conclusion, NNSA decided to eliminate a smaller CUC/CNC/CNPC from detailed analysis.

Regarding the CPC, NNSA identified the following potential alternatives, but eliminated them for the reasons set forth below:

New CPC with a Smaller Capacity. NNSA considered whether it would be reasonable to build a new CPC with a capacity of fewer than 125 pits per year (single shift). In a detailed report published in September 2007,³⁵ NNSA concluded that if it constructed a new pit facility with a capacity to produce 80 pits per year, the reduction in square footage would be small (less than a few percent) compared to a new facility designed for 125 pits per year (single shift). The reason for this is that the reduction in the number of equipment processing stations is only 6 stations from the total estimated requirement of 132 major processing stations. Reductions in the processing stations based on a lower production requirement only decreases a small amount of equipment that would be needed to provide production assurances in the capacity increase from 80 pits per year to 125 pits per year (single shift). From a design perspective for a new facility, 125 pits per year plant is an optimal minimum. The expected environmental impacts on construction and operation of a CPC at 125 pits per year would not be significantly different from 80 pits per year and the larger capacity provides better assurance of meeting the purpose and need for production of pits.

Purchase Pits. While there is no national policy that prohibits purchase of defense materials such as pits from foreign sources, NNSA has determined that the uncertainties associated with obtaining them from foreign sources render this alternative unreasonable for an assured long-term supply.

³⁵ Plutonium Processing Facility Reduced Capacity Study, NNSA, September 2007.

Upgrade Building 332 at Lawrence Livermore National Laboratory. Building 332 at LLNL is located in what is known as the “Superblock.” This building is a plutonium R&D facility containing a wide variety of plutonium processing and fabrication technologies but offering minimal production capabilities. Activities in Building 332 include demonstrating improved technologies for plutonium metal preparation, casting, fabrication, and assembly; fabrication of components for subcritical tests; surveillance of LLNL pits; support for LANL pit surveillance; and fundamental and applied research in plutonium metallurgy. Building 332 does not have a pit manufacturing mission and is small in comparison to the production facilities at LANL. Additionally, because of the significant population around LLNL, an upgrade alternative at LLNL is undesirable.

Consider Other Sites for the CPC. In order to determine the reasonable site alternatives for a CPC, all existing, major DOE sites were initially considered as a host location for a CPC. Sites that do not maintain Category I/II SNM were eliminated from consideration, as were sites that did not conduct major NNSA program activities. Other DOE sites were not considered reasonable locations because they do not satisfy certain criteria such as low surrounding populations, mission compatibility, or synergy with the site’s existing mission. Following this process, NNSA decided that Los Alamos, NTS, Pantex, SRS, and Y-12 are the reasonable site alternatives for a CPC (71 FR 61731).

Redesign of Weapons to Require Less or No Plutonium. The pits in the nuclear weapons stockpile were designed and built with plutonium, and in an era when nuclear testing was used to verify these designs. Replacing these pits with new ones that would use little or no plutonium (i.e., they would use highly enriched uranium instead of plutonium) for the sole purpose of not building a long-term, assured pit production facility would not be reasonable. Underground testing would likely be required to verify performance of a design that uses uranium instead of plutonium. In addition, these new pits would require costly changes in weapon delivery systems.

Do Not Produce New Pits. The latest studies on pit aging indicate that the pits currently in the stockpile may be viable for more than 85 years. It may become necessary to manufacture new pits for a number of reasons including new weapon design, changes in other components in the weapon that might require a new pit (for example a change in the HE to be used or unavailability of certain materials or components). Prudent management of NNSA’s mission dictates that NNSA have the ability to produce all components necessary for the nuclear weapons stockpile to adequately manage all potential risks to the stockpile.

NNSA Flight Testing. In addition to the WSMR, NNSA considered three other DoD flight test ranges. A team of NNSA officials visited these sites, discussed their availability and assets with the sites’ technical staff and management, and evaluated their ability to conduct NNSA flight test operations. However, as explained below, NNSA eliminated them from further consideration because they are unreasonable from the standpoint of technical risk.

NNSA considered areas B-70 and B-75, on the west side of Eglin Air Force Base. Eglin is one of the Air Force's largest bases, and is a primary test center for non-nuclear munitions. Located on the coast of the panhandle of Florida, the base covers 724 square miles of land, and has 97,963 miles of water ranges in the Gulf. NNSA has conducted discrete flight tests at Eglin in the past and may do so in the future. However, the geological features, including the terrain and

short depth to groundwater, present problems for more routine flight tests (e.g., penetration testing, difficult recovery of units after testing). Thus, Eglin would not provide a suitable environment for most flight testing.

NNSA also considered China Lake, an airborne weapons testing and training range operated by the U.S. Navy. It is located in the northeast of California's Mojave Desert in northwestern San Bernardino County. China Lake is the US Navy's largest single holding of land, covering of 1.1 million acres. Although the technical assets at China Lake are sufficient to support NNSA Flight Test Operations, the geology and soils are not considered adequate for testing all gravity weapons.

NNSA also considered the Utah Test and Training Range (UTTR). UTTR is a vast military area in northern Utah, about 70 miles west of Salt Lake City. UTTR is the nation's largest combined restricted land and closed "special use" airspace area. The existing assets, such as optical systems, radar, and communications are all dated and its management has no plans for upgrading or replacing them. Soil composition is moist and soft over the entire range and was not considered suitable for conducting all NNSA Flight Test Operations.

Tritium R&D Alternatives.

Proposed Changes to the Tritium Production Mission. With the exception of the irradiation of tritium targets (which occurs at the TVA Watts Bar commercial nuclear reactor), all other elements of tritium production are currently conducted at SRS. Tritium production activities are conducted in new, state-of-the-art facilities that were specially designed and built for this mission. There are no existing facilities at sites other than SRS for performing these missions. As such, any proposal to transfer the tritium production mission from SRS was considered to be unreasonable.

Changing Tritium Missions at SNL/NM. As noted in Section 3.9.1, SNL/NM has very small inventories of tritium in conjunction with its neutron tube target loading. Projected inventories are not expected to increase and will not represent increases to security and infrastructure requirements. Expanding SNL/NM to take on additional tritium R&D missions would require additional increase in infrastructure requirements, limits etc. Thus, for a future mission or decision, this site is essentially equivalent to a "greenfield" site and was considered unreasonable for consolidation activities. Likewise, the programmatic need to conduct neutron tube loading R&D in conjunction with the neutron tube target loading makes transfer of this mission from SNL/NM unreasonable.

Consolidate Tritium R&D at LLNL. Although LLNL has a low tritium inventory, the site will be able to accommodate approximately 35 grams of tritium in the near future. The facility infrastructure will support the loading of tritium targets for the NIF. In comparing LLNL's tritium limit and inventories to existing inventories and limits at LANL and SRS, it falls far short of what would be necessary to accommodate these missions. To accommodate the tritium R&D mission, LLNL would need to increase projected tritium limits about 10 fold or slightly higher. As such, LLNL was recommended for consideration as a "donor" site for tritium R&D rather than as a "receiver" site.

Transfer NIF Tritium Target Loading From LLNL. LLNL is in the process of developing a capability to fill tritium targets for NIF experiments. The success of the NIF experiments, particularly to achieve target ignition is very sensitive to impurities in the target. One of these impurities is Helium-3 which accumulates in the target at the rate of 6.4 atomic parts per million per hour from tritium decay. Any tritium consolidation option that moves NIF target tritium loading to a location not collocated with NIF, introduces additional time and handling of the NIF targets before the experiments can be conducted. It seems unlikely targets produced at a site other than at LLNL could be brought to NIF and used in experiments within the time constraints stated for experimental success, particularly since most of the 36 hours is required for target conditioning and characterization at NIF itself. As such, NNSA has concluded that it is unreasonable to transfer the NIF tritium target loading from LLNL.

3.16 COMPARISON OF IMPACTS

Comparison of potential environmental impacts is based on the information in Chapter 4, Affected Environment, and analyses in Chapter 5, Environmental Impacts. Its purpose is to present the impacts of the alternatives in comparative form. For the programmatic alternatives to restructure SNM facilities, Table 3.16-1 (at the end of the chapter) presents a comparison of the potential impacts of construction and operation associated with the No Action Alternative, DCE Alternative, CCE Alternative, and Capability Based Alternative. The No Action Alternative is presented in Table 3.16-1 as a benchmark for comparison of the impacts associated with the action alternatives. Table 3.16-2 presents a summary comparison of the Category I/II SNM Consolidation for LLNL and Table 3.16-3 presents a summary comparison of the Category I/II SNM Consolidation at Pantex.

A detailed analysis of the project-specific alternatives is contained in Section 5.13 (HE R&D), Section 5.14 (Tritium R&D), Section 5.15 (Flight Testing), Section 5.16 (Hydrodynamic Testing), Section 5.17 (Major Environmental Test Facilities), and Section 5.18 (Non-Nuclear Weapons Support Functions at SNL/CA). For the project-specific actions, Tables 3.16-4 through 3.16-8 are provided.

In addition to the comparison presented in Table 3.16-1, this section presents an overview of the major environmental impacts associated with the programmatic alternatives presented in this SPEIS. This presentation is an overview, focusing on the major discriminator between the programmatic alternatives with respect to land use, employment, transportation, and accidents. A detailed analysis of the environmental impacts associated with all alternatives (by site) is presented in Chapter 5, Sections 5.1 through 5.9. A detailed transportation analysis is presented in Section 5.10.

3.16.1 Land Use for Programmatic Alternatives

For land use, both the No Action Alternative and the Capability Based Alternative have the least impacts, in that the total area of the seven Complex sites analyzed in this SPEIS (LANL, LLNL, NTS, Pantex, SNL, SRS, and Y-12) remains the same at approximately 1,000,000 acres.

For the DCE Alternative, the Complex would remain the same size, but a CPC would be constructed at one of five site alternatives. This would disturb an area of approximately 140 acres during construction, resulting in a 110 acre facility within the existing boundaries of one of these sites. For Los Alamos, this disturbed land could be a bit smaller, as an alternative to use existing and planned pit manufacturing facilities is being considered along with a Greenfield CPC alternative. At Y-12, if the UPF were constructed, consolidation from existing facilities could ultimately reduce the area associated with nuclear production activities from 150 acres to approximately 15 acres.

Under the Consolidated Centers of Excellence (CCE) Alternative, the Complex's size could be reduced. Depending upon the option (Consolidated Nuclear Production Center [CNPC] or Consolidated Nuclear Centers [CNC]), this alternative would involve the construction of facilities at one or two sites, and could resulting in a 545-acre facility at one of five candidate

sites. If Los Alamos, NTS, or SRS were selected as the site for CCE facilities, both Pantex and Y-12 could be closed. This could reduce the size of the Complex by 16,777 acres. If Pantex (but not Y-12) were selected for CCE facilities, Y-12 could close and the size of the Complex reduced by approximately 800 acres. If Y-12 (but not Pantex) were selected for CCE facilities, Pantex could close and the Complex would be reduced by 15,977 acres.

3.16.2 Impacts on Complex Facilities for Programmatic Alternatives

Under the No Action Alternative, NNSA would continue the trend of closing, replacing, and upgrading older facilities consistent with previous decisions. Surplus facilities with no inherent value to DOE, NNSA, or the community would ultimately be dispositioned or undergo decontamination and decommissioning (D&D). For example, at Y-12, many excess buildings and infrastructure have been closed over the past decade, and approximately 244 buildings, with more than 1.1 million square feet, have been demolished or removed. In the future, as part of the environmental cleanup strategic planning, DOE and NNSA are developing an Integrated Facility Disposition Project (IFDP). The IFDP is a strategic plan for disposing of legacy materials and facilities at Oak Ridge National Laboratory (ORNL) and Y-12 that uses an integrated approach. Under the IFDP, the D&D of approximately 188 facilities at ORNL and 19 facilities at Y-12, as well as the remediation of soil and groundwater contamination there, would occur over the next decade. The IFDP will be conducted as a remedial action under CERCLA. Similar activities at other NNSA sites are ongoing. For instance, at LLNL, approximately 20 facilities with a combined floor space of 234,443 square feet are being deactivated.

With respect to the programmatic alternatives, if a site other than Y-12 or Pantex is selected for a CNPC, Pantex and Y-12 could be closed. At Pantex, this would involve closing approximately 400 buildings totaling 1.8 million square feet. At Y-12, approximately 5.3 million square feet of floor space and approximately 390 facilities would be closed. For each of the programmatic action alternatives, moving plutonium storage to Zone 12 at Pantex would result in closing more than 74,200 square feet of storage facilities in Zone 4.

3.16.3 Impacts on Complex Facilities for Project-Specific Alternatives

With respect to potential cumulative impacts, project specific actions could also affect the total number of facilities and square footage devoted to NNSA weapons activities. This could result in additional facility closures or transfer of facilities from the NNSA to another user. For example, if flight testing were moved from TTR, approximately 195 buildings, covering approximately 180,000 square feet, could be closed or transferred to another user.³⁶ For the Hydrodynamic Testing Consolidation-in-Place Alternative, 29 facilities at LANL, LLNL, and SNL/NM, with a combined floor space of 56,475 square feet could be closed or transferred. For alternatives that move HE R&D from LLNL Site 300, up to 17 acres of facilities, involving more than 35,000 square feet, could be closed or transferred. If NNSA were to ultimately close Site 300, up to 115 buildings with a floor space of approximately 340,000 square feet could be closed or transferred.

³⁶ This SPEIS does not identify future users or uses of facilities that may or may not be closed. Any such actions are premature and would be more appropriately addressed if and when facilities become excess.

3.16.4 Employment Under the Programmatic Alternatives

For employment, the No Action Alternative would have the least impacts with the workforce remaining at the current level of approximately 27,000 management and operating contractors at the major sites analyzed in this SPEIS.

For the DCE Alternative, a new CPC could be constructed at Los Alamos, NTS, Pantex, SRS, or Y-12. If constructed, approximately 850 construction jobs and an operational workforce of approximately 1,780 could be added to the Complex.

The CCE Alternative has the greatest potential for employment impacts. The construction of CCE facilities could require more than 4,000 construction jobs and an operational workforce of approximately 4,500 could be added to the selected site(s). If Pantex is not selected for CCE facilities, Pantex could be closed, resulting in a loss of approximately 1,650 jobs. If CCE facilities are not located at Y-12, Y-12 could be closed with a loss of approximately 6,500 jobs.

For the Capability Based Alternative, the reduced level of production would entail the loss of approximately 3,000 jobs (400 at Pantex, 15 at SRS, and 2,600 at Y-12).

3.16.5 Transportation Under the Programmatic Alternatives

For the No Action Alternative, there would be no impacts to the existing transportation requirements of the Complex. Pits would continue to be transported from LANL to Pantex, Canned subassemblies (CSAs) would continue to be transported from Y-12 to Pantex, tritium reservoirs would continue to be transported between SRS and Pantex, and other required parts and materials would be transported among various NNSA sites.

For the DCE Alternative, transportation related to pit production could increase if a CPC were located at a site other than Pantex. If the CPC were located at Pantex, no off-site transportation related to pit production would be required.

For the CCE Alternative, if facilities were located at sites other than Y-12 and Pantex, up to 60 metric tons of plutonium, mostly in pit form, presently being stored at Pantex would be transported to the CNPC, and 252 tons of HEU would be transported from Y-12 to the CNPC. For the CNPC option, annual transportation related to nuclear production would cease once the CNPC becomes operational. For the CNC option, there would be annual transportation related to pits and CSAs between the CPC, CUC, and A/D/HE Center.

For the Capability Based Alternative, transportation requirements would be the same as for the No Action Alternative, except that the number of CSAs that would need to be transported from Y-12 to Pantex, would be reduced by approximately 50 percent and tritium shipments could be reduced by approximately 50 percent.

3.16.6 Accidents and Malicious Acts in Programmatic Alternatives

For the No Action Alternative and the Capability-Based Alternative there would be no major difference in accident risks and consequences. For the DCE and CCE Alternatives, the location of any new facilities could impact the risks and consequences associated with accidents. In general, if missions were conducted at locations with populations lower than the populations at the sites where those missions are currently conducted, potential consequences would likely decrease. For example, if a CNPC were located at NTS, potential consequences associated with the A/D/HE mission, the CUC mission, and the CPC mission would be reduced compared to the No Action Alternative because of the greater distance to the site boundary and the smaller population within the surrounding area.

A draft classified appendix to this SPEIS has been prepared that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix B (Section B.12.3) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems. As discussed in that section, the NNSA strategy for the mitigation of environmental impacts resulting from extreme events, including intentional destructive acts or terrorism, has three distinct components: (1) prevent or deter terrorists from making successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. These data will provide NNSA with information upon which to base, in part, decisions regarding transformation of the Complex. The draft classified appendix evaluates several intentional destructive act scenarios for alternatives at the following sites (LANL [both at TA-16 and TA-55], LLNL, NTS, SRS, Pantex, and Y-12) and calculates consequences to the noninvolved worker, maximally exposed individual, and population in terms of radiation dose and LCFs. Although the results of the analyses cannot be disclosed in this unclassified SPEIS, the following general conclusion can be made: the potential consequences of intentional destructive acts are highly dependent upon distance to the site boundary and size of the surrounding population- the closer and higher the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities, as new security features can be incorporated into their design. In other words, protection forces needed to defend new facilities may be smaller due to inherent security features included in a new facility.

3.16.7 *Infrastructure Demands for the Programmatic Alternatives*

Electricity.

Under the No Action Alternative, all sites have an adequate existing electrical infrastructure to support current and planned activities.

LANL has adequate electricity to support all of the alternatives. However, operation of a CNPC would have the potential to use approximately 96 percent of the peak power capacity that is available.

At NTS, the existing infrastructure would be adequate to support all construction requirements. To support operations for a CUC, CNC, or CNPC, NTS would need to procure additional power.

At Pantex, the existing infrastructure would be adequate to support all construction requirements. To support operations for a CUC or CNPC, Pantex would need to procure additional power.

At SRS and Y-12, the existing infrastructure would be adequate to support the construction and operation of all alternatives. Construction and operation would have a negligible impact on current site infrastructure.

Water.

Under the No Action Alternative, all sites have an adequate existing water infrastructure to support current and planned activities.

LANL has adequate water rights to support a CPC, CUC, or A/D/HE Center. However, operation of multiple new facilities (CNC or CNPC) would exceed the current LANL water rights.

At NTS, the sustainable site capacity for water would be adequate to support the construction and operation of all alternatives.

At Pantex, the existing wellfield capacity would be adequate to support the construction and operation of all alternatives.

At SRS and Y-12, the existing water infrastructure would be adequate to support the construction and operation of all alternatives.

3.17 PREFERRED ALTERNATIVES

CEQ regulations require an agency to identify its preferred alternative to meet its purpose and need, if one exists, in a Draft EIS (40 CFR 1502.14(e)). At this time, NNSA has identified the preferred alternatives as described below. This is based on the consideration of environmental impacts described in this Draft SPEIS, as well as consideration of other factors such as mission and infrastructure compatibility, economic analyses, safety, safeguards and security, and workforce training and retention.

Restructuring SNM Facilities Preferred Alternatives

Pursue Distributed Centers of Excellence as follows:

- Plutonium Manufacturing and R&D: Los Alamos (50/80 Alternative) would provide up to 80 pits per year enabled by construction and operation of the Chemistry and Metallurgy Research Replacement - Nuclear Facility (CMRR-NF). Other national security actinide needs and missions would be supported at TA-55 on a priority basis (e.g., emergency response, material disposition, nuclear energy).
- Uranium Manufacturing and R&D: Y-12 would continue as the uranium center providing component and canned subassembly production, surveillance and dismantlement. Independent of this SPEIS, NNSA is completing construction of the HEUMF and consolidating HEU storage in that facility; and can proceed with the preliminary design of a UPF that could be located at any of the sites under consideration in this SPEIS.
- Assembly/Disassembly/High Explosives Production and Manufacturing: Pantex would remain the Assembly/Disassembly/High Explosives production and manufacturing center. Consolidate non-destructive surveillance operations at Pantex.
- Consolidation of Category I/II SNM: Phase-out Category I/II operations at LLNL Superblock by the end of 2012. Consolidate Category I/II SNM at Pantex within Zone 12, and close Zone 4.

Restructuring R&D and Testing Facilities Preferred Alternatives

HE R&D. Reduce footprint of NNSA weapons activity HE production and R&D; reduce number of firing sites as well. Use of energetic materials for environmental testing (e.g., acceleration or sled tracks, shock loading, or in explosive tubes) is not included in HE R&D. Consolidate weapons HE R&D and testing at the following locations by 2010.

- Pantex would remain the HE production (formulation, processing, and testing) and machining center. All HE production and machining to support nuclear explosive package (NEP) development is performed at Pantex. HE experiments up to 22 kg HE could remain at Pantex;

- NTS would remain the R&D testing center for large quantities of HE (greater than 10 kg);
- LLNL would be the HE R&D center for formulation, processing, and testing (less than 10 kg) HE at the High Explosives Applications Facility (HEAF);
- SNL/NM would remain the energetic devices R&D center (less than 1 kg of HE) at the existing Explosives Test Facility (ETF); and
- LANL would produce HE detonators and conduct contained HE R&D.

Maintain one open-burn/open detonation area at each site for safety and disposal purposes.

Tritium R&D. Consolidate Tritium R&D at SRS. SRS would remain the site for tritium supply management and provide R&D support to production operations and gas transfer system development. Neutron generator loading at SNL/NM and production of National Ignition Facility targets at LLNL, which involve small quantities of tritium, would continue and would not be included in this consolidation. Move bulk quantities of tritium from LANL to SRS by 2009. Remove tritium materials above the 30 gram level from the Weapons Engineering Tritium Facility (WETF) at LANL by 2012.

NNSA Flight Test Operations. Cease NNSA operation of TTR in approximately 2009 and conduct flight testing at a DoD facility. No Category I/II SNM will be used in future flight tests.

Hydrodynamic Testing. Cease open-air hydrotesting at LANL and LLNL in 2009, and conduct future open-air hydrotesting at NTS. Consolidate in-place LANL and LLNL hydrotesting facilities. Close CFF at LLNL in approximately 2015 which could enable transfer or closure of Site 300. As the LANL Dual Axis Radiographic Hydrodynamic Test (DARHT) facility approaches end of life in approximately 2025, plan for a next generation facility at the NTS.

Major Environmental Test Facilities. Consolidate major environmental testing at SNL/NM and conduct infrequent operations requiring Category I/II SNM in security campaign mode. Close LANL and LLNL major environmental testing facilities by 2010 (except those in LLNL Building 334). Move environmental testing of nuclear explosive packages currently performed in LLNL Building 334 to Pantex by 2012. As SNL/NM facilities used for infrequent Category I/II SNM testing (Annular Core Research Reactor and Aerial Cable Facility) reach the end of their life, NNSA would evaluate building replacement facilities at NTS.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
Land Use							
LANL	Current and planned activities would continue as required to accomplish assigned missions. LANL has approximately 2,000 structures with approximately 8.6 million square feet under roof, spread over an area of approximately 25,600 acres.	<i>Greenfield CPC:</i> Potential disturbance of 140 acres for construction and 110 acres for operation. <i>Upgrade:</i> Potential disturbance of 13 acres for construction and 6.5 acres for operation.. <i>50/80:</i> Potential disturbance of 6.5 acres for construction and 2.5 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.	Potential disturbance of 300 acres from construction and 300 acres from operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 1.2% of LANL total land area.	195 acres (includes 50 acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 1% of LANL total land area.	545 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Two non-contiguous TAs would be used for the CNPC. Land required would be approximately 2.3% of LANL total land area. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	Potential disturbance of 6.5 acres. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of LANL total land area.
NTS	Current and planned activities would continue as required to accomplish assigned missions. Approximately 45 percent of NTS is currently unused or provides buffer zones for ongoing programs or projects, while about 7-10 percent (60,000 – 86,500 acres) of the site has been disturbed.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of NTS total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of NTS total land area.	Because NTS would use existing capabilities at the DAF, potential land disturbance for construction and operation would be approximately 200 acres. Land required would be less than 1% of NTS total land area.	195 acres (includes 50-acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans.	445 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue on the 15,977- acre site as required to accomplish assigned missions. No new land disturbance expected.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of Pantex total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of Pantex total land area.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	545 acres (includes 100-acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 would close, reducing the size of the Complex by approximately 800 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
SRS	Current and planned activities would continue on the 198,420-acre site as required to accomplish assigned missions. Approximately 77 acres of additional land would be disturbed by construction of the Mixed-Oxide (MOX) Fuel Fabrication Facility which broke ground August 2007 and the Pit Disassembly and Conversion Facility (PDCF) scheduled to break ground in 2010.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area.	Potential disturbance of 50 acres for construction and 35 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area.	Potential disturbance of 300 acres from construction and 300 acres from operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be less than 1% of SRS total land area	195 acres (includes 50 acre buffer area) needed to operate CNC. Land uses would remain compatible with surrounding areas and with land use plans.	545 acres (includes 100 acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Y-12 and Pantex would close, reducing the size of the Complex by 16,777 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue on the 800-acre site located on the 35,000-acre Oak Ridge Reservation as required to accomplish assigned missions.	Potential disturbance of 140 acres for construction and 110 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 17.5% of Y-12 total land area	UPF could disturb approximately 35 acres for construction and 8 acres for operation at Y-12. Land uses would remain compatible with surrounding areas and with land use plans. UPF would enable protected area to be reduced by 90%.	Potential disturbance of 300 acres for construction and 300 acres for operation. Land uses would remain compatible with surrounding areas and with land use plans. Land required would be approximately 37.5% of Y-12 total land area.	Y-12 performs the CUC mission; therefore the impact of a CNC at this site is identical to the CPC impact.	518 acres (includes 100 acre buffer area) needed to operate CNPC. Land uses would remain compatible with surrounding areas and with land use plans. Pantex would close, reducing the size of the Complex by 15,977 acres.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Visual Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would be visible from higher elevations beyond LANL boundary; however, change would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	Construction activities would create short-term, temporary visual impacts. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	New facilities would not be visible outside of NTS boundary; change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. New facilities would not be visible outside of NTS boundary. No change to VRM Classification.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities	Short-term, temporary visual	Construction activities	No A/D/HE Center is	Pantex performs the	New facilities would be	Planned activities

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	would continue as required resulting in no additional impacts.	impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	would create short-term, temporary visual impacts. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	obstructed from off-site view. Change would be consistent with currently developed areas. No change to VRM Classification.	would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Current and planned activities would continue with short-term impacts to visual resources resulting from construction of the MOX/PDCF facilities in the F-Area. Changes would be consistent with existing structures of the area and no change to VRM classification would be required.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Construction activities would create short-term, temporary visual impacts. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	New facilities would be obstructed from off-site view. Change would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. The reference location is obstructed from off-site view. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	UPF could disturb approximately 35 acres at Y-12. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Short-term, temporary visual impacts from construction. Changes to visual appearance would be consistent with currently developed areas. No change to VRM Classification.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Site Infrastructure							
LANL	Current and planned activities would continue as required resulting in no additional impacts. The current power pool peak power capacity is 130 megawatts-electric [MWe]). The available site capacity is 43 MWe.	Under all approaches, existing infrastructure would be adequate to support construction and operation requirements. Operation of a CPC would have the potential to use approximately 26% of the peak power capacity that is available.	Existing infrastructure would be adequate to support construction and operation requirements. Operation of a CUC would have the potential to use approximately 43% of the peak power capacity that is available.	Operation of A/D/HE Center would have the potential to use approximately 28% of the peak power capacity that is available.	Although the CNC operations would not exceed LANL electrical power capacity, the total load could approach approximately 70% of the peak power capacity that is available.	Operation of a CNPC would have the potential to use approximately 96% of the peak power capacity that is available.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
NTS	Current and planned activities would continue as required resulting in no additional impacts. NTS would be expected to continue using	Existing infrastructure would be adequate to support construction and operation requirements. Power requirements would be 64%	Existing infrastructure would be adequate to support construct requirements. Power requirements would be	Existing infrastructure would be adequate to support construction. Power requirements would be 69% of	Power requirements would be 288% of available site electrical energy capacity. For operations, NTS would need to procure additional	Power requirements would be 357% of available site electrical energy capacity. For operations, NTS would need to procure additional	NTS would be unaffected by the Capability Based Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	101,377 MWh of electricity per year. Electrical usage is below current site capacity.	of available site electrical energy capacity.	224% of available site electrical energy capacity. For operations, NTS would need to procure additional power.	available site electrical energy capacity.	power.	power.	
Pantex	Current and planned activities would continue as required resulting in no additional impacts to site infrastructure. Pantex would be expected to continue using about 81,850 MWh of electricity per year.	Existing infrastructure would be adequate to support construction and operation requirements. Power requirements would be 40% of available site electrical capacity.	Existing infrastructure would be adequate to support construction requirements. During operations, power requirements would be 140% of available site electrical energy capacity. To support a CUC, Pantex would have to procure additional power.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	During operations, power requirements would be 148% of available site electrical energy capacity. To support a CNPC, Pantex would have to procure additional power.	Planned activities would continue as required to support smaller stockpile requirements. Infrastructure needs would be reduced.
SRS	Current and planned activities would continue, with the increased electrical usage from the MOX/PDCF facilities for a electrical use of 405,000 MWh/yr (370,000 MWh/yr existing plus 35,000 MWh/yr for the MOX/PDCF facilities)	Existing infrastructure would be adequate to support construction and operation requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Construction and operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support operation requirements. Operation would require 15% of available electrical site capacity. Operation requirements would have a negligible impact on current site infrastructure.	Existing infrastructure would be adequate to support construction requirements. Operation requirements would have a negligible impact on current site infrastructure.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts to site infrastructure. Y-12 would be expected to continue using about 350,000 MWh of electricity per year.	Existing infrastructure would be adequate to support construction and operation requirements. During operations, power requirements would be <1% of available site electrical capacity.	Existing infrastructure would be adequate to support construction and operation requirements. During operations, power requirements would be <1% of available site electrical capacity.	Existing infrastructure would be adequate to support construction requirements. During operations, power requirements would be 1.5% of available site electrical capacity.	By definition, there is no CNC at Y-12.	Existing infrastructure would be adequate to support operation requirements. During operations, power requirements would be 7.1% of available site electrical capacity.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Air Quality							
LANL	Current and planned activities would continue as required resulting in no additional impacts. The area encompassing LANL and Los Alamos County is classified as an attainment area for all six criteria pollutants. Simultaneous operation of LANL's air emission sources	Construction activities would create temporary increase in air quality impacts, but would not result in violations of the National Ambient Air Quality Standards (NAAQS). Operations would result in incremental increases less than 5% of baseline for most	Construction activities would create temporary increased in air quality impacts similar to CPC. For operations, CUC contribution to non-radiological emissions would not cause any standard or guideline to be exceeded.	Construction activities would create temporary increase in air quality impacts that could result in exceeding PM ₁₀ regulatory limits. Operations could have the potential to exceed the 24-hour standard for nitrogen	Operations would result in incremental increases less than 5% of baseline for most pollutants. The greatest increase would occur for total suspended particulates (TSP), which could increase by approximately 28%.	Operations could have the potential to exceed the 24-hour standard for nitrogen dioxide and the 24-hour standard for TSP.	The higher level of pit production would result in the annual emission of an additional 0.000019 curies per year of plutonium from the Plutonium Facility Complex.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	at maximum capacity, as described in the Title V permit application, would not exceed any state or Federal ambient air quality standards.	pollutants. The greatest increase would occur for total suspended particulates (TSP), which could increase by approximately 28%.		dioxide and the 24-hour standard for TSP.			
NTS	Current and planned activities would continue as required resulting in no additional impacts. No emission limits for any criteria air pollutants or HAPS have been exceeded. Measured concentration of non-radiological criteria pollutants are below regulatory requirements. The estimated annual dose to the public from radiological emissions from current and past NTS activities is well below the 10 millirem per year dose limit.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required resulting in no additional impacts. Pantex is in compliance with all National Ambient Air Quality standards.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Emissions from current and planned MOX/PDCF facilities would result in no additional impacts. SRS is in compliance with all National Ambient Air Quality standards.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for construction and operation. No NAAQS exceeded.	Negligible impacts to air quality for operations. No NAAQS exceeded.	Negligible impacts to air quality for operations. No NAAQS exceeded.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue, resulting in no additional impacts. Y-12 is designated non-attainment area for 8-hour ozone and is in compliance with all other National Ambient Air Quality standards.	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated using dust suppression), and the 8-hour	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated	Temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC plus UPF impact.	Potential to exceed PM-10 and ozone levels due to high background levels.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by CPC operations.	using dust suppression), and the 8-hour ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by UPF operations.	using dust suppression), and the 8-hour ozone concentration. The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by A/D/HE Center operations.			
Noise							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Construction activities and additional traffic would generate temporary increases in noise, but would not extend far beyond the boundaries of the construction site. Noise from operations similar to existing operations.	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	Same as No Action Alternative.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Construction activities and additional traffic would generate temporary increases in noise, but would not extend far beyond the boundaries of the construction site. Noise from operations similar to existing operations.	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required resulting in no additional impacts.	Construction activities and additional traffic would generate temporary increases in noise, but would not extend far beyond the boundaries of the construction site. Noise from operations similar to existing operations.	Same as CPC.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Same as CPC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Construction of the MOX/PDCF facilities and additional traffic supporting this construction would	Construction activities and additional traffic would generate temporary increases in noise, but would not extend	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	Planned activities would continue as required to support smaller stockpile

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	temporarily generate additional noise impacts. Construction noise not expected off-site.	far beyond the boundaries of the construction site. Noise from operations similar to existing operations.					requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue, with traffic as the primary contributor to noise to the surrounding population, and no additional impacts expected.	Construction activities and additional traffic would generate temporary increases in noise, but would not extend far beyond the boundaries of the construction site. Noise from operations similar to existing operations.	Same as CPC.	Same as CPC.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Same as CPC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Water Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Approximately 359 million gallons of groundwater are used at LANL. Discharges were in compliance with discharge permits.	For construction and operation of the Greenfield CPC, annual groundwater use would increase by approximately 22%. However, LANL water use would remain within water rights.	For construction and operation, the increase in groundwater consumption would be approximately 29%. LANL water use would remain within water rights.	For construction and operation, annual groundwater use would increase by approximately 36%. LANL water use would be within water rights.	Annual groundwater use would increase by approximately 52%. LANL groundwater use would exceed water rights by approximately 2 million gallons/year.	Annual groundwater use would increase by approximately 110%. LANL groundwater use would exceed water rights by approximately 212 million gallons/year.	Same a No Action Alternative.
NTS	Current and planned activities would continue with an expected demand for groundwater of 634 million gallons per year. The annual maximum production capacity of site potable supply wells is approximately 2.1 billion gallons per year while the sustainable site capacity is estimated to be approximately 1.36 billion gallons per year	For construction and operation, annual groundwater use would require approximately 7% of sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	For construction and operation, annual groundwater use would require less than 8% of sustainable water capacity. No impact on groundwater availability or quality is anticipated.	For construction and operation, annual groundwater use would require approximately 10% of sustainable water capacity. No impact on groundwater availability or quality is anticipated.	Operation of the CNC would use approximately 14.2% of the sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	Operation of the CNPC would use approximately 23.7% of the sustainable site water capacity. No impact on groundwater availability or quality is anticipated.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required with an expected demand for water of 130,000 million gallons per year. Pantex obtains its water from the City of Amarillo, which obtains water from the	For construction and operation, annual groundwater use would increase by 68% compared to existing use. No impact on groundwater availability or quality is anticipated from construction activities.	For construction and operation, annual groundwater use would increase by approximately 81% compared to existing use. No impact on groundwater availability or quality is anticipated from	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	CNPC operations would increase groundwater use by approximately 150% compared to existing use. CNPC would require total of approximately 315.5 million gallons/year. The Pantex wellfield has a	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	Ogallala aquifer.	Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CPC would be approximately 0.0003 percent of the estimated annual total depletion.	construction activities. Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CUC would be approximately 0.0004 percent of the estimated annual total depletion.			water capacity of approximately 422.7 million gallons/ year. Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CNPC would be less than 1 percent of the estimated annual total depletion.	
SRS	Current and planned activities would continue as required with an expected demand for water (groundwater and surface water) of 3.5 billion gallons/yr plus a small increase for the operation of the MOX/PDCF facilities.	For construction and operation, annual water use would increase by approximately 2% compared to existing use.	For construction and operation, annual water use by 3% compared to existing use.	For construction and operation, annual water use would increase by approximately 4% compared to existing use.	Operation of CNC would increase water use by approximately 5% compared to existing use.	Operation of CNPC would increase water use by 9% compared to existing use.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required with an expected demand for water of approximately 2,000 million gallons per year.	For construction and operation, annual water use would increase by approximately 4% compared to existing use.	For construction and operation, annual water use would increase by approximately 5% compared to existing use.	For construction and operation, annual water use would increase by approximately 6% compared to existing use.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Operation of CNPC would increase water use by approximately 20% compared to existing use.	Planned activities would continue as required to support smaller stockpile requirements.
Geology and Soils							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Under all approaches impacts would be minor. Appropriate mitigation measures would minimize soil erosion and impacts. All facilities would be designed and constructed in accordance with DOE Order 420.1.	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	Same a No Action Alternative.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Impacts would be minor. Appropriate mitigation measures would minimize soil erosion and impacts.	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required with no expected impacts on the Pullman and Randall soil series, or other geological and soil resources.	Impacts would be minor. Appropriate mitigation measures would minimize soil erosion and impacts.	Same as CPC.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Same as CPC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
SRS	Construction of the MOX/PDCF facilities would have minor impacts to the Coastal Plain sediments and other soil resources, but would be small and mitigated by erosion and runoff controls.	Impacts would be minor. Appropriate mitigation measures would minimize soil erosion and impacts.	Same as CPC.	Same as CPC.	Same as CPC.	Same as CPC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required with no expected impacts to soils in an area highly prone to erosion.	Impacts would be minor. There is a moderate seismic risk at Y-12, but this should not impact the construction and operation of the CPC and UPF. Appropriate mitigation measures would minimize soil erosion and impacts.	Same as CPC.	Same as CPC.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Same as CPC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Biological Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	TA-55 contains core and buffer areas of environmental interest for the Mexican Spotted Owl. Potential impacts would be within previously and substantially developed areas.	TA-55 contains core and buffer areas of environmental interest for the Mexican Spotted Owl. Potential impacts would be within previously and substantially developed areas.	Potential impacts at TA-16 would be within previously and substantially developed areas.	Potential impacts would be within previously and substantially developed areas.	Same as CNC.	Same a No Action Alternative.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	Same as CUC.	Reference location is in highly developed area, impacts would be minimal.	Same as CNC.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required resulting in no additional impacts.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC	Reference location is in highly developed area, impacts would be minimal.	Planned activities would continue as required to support smaller stockpile requirements

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.				Operation in next column.	resulting in no additional impacts.
SRS	Some animals and birds could be temporarily displaced by construction of the MAX/PDCF facilities, but this would be small due to the areas existing partial development.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.	Construction would not impact biological resources because new facilities would be sited on previously disturbed land.	Same as CUC.	Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biological diverse species mix.	Same as CNC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue as required resulting in no additional impacts.	Short-term impacts could occur during construction activities. Facilities would be sited on previously disturbed land. Operations would not impact biological resources because activities would be located in previously disturbed or heavily industrialized portions that do not contain habitat sufficient to support biologically diverse species mix.	Same as CPC.	Short-term impacts could occur during construction activities. Facilities would be sited on previously disturbed land.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Reference location is in highly developed and previously disturbed area, therefore there would be no impacts to biological resources.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Cultural and Paleontological Resources							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Under all approaches there is a potential for resources to be disturbed. The number resources impacted would increase as the number of acres disturbed increases.	Under all approaches there is a potential for resources to be disturbed. The number resources impacted would increase as the number of acres disturbed	Same as CUC.	No impacts are anticipated from operation activities.	Same as CNC.	Same a No Action Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
			increases.				
NTS	Current and planned activities would continue as required resulting in no additional impacts.	There is a low probability of impacts to cultural resources to occur.	There is a low probability of impacts to cultural resources to occur.	Same as CUC.	No impacts to cultural resources are anticipated from operation activities.	Same as CNC.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue with no expected impacts on the 69 identified archeological sites located on the Pantex site.	No cultural resources would be impacted. Probabilities for impacts at other areas on the site would depend on the locations since some area on the site can exhibit a higher density of cultural resources. There would be no impacts from operation activities.	No cultural resources would be impacted. Probabilities for impacts at other areas on the site would depend on the locations since some area on the site can exhibit a higher density of cultural resources.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	There would be no impacts from operation activities.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Construction of the MOX/PDCF facilities is not expected to impact any of the approximately 800 recorded archeological and culturally significant sites at SRS. Prior to any soil disturbance a registry search and on-site inspection would take place.	The reference location is located in an Archaeological Zone 2 (area with moderate archaeological potential) and close to a Zone 1 (high archaeological potential) area. Therefore there is a high probability that resources are located w/in the reference location and would be impacted by construction activities. There would be no additional impacts from operation activities.	The reference location is located in an Archaeological Zone 2 (area with moderate archaeological potential) and close to a Zone 1 (high archaeological potential) area. Therefore there is a high probability that resources are located w/in the reference location and would be impacted by construction activities.	Same as CUC.	There would be no impacts to cultural and archaeological resources from operation activities.	Same as CNC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue with no impacts to an area rich in historical and cultural resources and no identified Native American resources.	Construction of the CPC and UPF would be compatible and consistent with the current status of cultural resources and activities would take place in areas outside of the proposed historic district. There would be no impacts as a result of operational activities.	Same as CPC.	Construction of the CPC and UPF would be compatible and consistent with the current status of cultural resources and activities would take place in areas outside of the proposed historic district.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	There would be no impacts as a result of operational activities.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Socioeconomics							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Employment at LANL is expected to continue	<i>Greenfield CPC</i> : 850 workers during the peak year of construction. Total of 1,751 jobs. 1,780 operational workers, total of 3,667 jobs	1,300 workers during the peak year of construction. Total of 2,678 jobs. No appreciable changes to regional socioeconomic	3,820 jobs during peak year of construction. Total 7,869 jobs. No appreciable changes to regional socioeconomic	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	Employment at LANL is expected to continue to rise due to increased pit production.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	to rise due to both increased pit production and increased remediation and D&D activities. If LANL's employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011.	<i>Upgrade 125:</i> 300 workers during peak year of construction. Total of 618 jobs. 1,780 operational workers, total of 3,667 jobs. <i>50/80:</i> 190 workers during peak year of construction. Total of 391 jobs 680 operational workers, total of 1,401 jobs. Under all approaches there would be no appreciable changes to regional socioeconomic characteristics expected.	characteristics expected.	characteristics expected.		Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	
LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a loss of approximately 610 jobs representing a decrease of 4.5 % of the workforce. The total loss of jobs in the economic area would be 1,260.							
NTS	Current level of NTS employment is expected to continue. Current and planned activities would continue as required resulting in no additional impacts.	850 workers during the peak year of construction. Total of 1,751 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,678 jobs. 935 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	525 jobs during peak year of construction. Total 1,025 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Pantex is expected to continue present operations with an employment level of about 3,800 employees.	850 workers during the peak year of construction. Total of 1,579 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,414 jobs. 935 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	2,715 operational workers. Total of 5,319 jobs. No appreciable changes to regional socioeconomic characteristics expected. Y-12 could be closed, resulting in a loss of approximately 6,500 jobs.	Reduced operations would reduce the workforce from 1,644 to 1,230. This workforce, which currently represents approximately 1.6% of area employment, would fall to 1.2%. No major impact would occur.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
SRS	The current level of employment at SRS is about 15,000, which is expected to be increased by the construction of the MOX/PDCF facilities which would add an additional 1,968 construction workers and once operational an additional 1,120 employees.	850 workers during the peak year of construction. Total of 1,460 jobs. 1,780 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	1,300 workers during the peak year of construction. Total of 2,233 jobs. 935 operational workers.No appreciable changes to regional socioeconomic characteristics expected.	3,820 workers during the peak year of construction. Total of 6,561 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	2,715 operational workers. No appreciable changes to regional socioeconomic characteristics expected	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex and Y-12 could be closed, resulting in a loss of approximately 8,150 jobs.	Reduced operations would reduce the workforce by approximately 25 workers. This reduction would be inconsequential relative to the total site workforce.
Y-12	Y-12 is expected to continue present operations with an employment level of about 6,500 employees.	850 workers during the peak year of CPC construction. During operations, CPC would employ 1,780. No appreciable changes to regional socioeconomic characteristics expected.	Construction of UPF would require approximately 900 workers during the peak year of construction. During operations, UPF would employ 600. No appreciable changes to regional socioeconomic characteristics expected.	3,820 workers during the peak year of construction. Total of 19,864 jobs. 1,285 operational workers. No appreciable changes to regional socioeconomic characteristics expected.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	4,500 operational workers. No appreciable changes to regional socioeconomic characteristics expected. Pantex could be closed, resulting in a loss of approximately 1,650 jobs.	Reduced operations would reduce the workforce from 6,500 to 3,900 workers. The loss of 2,600 direct jobs could result in the loss of up to 10,920 indirect jobs for a total of 13,520 jobs lost. This would represent 6.5 percent of the total ROI employment.
Environmental Justice							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	Minority population: 57 percent within the census tracts containing LANL Low-Income population: 9.3 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CUC.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CNC.	Same a No Action Alternative.
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Minority population: 50 percent of ROI Low-Income population: 11 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CUC.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CNC.	NTS would be unaffected by the Capability Based Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		low-income populations.					
Pantex	Current and planned activities would continue resulting in no disproportionate impacts to the 21% minority population or the 44,312 individuals living near the Pantex Plant identified as living below the Federal poverty level.	Minority population: 33.1 percent of ROI Low-Income population: 13 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Current activities and the construction and operation of the MOX/PDCF facilities are not expected to disproportionately impact the minority groups or 109,296 identified as living below the Federal poverty threshold living near SRS.	Minority population: 40.1 percent of ROI Low-Income population: 9 percent of ROI Construction or operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CUC.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CNC.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Y-12	Current and planned activities would continue resulting in no disproportionate impacts to the 7 % minority population or the 122,216 individuals living near Y-12 identified as living below the Federal poverty level.	Minority population: 11.1 percent of ROI Low-Income population: 12 percent of ROI Construction and operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Same as CPC.	Construction activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Operation activities would not result in any disproportionately high or adverse effects on minority or low-income populations.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
Health and Safety							
LANL	Current and planned activities would continue as required resulting in no additional impacts. SRS operations expected to cause total dose to the offsite MEI of 1.7 mrem/yr. Worker dose from increased pit production at TA-55 would increase from 90 person-rem per year to 220	<i>Greenfield CPC:</i> Potential worker fatalities during construction: 0.6 <i>Upgrade:</i> 0.2 <i>50/80:</i> 0.1 <i>Greenfield CPC and Upgrade:</i> Collective dose to population during operations: 5.9×10^{-7} person-rem; 4×10^{-10} latent cancer fatalities (LCFs)	Potential worker fatalities during construction: 0.9. Collective dose to population during operations: 0.376 person-rem; 2.3×10^{-4} LCFs annually. MEI dose: 0.046 mrem; 2.8×10^{-8} LCFs annually.	Potential fatalities during construction: 2.6. Collective dose to population during operations: 0.003 person-rem; 1.8×10^{-6} LCFs annually. MEI dose: 3.52×10^{-4} mrem; 2.1×10^{-7} LCFs annually.	Collective dose to population during operations: 0.376 person-rem; 2.3×10^{-4} LCFs. MEI dose: 0.046 mrem; 2.8×10^{-5} LCFs annually. Worker dose: 344 person-rem; 0.21 LCFs annually.	Collective dose to population during operations: 0.379 person-rem; 2.3×10^{-4} LCFs. MEI dose: 0.046 mrem; 2.86×10^{-5} LCFs annually. Worker dose: 386 person-rem; 0.23 LCFs annually.	Collective dose to population during operations: 2.5×10^{-8} person-rem ; 1×10^{-11} LCFs. Worker dose from increased pit production at TA-55 would increase from 90 person-rem per year to 220

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	person-rem per year	<p>MEI dose: 3.6×10^{-9} mrem; 2.2×10^{-15} LCFs annually.</p> <p>Worker dose: 333 person-rem; 0.20 LCFs annually.</p> <p>50/80: Collective dose to population during operations: 2.5×10^{-8} person-rem; 1×10^{-11} LCFs</p> <p>MEI dose: 3.0×10^{-9} mrem; 1.8×10^{-15} LCFs annually</p> <p>Worker dose: 154 person-rem; 0.09 LCFs annually.</p>	<p>Worker dose: 11 person-rem; 0.006 LCFs annually.</p>	<p>A/D/HE Center worker dose: 42 person-rem; 0.24 LCFs annually.</p>			<p>person-rem per year.</p>
<p>LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential health impacts to LANL employees and the population surrounding LANL. Radiation doses to workers would be expected to decrease by approximately 220 person-rem. Plutonium emissions would decrease by approximately 0.00084 Curies.</p>							
NTS	<p>Current and planned activities would continue as required resulting in no additional impacts. NTS operations expected to produce MEI dose of approximately 0.2 mrem/yr.</p>	<p>Potential worker fatalities during construction: 0.7.</p> <p>Collective dose to population during operations: 2.7×10^{-8} person-rem; 2×10^{-11} LCFs.</p> <p>MEI dose: 1.6×10^{-9} mrem; 1×10^{-15} LCFs annually.</p> <p>Worker dose: 333 person-rem; 0.20 LCFs annually.</p>	<p>Potential worker fatalities during construction: 0.9.</p> <p>Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.80×10^{-6} LCFs.</p> <p>MEI dose: 4.06×10^{-3} mrem; 2.44×10^{-6} LCFs annually.</p> <p>Worker dose: 11 person-rem; 0.006 LCFs annually.</p>	<p>Potential worker fatalities during construction: 0.2.</p> <p>Collective dose to population during operations: 9.79×10^{-5} person-rem; 5.8×10^{-8} LCFs annually.</p> <p>MEI dose: 3.12×10^{-5} mrem; 1.8×10^{-8} LCFs annually</p> <p>Worker dose: 42 person-rem; 0.24 LCFs annually.</p>	<p>Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.8×10^{-6} LCFs.</p> <p>MEI dose: 4.06×10^{-3} mrem; 2.5×10^{-9} LCFs annually.</p> <p>Worker dose: 344 person-rem; 0.21 LCFs annually.</p>	<p>Collective dose to population during operations: 1.3×10^{-2} person-rem; 7.8×10^{-6} LCFs.</p> <p>MEI dose: 4.09×10^{-3} mrem; 2.5×10^{-9} LCFs annually.</p> <p>Worker dose: 386 person-rem; 0.23 LCFs annually.</p>	<p>NTS would be unaffected by the Capability Based Alternative.</p>
Pantex	<p>Current and planned activities would result in a dose to the MEI of 4.28×10^{-9} person-rem per year.</p>	<p>Potential worker fatalities during construction: 0.7.</p> <p>Collective dose to population during operations: 1.2×10^{-7} person-rem; 7.2×10^{-11}</p>	<p>Potential worker fatalities during construction: 0.9</p> <p>Collective dose to population during operations: 0.138 person-</p>	<p>No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.</p>	<p>Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.</p>	<p>Collective dose to population during operations: 0.138 person-rem; 8.3×10^{-5} LCFs;</p> <p>MEI dose: 0.019 mrem;</p>	<p>Reduced operations would reduce the number of workers involved in radiological operations from</p>

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		LCFs. MEI dose: 1.7×10^{-8} mrem; 1×10^{-14} LCFs annually. Worker dose: 333 person-rem; 0.20 LCFs annually.	rem; 8.3×10^{-5} LCFs. MEI dose: 0.019 mrem; 1.1×10^{-8} LCFs annually. Worker dose: 11 person-rem; 0.006 LCFs annually.			1.1×10^3 LCFs annually. Worker dose: 386 person-rem; 0.23 LCFs annually.	approximately 334 to 250. Total worker dose reduced from 44.1 person-rem to 33 person-rem. Statistically, LCFs would be reduced from 2.6×10^{-2} to 2.0×10^{-2} .
SRS	Current dose to the MEI from SRS operations is approximately 0.05 mrem/yr. Operation of the MOX/PDCF facilities is expected to add less than 1.8 person-rem to the 50 mile population surrounding SRS.	Potential worker fatalities during construction: 0.7. Collective dose to population during operations: 5.9×10^{-7} person-rem; 4×10^{-10} LCFs. MEI dose: 3.6×10^{-9} mrem; 2.2×10^{-12} LCFs annually Worker dose: 333 person-rem; 0.20 LCFs annually.	Potential worker fatalities during construction: 0.9. Collective dose to population during operations: 0.138 person-rem; 8.3×10^{-5} LCFs. MEI dose: 3.36×10^{-3} mrem; 2.02×10^{-6} LCFs annually. Worker dose: 11 person-rem; 0.006 LCFs annually.	Potential worker fatalities during construction: 2.6. Collective dose to population during operations: 3.19×10^{-3} person-rem; 1.9×10^{-6} LCFs. MEI dose: 2.52×10^{-5} mrem; 1.5×10^{-8} LCFs annually. Worker dose: 42 person-rem; 0.24 LCFs annually.	Collective dose to population during operations: 0.426 person-rem; 2.6×10^{-4} LCFs. MEI dose: 3.36×10^{-3} mrem; 2.02×10^{-6} LCFs annually. Worker dose: 344 person-rem; 0.21 LCFs annually.	Collective dose to population during operations: 0.429 person-rem; 2.6×10^{-4} LCFs . MEI dose: 3.39×10^{-3} mrem; 2.1×10^{-6} LCFs annually. Worker dose: 386 person-rem; 0.23 LCFs annually.	Reduced tritium operations would reduce the total tritium worker dose from 4.1 person-rem to 3.1 person-rem. Statistically, the number of LCFs would be reduced from 2.5×10^{-3} to 1.9×10^{-3} .
Y-12	Current and planned activities are expected to result in a dose to the MEI of about 0.4 mrem/yr.	Potential worker fatalities during construction of CPC: 0.6 Collective dose to population during CPC operations: 1.2×10^{-7} person-rem; 7.2×10^{-11} LCFs. MEI dose: 1.7×10^{-8} mrem; 1×10^{-11} LCFs annually. Worker dose: 333 person-rem; 0.20 LCFs annually.	Potential worker fatalities during construction of UPF: 0.7. Collective dose to population during UPF operations: 10.8 person-rem; 6.5×10^{-3} LCFs. MEI dose: 0.8 mrem; 4.8×10^{-4} LCFs annually. UPF worker dose: 12.6 person-rem; 0.008 LCFs annually.	Potential worker fatalities during construction: 0.2. Collective dose to population during A/D/HE Center operations: 0.032 person-rem; 1.9×10^{-5} LCFs. MEI dose: 3.75×10^{-3} mrem; 2.25×10^{-6} LCFs annually Worker dose: 42 person-rem; 0.24 LCFs annually.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Collective dose to population during operations: 10.8 person-rem ; 6.5×10^{-3} LCFs. MEI dose: 0.8 mrem; 4.8×10^{-4} LCFs annually. Worker dose: 386 person-rem; 0.23 LCFs annually.	Reduced operations would reduce the number of workers involved in radiological operation from approximately 839 to 500, reducing the total worker dose from 32. person-rem to 19.1 person-rem. Statistically, the number of LCFs would be reduced from 1.9×10^{-2} to 1.1×10^{-2} .

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives				CAPABILITY BASED ALTERNATIVE	
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation		CNPC Operation
Facility Accidents							
LANL	Current and planned activities would continue as required resulting in no additional impacts. Under all alternatives analyzed in the LANL SWEIS, the facility accident with the highest radiological risk to the offsite population would be a lightning strike fire at the Radioassay and Nondestructive Testing Facility located in TA-54. If this accident were to occur, there could be 6 additional LCFs in the offsite population.	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 26 LCFs in the offsite population could result from such an accident. Offsite maximally exposed individual (MEI) would receive a dose of 87.5 rem. Statistically, MEI would have 1 chance in 19 of LCF. When probabilities are taken into account, the accident with the highest risk is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately 9×10^{-4} , or approximately 1 in 1,000. For the population, the LCF risk would be 0.19, or approximately 1 in 5.	Accident with the highest consequences to the offsite population is the fire in the EU warehouse. Approximately 0.06 LCFs in the offsite population could result from such an accident. Offsite MEI individual would receive a maximum dose of 0.926 rem. Statistically, MEI would have 1 chance in 1,800 of LCF. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 6×10^{-7} , or less than one in a million. For the population, the LCF risk would be 7.2×10^{-5} , or approximately 1 in 10,000.	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 3 LCFs in the offsite population could result from such an accident. Offsite MEI would receive a dose of 73.8 rem. Statistically, this MEI would have 1 chance in 23 of an LCF. When probabilities are taken into account for this accident, the LCF risk to the MEI would be approximately 9×10^{-6} , or approximately 1 in 100,000. For the population, the LCF risk would be 3×10^{-4} , meaning that an LCF would statistically occur once every 3,000 years in the population.	See CPC and CUC.	See CPC and CUC and A/D/HE.	Same as No Action Alternative.
<p>LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential accident impacts to LANL employees and the population surrounding LANL.</p>							
NTS	Current and planned activities would continue as required resulting in no additional impacts. The maximum reasonably foreseeable accident at the NTS would be a non-nuclear explosion involving high explosives in a storage bunker, which has a probability of occurrence of 1 in 10,000,000. The following consequences are estimated if	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 0.5 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of approximately 2 rem. Statistically, the MEI would have a 0.001 chance of	Accident with the highest consequences to the offsite population is fire in the EU warehouse. Approximately 0.0008 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.0037 rem. Statistically, the LCF risk to the MEI would be approximately 2×10^{-6} , or	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 0.06 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 0.29	See CPC and CUC.	See CPC and CUC and A/D/HE.	NTS would be unaffected by the Capability Based Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	such an accident occurs: MEI dose of 34 rem, which would result in a 0.02 probability of an LCF; population dose of 5,800 to 110,000 person-rem, which would result in 3-55 LCFs.	developing a LCF (i.e., about 1 chance in 1,000 of an LCF). When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 6×10^{-6} , or approximately 1 in 150,000. For the population, the LCF risk would be approximately 2×10^{-3} , meaning that an LCF would statistically occur once every 400 years in the population.	about 1 in half a million. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 2×10^{-9} , or about 1 in half a billion. For the population, the LCF risk would be approximately 9×10^{-7} , or about 1 in a million.	rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF (i.e., about 1 chance in 57,000 of an LCF). When probabilities are taken into account for this accident, the LCF risk to the MEI would be approximately 2×10^{-8} , or less than 1 chance in a million. For the population, the LCF risk would be approximately 7×10^{-6} , or approximately once every 150,000 years.			
Pantex	Current and planned activities would continue as required resulting in no additional impacts. Potential accident scenarios and impacts for the No Action Alternative would be the same as presented in the A/D/HE facility column.	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 5.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 23.1 rem. Statistically, the MEI would have a 0.01 chance of developing a LCF (i.e., about 1 chance in 100 of an LCF). When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately 8×10^{-5} , or approximately one in 10,000. For the population, the LCF risk would be 3×10^{-2} , meaning that an LCF would statistically occur once every	Accident with the highest consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.02 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.07 rem. Statistically, this MEI would have a 0.00004 chance of developing a LCF, or about 1 in 25,000. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 3×10^{-8} , or approximately 1 in 33 million. For the population, the LCF risk would be 1×10^{-5} , or approximately 1	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 0.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 3.6 rem. Statistically, this MEI would have a 0.002 chance of developing a LCF (i.e., about 1 chance in 500 of an LCF). When probabilities are taken into account for this accident, the LCF risk to the MEI would be 2×10^{-7} , or approximately 1 in 5 million. For the population, the LCF risk would be approximately 9×10^{-5} , or approximately 1	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	See CPC and CUC and A/D/HE.	Planned activities would continue as required to support smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		31 years in the population.	in 100,000.	in 10,000. Note: the accidents described above are for the existing A/D/HE mission. No A/D/HE Center is proposed at Pantex because Pantex currently conducts this mission.			
SRS	Current and planned activities would continue as required resulting in no additional impacts. The bounding accident at SRS, which is associated with the plutonium disposition program, would cause an MEI dose of approximately 8.8 rem. The maximum population dose was 21,000 rem, which would equate to approximately 12.6 LCFs.	Accident with the highest consequences to the offsite population is the beyond evaluation basis earthquake and fire. Approximately 10.5 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of approximately 3 rem. Statistically, the MEI would have a 0.002 chance of developing a LCF, or about 1 in 500. When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 1×10^{-5} , or approximately 1 in 100,000. For the population, the LCF risk would be approximately 6×10^{-2} , meaning that an LCF would statistically occur once every 18 years in the population.	Accident with the highest consequences to the offsite population is the aircraft crash into the EU facilities. Approximately 0.03 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.01 rem. Statistically, this MEI would have a 7×10^{-6} chance of developing a LCF, or about 1 in 150,000. When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 4×10^{-9} , or approximately 1 in 250 million. For the population, the LCF risk would be 2×10^{-5} , or approximately 1 in 50,000.	Accident with the highest consequences to the offsite population is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 1.49 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 0.5 rem. Statistically, this MEI would have a 0.0003 chance of developing a LCF, or about 1 in 3,300. When probabilities are taken into account for this accident, the LCF risk to the MEI would be 3×10^{-8} , or approximately 1 in 33 million. For the population, the LCF risk would be 1×10^{-4} , or approximately 1 in 6,500.	See CPC and CUC	See CPC and CUC and A/D/HE	Planned activities would continue as required to support smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.
Y-12	Current and planned activities would continue as required resulting in no additional	Accident with the highest consequences to the offsite population is the beyond	Accident with the highest consequences to the offsite population is the aircraft	Accident with the highest consequences to the offsite population is the	Y-12 performs the CUC mission, therefore the impact of a CNC at this	See CPC and UPF and A/D/HE	Planned activities would continue as required to support

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	impacts. Potential accident scenarios and impacts for the No Action Alternative would be the same as presented in the UPF facility column.	<p>evaluation basis earthquake and fire. Approximately 177 LCFs in the offsite population could result from this accident. An offsite MEI would receive a dose of 219 rem. Statistically, the MEI would have a 0.1 chance of developing a LCF, or about 1 in 10.</p> <p>When probabilities are taken into account, the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 2×10^{-3}, or approximately 1 in 500. For the population, the LCF risk would be 1.07, meaning that approximately 1 LCF would statistically occur once every year in the population.</p>	<p>crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF, or about 1 in 5,000.</p> <p>When probabilities are taken into account, the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 5×10^{-7}, or about 1 in 2 million. For the population, the LCF risk would be 4×10^{-4}, or about 1 in 2,500.</p> <p>Note: the accidents described above are for the UPF. No CUC is proposed at Y-12 because Y-12 currently conducts this mission.</p>	<p>explosive driven plutonium and tritium dispersal from an internal event. Approximately 28.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 55 rem. Statistically, this MEI would have a 0.03 chance of developing a LCF, or about 1 in 30.</p> <p>When probabilities are taken into account for this accident, the LCF risk to the MEI would be 7×10^{-6}, or about 1 in 150,000. For the population, the LCF risk would be 3×10^{-3}, or about 1 in 350.</p>	<p>site is identical to the CPC impact.</p>	<p>smaller stockpile requirements. It is anticipated that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.</p>	
Transportation							
LANL	Current and planned activities would continue as required resulting in no additional impacts.	<p>Under all approaches increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.</p> <p>If NNSA Category I/II SNM</p>	<p>Increase in traffic during construction would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.</p>	Same as CUC.	<p>Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.</p>	Same as CNC.	Same as No Action Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
		missions are phased out, all Category I/II inventories of radioactive material would be transferred to other sites w/in the NNSA Complex.					
<p>LANL Plutonium Phaseout: If LANL is not selected as the site for the CPC or CNPC, NNSA proposes to phase-out NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in waste generated at LANL. LLW would decrease by approximately 11%, Mixed LLW would decrease by 14%; TRU would decrease by 80%.</p>							
NTS	Current and planned activities would continue as required resulting in no additional impacts.	Increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Increase in traffic during construction would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Same as CUC.	Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Same as CNC.	NTS would be unaffected by the Capability Based Alternative.
Pantex	Current and planned activities would continue as required resulting in no additional impacts.	Increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Increase in traffic during construction would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.	Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.	Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Planned activities would continue as required to support smaller stockpile requirements resulting in no additional impacts.
SRS	Increases to traffic during the construction and operation period of the MOX/PDCF facilities would occur. The impacts would be small in comparison to existing traffic and during th construction period could be eased with additional security guards detailed to SRS access points during th rush hours.	Increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels. Radiological transportation would include transport of pits from Pantex to SRS and recycle of EU parts to Y-12.	Increase in traffic during construction would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Same as CUC.	Radiological transportation would include the impacts associated with the CPC plus transport of EU parts to and from Pantex. There would also be a one-time transport of HEU from Y-12 to the CNC. Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic	Radiological transportation would include transport of TRU waste. There would be a one-time transport of SNM from Y-12 and Pantex to the CNPC. Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Reduction in employees would have an inconsequential impact on traffic. A reduction in tritium operations would reduce the transportation of tritium.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives				CAPABILITY BASED ALTERNATIVE	
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation		CNPC Operation
Y-12	Current and planned activities would continue as required resulting in no additional impacts.	Increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels. Radiological transportation for the CPC would include transport of pits from Pantex to Y-12, return of pits and EU parts to Pantex, and shipment of TRU waste to WIPP.	Radiological transportation for the UPF would include transport of EU parts to/from Pantex, and shipment of LLW to NTS.	Increase in traffic during construction and operation would occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Y-12 performs the CUC mission, therefore the impact of a CNC at this site is identical to the CPC impact.	Radiological transportation of impacts associated with CPC and UPF would not occur, with the exception of TRU waste transportation. There would be a one-time transport of SNM from Pantex to the CNPC. Increased traffic from the addition of new employees would also occur. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels.	Reduction in employees could cause a short-term decrease in road congestion. Reduction operation would reduce the transportation of secondaries and cases by approximately 50% compared to the No Action Alternative.
Waste Management							
LANL	<p>Current and planned activities would continue as required resulting in no additional impacts.</p> <p>Wastes in 2005 were as follows:</p> <p>LLW (yd³): 7,080 Mixed LLW (yd³): 90 TRU Waste(yd³): 100 Mixed TRU(yd³): 130 Hazardous (lbs.): 43,400</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all regulatory requirements.</p>	<p>Construction (Greenfield/Upgrade/50/80 Upgrade) TRU solid (yd³): 0/200/0 LLW solid (yd³): 0/200/0 Hazardous liquid (gal): 6.5/4/4</p> <p>Operation (Greenfield/Upgrade/50/80 Upgrade) TRU solid (yd³): 850/850/575 Mixed TRU(yd³):310/310/2.6 LLW solid (yd³): 3,500/3,500/1,850 LLW liq (yd³): 0/0/19.5 Non-hazardous solid (tons): 3.6/3.6/265 Non-hazardous liquid (gal): 69,500/69,500/16,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (yd³):3,515 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous solid (tons): 15 Hazardous liquid (gal): 0 Non-hazardous solid (yd³): 7,500 Non-hazardous liquid (gal): 50,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,900 Mixed TRU solid (yd³): 0 Hazardous (tons): 0 Non-hazardous solid (tons): 7,100 Non-hazardous liquid (gal): 40,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (yd³): 1,350 Hazardous waste liquid (gal): 8,850 Non-hazardous Solid Waste (yd³): 15,000 Non-hazardous Liquid</p>		<p>TRU solid (yd³): 850 LLW liquid (gal):8,925 LLW solid (yd³): 11,640 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd³): 72.3 Mixed TRU solid (yd³): 310 Hazardous solid (tons): 1,368.6 Hazardous liquid (gal): 8,850.5 Non-hazardous solid (tons): 29,900 Non-hazardous liquid (gal): 165,500</p>	Same a No Action Alternative.

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
				Waste (gal):46,000			
NTS	<p>Current and planned activities would continue as required resulting in no additional impacts.</p> <p>Wastes from 2001</p> <p>LLW (yd³): 0 Hazardous (tons): 4.86 Sanitary (tons): 4,550</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all regulatory requirements.</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous (tons): 7 Non-hazardous solid (yd³): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operation TRU solid (yd³): 950 LLW liquid (gal): 0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6 Non-hazardous solid (yd³): 8,100 Non-hazardous liquid (gal): 75,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (gal):3,515 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous liquid (tons): 15 Hazardous solid (tons): 0 Non-hazardous solid (yd³): 7,500 Non-hazardous liquid (gal): 50,000</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 9,000 Mixed TRU solid (yd³): 0 Hazardous (tons): 0 Non-hazardous solid (yd³): 6,400 Non-hazardous liquid (gal): 40,000</p> <p>Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd³): 12,000 Non-hazardous Liquid Waste (gal):46,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):3,515 LLW solid (yd³): 12,000 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 15,600 Non-hazardous liquid (tons): 125,000</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):8,925 LLW solid (yd³): 12,640 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19.9 Hazardous liquid (ton): 6.5 Non-hazardous solid (yd³): 27,600 Non-hazardous liquid (gal): 171,000</p>	<p>NTS would be unaffected by the Capability Based Alternative.</p>
Pantex	<p>The following existing levels of waste generation would be expected to continue:</p> <p>Wastes from 2005</p> <p>LLW (yd³): 96.8 Mixed LLW (yd³): 1.8 Hazardous (yd³): 711 Non-hazardous (yd³): 6,375 Sanitary (yd³): 944.9 TSCA (yd³): 2,036 Universal (yd³): 31</p> <p>Existing waste management facilities are sufficient to manage these levels and maintain compliance with all</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 0 Mixed TRU solid (yd³): 0 Hazardous waste (tons): 7 Non-hazardous solid (yd³): 10,900 Non-hazardous liquid (gal): 56,000</p> <p>Operation TRU solid (yd³): 950 LLW liquid (yd³): 0 LLW solid (yd³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd³): 2.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6</p>	<p>Construction TRU solid (yd³): 0 LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000</p> <p>Operation TRU solid (yd³): 0 LLW liquid (gal):3,615 LLW solid (yd³): 8,100 Mixed LLW liquid (gal): 3,620 Mixed LLW solid (yd³): 70 Mixed TRU solid (yd³): 0 Hazardous solid (tons): 15 Hazardous liquid (tons): 0</p>	<p>No A/D/HE Center is proposed at Pantex because the A/D/HE mission is part of the No Action Alternative.</p>	<p>Pantex performs the A/D/HE mission; therefore the impact of a CNC at this site is identical to the CNPC impact. See CNPC Operation in next column.</p>	<p>TRU solid (yd³): 950 LLW liquid (gal):3,615 LLW solid (yd³): 12,000 Mixed LLW liquid (gal): 3,620 Mixed LLW solid (yd³): 72.5 Mixed TRU solid (yd³): 340 Hazardous solid (tons): 19 Hazardous liquid (tons): 0.6 Nonhazardous solid (yd³): 15,600 Nonhazardous liquid (gal): 125,000</p>	<p>Current and planned activities would continue as required to support smaller stockpile requirements.</p> <p>LLW (yd³): 73 Mixed LLW (yd³): 1.4 Hazardous (yd³): 530 Non-hazardous (yd³): 4,800 No major impacts are expected.</p>

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	regulatory requirements.	Non-hazardous solid (tons): 8,100 Non-hazardous liquid (gal): 75,000	Non-hazardous solid (tons): 7,500 Non-hazardous liquid (yd ³): 50,000				
SRS	Existing levels of waste generation of: Wastes from 2001 TRU (yd ³): 64.1 LLW (yd ³): 4,610 Mixed TRU (yd ³): 380 Hazardous (yd ³): 45.3 Sanitary (yd ³): 1,560 And are expected to be increased by the construction of the MOX/PDCF facilities which are expected to add: TRU (yd ³): 500 LLW (yd ³): 270 Mixed (yd ³): 6.5 Existing waste management facilities are more than adequate to manage these wastes in compliance with all regulatory requirements.	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 0 Mixed TRU solid (yd ³): 0 Hazardous (tons): 7 Non-hazardous solid (yd ³): 10,900 Non-hazardous liquid (gal): 56,000 Operation TRU solid (yd ³): 950 LLW liquid (yd ³): 0 LLW solid (yd ³): 3,900 Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd ³): 2.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (tons): 0.6 Non-hazardous solid (yd ³): 8,100 Non-hazardous liquid (gal): 75,000	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 70 Mixed TRU solid (yd ³): 0 Hazardous (tons): 6 Non-hazardous solid (tons): 1,000 Operation TRU Solid Waste (yd ³): 0 Low Level Liquid Waste (gal): 3,515 Low Level Solid Waste (yd ³): 8,100 Mixed Low Level Liquid Waste (gal): 3,616 Mixed Low Level Solid Waste (yd ³): 70 Mixed TRU Solid Waste (yd ³): 0 Hazardous waste solid (tons): 15 Hazardous waste liquid (tons): 0 Non-Hazardous Solid Waste (yd ³): 7,500 Non-Hazardous Liquid Waste (gal) : 50,000	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 9,000 Mixed TRU solid (yd ³): 0 Hazardous (tons): 0 Non-hazardous solid (tons): 6,400 Non-hazardous liquid (gal): 40,000 Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste (yd ³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd ³): 12,000 Non-hazardous Liquid Waste (gal):46,000	TRU solid (yd ³): 950 LLW liquid (gal):3,515 LLW solid (yd ³): 12,000 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd ³): 72.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 19 Hazardous liquid (tons): 0.6 Nonhazardous solid (tons): 15,600 Nonhazardous liquid (gal): 125,000	TRU solid (yd ³): 950 LLW liquid (yd ³):8,925 LLW solid (yd ³): 12,040 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd ³): 72.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 19.9 Hazardous liquid (tons): 6.5 Nonhazardous solid (yd ³): 27,600 Nonhazardous liquid (gal): 171,000	Reduced tritium operations would reduce LLW by approximately 50%, from 620 yd ³ to approximately 310 yd ³ . No other waste streams would be affected.
Y-12	Wastes generated in 2003: LLW liquid (yd ³): 17.4 LLW solid (yd ³): 7,800 Mixed LLW liquid (yd ³): 17.9 Mixed LLW solid (yd ³): 21.1	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 0 Mixed TRU solid (yd ³): 0 Hazardous (tons): 7 Non-hazardous solid (tons): 10,900 Non-hazardous liquid (gal): 56,000 Operations TRU solid (yd ³): 950 LLW liquid (yd ³):0 LLW solid (yd ³): 3,900	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 70 Mixed LLW solid (yd ³): 4 Hazardous (tons): 4 Non-hazardous solid (yd ³): 800 Non-hazardous liquid (gal): 0 Operations TRU solid (yd ³): 0 LLW liquid (gal):3,515 LLW solid (yd ³): 7,800	Construction TRU solid (yd ³): 0 LLW solid (yd ³): 9,900 Mixed TRU solid (yd ³): 0 Hazardous (tons): 0 Non-hazardous solid (yd ³): 7,100 Non-hazardous liquid (gal): 45,000 Operation Low Level Liquid Waste (gal): 5,410 Low Level Solid Waste	TRU solid (yd ³): 950 LLW liquid (gal): 3,515 LLW solid (yd ³): 11,700 Mixed LLW liquid (gal): 3,616.4 Mixed LLW solid (yd ³): 72.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 19 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 15,600 Non-hazardous liquid	TRU solid (yd ³): 950 LLW liquid (gal): 8,925 LLW solid (yd ³): 11,740 Mixed LLW liquid (gal): 3,622.4 Mixed LLW solid (yd ³): 23.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 18.9 Hazardous liquid (tons): 6.5 Non-hazardous solid (yd ³):	LLW liquid (yd ³): 10.4 LLW solid (yd ³): 4,700 Mixed LLW liquid (yd ³): 10.7 Mixed LLW solid (yd ³): 12.7

Table 3.16-1 — Comparison of Environmental Impacts Among Programmatic Alternatives (continued)

SITE	NO ACTION ALTERNATIVE	Major New Restructured SNM Facilities in the DCE and CCE Alternatives					CAPABILITY BASED ALTERNATIVE
		CPC	CUC (or UPF at Y-12)	A/D/HE	CNC Operation	CNPC Operation	
	Existing waste management facilities are more than adequate to manage these wastes in compliance with all regulatory requirements	Mixed LLW liquid (gal): 0.4 Mixed LLW solid (yd ³): 2.5 Mixed TRU solid (yd ³): 340 Hazardous solid (tons): 4.0 Hazardous liquid (gal): 0.6 Non-hazardous solid (tons): 8,100 Non-hazardous liquid (gal): 75,000	Mixed LLW liquid (gal): 3,616 Mixed LLW solid (yd ³): 21 Mixed TRU solid (yd ³): 0 Hazardous solid (tons): 14 Hazardous liquid (gal): 0 Non-hazardous solid (tons): 7,125 Non-hazardous liquid (gal): 50,000	(yd ³): 40 Mixed Low Level Liquid Waste (gal): 6 Hazardous waste solid (tons): .90 Hazardous waste liquid (tons): 5.9 Non-hazardous Solid Waste (yd ³): 12,000 Non-hazardous Liquid Waste (gal): 46,000	(gal): 125,000	27,225 Non-hazardous liquid (gal): 171,000	

Table 3.16-2 — Summary of Impact Comparison of SNM Consolidation: Transfer SNM from LLNL

Resource	No Action Alternative	Remove Category I/II SNM from LLNL (Includes the impacts of phasing out Category I/II SNM operations from LLNL Superblock)
Land	No land issues	No land impacts or issues
Noise	No noise impacts	No change
Air Quality	No changes to air quality	<ul style="list-style-type: none"> • no emissions of radionuclides to air from Superblock; therefore, phasing out this facility would have no effect on radiological air quality • no non-radiological changes expected
Socioeconomic	No change	<ul style="list-style-type: none"> • if Superblock operated as Category III SNM facility: minor impacts to facility employment associated with security force reductions • if Superblock closed and undergoes D&D: employment would be expected to increase because of the D&D work, but would likely not be significant, and would be offset by the transfer of some personnel to LANL.
Transportation	No change. LLNL is authorized to transport approximately 584 shipments annually.	<ul style="list-style-type: none"> • less than 19 shipments of radiological material expected • population dose for all shipments: < 3 person-rem • LCF risk: <0.01
Human Health	There are no emissions of radionuclides from Superblock.	<ul style="list-style-type: none"> • phasing out Category I/II SNM operations from Superblock would have no effect on population doses to the surrounding population. • material-at-risk limit for Superblock reduced by 60%; • bounding accident source term for Superblock reduced by 60% • Superblock accident consequences reduced from 1.3 LCFs to 0.52
Waste Management	Small quantities of hazardous, and liquid and solid non-hazardous wastes	<ul style="list-style-type: none"> • if Superblock operated as Category III SNM facility: wastes would drop to 10% of current quantities (to 10 TRU waste drums per year and 40 LLW drums per year) • if Superblock closed and undergoes D&D: waste would increase in short-term; for bounding case, wastes could double to 200 TRU waste drums and 800 LLW drums for per year for several years

Table 3.16-3 — Summary of Impact Comparison of SNM Consolidation: Transfer SNM from Pantex Zone 4 to Zone 12

Resource	No Action Alternative	Move Pu Storage from Zone 4 to Newly Constructed Underground Pu Storage Facility in Zone 12 at Pantex
Land	No land issues	Would disturb 57 acres of brown-field land for construction; 11 acres utilized once operational
Noise	No noise impacts	Minor increase in noise during construction of new 456,000 sq. ft. underground storage facility
Water	Water use limited to personal consumption of employees	Would require an additional 2,950,000 gallons of water for five-year construction period
Air Quality	No impacts to air from SNM storage	Minor fugitive dust emissions during construction of new underground storage facility
Socioeconomics	Currently employs 40 workers	No change
Transportation	No impacts	No impacts, all transportation on-site
Human Health	Average dose of 12 mrem to 10 radiological workers	Movement of material would entail an additional total dose of 1,100 person-rem, which would statistically translate into approximately 0.657 LCFs
Waste Management	No waste generation	Once material moved D&D of old facility would be expected to generate <ul style="list-style-type: none"> • 12,000 yd³ of solid waste • 700 yd³ of LLW

Table 3.16-4 — Summary of Impact Comparison of Tritium R&D Alternatives

Resource	No Action	SRS Consolidation	LANL Consolidation	Downsize-in-Place
Land	Continue operations at LLNL, LANL, and SRS	No new land disturbed	No new land disturbed	No new land disturbed
Noise	Continue operations at LLNL, LANL, and SRS	No change	No change*	No change
Air Quality	Continue operations at LLNL, LANL, and SRS No change	<ul style="list-style-type: none"> • SRS tritium emissions increase by 1,000 Curies (2.4% increase over current tritium emissions) • LANL tritium emissions decrease by 1,000 Curies (42% decrease compared to current tritium emissions) • No change to non-radiological emissions 	No change*	No change
Socioeconomic	Continue operations at LLNL, LANL, and SRS No change	<ul style="list-style-type: none"> • 25 jobs restructured at LANL • 25 new jobs would be created at SRS 	No change*	No change
Human Health	Continue operations at LLNL, LANL, and SRS	<ul style="list-style-type: none"> • Average exposure to worker from tritium R&D would be approximately 4.3 mrem • Total worker dose: 0.11 person-rem • Worker LCF risk: 6.6×10^{-5} • MEI dose at SRS: increase by 0.0008 mrem/year; • 50-mile population dose: increase 0.041 person-rem. • LANL decreases would be similarly small 	No change*	No change
Waste Management	Continue operations at LLNL, LANL, and SRS	Wastes would change by less than 1%	No change*	No change

* Consolidation to LANL includes LLNL tritium R&D activities, which amount to one glovebox system.

Table 3.16-5 — Summary of Impact Comparison of HE R&D Alternatives

Resource	No Action	Consolidate HE R&D to LANL	Consolidate HE R&D to LLNL	Consolidate HE R&D to Pantex	Consolidate HE R&D to SNL/NM	Consolidate HE R&D to NTS
Donor Sites	Not Applicable	SNL/NM, LLNL, Pantex	SNL/NM, LANL, Pantex	SNL/NM, LLNL, LANL	Pantex, LLNL, LANL	SNL/NM, LLNL, Pantex, LANL
Land	Continue operations at LANL, LLNL, SNL/NM, Pantex	5 acres disturbed at LANL in vicinity of the Two-Mile Mesa Complex (includes portions of TA-6, TA-22, and TA-40)	8-10 acres disturbed on main LLNL site near the HEAF	5.7 acres disturbed in vicinity of Zone 11 and Zone 12	13.5 acres disturbed in Technical Areas 2 or 3	15 acres disturbed in vicinity of the BEEF
Noise	Continue operations at LANL, LLNL, SNL/NM, Pantex	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	None detectable outside of HEAF.	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted	“thunder-like” explosives testing; noise occasional, not continuous; public, and sensitive wildlife receptors unlikely to be adversely impacted
Air Quality	Continue operations at LANL, LLNL, SNL/NM, Pantex	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.	Short-term impacts from construction; Operation increases in pollutants would be less than 1% of site emissions. No radiological emissions.
Socioeconomic	Continue operations at LANL, LLNL, SNL/NM, Pantex	<ul style="list-style-type: none"> • 125 peak construction jobs; • LANL: +300 jobs • LLNL: -175 jobs • SNL/NM: -45 jobs • Pantex: none 	<ul style="list-style-type: none"> • 150 peak construction jobs; • LLNL: +300 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • Pantex: none 	<ul style="list-style-type: none"> • 210 peak construction jobs; • Pantex: +160 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • LLNL: -175 jobs 	<ul style="list-style-type: none"> • 220 peak construction jobs; • SNL/NM: +325 jobs • LANL: -150 jobs • LLNL: -175 jobs • Pantex: -10 jobs 	<ul style="list-style-type: none"> • 250-300 peak construction jobs; • NTS: +250 jobs • LLNL: -175 jobs • LANL: -150 jobs • SNL/NM: -45 jobs • Pantex: none

Table 3.16-5 — Summary of Impact Comparison of HE R&D Alternatives (continued)

Resource	No Action	Consolidate HE R&D to LANL	Consolidate HE R&D to LLNL	Consolidate HE R&D to Pantex	Consolidate HE R&D to SNL/NM	Consolidate HE R&D to NTS
Human Health	Continue operations at LANL, LLNL, SNL/NM, Pantex	No change				
Waste Management	Continue operations at LANL, LLNL, SNL/NM, Pantex	Construction solid waste: 4,930 cubic yards. Operational wastes minimal.	Construction solid waste: 6,200 cubic yards. Operational wastes minimal.	Construction solid waste: 1,550 cubic yards. Operational wastes minimal.	Construction solid waste: 7,440 cubic yards. Operational wastes minimal.	Construction solid waste: 4,650 cubic yards. Operational wastes minimal.

Table 3.16-6 — Summary of Impact Comparison of Flight Testing Alternatives

Resource	No Action Alternative	Mobile Upgrade Alternative	Campaign Mode at TTR Alternative	Move to NTS Alternative	Move to WSMR Alternative
Impacts to Land	No land issues	No land impacts or issues	Same as No Action	Disturb less than 2 acres at NTS Free up 179,200 acres at Tonopah	Disturb less than 2 acres as WSMR Free up 179,200 acres at Tonopah
Noise Impacts	No noise impacts to public	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Impact on Air Quality	No impacts to air	Same as No Action	Same as No Action	Temporary PM-10 emissions during Construction	Temporary PM-10 emissions during Construction
Socioeconomic Impacts	Currently employs 135 at Tonopah	No impact to jobs	Loss of 92 jobs at Tonopah	Loss of 135 at Tonopah and gain of 135 at NTS	Loss of 135 at Tonopah and gain of 135 at WSMR
Human Health Impacts	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)	No radiological emissions (note 1)
Waste Management Impacts	Small quantities of hazardous and liquid and solid non-hazardous	Same as No Action	Same as No Action	Same as No Action	Same as No Action

Note 1: Some Flight Test operations utilize depleted uranium in the Join Test Assembly. There is no explosive event and the depleted uranium is contained within the weapon case. Following each flight test, the depleted uranium is removed.

Table 3.16-7 — Summary of Impact Comparison of Hydrodynamic Testing Alternatives

Resource	No Action Alternative	Downsize in Place Alternative	Consolidate at LANL Alternative	Consolidate at NTS Alternative
Impacts to Land	No land issues	Would not require additional land	Require 5-7 acres additional land	Require 17 acres additional land
Noise Impacts	Limited to workers at facilities	Limited to workers at closure and facility sites	Limited to workers at closure construction and work sites	Limited to workers at closure construction and work sites
Impact on Air Quality	Less than 100 pounds of NOX and CO emissions/year from DARHT & CFF	Same as No Action	Construction PM-10 Emissions	Construction PM-10 Emissions
Socioeconomic Impacts	None as facilities do not employ but are used and managed by other programs	Closure employment of 313 man years	Closure employment of 508 man-years Construction employment of 60 man-years	Closure employment of 508 man-years Construction employment of 175 man-years
Human Health Impacts	No human health issues	No impacts	No impacts	No impacts
Waste Management Impacts	Small quantities of hazardous waste generated by DARHT and CFF	Additional waste from facility closures	Additional waste from facility closures	Additional waste from facility closures

Table 3.16-8 — Summary of Impact Comparison of Major Environmental Test Facilities Alternatives

Resource	No Action Alternative	Consolidate in Place Alternative	Move All ETF to NTS	Move all ETF to SNL/NM
Impacts to Land	Currently has 500,708 sq ft of floor space at four sites	Reduce building floor space by 62,777 sq ft	Reduce building floor space by 546,385 sq ft but require 23.5 acres of land at NTS	Reduce building floor space by 159,268 sq ft but require 2.5 acres of land at SNL/NM
Noise Impacts	Limited to workers at work sites	Limited to workers at closure and work sites	Limited to workers at closure construction and work sites	Limited to workers at closure construction and work sites
Transportation	No transportation issues	No transportation issues	Closure D&D could cause traffic congest at LANL and Sandia	Closure D&D could cause traffic congestion at LANL
Impact on Air Quality	Small emissions from Bldg 836 at LLNL	Same as no action alternative	PM-10 issues during Construction	PM-10 issues during Construction
Socioeconomic Impacts	Currently employs 29 at LANL 6 at LLNL 224 at SNL/NM	Jobs Lost: 6 at LLNL 16 at SNL/NM	Jobs Lost: 29 at LANL 6 at LLNL 224 at SNL/NM	Jobs Lost: 29 at LANL 6 at LLNL 16 at SNL/NM
Human Health Impacts	No human health issues	Same as no action alternative	Same as no action alternative	Same as no action alternative
Waste Management Impacts	Small waste generation from DAF and SNL/NM	Additional waste from facility closures	Additional waste from facility closures	Additional waste from facility closures

Chapter 4
AFFECTED ENVIRONMENT

Chapter 4

AFFECTED ENVIRONMENT

In Chapter 4, the affected environment descriptions provide the context for understanding the environmental impacts described in Chapter 5. They serve as a baseline – or description of current environmental conditions - from which any environmental changes brought by implementing the alternatives can be evaluated. The affected environment at Los Alamos National Laboratory (LANL), Nevada Test Site (NTS), Pantex Plant (Pantex), Savannah River Site (SRS), Y-12 National Security Complex (Y-12), Sandia National Laboratories/New Mexico (SNL/NM), Lawrence Livermore National Laboratory (LLNL), (including SNL/California), Tonopah Test Range (TTR), and the White Sands Missile Range (WSMR) are described for the following impact areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, radiation and hazardous chemical environment, transportation, and waste management.

4.0 INTRODUCTION

In accordance with the Council on Environmental Quality (CEQ) *National Environmental Policy Act* (NEPA) regulations (40 *Code of Federal Regulations* [CFR] 1500-1508) for preparing an environmental impact statement (EIS), the affected environment is “interpreted comprehensively to include the natural and physical environment and the relationship of people with the environment.”

The candidate sites for the various Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) alternatives are LANL, NTS, Pantex, SRS, Y-12, SNL/NM, SNL/CA, LLNL, TTR, and the WSMR. The level of detail presented for the affected environment varies depending on the potential for impacts on a particular resource as result of implementation of the various Complex Transformation SPEIS alternatives.

Recent environmental documents (e.g., site environmental reports) and relevant laws and regulations were used in describing the existing environment at each of the candidate sites. These documents are cited as appropriate. A listing of the information and references used to develop this chapter and the SPEIS is included in Chapter 12, References.

4.1 LOS ALAMOS NATIONAL LABORATORY

The LANL was established as a nuclear weapons design laboratory in 1943 and was formerly known as the Los Alamos Scientific Laboratory. Its facilities are located on approximately 25,600 acres in north-central New Mexico. It is 60 miles north-northeast of Albuquerque, 25 miles northwest of Santa Fe, and 20 miles southwest of Española in Los Alamos and Santa Fe Counties. The location of the facility is shown in Figure 4.1-1.

LANL’s principal NNSA missions are to conduct research and development of nuclear weapons; design and test advanced technology concepts; design weapons; provide safety and reliability

assessments of the stockpile; maintain interim production capabilities for limited quantities of plutonium components (e.g., pits); and manufacture nuclear weapon detonators for the stockpile. LANL maintains Category I/II quantities of special nuclear materials (SNM) associated with the nuclear weapons program and material no longer needed by the weapons program.

4.1.1 Land Resources

4.1.1.1 *Onsite Land Uses*

LANL is divided into technical areas (TAs) that are used for building sites, experimental areas, support facilities, roads, and utility rights-of-way (see Figure 4.1.1-1). However, these uses account for only a small part of the total land area; much of the LANL land provides buffer areas for security and safety or is held in reserve for future use. LANL has approximately 2,000 structures with approximately 8.6 million square feet under roof, spread over an area of approximately 25,600 acres. Approximately 826 acres of land are available for development or redevelopment (LANL 2006a).

As shown in Figure 4.1.1-1, the facilities identified as “Key” are those that house activities critical to meeting work assignments assigned to LANL (LANL 2006a). The remaining facilities at LANL are identified as “Non-Key” Facilities and comprise all or the majority of 30 of LANL’s 48 TAs and approximately 14,224 acres. Non-Key Facilities include the Nonproliferation and International Security Center and the TA-46 sewage treatment facility (LANL 2006a).

Although developed areas play a vital role at LANL, they make up only a small part of the site. Most of the site is undeveloped to provide security, safety, and expansion possibilities for future mission-support requirements. There are no agricultural activities present at LANL, nor are there any prime farmlands in the vicinity. In 1977, DOE designated LANL as a National Environmental Research Park; and, in 1999, the White Rock Canyon Reserve was dedicated. The Reserve is about 1,000 acres in size and is located on the southeast perimeter of LANL. It is managed jointly by DOE and the National Park Service for its significant ecological and cultural resources and research potential (DOE 2003f). LANL is separated into the following internal land use categories: service and support, experimental science, high explosives research and development, high explosives testing, nuclear materials research and development, physical and technical support, public and corporate interface, reserve, theoretical and computational science, and waste management (see Figure 4.1.1-2) (LANL 2003g). The 10 land use categories and activities at LANL are defined below (LANL 2006a).

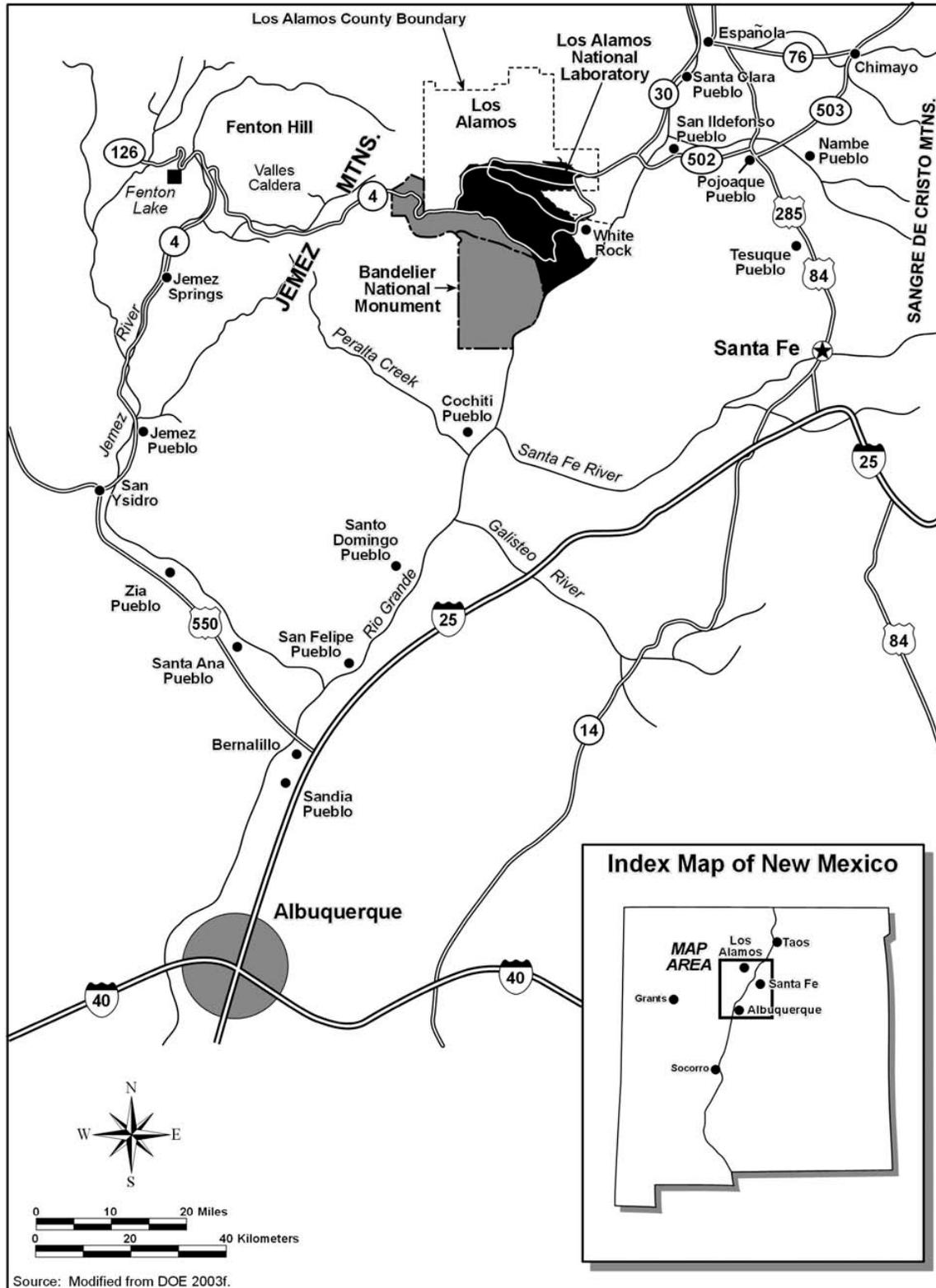
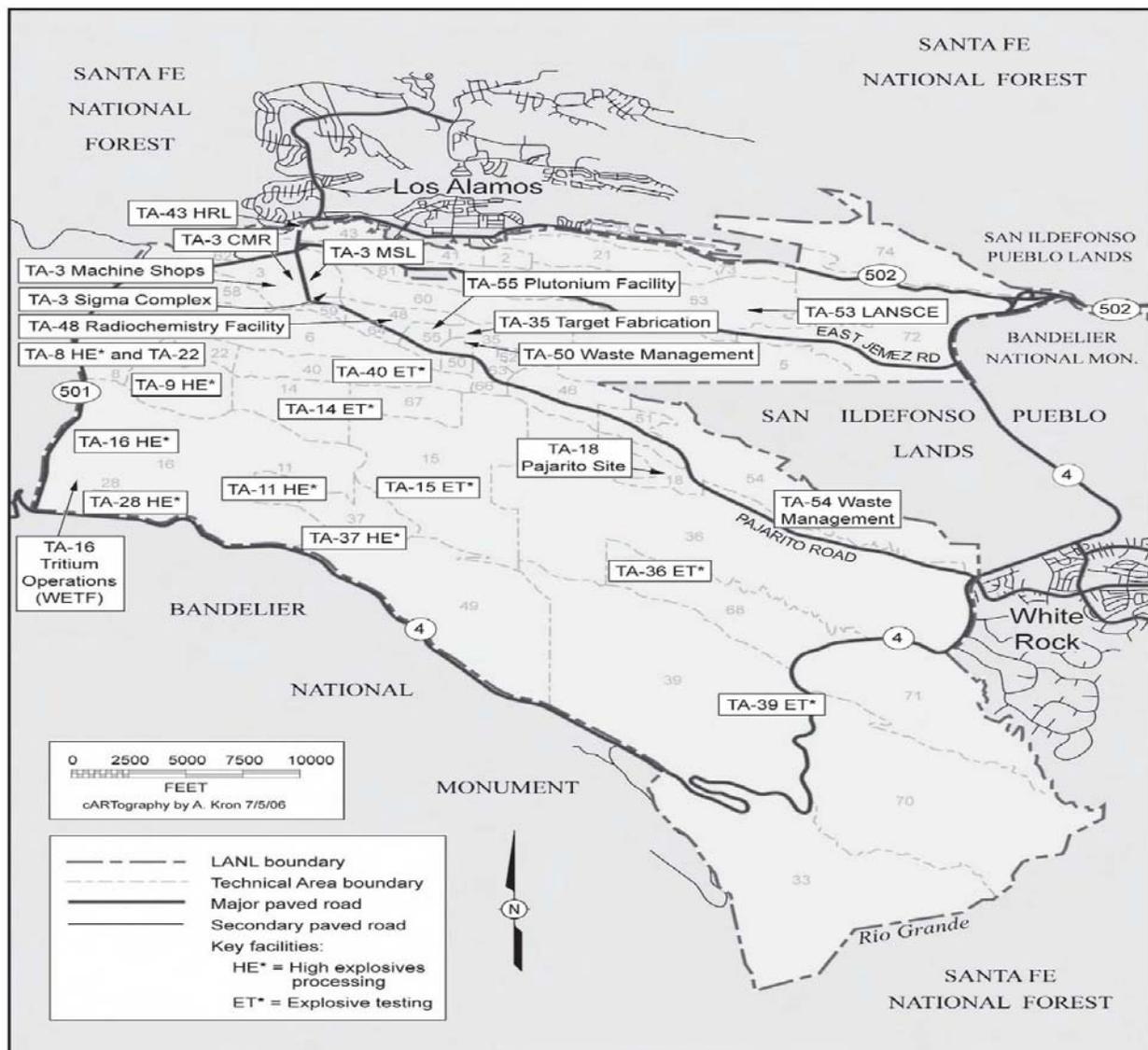


Figure 4.1-1 — Location of LANL



Source: LANL 2006a.

Figure 4.1.1-1 — TAs and Key Facilities at LANL

- *Administration, Service, and Support*—Administrative functions, nonprogrammatic technical expertise, support, and services for LANL management and employees.
- *Experimental Science*—Applied research and development activities tied to major programs.
- *High-Explosives Research and Development*—Research and development of new explosive materials. This land is isolated for security and safety.
- *High-Explosives Testing*—Large, isolated, exclusive-use areas required to maintain safety and environmental compliance during testing of newly developed explosive materials and new uses for existing materials. This land also includes exclusion and buffer areas.
- *Nuclear Materials Research and Development*—Isolated, secured areas for conducting research and development involving nuclear materials. This land use includes security and radiation hazard buffer zones. It does not include waste disposal sites.

- *Physical and Technical Support*—Includes roads, parking lots, and associated maintenance facilities; infrastructure such as communications and utilities; facility maintenance shops; and maintenance equipment storage. This land use is generally free from chemical, radiological, or explosives hazards.
- *Public and Corporate Interface*—Provides link with the general public and other outside entities conducting business at LANL, including technology transfer activities.
- *Reserve*—Areas that are not otherwise included in one of the previous categories. It may include environmental core and buffer areas, vacant land, and proposed land transfer areas.
- *Theoretical and Computational Science*—Interdisciplinary activities involving mathematical and computational research and related support activities.
- *Waste Management*—Provides for activities related to the handling, treatment, and disposal of all generated waste products, including solid, liquid, and hazardous materials (chemical, radiological, and explosive).

4.1.1.2 *Surrounding Land Uses*

LANL is located in Los Alamos County approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (LANL 2006b). The land surrounding LANL is largely undeveloped, and large tracts of land north, west, and south of the LANL site are held by the Santa Fe National Forest, the U.S. Bureau of Land Management (BLM), the Bandelier National Monument, private land owners, State of New Mexico, and the Los Alamos County. Pueblo de San Ildefonso borders the LANL to the east (LANL 2006a). The closest residential town from LANL is White Rock which is approximately a mile away. Residents of San Ildefonso are approximately 2.75 miles northeast of LANL.

Most developments within Los Alamos County are confined to mesa tops. The U.S. Forest Service (USFS) is responsible for the Santa Fe National Forest, which encompasses 1,567,181 acres in the Sangre De Cristo Mountains to the east and Jemez Mountains to the west of LANL.

Los Alamos County consists of approximately 69,860 acres, most of which is federally owned. Approximately 8,751 acres, including land that has been conveyed from DOE, are under county jurisdiction (LANL 2006a).

The lands of the Pueblo of San Ildefonso are located immediately east of LANL. The Pueblo own or has use of 30,241 acres of land, including approximately 2,106 acres recently transferred from DOE. Land use of the Pueblo is a mixture of residential use, gardening and farming, cattle grazing, hunting, fishing, food and medicinal plant gathering, and firewood production, along with general cultural and resource preservation (LANL 2006a).

The National Park Service (NPS) is responsible for the Bandelier National Monument. The area consists of two units, the Main Unit (32,937 acres), located immediately south of LANL, and the Tsankawi Unit (790 acres) located to the northeast of LANL. The Tsankawi Unit is undeveloped, and only a small portion of the Main Unit has been developed for visitors (approximately 70 percent has been designated as a Wilderness Area) (LANL 2006a).

The Santa Fe National Forest is managed for multiple-use activities, such as logging, cattle grazing, and recreation. The Dome Wilderness Area is located within the National Forest near Bandelier National Monument and provides habitat for a number of Federal and state protected species (LANL 2006a).

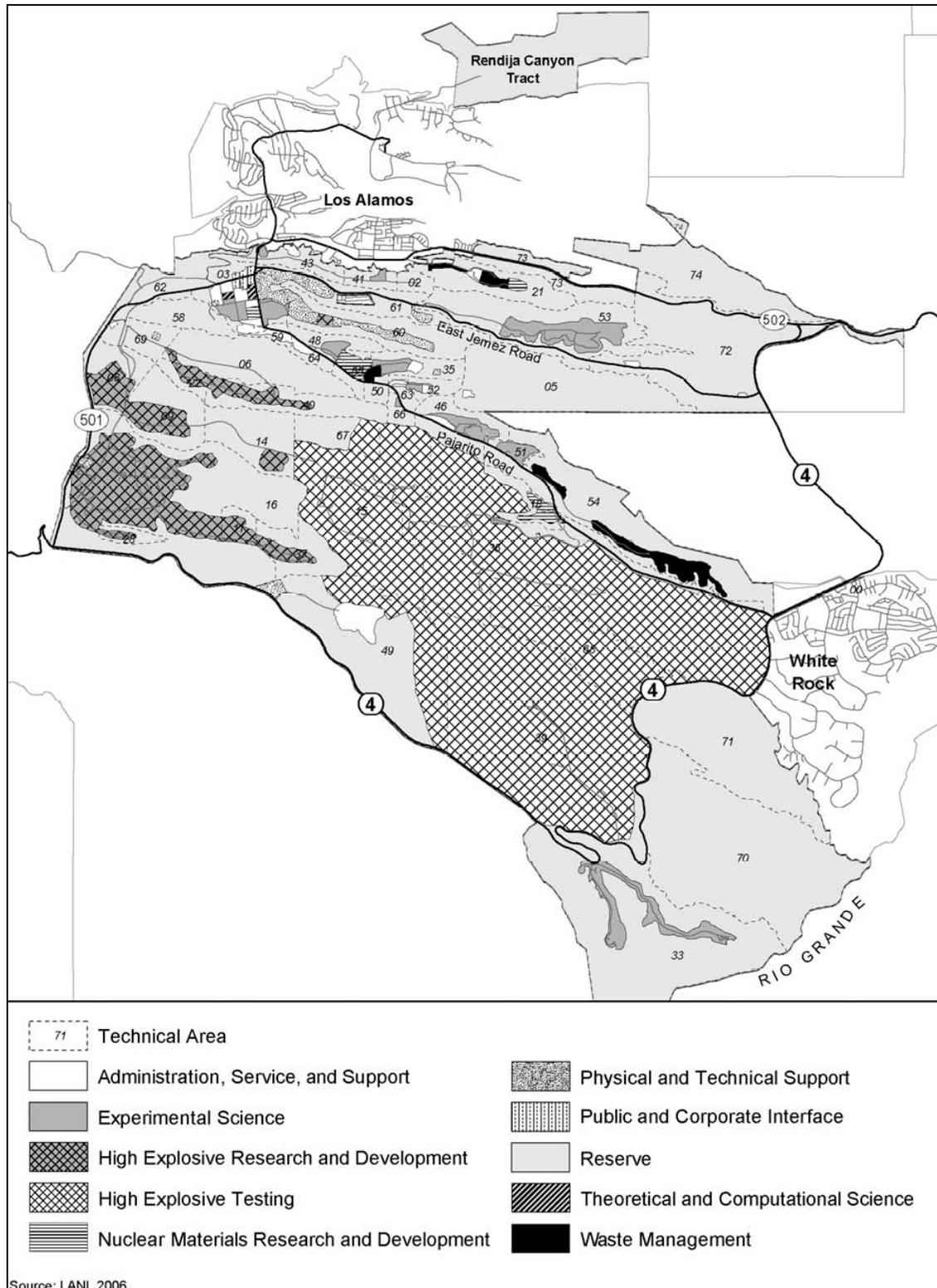


Figure 4.1.1-2 — Generalized Land Use at LANL

4.1.2 Visual Resources

LANL and the surrounding region are characterized by forested areas with mountains, canyons, and valleys, as well as diverse cultures and ecosystems. The area is dominated by the Jemez Mountains to the west and the Sangre de Cristo Mountains to the east. These two mountain ranges are divided north to south by the Rio Grande. LANL is located on the Pajarito Plateau, which is cut by steeply-sloped and deeply-eroded canyons that have formed isolated finger-like mesas running west to east. Mesa tops at LANL range in elevation from approximately 7,800 feet on the west to about 6,200 feet on the east (LANL 2006a).

The topography of northern New Mexico is rugged, especially in the vicinity of LANL. Mesa tops are cut by deep canyons, creating sharp angles in the land form. Often, little vegetation grows on these steep slopes, exposing the geology, with contrasting horizontal planes varying from fairly bright reddish orange to almost white in color. A variety of vegetation occurs in the region, the density and height of which may change over time and can affect the visibility of an area within the LANL viewshed. Generally, portions of LANL located along mesa tops at lower elevations toward the eastern site boundary are covered with grasslands, mixed shrubs, or short trees, with sparsely distributed taller trees, allowing greater visibility from within the viewshed. In contrast, portions of LANL located at upper elevations toward the western boundary are more densely covered by tall mixed conifer forests that reduce the visibility of these areas (LANL 2006a).

Undeveloped lands within LANL have a BLM Visual Resource Contrast rating of Classes II and III, which are described in Table 4.1.2-1. Changes to the landscape within these classes may be seen but should not dominate the view.

Table 4.1.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low and must not attract attention.
Class II	To retain the existing character of the landscape, the level of change to the characteristic landscape should be low.
Class III	To partially retain the existing character of the landscape, the level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape, the level of change to the characteristic landscape can be high.

Source: BLM 1980.

As viewed from a distance at lower elevations, LANL is primarily distinguishable among the trees in the daytime by views of its water storage towers, emission stacks, the domes at TA-54, and occasional glimpses of older buildings. The new National Security Sciences Building is eight stories in height and is highly visible. The Los Alamos townsite appears mostly residential in character, with the water storage towers being visible against the forested backdrop of the Jemez Mountains. At elevations above LANL, along the upper reaches of the Pajarito Plateau rim, the view of LANL is primarily of scattered buildings among heavily forested areas and the

multi-storied buildings within TA-3. Similarly, the residential character of the Los Alamos townsite is predominately visible from higher elevation viewpoints (LANL 2006a, LANL 2004f).

At night, the lights of LANL, the Los Alamos townsite, and White Rock are directly visible from various locations across the viewshed as far away as the towns of Española and Santa Fe. Because there is little nighttime activity at LANL, there are relatively few security light sources compared to the nearby communities; thus, at a distance, the distinction between LANL and the two communities is lost to the casual observer (LANL 2006a).

An important viewpoint of LANL is the Bandelier National Monument. Views from the Main Unit are generally of natural landscapes, although, there are instances where LANL structures are visible. LANL structures are also visible from the Tsankawi Unit (LANL 2006a).

The Cerro Grande Fire of 2000 altered views of LANL from various locations in Los Alamos County. While many LANL facilities are still generally screened from view, some developed areas that were previously screened by vegetation are now more visible to passing traffic (LANL 2006a).

Following September 11, 2001, a number of changes that limited or redirected public access to facilities at LANL were initiated resulting in fewer opportunities for the public to view LANL facilities (LANL 2006a).

4.1.3 Site Infrastructure

Site infrastructure includes the physical resources required to support the construction and operation of LANL facilities. Utility infrastructure at LANL encompasses the electrical power, natural gas, and, water supply systems. These systems are described in Table 4.1.3-1.

Table 4.1.3- 1 —LANL Site Infrastructure

Characteristics	Current Value
Land Use	
Area (acres)	25,600
Roads (miles)	80 ^a
Electricity^b	
Energy (MWh/yr) ^c	1,138,800
Peak load (MWe) ^d	130
Fuel^e	
Natural Gas (million yd ³)	44
Water	
Usage (million gal/year)	359

^a Includes paved roads and paved parking areas only.

^b Usage and capacity values are for the entire Los Alamos Power Pool.

^c Energy – energy use during normal operations

^d Peak load - Maximum demand of electricity

^e Contractually-limited capacity for the natural gas delivery system servicing the Los Alamos area.

Source: LANL 2006a.

4.1.3.1 *Ground Transportation*

Motor vehicles are the primary means of transportation to LANL. The nearest commercial bus terminal is located in Santa Fe, New Mexico, about 25 miles. The nearest commercial rail connection is at Lamy, New Mexico, 52 miles southeast of LANL. There is a spur into central Santa Fe used by the Santa Fe Southern Railway. However, LANL does not currently use rail for commercial transport (LANL 2006a).

Park-and-ride services are provided by a commercial corporation in conjunction with the New Mexico State Highway and Transportation Department. Over 80 daily departures between Santa Fe and Española; Santa Fe and Los Alamos; Española and Los Alamos; and Albuquerque, Santa Fe, and Los Alamos are provided for commuters. Monthly passes are available for unlimited use of most park-and-ride services (LANL 2006a).

Hazardous, radioactive, industrial, commercial, and recyclable materials, including wastes, are routinely transported to, from, and on the LANL site. Hazardous materials include commercial chemical products that are nonradioactive and are regulated and controlled based on whether they are listed materials, or if they exhibit the hazardous characteristics of ignitability, toxicity, corrosivity, or reactivity. Radioactive materials include special nuclear material (plutonium, enriched uranium), medical radioisotopes, and other miscellaneous radioactive materials. Offsite transport, both to and from LANL, is performed by commercial carriers and by DOE safe secure transport trailers (LANL 2006a).

The primary route designated by the State of New Mexico to be used for radioactive and other hazardous material transport to and from LANL is the 40-mile corridor between LANL and Interstate 25 at Santa Fe. This route passes through the Pueblos of San Ildefonso, Pojoaque, Nambe, and Tesuque, and is adjacent to the northern segment of Bandelier National Monument. This primary transportation route bypasses the city of Santa Fe on NM 599 to Interstate 25 (LANL 2006a).

Numerous regulations and requirements govern the transportation of hazardous and radioactive materials, including those of the U.S. Department of Transportation, U.S. Nuclear Regulatory Commission, DOE, and LANL. Additional transportation information is presented in 4.5.3.12 (LANL 2006a).

4.1.3.2 *Electricity*

Electrical service to LANL is supplied through a cooperative arrangement with Los Alamos County, known as the Los Alamos Power Pool, which was established in 1985. Electric power is supplied to the pool through two existing regional 115-kilovolt electric power lines. The first line (the Norton-Los Alamos line) is administered by DOE and originates from the Norton Substation east of White Rock, and the second line (the Reeves Line) is owned by the Public Service Company of New Mexico and originates from the Bernalillo-Algodones Substation south of LANL. Both substations are owned by the Public Service Company of New Mexico (LANL 2006a).

Import capacity is now limited only by the physical capability (thermal rating) of the transmission lines based on transmission agreements made in 2002 with the Public Service Company of New Mexico. The import capacity is about 110 to 120 megawatts from a number of hydroelectric, coal, and natural gas-powered generators throughout the western United States (LANL 2006a).

Within LANL, DOE also operates a natural gas-fired steam and electrical power generation plant at the TA-3 Co-Generation Complex, which can produce as much as 20 megawatts of electric power that is shared by the Power Pool under contractual arrangement. Generally, onsite electricity production is used to fill the difference between peak loads and the electric power import capability. The DOE-maintained electric distribution system at LANL consists of various low-voltage transformers at LANL facilities and about 34 miles of 13.8-kilovolt distribution lines. It also consists of two older power distribution substations: the Eastern TA Substation and the TA-3 Substation. Construction of the new Western TA Substation was completed in 2002. This 115-kilovolt (13.8-kilovolt distribution) substation has a main transformer rated at 56-megavolt-amperes or about 45 megawatts. The substation provides redundant capacity for LANL and the Los Alamos Townsite in the event of an outage at either of the two existing LANL substations (LANL 2006a).

To address the potential for an electrical brownout or blackout, plans have been proposed to construct new transmission line segments, one from the Norton Substation to the Southern TA Substation, a new substation under construction near White Rock, and from the new Southern TA Substation to the Western TA Substation as well. The first segment would be constructed at 345 kilovolts but operated in the short term at 115 kilovolts, as large pulse power loads at LANL would need the higher voltage in the future. The second segment would be constructed and operated at 115 kilovolts. Construction of the portion of the new transmission line from the Southern TA Substation to the Western TA Substation is now complete. The construction of the portion of the line from the Norton Substation to the Southern TA Substation is under negotiation. Other electrical system upgrades at the site are planned or already underway (LANL 2006a).

4.1.3.3 *Fuel*

Natural gas is the primary heating fuel used at LANL. Natural gas is delivered to the site by a high-pressure main and distribution system with pressure-reduction stations at LANL buildings. The main gas supply line and associated meter stations are owned by the Public Service Company of New Mexico (LANL 2006a).

About 98 percent of the gas consumed at LANL is used to heat air and generate steam. The TA-3 Co-Generation Complex is the principal consumer of natural gas at LANL. The remainder is used for steam-generated electrical power production at the TA-3 Co-Generation Complex. The TA-3 Co-Generation Complex currently has three dual fuel boilers with associated steam turbine-generator sets, which use natural gas as the primary fuel and Number-2 fuel oil available for use as a standby fuel. Low-pressure steam is supplied to the TA-3 district heat system and some of the process needs. The electricity is then routed into the power grid. The TA-3 steam distribution system has about 5.3 miles of steam supply and condensate return lines. Steam used

to heat facilities is also currently generated at the TA-21 steam plant. This facility has three relatively small boilers, each with only about 5 percent of the capacity of the units at the TA-3 Co-Generation Complex. They are primarily natural gas-fired but can also burn Number-2 fuel oil. Steam produced in the TA-21 steam plant is used to provide space heat for the buildings in TA-21. LANL also maintains about 200 other smaller boilers, which are primarily natural gas fired. As mentioned above, relatively small quantities of fuel oil are also stored at LANL as a backup fuel source for emergency generators, and use is therefore negligible (LANL 2006a).

4.1.3.4 ***Water***

The Los Alamos County water production system consists of 14 deep wells, 153 miles of main distribution lines, pump stations, and storage tanks. The system supplies potable water to all of the County, LANL, and Bandelier National Monument. The deep wells are located in three well fields (Guaje, Otowi, and Pajarito). Water is pumped into production lines, and then booster pump stations lift this water to reservoir tanks for distribution. Prior to distribution, the entire water supply is disinfected (LANL 2006a).

DOE transferred operation of the system to Los Alamos County under a lease agreement. Under the agreement, DOE retained responsibility for operation of the distribution system within LANL boundaries, whereas the county assumed full responsibility to ensure compliance with Federal and state potable water regulations. DOE retains the right to withdraw an equivalent of about 5,541 acre-feet of water per year from the main aquifer and to purchase a water allocation of some 1,200 acre-feet per year from the San Juan-Chama Transmountain Diversion Project. LANL is now considered a Los Alamos County water customer, and the County issues an invoice for water consumed by LANL (LANL 2006a).

About 359 million gallons of water were used at LANL in 2005. Water demand at the site continues to be less than 30 percent (1,662 acre-feet per year) of the quantity allowed under the contract with the water utility. The firm rated capacity of the Los Alamos water production system is 7,797 gallons per minute or 4.1 billion gallons annually. The firm rated capacity is the maximum amount of water that can be pumped immediately to meet peak demand (LANL 2006a).

The onsite water distribution system is more than 50 years old. Portions of the system are replaced as problems arise. The condition of the water distribution system was identified as a concern in the *1999 LANL SWEIS*. An initiative is underway to install additional water meters and a Supervisory Control and Data Acquisition and Equipment Surveillance System on the water distribution system to track water usage and determine specific water use for various applications. Accumulated data will establish a baseline for future conservation efforts. DOE has also initiated efforts to automate monitoring to improve system response for emergency situations. DOE has instituted a number of conservation and gray-water-reuse projects, including a cooling tower conservation project to reduce water usage further and ensure that future LANL initiatives are not limited by water availability (LANL 2006a).

4.1.4 Air Quality and Noise

4.1.4.1 Air Quality

LANL provides regulatory and environmental surveillance leadership and services to meet air quality obligations and public assurance needs by developing and implementing programs to ensure institutional compliance with State and Federal Laws related to air quality regulations, and DOE Orders for emergency management, air quality surveillance, and dose assessment activities, as well as to address community concerns related to air quality issues (LANL 2006b).

4.1.4.1.1 Meteorology and Climatology

Los Alamos has a semiarid, temperate mountain climate. This climate is characterized by seasonable, variable rainfall with precipitation ranging from 10 to 20 inches per year. The climate of the Los Alamos townsite is not as arid (dry) as that part near the Rio Grande, which is arid continental. Meteorological conditions within Los Alamos are influenced by the elevation of the Pajarito Plateau (DOE 2002). Normal (30-year mean) precipitation for the communities of Los Alamos and White Rock and the extremes of precipitation are unchanged for the expanded period 1971 through 2000 (LANL 2006a, LANL 2004e).

There are four distinct seasons in Los Alamos County, winters are generally mild, with occasional winter storms; spring is the windiest season; summer is the rainy season, with occasional afternoon thunderstorms; and fall is typically dry, cool, and calm (LANL 2006).

Normal (30-year mean) minimum and maximum temperatures for the community of Los Alamos range from a mean low of 17.4 °F in January to a mean high of 80.6 °F in July. Los Alamos townsite temperatures have dropped as low as -18 °F and have reached as high as 95 °F. The normal annual precipitation for Los Alamos is approximately 19 inches. The lowest recorded annual precipitation in Los Alamos townsite was 7 inches and the highest was 39 inches (DOE 2002).

Since 1999, the most widespread and pervasive climatological change in the region has been drought. LANL precipitation records show that between 1995 and 2005 there were two years (1997 and 2005) with above average precipitation. Precipitation patterns leading into the recent drought are strikingly similar, but of greater duration, to the period from 1953 to 1956, commonly referred to as the 1950s drought. The 1950s drought consisted of 4 years of progressively declining rainfall, with a sharp increase in precipitation in 1957 that ended the drought. The recent drought has been partially responsible for several disturbances that have greatly affected the regional environment. Dry weather facilitated the Cerro Grande Fire in May 2000, and set the stage for the bark beetle infestation that started around the summer of 2002 (LANL 2006a). Precipitation in 2004 was close to average (LANL 2005g).

4.1.4.1.2 Ambient Air Quality

Only a limited amount of ambient air monitoring has been performed for nonradiological air pollutants within the LANL region. New Mexico Environment Department (NMED) operated a

DOE-owned ambient air quality monitoring station adjacent to Bandelier National Monument between 1990 and 1994 to record sulfur dioxide, nitrogen dioxide, ozone, and PM₁₀ levels. DOE and NMED discontinued operation of this station in fiscal year 1995 because recorded values were well below applicable standards.

New Mexico State had ambient air quality control standards for beryllium, which were repealed in 1995. To ensure that LANL beryllium emissions did not exceed those standards, ambient air monitoring of beryllium was performed at LANL from 1988 to December 1995. The recorded beryllium levels were low, and as a result, beryllium monitoring was discontinued after December 1995. Beryllium monitoring resumed in 1998 through the present at over 20 sites located near potential beryllium sources at LANL or in nearby communities. Air concentrations remain very similar to those measured previously.

After the Cerro Grande Fire in the spring of 2000, there was concern that an adequate baseline of nonradiological ambient air sampling was not in place at LANL. Therefore, in 2001, DOE designed and implemented a new air monitoring program, entitled NonRadNET, to provide nonradiological background ambient data under normal conditions. The NonRadNET program includes real-time ambient sampling for PM₁₀ and PM_{2.5}. Additionally, air samples were collected in the first year of this program and analyzed for up to 20 inorganic elements and up to 160 volatile organic compounds. The results for PM₁₀ and PM_{2.5} for 2005 are presented in Table 4.1.4-1. Results for the inorganic elements and the volatile organic compounds were all below any published ambient or occupational exposure limits. More information about this ambient monitoring program can be found in the report entitled *Nonradioactive Ambient Air Monitoring at Los Alamos National Laboratory 2001-2002* (LANL 2006a).

Table 4.1.4-1— Ambient Air Monitoring for Particulate Matter

Station Location	Constituent	Annual Mean Monitored Value (micrograms per cubic meter)	NAAQS Primary Annual Standard (micrograms per cubic meter)	Maximum 24-Hour Monitored Value (micrograms per cubic meter)	NAAQS 24-Hour Standard (micrograms per cubic meter)
48 th Street, Los Alamos	PM ₁₀	12	50	34	150
	PM _{2.5}	7	15	20	65
Los Alamos Medical Center	PM ₁₀	15	50	55	150
	PM _{2.5}	8	15	27	65
White Rock Fire Station	PM ₁₀	13	50	34	150
	PM _{2.5}	7	15	20	65

Note: NAAQS = National Ambient Air Quality Standards, PM_n = Particulate matter less than n microns in aerodynamic diameter.
Source: LANL 2006a.

Criteria pollutants released from LANL operations are emitted primarily from combustion sources such as boilers and emergency generators. Estimated emissions from operations at LANL for the years 1999 through 2005 are shown in Table 4.1.4-2. This data includes emissions from the operation of facilities at LANL (LANL 2006a).

Table 4.1.4- 2 — Emissions of Criteria Pollutants

Pollutant ^a	Emissions per year ^b						
	1999	2000	2001	2002	2003	2004 ^b	2005
Carbon Monoxide	32	26	29.08	28.1	31.9	35.4	35.1
Nitrogen Oxides	88	80	93.8	64.7	49.6	50.5	50.5
Particulate Matter	4.5	3.8	5.5	15.5 ^c	22.1 ^c	4.8	5.0
Sulfur Oxides	0.55	4.0 ^d	0.82	1.3 ^e	1.6 ^e	1.5	1.0

^a Tons per year.

^b Values include emissions from small boilers and heaters not included in previous years' emissions inventories.

^c Increased emissions of particulate matter were primarily due to operation of three air curtain destructors used to burn wood and slash from the fire mitigation activities.

^d The higher emissions of sulfur oxides were due to the main steam plant burning fuel oil during the Cerro Grande Fire.

^e The increased emissions of sulfur oxides were due to operation of the three air curtain destructors used to burn wood and slash from fire mitigation activities.

Source: LANL 2006a.

Approximately two-thirds of the most significant criteria pollutants, nitrogen oxides, result from the TA-3 steam plant. In late 2000, DOE received a permit from the NMED to install flue gas recirculation equipment on the steam plant boilers to reduce emissions of nitrogen oxide. This equipment became operational in 2002, and initial source tests indicated a reduction in emissions, of approximately 64 percent. The water pump, which was a large source of nitrogen oxide emissions, was transferred to Los Alamos County in November 2001 (LANL 2003g, 2004h).

Under the Title V Operating Permit program, LANL is a major source, based on the potential to emit, for nitrogen oxides (NOX), carbon monoxide (CO), and volatile organic compounds (VOCs). In 2005, the TA-3 steam plant and boilers located across the LANL were the major contributors of NOX, CO, and particulate matter (PM). Research and Development (R&D) activities were responsible for most of the VOC and hazardous air pollutants emissions. A summary of the data is presented in Table 4.1.4-3.

Table 4.1.4-3 — Operation Permit Emission Limits

Facility	Emissions (tons per year unless stated)					
	Nitrogen Oxides	Carbon Monoxide	Volatile Organic Compounds	Sulfur Dioxide	Particulate Matter	Hazardous Air Pollutants
LANL – Entire Facility	245	225	200	150	120	24 combined/ 8 individual
Asphalt Production (TA-60-BDM)	1.0	2.6	1.0	1.0	0.04 grams per dry standard cubic foot, 35.4 pounds per hour	NA
Beryllium Activities						
CMR Facility (TA-3-29)	NA	NA	NA	NA	Beryllium 10 grams per 24 hours	NA
Sigma Facility (TA-3-66)	NA	NA	NA	NA	Beryllium 10 grams per 24 hours	NA
Beryllium Technology Facility (TA-3-141)	NA	NA	NA	NA	Beryllium 0.35 grams per 24 hours 3.5 grams per year	NA
TA-16-207	NA	NA	NA	NA	Beryllium 10 grams per 24 hours	NA
TA-35-87	NA	NA	NA	NA	Beryllium 10 grams per 24 hours	NA
Target Fabrication Facility (TA-35-213)	NA	NA	NA	NA	Beryllium 1.8×10^{-4} grams per year, 0.36 grams per year	NA

Table 4.1.4-3 — Operation Permit Emission Limits (continued)

Facility	Emissions (tons per year unless stated)					
	Nitrogen Oxides	Carbon Monoxide	Volatile Organic Compounds	Sulfur Dioxide	Particulate Matter	Hazardous Air Pollutants
Plutonium Facility (TA-55-PF4)						
Machining Operation	NA	NA	NA	NA	Beryllium - 0.12 grams per 24 hours, 2.99 grams per year Aluminum - 0.12 grams per 24 hours, 2.99 grams per year	NA
Foundry Operation	NA	NA	NA	NA	Beryllium - 3.49×10^5 grams per 24 hours, 8.73×10^4 grams per year Aluminum - 3.49×10^5 grams per 24 hours, 8.73×10^4 grams per year	NA
Boilers and Heaters ^a	80	80	50	50	50	NA
Carpenter Shops						
TA-15-563	NA	NA	NA	NA	2.81	NA
TA-3-38	NA	NA	NA	NA	3.07	NA
Chemical Usage (facility wide)	NA	NA	200	NA	NA	8 individual chemical 24 total
Degreasers – TA-55-DG-1, TA-55-DG-2, and TA-55-DG-3	NA	NA	200 facility wide	NA	NA	8 individual 24 total
Internal Combustion Sources						
TA-33-G-1 (diesel generator)	18.1 tons per year, 40.3 pounds per hour	15.2 tons per year, 33.7 pounds per hour	0.3 tons per year, 0.7 pounds per hour	2.5 tons per year, 5.5 pounds per hour	TSP 0.6 tons per year, 1.4 pounds per hour PM ₁₀ 0.6 tons per year, 1.4 pounds per hour	NA
Various Standby Generators ^b	NA	NA	NA	NA	NA	NA
Data Disintegrator/Industrial Shredder	NA	NA	NA	NA	TSP 9.9 tons per year, 2.3 pounds per hour PM ₁₀ 9.9 tons per year, 2.3 pounds per hour	NA
Power Plant at TA-3-22						
TA-3-22-1	10.2 pounds per hour gas 11.3 pounds per hour oil	7.0 pounds per hour gas 6.5 pounds per hour oil	1.0 pounds per hour gas 0.3 pounds per hour oil	1.1 pounds per hour gas 9.6 pounds per hour oil	TSP 1.3 pounds per hour gas 4.3 pounds per hour oil PM ₁₀ 1.3 pounds per hour gas 3.0 pounds per hour oil	NA
TA-3-22-2	10.2 pounds per hour gas 11.3 pounds per hour oil	7.0 pounds per hour gas 6.5 pounds per hour oil	1.0 pounds per hour gas 0.3 pounds per hour oil	1.1 pounds per hour gas 9.6 pounds per hour oil	TSP 1.3 pounds per hour gas 4.3 pounds per hour oil PM ₁₀ 1.3 pounds per hour gas 3.0 pounds per hour oil	NA
TA-3-22-3	10.2 pounds per hour gas 11.3 pounds per hour oil	7.0 pounds per hour gas 6.5 pounds per hour oil	1.0 pounds per hour gas 0.3 pounds per hour oil	1.1 pounds per hour gas 9.6 pounds per hour oil	TSP 1.3 pounds per hour gas 4.3 pounds per hour oil PM ₁₀ 1.3 pounds per hour gas 3.0 pounds per hour oil	NA
Boilers Combined	60.2 tons per	41.3 tons per year	5.6 tons per year	7.9 tons per year	TSP 8.4 tons per year PM ₁₀ 8.2 tons per year	NA

Table 4.1.4-3 — Operation Permit Emission Limits (continued)

Facility	Emissions (tons per year unless stated)					
	Nitrogen Oxides	Carbon Monoxide	Volatile Organic Compounds	Sulfur Dioxide	Particulate Matter	Hazardous Air Pollutants
Power Plant at TA-3-22						
TA-3-22 CT-1	23.8 pounds per hour 33.2 tons per year	170.9 pounds per hour 19.8 tons per year	1.0 pounds per hour	1.4 pounds per hour 1.9 tons per year	TSP 1.6 pounds per hour 2.3 tons per year PM ₁₀ 1.6 pounds per hour 2.3 tons per year	NA

NA = not available, CMR = Chemistry and Metallurgy Research, TSP = total suspended particulate, PM₁₀ = particulate matter less than 10 microns in aerodynamic diameter, TA = technical area.

^a Including TA-16-1484-BS-1, TA-16-1484-BS-2, TA-21-357-1, TA-21-357-2, and TA-21-357-3, TA-48-1-BS-1, TA-48-1-BS-2, TA-48-1-BS-6, TA-50-2, TA-53-365-BHW-1, TA-53-365-BHW-2, TA-55-6-BHW-1, TA-55-6-BHW-2, TA-59-BHW-1, TA-59-BHW-2.

^b Standby generators are limited to an average of 168 hours per year; tons per year to metric tons per year, multiply by 0.9072.

Note: To convert pounds per hour to kilograms per hour, multiply by 0.45359; tons per year to metric tons per year, multiply by 0.90718.

Source: LANL 2006a

4.1.4.1.3 Radiological Air Emissions

The LANL radiological air-sampling network, referred to as AIRNET, measures the environmental levels of airborne radionuclides, such as plutonium, americium, uranium, tritium, and activation products that could be released from LANL operations. Most regional airborne radioactivity comes from the following sources: (1) natural radioactive constituents in particulate matter (such as uranium and thorium), (2) terrestrial radon diffusion out of the Earth and its subsequent decay products, (3) material formation from interaction with cosmic radiation, and (4) fallout from past atmospheric nuclear weapons tests conducted by several countries. Table 4.5.4.1-4 summarizes regional levels of radioactivity in the atmosphere over the period 1999-2005 (LANL 2006a).

Table 4.1.4-4 — Annual Average Background Concentration of Radioactivity in the Regional Atmosphere

	Units ^a	EPA Concentration Limit ^b	1999	2000	2001	2002	2003	2004	2005
Gross Alpha	fCi/m ³	NA	1	1	0.8	0.8	0.8	1.1	0.9
Gross Beta	fCi/m ³	NA	13.4	13	13.9	13.3	13.7	18.3	16.3
Tritium	pCi/m ³	1,500	0.5	0.8	NM	NM	NM	0.1	0.1
Strontium-90	aCi/m ³	19,000	NA	NA	NA	4	11	NA	NA
Plutonium-238	aCi/m ³	2,100	NM	0	0	0	NM	0.09	0
Plutonium-239 and Plutonium-240	aCi/m ³	2,000	0.1	0	0.1	0.3	NM	NM	0.1
Americium-241	aCi/m ³	1,900	NM	0.3	NM	0.3	NM	NM	0.1
Uranium-234	aCi/m ³	7,700	16.1	17.1	17.9	21.7	20.9	17.4	12.4
Uranium-235	aCi/m ³	7,100	1.2	0.9	1.3	2.4	1.8	1.17	1.2
Uranium-238	aCi/m ³	8,300	15.2	15.9	17.7	21.8	20.1	17.0	13.2

EPA = U.S. Environmental Protection Agency, NA = not available, NM = not measurable, m³ = cubic meters, pCi = picocurie = 10⁻¹² curie, fCi = femtocurie = 10⁻¹⁵ curie, aCi = attocurie = 10⁻¹⁸ curie.

Source: LANL 2006a.

In 2005, 28 stacks were continuously monitored for the emission of radioactive material to the ambient air. A total of 19,100 curies of stack emissions were measured for year 2005. This

included 704 curies of tritium emissions and 18,400 curies of activation products from the Los Alamos Neutron Science Center (LANSCE). Airborne emissions of plutonium, uranium, americium, and thorium were less than 0.00002 curies. Overall, radiological air emissions at LANL tend to be dominated by emissions from LANSCE stacks and tritium (LANL 2006a). Table 4.1.4-5 provides further detailed emissions data for buildings with sampled stacks in the years 1999 through 2005. Overall, radiological air emissions at LANL tend to be dominated by emissions from LANSCE stacks and tritium.

Table 4.1.4-5 — Range of Annual Airborne Radioactive Emissions from LANL with Sampled Stacks from 1999 through 2005 (curies)

TA Building	Tritium ^a	Americium-241	Plutonium ^b	Uranium ^c	Thorium ^d	P/VAP ^e	G-MAP ^f	Strontium-90
TA-3-029	–	1.3×10^{-7} - 2.6×10^{-6}	2.1×10^{-6} - 2.1×10^{-5}	2.8×10^{-6} - 9.8×10^{-6}	1.3×10^{-7} - 1.3×10^{-6}	2.2×10^{-5} ^g	–	2.1×10^{-7} - 3.9×10^{-7}
TA-3-102	–	1.0×10^{-10} ^h	3.9×10^{-10} ⁱ	4.4×10^{-9} - 3.3×10^{-7}	8.0×10^{-10} - 7.2×10^{-9}	–	–	–
TA-16-205	140-7900 ^j	–	–	–	–	–	–	–
TA-21-155	66-520	–	–	–	–	–	–	–
TA-21-209	61-760	–	–	–	–	–	–	–
TA-48-001	–	–	1.7×10^{-9} ⁱ	6.1×10^{-10} - 6.5×10^{-9}	1.1×10^{-9} ^h	0.00023-0.017	–	–
TA-50-001	–	6.9×10^{-9} - 1.3×10^{-7}	7.4×10^{-9} - 5.1×10^{-8}	2.5×10^{-8} ⁱ	3.7×10^{-8} - 7.0×10^{-8}	–	–	–
TA-50-037	–	5.8×10^{-10} ⁱ	8.9×10^{-10} ⁱ	1.9×10^{-8} ^k	3.4×10^{-9} ^h	–	–	3.4×10^{-9} ^h
TA-50-069	–	5.8×10^{-11} - 7.6×10^{-10}	9.9×10^{-11} - 5.3×10^{-9}	–	1.2×10^{-10} - 1.2×10^{-9}	–	–	–
TA-53-003	0.57-1.8	–	–	–	–	3.5×10^{-10} ^h	1.7- 8.4	–
TA-53-007	0.45-7.2	–	–	–	–	0.016-60	300-18,400	–
TA-55-004	1.8-61	6.2×10^{-9} - 5.9×10^{-7}	4.3×10^{-8} - 2.5×10^{-6}	7.1×10^{-8} - 2.3×10^{-7}	3.4×10^{-8} - 1.5×10^{-7}	–	–	5.6×10^{-8} ^h

TA = technical area.

a Includes both gaseous and oxide forms of tritium.

b Includes plutonium-238, plutonium-239, and plutonium-240.

c Includes uranium-234, uranium-235, and uranium-238.

d Includes thorium-228, thorium-230, and thorium-232.

e P/VAP - Particulate and vapor activation products.

f G-MAP - Gaseous mixed activation products.

g Only emitted during 2005.

h Only emitted during 2003.

i Only emitted during 2002.

j The 7,900 curies were an unanticipated one-time release in 2001.

k Only emitted during 1999.

Source: LANL 2006a.

4.1.4.2 Noise

Noise, air blasts, and ground vibrations are intermittent aspects of the LANL area environment. Although the receptor most often considered for these environmental conditions is human, sound and vibrations may also be perceived by animals in the area. Little is known about how different wildlife species may react to these noises and vibrations; however, the observed vigor and wellness of area wildlife and federally-protected bird populations suggests that LANL noise and vibration conditions do not pose problems for wildlife in the area (LANL 2006a).

Public noise is the noise that is present outside LANL site boundaries. Public noise originates from the combined effect of existing LANL traffic and site activities and the noise generated by activities around the Los Alamos and White Rock communities. Worker noise is the noise generated by DOE activities within LANL boundaries. Air blasts consist of a higher frequency portion of audible air pressure waves that accompany an explosives detonation. This noise can be heard by both LANL workers and the area public. The lower frequency portion of air pressure waves is not audible, but may cause a secondary and audible noise within a test structure that may be heard by workers. Air blasts and most ground vibrations generated at LANL result from test activities that involve aboveground explosives research (LANL 2006a).

The forested condition of much of LANL (especially where the explosives test areas are located), atmospheric conditions in the area, and the regional topography that consists of widely varied elevations and rock formations, all influence how noise and vibrations can be both attenuated and channeled away from receptors. Together these regional features minimize the noise pollution and ground vibration concerns in the area due to LANL site operations. Loud sudden blast noises associated with explosive tests are similar to the sound of thunder and may occasionally startle members of the public and LANL workers alike. Although these noises are sporadic or episodic in nature, they contribute to noise pollution in the area (LANL 2006a).

Loss of large forest areas from the Cerro Grande Fire in 2000 compromised the ability of the natural environment to absorb noise. However, types of noise and noise levels associated with LANL and from activities in nearby communities have not changed significantly as a result of the fire (LANL 2006a).

The standard unit used to report sound level is the decibel (dB) which is a measure of the sound pressure independent of frequency. Noise, however, is generally a combination of many sound frequencies, some of which are more readily detected by the human ear. The A-weighted decibel (dBA) is a modification of the decibel unit that accounts for the perceived loudness of noise by human ears (LANL 2006a).

Existing LANL-related publicly detectable noise levels are generated by a variety of sources, including onsite transport via truck and automobile, high explosive tests, and firearms practice activities. Noise levels within Los Alamos County unrelated to LANL are generated predominantly by traffic and to a much lesser degree by residential, commercial, and industrial-related activities within the nearby areas (LANL 2006a).

Construction activities at LANL have produced a steady increase in temporary construction noise since 1999; however, these noise level increases have not resulted in increased annoyance to the public. Operation of new and modified facilities has not been reported to result in increased annoyance to the public from offsite noise impacts (LANL 2006a).

Los Alamos County has promulgated a local noise ordinance that establishes noise level limits for residential land uses. Noise levels that affect residential receptors are limited to a maximum of 65 dBA in the daytime and 53 dBA at night (that is between 9 p.m. and 7 a.m.). Permissible daytime noise levels can reach 75 dBA in residential areas for no more than 10 minutes each hour. A permit is required for activities that fail to satisfy the noise ordinance limits (LANL 2006a).

Traffic noise generated by traffic at the LANL site is exempt from Los Alamos County noise regulations, but not state and federal noise standards. Traffic noise constitutes the majority of background noise in the county. Sound measurements have been collected to target traffic noise at various places in the county; however, the sound levels are found to be highly dependent upon the exact measurement location, time of day, and meteorological conditions. For this reason, there is no single representative measurement for ambient traffic noise for the LANL site (LANL 2006a).

Noise generated by traffic has been computer modeled to estimate the impact of incremental traffic for various studies, including recent NEPA analyses. The results indicate that planned new activities would impose a very minor change from current levels. While very few measurements of nonspecific background ambient noise in the LANL area have been made, two such measurements have been sampled at locations near the LANL boundaries near public roadways (LANL 2006a).

Background noise levels were found to range from 31 to 35 dBA at the vicinity of the entrance to Bandelier National Monument and New Mexico State Rout 4. At White Rock, background noise levels range from 38 to 51 dBA; this is slightly higher than was found near Bandelier National Monument, probably due to higher levels of traffic, the presence of a residential neighborhood, and the different physical setting (LANL 2006a).

The detonation of high explosives represents the peak noise levels generated by LANL operations. High explosives detonations produce air blasts and ground vibrations.

4.1.5 Water Resources

4.1.5.1 *Surface Water*

Watersheds that drain LANL property are dry for most of the year. No perennial surface water extends completely across LANL land in any canyon. The canyons consist of over 85 miles of watercourses located within LANL and immediately upstream of LANL within Los Alamos Canyon. Of the 85 miles of watercourse, approximately two miles are naturally perennial, and approximately three miles are perennial waters created by effluent (LANL 2006a).

The remaining 80 or more miles of watercourse are dry for varying lengths of time. Streams that drain LANL area are dry for most of the year, and the area's surface water flows primarily in intermittent streams in response to local precipitation or snowmelt. The flow in these streams is ephemeral. Other streams may sometimes have the water table higher than the streambed and/or extensive snowmelt in the watershed and are said to be intermittent. Intermittent streams may flow for several weeks to a year or longer (LANL 2006a).

Some of the surface water at LANL comes from groundwater discharging as springs into canyons. Surface water at LANL is not a source of municipal, industrial, irrigation, or recreational water, though it is used by wildlife. Although there is minimal direct use of surface water within LANL boundaries, flows may extend beyond site boundaries where there is more potential for use. Surface waters that flow off LANL may reach the Rio Grande, where contaminants could flow downstream (LANL 2006a, LANL 2006b).

4.1.5.1.1 Surface Water Quality

Surface water quality has been affected by LANL operations, with the greatest effects caused by past discharges into Acid, Pueblo, Los Alamos, and Mortandad Canyons. TA-55 contains no permanent, natural surface water bodies and the developed areas are not located within a delineated floodplain (DOE 2002).

In accordance with DOE Order 450.1, Environmental Protection Program, and other statutory requirements, LANL personnel routinely monitor surface water, stormwater, and sediments as part of their ongoing environmental monitoring and surveillance program. The monitoring results are published annually in Environmental Surveillance Reports. Since 1999 LANL personnel expanded the water monitoring to a site-wide monitoring program that integrates groundwater, surface water, stormwater, and sediment monitoring, on a watershed basis.

Effluent quality from the TA-50 Radioactive Liquid Waste Treatment Facility has improved since 1999. New treatment processes have been installed to improve effluent quality. The 2005 calendar year marked the sixth consecutive year that the Radioactive Liquid Waste Treatment Facility effluent had no National Pollutant Discharge Elimination System (NDPES) violations or exceedances of the DOE Derived Concentration Guides for radioactive liquid wastes (LANL 2006). Annual average alpha activities in the Radioactive Liquid Waste Treatment Facility effluent was reduced to 5.2 picocuries per liter in 2005, compared to the DOE Derived Concentration Guide of 30 picocuries per liter (LANL 2006). Table 4.1.5-1 summarizes the water quality in the Radioactive Liquid Waste Treatment Facility effluent for 2005 for certain contaminants.

Table 4.1.5-1 — Selected Water Quality Data for Radioactive Liquid Waste Treatment Facility Effluent in 2005

Contaminant	Effluent Concentration in 2004	Standard Concentration Limit	Water Quality Standard
Sum of 39 radionuclide ratios, including tritium	Less than 0.18	1.0 Sum of Ratios	DOE Derived Concentration Guideline
Nitrogen as nitrate	3.7 milligrams per liter	10 milligrams per liter	NMED Groundwater Standard for Human Health
Fluoride	0.24 milligrams per liter	1.6 milligrams per liter	NMED Groundwater Standard for Human Health
Total dissolved solids	182 milligrams per liter	1,000 milligrams per liter	NMED Groundwater Standard for Domestic Water Supply
Perchlorate	Not detected	(a)	No current standard
Tritium	3,200 picocuries per liter	2,000,000 picocuries per liter	DOE Derived Concentration Guideline
		20,000 picocuries per liter	EPA Primary Drinking Water Standard

NMED = New Mexico Environment Department, EPA = U.S. Environmental Protection Agency.

^a The EPA has proposed a drinking water standard for perchlorate of 4 micrograms per liter, but it has not been issued yet.

Sources: LANL 2006a.

Table 4.1.5-2 summarizes the locations of LANL impacted surface water and sediments. The following are potential sources of contamination to local surface water resources (LANL 2006):

- Industrial effluents discharged through National Pollutant Discharge Elimination System (NPDES) permitted outfalls. This source is referred to as “NPDES-permitted outfalls” and includes point-source discharges from LANL wastewater treatment plants and cooling towers;
- Stormwater runoff, including stormwater runoff from certain industrial activities, construction activities, and solid waste management units ;
- Dredge and fill activities or other work within perennial, intermittent, or ephemeral water courses ; and
- Sediment transport.

Table 4.1.5-2 — Surface Water and Sediment Contamination Affected by LANL Operations

Contaminant	Onsite	Offsite	Significance	Trends
Radionuclides	Higher than background in sediments because of LANL contributions in Pueblo, DP, Los Alamos, Pajarito, and Mortandad Canyons.	Yes, in Los Alamos/Pueblo Canyons; slightly elevated in the Rio Grande and Cochiti Reservoir.	Sediments well below recreation screening levels Minimal exposure potential to runoff because events are typically sporadic Concentrations below levels for protection of biota	Sediment concentrations on lower Los Alamos Canyon are stable Overall reduced transport in canyons due to post-fire recovery Expect an increase in runoff in Pueblo and DP Canyons due to new urbanization
Polychlorinated Biphenyls in	Detected in sediment in nearly every canyon Detected in runoff in several canyons above NM stream standards	Yes, in the Los Alamos/Pueblo Canyons	Possible wildlife exposure in Los Alamos and Sandia Canyons when water is present. In Rio Grande, LANL contribution indistinguishable from high levels from upstream sources.	Insufficient data
Dissolved Copper, Lead, and Zinc	Detected in many canyons above NM acute aquatics life standards.	Yes, in Los Alamos Canyon	Most probably of urban origin; Laboratory sources seen on localized basis	Insufficient data
High Explosive Residues and Barium	Detections near or above screening values in Cañon de Valle base flow and runoff.	No	Minimal potential for exposure	Steady
Benzo(a)pyrene	Detections near or above industrial screening levels in Los Alamos Canyon.	Yes, in Los Alamos and Acid Canyons.	Origins uncertain; probably multiple sources.	None

Source: LANL 2006b.

Recent data from stormwater runoff monitoring detected some contaminants onsite and offsite, but the exposure potential for these contaminants is limited. Radionuclides have been detected in runoff at higher than background levels in Pueblo, DP, Los Alamos, and Mortandad Canyons, with sporadic detections extending offsite in Pueblo and Los Alamos Canyons. Stormwater runoff exceeded the wildlife habitat standard for gross alpha activity of 15 picocuries per liter since the Cerro Grande Fire in nearly all canyons. Los Alamos Canyon and Sandia Canyon runoff and base flows contain polychlorinated biphenyls at levels above New Mexico human health stream standards.

Dissolved copper, lead and zinc have been detected in many canyons above the New Mexico acute aquatic life stream standards, and these metals were detected offsite in Los Alamos Canyon. Some of this polychlorinated biphenyl (PCB) and metals' detections were upstream of LANL facilities, which indicate that non-LANL urban runoff was one source of the contamination. Mercury was detected slightly above wildlife habitat stream standards in Los Alamos and Sandia Canyons. The installation of erosion controls near the polychlorinated biphenyl and mercury sources to minimize further migration of these contaminants is an example of the watershed-based approach to surface water quality protection. Surface water in Cañon de Valle, a tributary of Water Canyon, occasionally has explosive residue levels greater than the 6.1 parts per billion EPA Tap Water Health Advisory level, but the barium levels have dropped below the New Mexico Groundwater Standard (LANL 2005j).

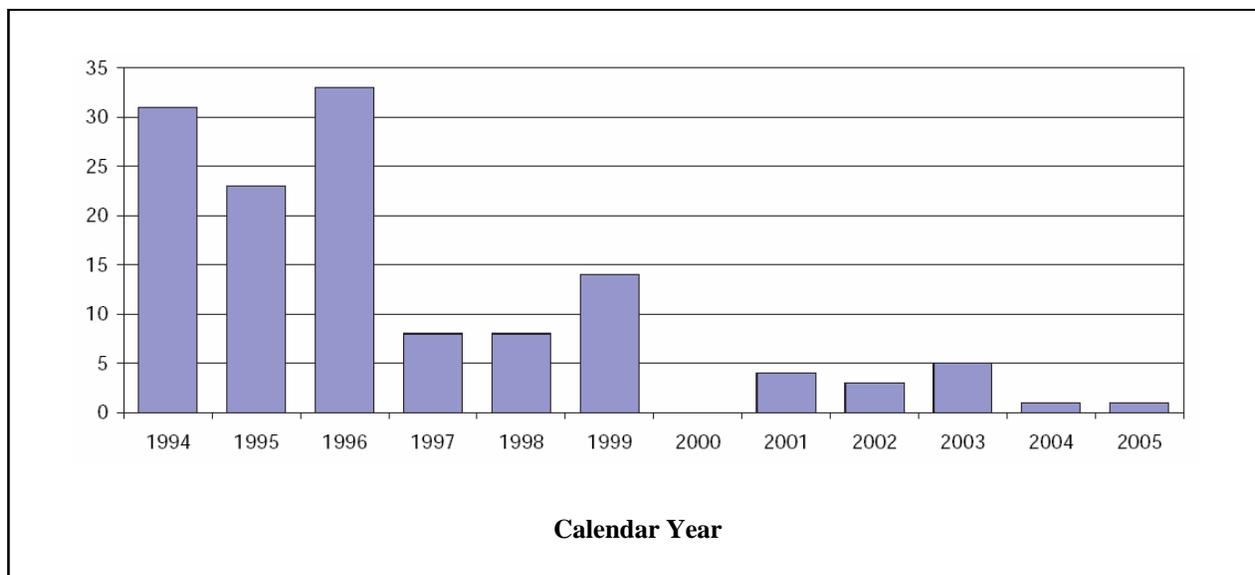
Los Alamos County, as owner and operator of the Los Alamos water supply system, is responsible for compliance with the requirements of the *Safe Drinking Water Act* (SDWA) and the New Mexico Drinking Water Regulations (NMEIB 2002). The SDWA requires Los Alamos County to collect samples from various points in the water distribution systems at the LANL, Los Alamos County, and Bandelier National Monument to demonstrate compliance with SDWA maximum contaminant levels (MCLs). EPA has established MCLs for microbiological organisms, organic and inorganic constituents, and radioactivity in drinking water. The state has adopted these standards in the New Mexico Drinking Water Regulations. EPA has authorized NMED to administer and enforce Federal drinking water regulations and standards in New Mexico. In 2005, the LANL conducted additional confirmation monitoring of the Los Alamos water supply system for quality assurance purposes (LANL 2005j).

In 2005, Los Alamos County and NMED conducted sampling for microbiological organisms, nitrate+nitrite (asN), radionuclides, total trihalomethanes, total haloacetic acids, volatile and semi-volatile organic compounds, and heavy metals in drinking water for SDWA compliance purposes. In addition, lead and copper samples were collected from 34 residential taps. Results showed that all samples were compliant with SDWA MCLs (LANL 2006b).

4.1.5.1.2 Surface Water Rights and Permits

In 2005, University of California (UC) and DOE/NNSA were co-permittees of the NPDES permit covering LANL operations. LANL's current industrial point-source NPDES permit contains 21 permitted outfalls that include one sanitary outfall and 20 industrial outfalls. LANL eliminated four outfalls for the NPDES Permit re-applications submitted on July 30, 2004 (LANL 2006a). LANL's new NPDES point-source permit was issued on June 2007 and became effective on August 1, 2007 and includes one sanitary outfall and 16 industrial outfalls for a total of 17 permitted outfalls (LANL 2006a, EPA 2007).

LANL personnel collect weekly, monthly and quarterly samples to analyze effluents for compliance with NPDES permit levels. Since 2000, LANL has maintained an average compliance rate with permit conditions of 99.75 percent. Generally, exceedances of permit standards in the 5 years since 2000 were of excess total residual chlorine. Figure 4.1.5-1 shows the number of effluent exceedances over the past 12 years at LANL.



Source: LANL 2006a.

Figure 4.1.5-1 — Number of Exceedances of NPDES Outfall Effluent Limits Over the Past 12 Years

4.1.5.2 *Groundwater*

The three modes of groundwater occurrence are; 1) perched alluvial groundwater in canyon bottom sediments, 2) zones of intermediate-depth perched groundwater whose location is controlled by availability of recharge and by changes in rock permeability, and 3) the regional aquifer beneath the Pajarito Plateau.

4.1.5.2.1 **Groundwater Quality**

The drinking water in the Los Alamos area has not been adversely impacted by DOE actions. Low levels (below drinking water standards or proposed standards) of tritium, perchlorate and dioxane [1,4-] have been detected since 2000 in one water supply well (Otowi-1) that is not currently used in the County drinking water system. Perchlorate was detected in all groundwater zones in Mortandad Canyon in 2005, in the regional aquifer supply well Otowi-1 in Pueblo Canyon off the LANL site, and just above background level (0.08 micrograms per liter) in the alluvial groundwater in Cañon del Valle (LANL 2006). Concentration values of perchlorate in Mortandad Canyon alluvial and intermediate groundwater exceed EPA Drinking Water Equivalent Value of 24.5 micrograms per liter, established in January 2006 (LANL 2006a). Dioxane [1,4-] was detected in two wells sampled from the perched intermediate zone in Mortandad Canyon (LANL 2006a). There is no Federal or state standard for dioxane [1,4-] and LANL and NMED are currently working to determine the extent and impact of this contaminant. All drinking water produced by the Los Alamos County water supply system meets Federal and state drinking water requirements (LANL 2006a)

The discharge of radioactive effluents has caused alluvial groundwater contamination in DP Canyon, Los Alamos Canyon, and Mortandad Canyon. Strontium-90 is consistently measured at

levels above the 8-picocuries-per-liter EPA drinking water maximum containment level (MCL) in these canyons. Mortandad Canyon also has a localized groundwater concentration of plutonium-238, plutonium-239, plutonium-240, and americium-241 above the 4-millirem DOE standard for drinking water. Mortandad Canyon is the only location where in the mid 1990s, tritium was detected above the 20,000 picocuries per liter EPA drinking water MCL; levels dropped below the standard in 2001, and have been dropping steadily since then. None of the radionuclide levels exceeded the 100-millirem-per-year DOE Derived Concentration Guide (DCG) for public dose (LANL 2004f, LANL 2005j).

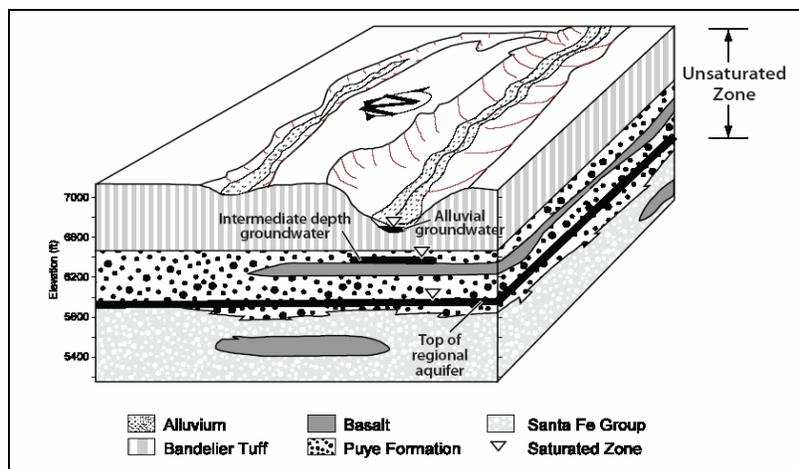
Discharges from the Radioactive Liquid Waste Treatment Facility caused high levels of nitrate and perchlorate in both alluvial and intermediate perched groundwater in Mortandad Canyon until new treatment methods were installed to remove nitrate in 1999 and perchlorate in 2002. Nitrate levels were below the 10-milligram-per-liter EPA MCL in Mortandad Canyon in 2003 and 2004 (for alluvial groundwater), but were close to or exceeded that level in previous years. Nitrate concentrations in Pueblo Canyon have been around the MCL in recent years. Maximum perchlorate levels have been below 200 parts per billion in alluvial and intermediate perched groundwater in Mortandad Canyon (LANL 2004f, 2005j). EPA has not established a drinking water standard for perchlorate.

Molybdenum is found in Los Alamos Canyon alluvial groundwater as a result of treatment chemicals no longer used in the TA-53 cooling towers. Levels in the alluvial groundwater have been quite variable in recent years and are often above the 1 milligram per liter New Mexico groundwater standard for irrigation use. Barium exceeds New Mexico groundwater standard by 10 times in alluvial groundwater, now used as a drinking water supply and RDX (an explosive) exceeds U.S. Environmental Protection Agency (EPA) drinking water risk levels by 20 to 40 times in intermediate and alluvial groundwater. The value for barium and RDX in the monitoring wells vary seasonally, but remain high. Neither barium or RDX are present in drinking water, but are present in alluvial groundwater of Cañon de Valle (LANL 2006b).

4.1.5.2.2 Groundwater Availability

The regional aquifer of the Los Alamos area occurs at a depth of approximately 1,200 feet along the western edge of the plateau and about 600 feet along the eastern edge. The regional aquifer lies about 1,000 feet beneath the mesa tops in the central part of the plateau. Water in the aquifer flows generally east or southeast toward the Rio Grande, and groundwater model studies indicate that underflow of groundwater from the Sierra de los Valles in the Jemez Mountains is the main source of recharge for the regional aquifer (Nylander et al. 2003).

About 350 to 620 feet of unsaturated tuff, basalt, and low moisture content sediments separate the alluvial and perched groundwater zones and the regional aquifer (Figure 4.1.5-2) (LANL 2005j). Groundwater flow from the Sierra de los Valles to the Pajarito Plateau may be affected by the Pajarito Fault.



Source: LANL 2006a.

Figure 4.1.5-2 — Illustration of Geologic and Hydrologic Relationships in the Los Alamos Area, Showing the Three Modes of Groundwater Occurrence

Deep below the ground surface, there is an area of saturation that forms the regional groundwater aquifer. The regional aquifer is the only aquifer in the area capable of serving as a municipal water supply; the regional aquifer supplies various customers including LANL, Los Alamos County, and others located in parts of Santa Fe and Rio Arriba Counties (LANL 2005j). Regional aquifer models have been developed that have focused on the amount of drawdown in the aquifer and the effects of pumping near the water supply wells for Los Alamos County and LANL. The recent regional drought would only affect water levels through increased withdrawals through water supply use, because recharge from the surface occurs at a slow rate, changing only over a period of decades.

The Los Alamos potable water production system consists of 14 deep wells, 153 miles of main distribution lines, pump stations, storage tanks, and nine chlorination stations. On September 8, 1998, DOE transferred operation of the system from the LANL to Los Alamos County under a lease agreement. Under this agreement, LANL retained responsibility for operating the distribution system within its boundaries, whereas the county assumed full responsibility for operating the water system, including ensuring compliance with Federal and state drinking water regulations. The system supplies potable water to the county, LANL, and Bandelier National Monument. DOE's rights to withdraw an equivalent of about 1,806 million gallons of water per year from the main aquifer and its right to purchase a water allocation from the San Juan-Chama Transmountain Diversion Project were included in the lease agreement (LANL 2000).

The recent drop in the water table remains 1 to 2 feet per year as projected in the 1999 LANL SWEIS. Water demand at LANL continued to be well below 30 percent of DOE's water rights that are leased by DOE to the county. In 2005, approximately 359 million gallons of water were used at LANL. While LANL total and consumptive water use has generally decreased from 1999 to 2005, water usage by other Los Alamos County users has exhibited a generally upward trend over the period.

4.1.6 Geology and Soils

LANL is located on the Pajarito Plateau within the Southern Rocky Mountains Physiographic Province. The Pajarito Plateau lies between the Sierra de Los Valles and the Jemez Mountains to the west and the Rio Grande to the east. It is formed of volcanic tuffs (welded volcanic ash) deposited by past volcanic eruptions from the Jemez Mountains to the west. The geology of the LANL region is the result of complex faulting, sedimentation, volcanism, and erosion over the past 20 to 25 million years (LANL 2006a).

4.1.6.1 Geology

A primary geologic feature in the region is the Rio Grande Rift, which begins in northern Mexico, trends northward across central New Mexico, and ends in central Colorado. The rift is a complex system of north-trending basins that have formed by down faulting of large blocks of the Earth's crust. In the Los Alamos area, the Rio Grande Rift is about 35 miles wide and encompasses the Española Basin. The Sangre de Cristo Mountains border the Rio Grande Rift on the east, and the Jemez Mountains lie over the western fault margin of the rift. The north-trending Pajarito Fault system is part of the Rio Grande Rift and consists of a group of interconnecting faults that are nearly parallel.

The Jemez Mountains are a broad highland built up over the last 13 million years through volcanic activity. Most of the bedrock on LANL property is composed of the salmon-colored Bandelier Tuff (DOE 2004e). The surface of the Pajarito Plateau is divided into numerous narrow, fingerlike mesas separated by deep east-to-west-oriented canyons that drain to the Rio Grande. The canyons were formed by streams flowing eastward across the plateau from the Jemez Mountains to the Rio Grande.

The Cerro Toledo "Interval" of the Bandelier Tuff unit consists of volcanoclastic sediments and tephra reaching a thickness of 400 feet (LANL 2004e), an increase from the previously reported maximum thickness of 130 feet (LANL 2006a).

In summary, the rocks present in the LANL region were predominantly produced by volcanic and sedimentary processes. The Pajarito Plateau is capped by the Bandelier Tuff. This unit attains a thickness of more than 700 feet in the LANL region and consists of ash-flow deposits of rhyolitic tuff and pumice, erupted between about 1.2 and 1.6 million years ago during the early to middle Quaternary period (i.e., Pleistocene) from the Valles and Toledo calderas located in the Jemez Mountains volcanic field (located west of LANL). Older, underlying units include the Puye Formation, which is a sedimentary unit comprised from materials derived from the Jemez Mountains and the ancestral Rio Grande and intruded in places by Cerros del Rio basalt flows. Underlying the Puye Formation is the Tschicoma Formation which consists of volcanic vent deposits. The Santa Fe Group is the most extensive unit in the Rio Grande Rift and largely consists of sedimentary materials and rocks' including evaporites derived from stream or deltaic deposits, but also contains volcanic tuff deposits and basalts. The Santa Fe Group sits atop Precambrian age (greater than 570 million years old) crystalline basement rock (LANL 2006a).

Overall, the complex interfingering and interlayering of strata beneath LANL results in variable properties that affect canyon wall formation, slope stability, subsurface fluid flow, seismic stability, and engineering properties of the rocks. In general, poorly indurated and densely fractured layers tend to form canyon slopes susceptible to failure during erosion or seismic events and require remediation prior to installing engineered structures on the mesa surfaces, in the canyons, or crossing canyon walls. In such cases, the direction and density of fractures is a critical engineering parameter. Beneath the Pajarito Plateau, the complex stratigraphy is reflected in the presence of perched groundwater zones. Perched groundwater occurs above welded tuffs in the Bandelier Tuff and other volcanic strata, above tuffs that have been altered to clays, above non-fractured basalt flows of the Cerro del Rio Basalts, and above fine-grained sedimentary deposits (such as lacustrine clays) in the Puye Formation (Robinson, Broxton, and Vaniman 2004). The upper surface of the regional aquifer (the water table) lies within the lower portion of the Puye Formation. The aquifer includes the full thickness of the Santa Fe Group except along the Rio Grande River, where the water table drops below the overlying Puye Formation. Interbedded basalt flows may account for localized confining conditions observed in the aquifer (NPS 2005a). The paleotopography and general dip to the southeast of the pre-Tshirege surface may strongly influence the direction of possible groundwater flow and contaminant migration in subsurface units. The paleotopography of the surface underlying the Bandelier Tuff may influence the flow direction of potential perched water zones (LANL 1999a).

In addition, the direction and rate of subsurface flow may be affected by the presence and orientation of fractures in some rock layers. As discussed above, these fractures may be related to cooling and formation of the individual strata. In some areas, faults related to seismic activity may also influence groundwater flow.

4.1.6.2 *Soils*

Most of the LANL facilities are located on mesa tops, where the soils are generally well-drained and thin (0 to 40 inches). TA-55 is located just to the southwest of the southern terminus of Rendija Canyon Fault, which is located about 0.8 miles northwest of the facility. Site stratigraphy is generally expected to be similar to that described above for TA-18, except that the thickness of overlying alluvium is thinner.

In May 2000, the Cerro Grande Fire burned approximately 43,000 acres, including about 7,700 acres on LANL (Balice, Bennett, and Wright 2004). The fire severely burned much of the mountainside that drains onto LANL (Gallaher and Koch 2004). The effects of the fire included increased soil erosion due to loss of vegetative cover, formation of hydrophobic soils, and soil disturbance during construction of fire breaks, access roads, and staging areas (DOE 2000f). The increased potential for flooding and erosion led to construction of mitigation structures to retain floodwaters and reinforce road crossings (DOE 2002i).

Combined with loss of vegetation, hydrophobic soil formation enhances the potential for increased runoff, soil erosion, downslope flooding, and degradation of water quality (Gallaher and Koch 2004). Approximately 9,310 acres of hydrophobic soils were formed in the Jemez Mountains from the Cerro Grande Fire (DOE 2000f).

Typical subsurface stratigraphy at LANL and TA-18 consists of welded and poorly welded volcanic tuffs that comprise the Tshirege Member of the Bandelier Tuff Formation. Site-specific investigations in Pajarito Canyon near TA-18 have found the tuff to be highly weathered and unwelded, with the upper 10 to 15 feet of the material classified as clayey sand or sandy clay. However, surrounding cliff faces consist of welded tuff exhibiting vertical jointing. The canyon tuff is overlain by up to 15 feet of sandy and silty alluvium. Soils derived from these deposits are typically sandy loams ((DOE 2002i).

4.1.6.3 Seismology

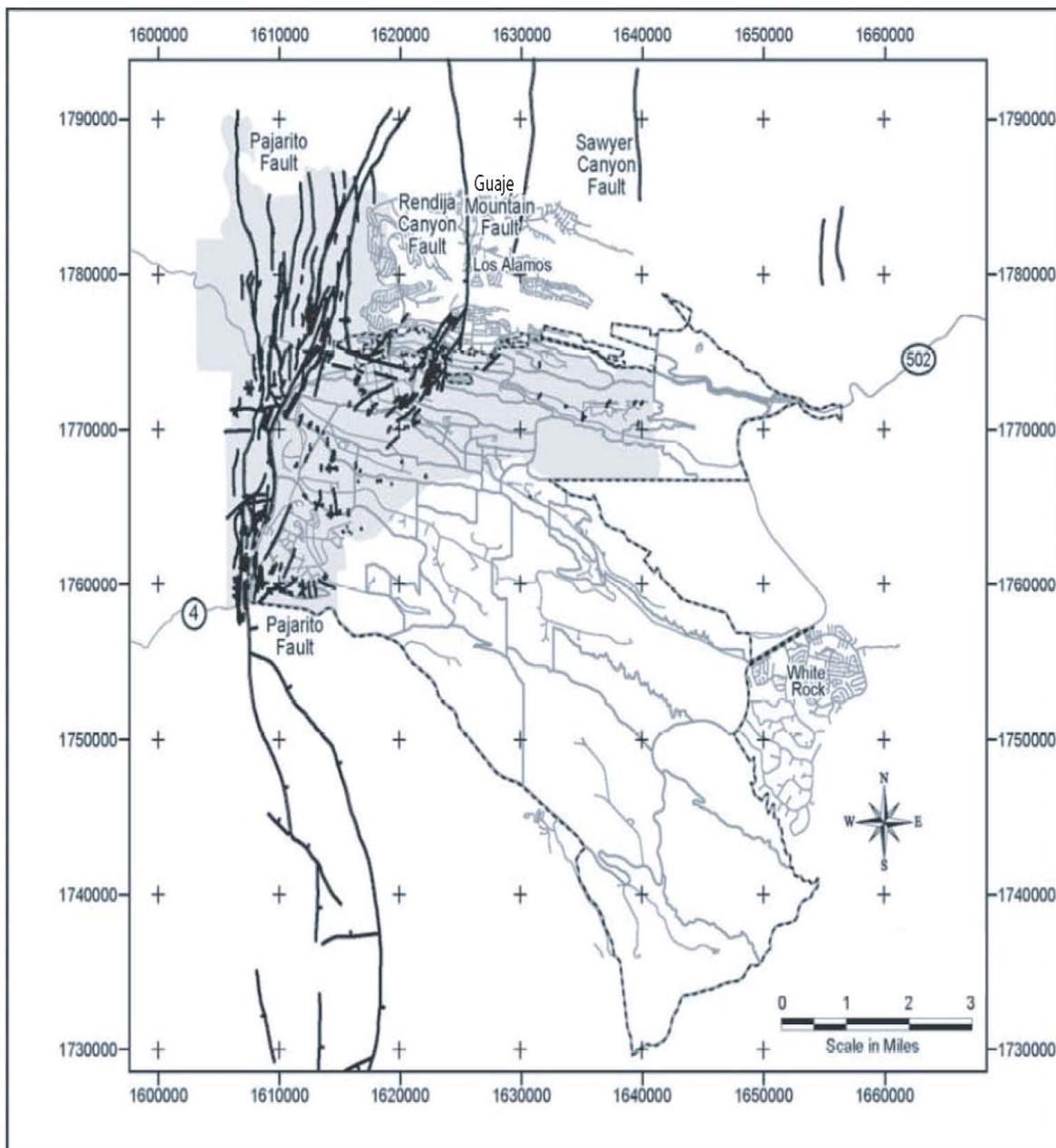
A comprehensive update to the LANL seismic hazards analysis was completed in 2007 (LANL 2007); the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the following description. The relevance of the revised understanding of seismic hazards to LANL facilities is discussed in Chapter 5. The 2007 seismic hazard study updates the 1995 LANL study that was used for the *1999 LANL SWEIS*. The studies consider all earthquake faults within 10 mi (16 km) that meet the definition of the term “capable fault” as used by the U.S. Nuclear Regulatory Commission to assess the seismic safety of nuclear power reactors (Title 10 *Code of Federal Regulations* [CFR] Part 100, Appendix A). New characterization data regarding the dynamic properties of the subsurface beneath LANL are those from investigations performed at the Chemistry and Metallurgy Research Replacement Facility. Recent geological studies have refined the understanding of fault geometry, slip characteristics, and the relationship of the faults in the LANL area. The methods used in the updated 2007 analysis follow the Senior Seismic Hazard Advisory Committee’s guidelines for a Level 2 analysis in *Recommendations for Probabilistic Seismic Hazard Analysis – Guidance on Uncertainty and Use of Experts*. The study was designed and performed under the following DOE standards (LANL 2006a):

- DOE Standard 1020-2002, Natural Phenomena Hazards Design and Evaluation Criteria for DOE Facilities;
- DOE Standard 1022-94, Natural Phenomena Hazards Site Characterization Criteria; and
- DOE Standard 1023-95, Natural Phenomena Hazard Assessment Criteria. The seismic hazards analysis report (LANL 2007) includes details on refinement of the seismic source model, ground motion attenuation relationships, dynamic properties of the subsurface (particularly the Bandelier Tuff) beneath LANL, as well as the probabilistic seismic hazard, horizontal and vertical hazards, and design basis earthquake for LANL.

The dominant contributor to seismic risk at LANL is the Pajarito Fault System. The main element of the system is the Pajarito Fault. Secondary elements include the Santa Clara Canyon Fault, the Rendija Canyon Fault, the Guaje Mountain Faults, and the Sawyer Canyon Fault. The general fault geometry in the system is reflected in Figure 4.1.6-1 (LANL 2006a).

4.1.6.3.1 Pajarito Fault

The geometry of the Pajarito Fault varies appreciably along its north-south extent. Its surface expression varies from a simple normal fault to broad zones of small faults to largely unfaulted monoclines. These features are all considered surface expressions of deep-seated normal faulting (LANL 2006a).



Source: LANL 2006a.

Figure 4.1.6-1— Mapped Faults in the LANL Area

In the latest studies, including trench excavations and borehole stratigraphy and structure, indicated more recent movement (Table 4.1.6-1). Recent studies also indicated that movement on the Pajarito Fault may be linked to movement on the other fault segments in the Pajarito Fault System. Five small earthquakes (magnitudes of 2 or less on the Richter scale) have been recorded in the Pajarito Fault since 1991. These small events, which produced effects felt at the surface, are thought to be associated with ongoing tectonic activity within the Pajarito Fault zone (LANL 2006a).

Table 4.1.6-1 — Summary of Movement on Faults of the Pajarito Fault System

Name	Approximate Length	Type	Most Recent Faulting Event	Maximum Earthquake Potential ^a
Pajarito	26 miles	Normal, down-to-the-east ^b	1,400 to 2,200 years ago	7
Rendija Canyon	8 miles	Normal, down-to-the-west	Less than 8,000 years ago	6.5
Guaje Mountain	8 miles	Normal, down-to-the-west	3,400 to 6,500 years ago	6.5

^a Richter magnitude.

^b The fault plane dips to the east and the crustal block on the east side of the fault slips downward to the east when fault movement occurs. Down-to-the-west reverses this fault plane angle and sense of movement.

Note: To convert miles to kilometers, multiply by 1.6093.

Sources: LANL 2007.

4.1.6.3.2 Rendija Canyon Fault

Studies of the Rendija Canyon Fault (LANL 2006a) indicate that it is a dominantly down-to-the-west normal fault located approximately 2 miles east of the Pajarito Fault. Trench exposures across the Rendija Canyon Fault indicate that the most recent surface rupture occurred about 8,600 or 23,000 years ago. The probabilistic displacement hazard for the worst-case scenario was determined to be less than 0.67 inches of displacement in 10,000 years. The low hazard resulted from the long recurrence interval (33,000 to 68,000 years), and related low slip rates on the Rendija Canyon Fault. Geologic mapping shows that there is no faulting in the near-surface directly beneath TA-55. The closest fault is about 1,500 feet west of the TA-55 Plutonium Facility. The Rendija Canyon Fault, therefore, does not continue from the Los Alamos town site directly south to TA-55 (LANL 2006a).

4.1.6.3.3 Guaje Mountain Fault

The Guaje Mountain Fault is subparallel to the Pajarito Fault and Rendija Canyon Fault and is located approximately 1.2 miles east of the Rendija Canyon Fault. It is somewhat shorter than the Rendija Canyon Fault and the southern extent is not well documented. Geologic surface mapping and trenching at Pajarito Mesa demonstrated the absence of faulting in that area for at least the last 50,000 to 60,000 years. Based on available data, a series of seismic events have been identified on the Guaje Mountain Fault. These range in age from 4,200 to 300,000 years ago and have up to approximately 7 feet of displacement (LANL 2006a).

4.1.6.3.4 Sawyer Canyon Fault

The Sawyer Canyon Fault is a short, west-dipping fault that is subparallel to and located east of the Rendija Canyon and Guaje Mountain Faults. Its effect on seismicity at LANL is relatively small because the surface trace is located at a distance from the site and the structure migrates away from LANL at depth. This fault is included in the 2007 seismic update to simplify modeling (LANL 2006a).

4.1.6.3.5 Other Areas of LANL

Surveying of Bandelier Tuff contacts at Mesita del Buey (TA-54) revealed 37 faults with vertical displacements of 2 to 26 inches (5 to 65 centimeters). These small faults appear to be secondary effects associated with large earthquakes in the main Pajarito Fault zone, or perhaps earthquakes

on other faults in the region. Geologic mapping and related field and laboratory investigations in the north-central to northeastern portion of LANL (TAs 53, 5, 21, 72, and 73) revealed only small faults that have little potential for seismic surface rupture. The study identified six small-displacement (less than 5 feet vertical displacement) faults or fault zones. These faults are considered subsidiary to the principal faults of the Pajarito Fault system (that is, the Pajarito, Rendija Canyon, and Guaje Mountain Faults) and likely experienced small amounts of movement during earthquakes on the principal faults.

4.1.6.3.6 Pajarito Fault System Event Chronology

Recent work has shown that the Pajarito Fault system is a broad zone of distributed deformation, and that the master Pajarito Fault itself probably breaks the surface along only part of its length in the vicinity of LANL (LANL 2004e). Most of the geologic structures that have been the targets of seismic studies are, in fact, faults subsidiary to the three main faults (that is, the Pajarito, Rendija Canyon, and Guaje Mountain Faults). As such, the individual faults do not provide a complete record of paleoseismic events for the entire system.

The potential seismic hazard at LANL is dominated by seismic ground motion associated with earthquakes on nearby faults. It also includes surface rupture along faults within the boundaries of LANL. New data obtained by the LANL Seismic Hazards Program over the last 5 years, combined with previous work, suggest that there may have been three Holocene surface-rupturing events within the Pajarito Fault system. A report in preparation by the LANL Seismic Hazards Geology Team will document a comprehensive review and re-evaluation of geochronological constraints on paleoseismic activity in the Pajarito Fault system. This study is being prepared to recalculate the probabilistic seismic hazard at LANL. The reanalysis of the seismic hazard will incorporate data from studies completed since the *1999 LANL SWEIS* (LANL 2006a). The *Update of the Probabilistic Seismic Hazard Analysis and Development of Seismic Design Ground Motions at the Los Alamos National Laboratory* was completed in 2007 (LANL 2007).

4.1.7 Biological Resources

This section describes ecological resources at LANL including terrestrial and aquatic resources, threatened and endangered (T&E) species, and floodplains and wetlands.

4.1.7.1 Terrestrial Resources

Five vegetation zones have been identified within LANL. In general these zones result from changes in elevation, temperature, and moisture along the approximately 12-mile wide, 5,000-foot elevational gradient from the Rio Grande to the western edge of the site. The five zones include: Juniper (*Juniperus monosperma* [Engelm.] Sarg.) Savannas; Piñon (*Pinus edulis* Engelm.)-Juniper Woodlands; Grasslands; Ponderosa Pine (*Pinus ponderosa* P. & C. Lawson) Forests; and Mixed Conifer Forests (Douglas fir [*Pseudotsuga menziesii* (Mimel) Franco], ponderosa pine, and white fir [*Abies concolor* (Gord. & Glend.) Lindl. Ex Hildebr.]). While Mixed Conifer Forests are prevalent at higher elevations to the west of LANL, within the site this vegetation zone is restricted to cooler north-facing canyons walls. This diversity in vegetative communities has resulted in the presence of over 900 species of vascular plants. There

is a comparable diversity in regional wildlife with 57 species of mammals, 200 species of birds, 28 species of reptiles, 9 species of amphibians, and over 1,200 species of arthropods having been identified (LANL 2006a, LANL 2004e).

Approximately 2,106 acres of land have been conveyed to Los Alamos County or transferred to the Department of the Interior to be held in trust for the Pueblo of San Ildefonso (LANL 2004e). This resulted in a reduction in the size of LANL to its present size of 25,600 acres. Much of the transferred land is in a natural state and falls within the Piñon-Juniper Woodland and Ponderosa Pine Forest Vegetation Zones.

4.1.7.2 *Wetlands and Floodplains*

4.1.7.2.1 *Wetlands*

Approximately 34 acres of wetlands have been identified within LANL boundaries during a survey in 2005 with 45 percent of these located in Pajarito Canyon. Wetlands in the LANL region are primarily associated with canyon stream channels or are present on mesas, often in association with springs, seeps, or effluent outfalls. Cochiti Lake and the area near the LANL Fenton Hill site (TA-57) support lake-associated wetlands. There are also some springs within White Rock Canyon that support wetlands. Wetlands in the general LANL region provide habitat for reptiles, amphibians, and invertebrates, and potentially contribute to the overall habitat requirements of a number of species, including sensitive species (LANL 2004e, LANL 2006a).

4.1.7.2.2 *Floodplains*

Floodplains are areas adjacent to watercourses that can become inundated with surface waters during high flows from runoff due to precipitation or snowmelt. At LANL, the floodplains are generally located in the canyons that lie between the mesa fingers (DOE 2002i). DOE regulations [10 CFR 1022.4] consider the critical action floodplain to be those areas affected during a 500-year flood (has a 0.2 percent chance of occurrence in any given year). The base floodplain, which is the floodplain considered by DOE's Resource Conservation and Recovery Act (RCRA) Permit, is the 100- year flood (has a 1.0 percent chance of occurrence in any given year) [40 CFR 270.14(b)(11)(iii)]. To meet the requirements of its RCRA permit, DOE delineated the 100-year floodplain boundaries within the facility in 1992 (McLin 1992). DOE considered the 100-year flood at LANL to be created by the 100-year, 6-hour storm (McLin, Van Eeckhout, and Earles 2001).

4.1.7.3 *Aquatic Resources*

The Rio Grande is a designated Wild and Scenic Rivers. Twelve species of fish (found in the Rio Grande, Cochiti Lake, and the Rito de los Frijoles) have been identified in the LANL region (LANL 2006a, LANL 2004e). No fish species have been found within LANL boundaries (LANL 2006a, LANL 2004e).

4.1.7.4 *Threatened and Endangered Species*

Federally-listed wildlife includes 2 endangered species, 2 threatened species, 1 candidate, and 8 species of concern. New Mexico protected and sensitive plants and animals include 3 endangered species, 7 threatened species, 2 species of concern, and 14 sensitive species. Additionally, 18 species of birds are listed as birds of conservation concern. Information related to the occurrence of these species within the LANL region is included in the Table 4.1.7-1.

4.1.7.5 *Biological Monitoring and Abatement Programs*

A wide variety of wild and domestic edible vegetables, fruit, grain, and animal products are harvested in the area surrounding LANL. Ingestion constitutes an important exposure pathway by which radionuclides and nonradionuclides can be transferred to humans. The objective of LANL's biota monitoring program is to:

- Measure radioactive and nonradioactive concentrations in foodstuffs from LANL and perimeter areas, and compare results to regional areas;
- Determine trends over time; and
- Provide data used to estimate dose from the consumption of foodstuffs.

Table 4.1.7- 1 — Federal and State Listed Species Potentially Occurring at LANL

Common Name	Scientific Name	Status		Notes
		Federal	State	
Plants				
Wood lily (Mountain lily)	<i>Lilium philadelphicum</i> L. var. <i>anadinum</i> (Nutt.) Ker		Endangered	Observed on Los Alamos County, Bandelier National Monument, and Santa Fe National Forest lands
Yellow lady's slipper orchid	<i>Cypripedium calceolus</i> L. var. <i>pubescens</i> (Willd.) Correll		Endangered	Observed on Bandelier National Monument lands
Amphibians				
Jemez Mountain salamander	<i>Plethodon</i> <i>neomexicanus</i>	Species of Concern	Threatened	Permanent resident, Los Alamos County, Bandelier National Monument, and Santa Fe National Forest lands
Birds				
American peregrine falcon	<i>Falco peregrinus</i> <i>anatum</i>	Species of Concern, Conservation Concern	Threatened	Forages on LANL, nests and forages on adjacent lands
Arctic peregrine falcon	<i>Falco peregrinus</i> <i>tundrius</i>	Species of Concern, Conservation Concern	Threatened	
Bald Eagle ^a	<i>Haliaeetus</i> <i>leucocephalus</i>	Threatened	Threatened	Observed as a migratory and winter resident along Rio Grande and adjacent LANL lands
Gray vireo	<i>Vireo vicinior</i>	Conservation Concern	Threatened	Considered accidental or transient to Bandelier National Monument
Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened	Sensitive	Breeding resident on LANL, Los Alamos County, Bandelier National Monument, Santa Fe lands; critical habitat designated on Santa Fe National Forest Lands
Southwestern willow flycatcher	<i>Empidonax traillii</i> <i>extimus</i>	Endangered	Endangered	Present on LANL and White Rock Canyons, Jemez Mountains, and near Española; potential nesting area on LANL

**Table 4.1.7- 1 — Federal and State Listed Species Potentially Occurring at LANL
 (continued)**

Common Name	Scientific Name	Status		Notes
		Federal	State	
Mammals				
Black-footed ferret	<i>Mustella nigripes</i>	Endangered		
New Mexico meadow mouse	<i>Zapus hudsonius luteus</i>	Species of Concern	Threatened	Permanent resident on Bandelier National Monument and Santa Fe National Forest lands; overwinters by hibernating
Spotted bat	<i>Euderma maculatum</i>		Threatened	Seasonal resident on LANL, Bandelier National Monument, and Santa Fe National Forest lands

a = The comment period on the 1999 proposal to remove the Bald Eagle from Endangered Species Act protection (i.e., delisting) was re-opened from February 16 thru June 19, 2006, the decision to delist the Bald Eagle is still pending.

Source: LANL 2005j

To evaluate LANL impacts from radionuclides, the analytical results of biota samples collected from on-site and perimeter areas are compared with regional or baseline statistical reference levels (LANL 2006a).

Foodstuffs samples that were collected in 2005 included fish from Cochiti Reservoir and purslane, an edible plant, from the Pueblo de San Ildefonso. Samples were also collected Area G and at the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility.

Levels of radionuclides, non-radionuclide inorganic metals, and PCBs in fish upstream and downstream of LANL were similar to each other and support previous studies that imply LANL is not the source of significant contaminants. Radionuclides in the fish from upstream and downstream sources are near detection limits or nondetectable (the result is less than three times the analytical uncertainty), except for one sample from Cochiti Reservoir that contained uranium-234 and uranium-238 just above the regional statistical reference levels (three standard deviations above background averages); however, the isotopic distribution indicates a natural origin of the uranium. Mercury levels in the fish upstream and downstream were similar but are at levels that have triggered fish consumption advisories on the Rio Grande. Similarly, PCB levels in bottom-feeding fish from both upstream and downstream sources exceed safe levels for regular consumption (LANL 2006a).

Wild edible plants (oak acorns, wild spinach, and purslane) were sampled in past years from Pueblo de San Ildefonso lands near the LANL boundary. Some radionuclides in these plants were at higher levels than natural or fallout levels; however, all were below levels that would result in a dose of 0.01 milirem for each pound of each consumed, which is 0.1 percent of the DOE dose limit of 100 millirem per year. In 2005, additional purslane samples and soil samples were collected to investigate the slightly elevated strontium-90 levels. The results confirmed suspicions that lower calcium levels in the soil results in increased uptake of fallout strontium-90 by the plants (LANL 2006a).

All non-radionuclide contaminant concentrations, with the exception of barium, in these wild edible plants were either undetected or within the regional statistical reference levels. The additional samples of purslane from background locations confirmed elevated barium concentrations in these plants that are most likely due to bioaccumulation of barium by purslane plants (LANL 2006a).

Honeybees sampled from hives on LANL property near a testing area where depleted uranium is used found only uranium-238 above regional statistical reference levels but at levels far below terrestrial animal dose screening levels (<0.01 radiation per day). All other radionuclides and all non-radionuclides were below regional statistical reference levels (LANL 2006a).

Samples of soil, vegetation, and small mammals (e.g., deer mice) at the Los Alamos Canyon Weir, a low rock dam designed to trap sediment being transported off LANL property in Los Alamos Canyon were collected. The levels of radionuclides and metals in these media were mostly below regional statistical reference levels and indicate that there is no measurable impact to the biota (LANL 2006a).

A special study of uranium uptake by ponderosa pine trees growing near firing sites at TA-15 was conducted to determine if variations in environmental uranium concentrations from open-air dynamic tests were similar to variations in uranium concentrations in trees. Results indicate that uranium concentrations were statistically similar in off-site and on-site ponderosa pine trees, indicating that dynamic tests conducted at LANL have not significantly impacted uranium concentrations in ponderosa pine pulp (LANL 2006a).

Moss samples were collected from several springs around northern New Mexico and analyzed for cesium-137 as part of another special study. Levels at two of the sampled springs were similar to those measured by other organizations at those springs. The varying levels of cesium-137 may be attributable to the exposure of the moss to dust or soil that contains fallout levels of cesium-137; the lowest levels were generally found on moss from springs that are relatively sheltered (LANL 2006a).

4.1.8 Cultural and Archaeological Resources

As of 2005, cultural and paleontological surveys have been conducted on approximately 90 percent of the land within LANL boundaries with 86 percent having been intensively surveyed. The majority of these surveys emphasized American Indian cultural resources. Information on these resources was obtained from the LANL cultural resources database, which is organized primarily by site type. Although about 400 cultural and paleontological resource sites have been determined to be NRHP eligible, most of the remaining sites have yet to be formally assessed and are therefore assumed to be eligible until assessed (LANL 2005h).

4.1.8.1 *Archaeological Resources*

Occupation and use of the Pajarito Plateau began as early as 10,000 BC as foraging groups used the area for gathering and hunting large game animals. Since 10,000 BC a succession of peoples has populated the LANL area as evident in its rich paleontological resources (LANL 2006a). Recent surveys have showed that a total of 1,915 paleontological resource sites have been identified at LANL. Of these, 1,776 are prehistoric sites related to the Paleoindian, Archaic, and Ancestral Pueblo Cultures, and 139 are related to early American Indian, Hispanic, and Euro-American Cultures.

4.1.8.2 *Historic Resources*

Two potential National Historic Landmarks and one potential National Register Historic District have been proposed at LANL. The former includes the “Project Y” Manhattan Project and Los Alamos National Laboratory Ancestral Pueblo National Historic Landmarks. “Project Y” of the Manhattan Project lasted only four years (1942 through 1946), but represented one of the defining moments of recent world history. The main goal of “Project Y” was the immediate development and possible deployment of the world’s first atomic weapon. The potential Los Alamos National Laboratory Ancestral Pueblo National Historic Landmark would consist of four discrete units totaling 132 acres and would recognize a number of the Ancestral Pueblo archaeological sites that are especially important due to integrity of location and the nature of the resource (LANL 2005h).

The potential Los Alamos Archaeology National Register Historic District would consist of a number of sites and clusters of sites that, while not deemed of sufficient significance to be considered for inclusion in the two potential National Historic Landmarks, nevertheless are important to the State of New Mexico and to the Nation. The proposed National Register Historic District would contain a total of 10 discrete components with a combined size of 1,496 acres. Included are six complexes rich in resources dating from the Archaic Period through the Ancestral Pueblo Classic Period and four components relating to the Homestead Period (LANL 2005h).

4.1.8.3 *Native American Resources*

Within LANL’s boundaries there are ancestral villages, shrines, petroglyphs (carvings or line drawings on rocks), sacred springs, trails, and traditional use areas that could be identified by Pueblo and Hispanic communities as traditional cultural properties. According to the DOE compliance procedure, American Indian tribes may request permission for visits to sacred sites within LANL boundaries for ceremonies (LANL 2006a).

Previous consultations were conducted with 19 American Indian tribes and two Hispanic communities to identify cultural properties important to them in the LANL region. All of the consulting groups stated that they had at least some traditional cultural properties present on or near LANL. Categories and numbers of traditional cultural properties identified included 15 ceremonial and archaeological sites, 14 natural features, 10 ethonobotanical sites, 7 artisan material sites, and 8 subsistence features. Although these resources were stated as being present throughout LANL and adjacent lands; no specific features or locations were identified that would permit formal evaluation and recognition as traditional cultural properties. In addition to physical cultural entities, concern has been expressed that “spiritual,” “unseen,” “undocumentable,” or “beingness” aspects can be present at LANL that are an important part of American Indian culture (LANL 2006a).

A “Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites at Los Alamos National Laboratory, New Mexico” was sent by DOE to 26 different tribes to help complete the traditional cultural properties identification and evaluation process begun in 1999. As of September 30, 2005, this process had narrowed the number of tribes with active

traditional cultural properties concerns on LANL to the Pueblo of San Ildefonso, the Pueblo of Santa Clara (Rendija Canyon), and possibly the Pueblo of Cochiti. DOE maintains ongoing discussions with these pueblos. Such discussions with the Pueblo of San Ildefonso have identified one traditional cultural property, which is in the process being forwarded to the New Mexico State Historic Preservation Office (SHPO) for review and concurrence. In addition, several other locations have been identified by the Pueblo of San Ildefonso for consideration as traditional cultural properties. None of these are locations that would have a significant impact on current mission activities at LANL.

A number of traditional cultural properties were identified in the Rendija Canyon Tract in 1993 in response to the then proposed Bason Land Exchange (LANL 2002); another traditional cultural property was identified during the Land Conveyance and Transfer Project. Although not directly disturbed, seven traditional cultural properties within the tract were threatened by persons driving through a traditional cultural properties-dense area and by disturbance through the removal of stones to use in the apparent burial of a pet. Corrective actions have been taken in order to prevent further damage to these sites including placing fencing around all traditional cultural properties in the Rendija Canyon Tract, posting areas as environmentally sensitive, documenting damage, strengthening gates, and installing surveillance cameras. Additionally, discussion have been held with Santa Fe National Forest archaeologists and recreation specialists to formulate a shared strategy for helping to prevent or limit future vandalism in Rendija Canyon (LANL 2006a).

4.1.9 Socioeconomic Resources

Socioeconomic characteristics addressed at LANL include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI.

LANL is located in Los Alamos County, New Mexico. Statistics for employment and regional economy, population, housing, and community services are presented for the ROI, a tri-county region consisting of Los Alamos, Rio Arriba, and Santa Fe Counties. Figure 4.1.9-1 presents a map of the counties composing the LANL ROI.

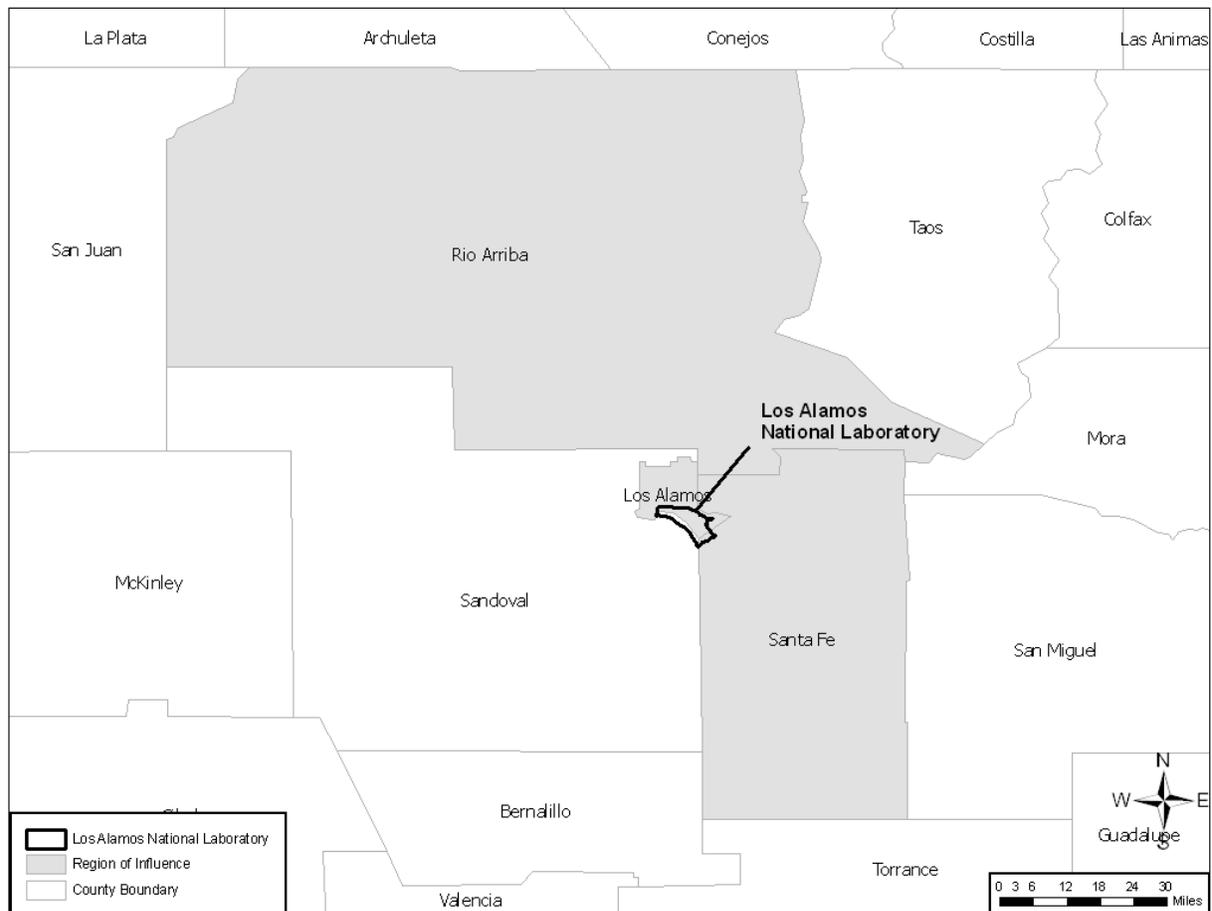


Figure 4.1.9-1 — Region of Influence for LANL

4.1.9.1 *Employment and Income*

In 2005, a total of 13,504 persons were employed by LANL contractors of which approximately 12,650 resided in New Mexico (LANL 2006a). Labor force statistics are summarized in Table 4.1.9-1. The civilian labor force of the ROI grew by approximately 9 percent from 132,244 in 2000 to 143,856 in 2005. The overall ROI employment experienced a growth rate of 8.6 percent with 126,066 in 2000 to 136,612 in 2005 (BLS 2007).

The ROI unemployment rate was 4.4 percent in 2005 and 4.0 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 2.8 percent in Los Alamos County to a high of 5.9 percent in Rio Arriba County. The unemployment rate in New Mexico in 2005 was 5.3 percent (State of New Mexico 2006).

Table 4.1.9-1 — Labor Force Statistics for the ROI and New Mexico

	ROI		New Mexico	
	2000	2005	2000	2005
Civilian Labor Force	100,492	109,535	852,293	915,489
Employment	96,434	104,695	810,024	867,317
Unemployment	4,058	4,840	42,269	48,172
Unemployment Rate (percent)	4.0	4.4	5.0	5.3

Source: BLS 2007.

Income information for the LANL ROI is provided in Table 4.1.9-2. There are major differences in the income levels among the counties making up the ROI, especially between Rio Arriba County at the low end with a median household income in 2004 of \$32,935 and a per capita income of \$22,194 and Los Alamos County at the upper end with a median household income of \$94,640 and a per capita income of \$52,524 (BEA 2007).

Table 4.1.9-2 — Income Information for the LANL ROI, 2004

	Per capita income (dollars)	Median household income (dollars)	Average earnings per job (dollars)
Los Alamos	52,524	94,640	71,641
Rio Arriba	22,194	32,935	24,511
Santa Fe	36,095	43,727	40,015
New Mexico	26,679	37,838	36,131

Source: BEA 2007.

4.1.9.2 *Population and Housing*

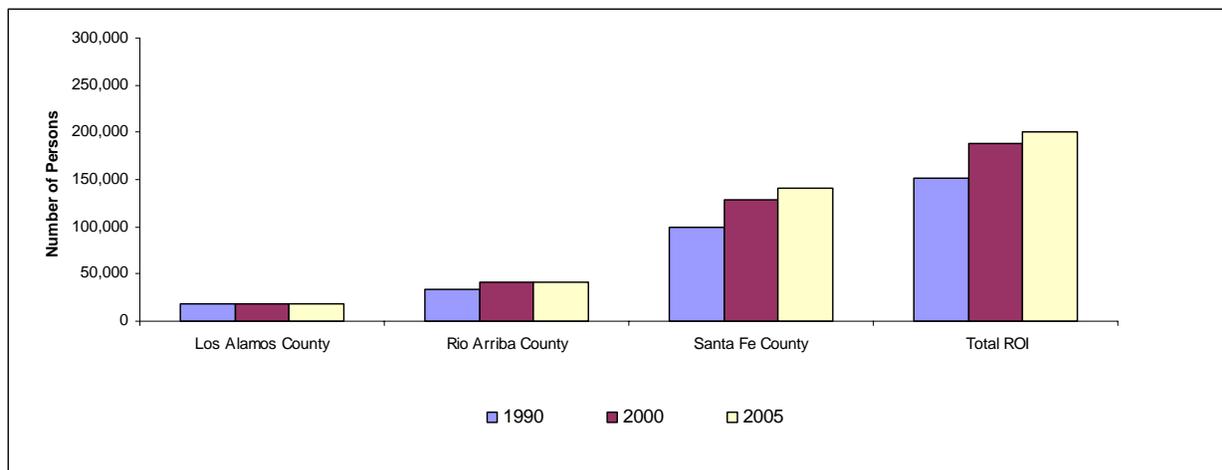
The ROI is used to analyze the primary economic impacts on population and housing. From 1990 to 2000, population within the LANL ROI has grown at approximately the same rate compared to the State of New Mexico. Table 4.1.9-3 presents historic and projected population in the ROI and the state.

Table 4.1.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Los Alamos	18,115	18,343	18,858	19,114	20,060
Rio Arriba	34,365	41,190	40,633	45,058	48,630
Santa Fe	98,928	129,292	140,801	158,624	191,403
ROI	151,408	188,825	200,292	222,796	260,093
New Mexico	1,515,069	1,819,046	1,925,985	2,112,986	2,383,116

Source: BBER 2004.

Between 1990 and 2000, the ROI population increased 25 percent from 151,408 in 1990 to 188,825 in 2000. From 2000 to 2005, the population of the ROI increased 6 percent to 200,292 in 2005. Santa Fe County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 10 percent. Los Alamos County had a 3.7 percent increase from 18,343 in 2000 to 18,858 in 2005 (USCB 2007a). Figure 4.1.9-2 presents the trends in population within the LANL ROI.



Source: USCB 2007.

Figure 4.1.9- 2 — Trends in Population for LANL ROI, 1990-2005

Table 4.1.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 86,417 with 77,786 occupied (90 percent). There were 56,923 owner-occupied housing units and 20,863 rental units. The median value of owner-occupied units in Los Alamos County was the greatest of the counties in the LANL ROI. The vacancy rate was the smallest in Los Alamos County (5.5 percent) with the highest in Rio Arriba County (16.5 percent).

Table 4.1.9-4 — Housing in the LANL ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Los Alamos County	7,937	7,497	5,894	1,603	440	5.5	228,300
Rio Arriba County	18,016	15,044	15,044	2,763	2,972	16.5	107,500
Santa Fe County	57,701	52,482	35,985	16,497	5,219	9.0	189,400
Total ROI	83,654	75,023	56,923	20,863	8,631	10.3	171,783

Source: USCB 2007.

4.1.9.3 Community Services

New Mexico is divided into 89 school districts, 7 of which are in the LANL ROI. Total public school enrollment in these districts was 25,416 students for the 2005 to 2006 school year (IES 2006a). Community services in the ROI include public schools, public safety, and medical services. The student-to-teacher ratio in these school districts ranges from a high of 15:1 in the Española Municipal School District in Rio Arriba County to a low of 11:1 in Chama Valley Independent Schools in Rio Arriba County. The student-to-teacher ratio in the ROI was 15:1 (IES 2006a).

The Los Alamos County Police Department has 31 officers and 10 detention staff. The Santa Fe Police Department has a total of 207 full time employees, 133 sworn employees and 74 civilian

(DOJ 2004). The Rio Arriba County Sheriff's department has 25 full time employees and 25 sworn employees (Rio Arriba 2007a).

The Los Alamos County fire Department provides fire suppression, medical, rescue, wildland fire suppression and fire prevention services to both LANL and the Los Alamos County community. There are six manned fire stations with 141 budgeted positions including 123 uniformed personnel (LANL 2006a). The Los Alamos County Fire Department has 31 officers and 10 detention staff. There are 15 fire districts serving Santa Fe (Santa Fe 2007) and 19 manned fire stations serving Rio Arriba (Rio Arriba 2007b).

Four hospitals serve the LANL ROI: Española, Los Alamos Medical Center, St. Vincent Hospital, and PHS Santa Fe Indian Hospital. These hospitals have a total bed capacity of 375 (ESRI 2007).

4.1.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of LANL. Figure 4.1.10-1 shows eight counties potentially affected by the current missions performed at LANL. These counties include Bernalillo, Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos. Table 4.1.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

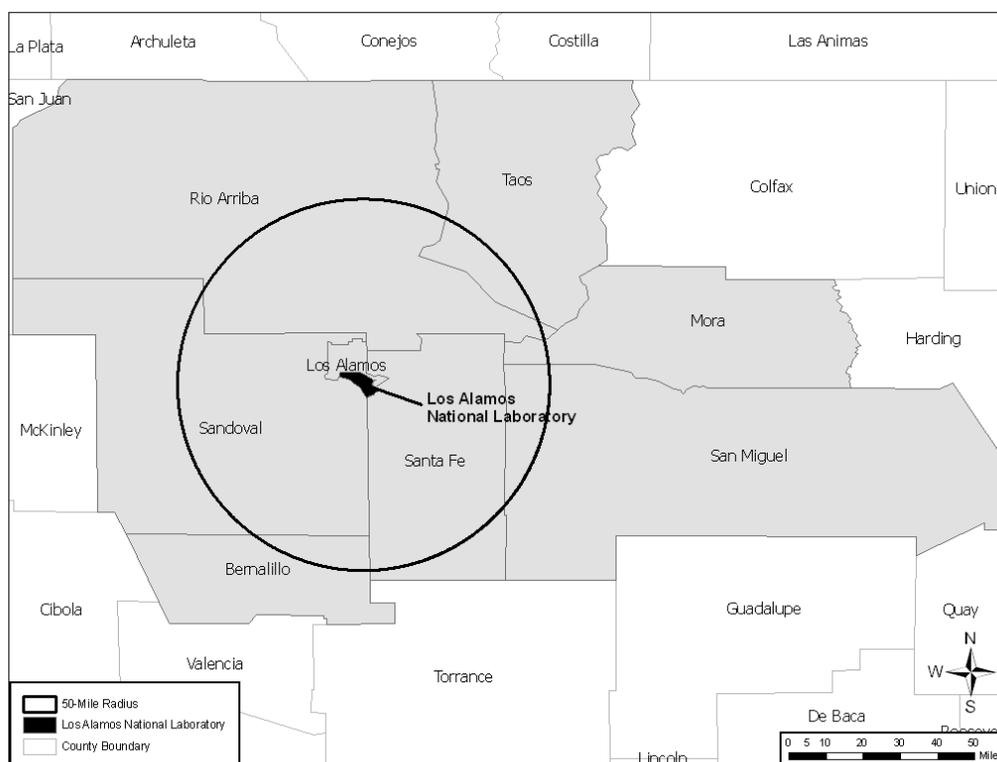


Figure 4.1.10-1 — Potentially Affected Counties Surrounding LANL

Table 4.1.10-1 — Demographic Profile of the Potentially Affected Counties Surrounding LANL, 2000

Population Group	Population	Percent
Minority	490,348	54.4
Hispanic alone	216,050	24.0
Black or African American	18,318	2.0
American Indian and Alaska Native	50,198	5.6
Asian	13,811	1.5
Native Hawaiian and Other Pacific Islander	879	0.1
Some other race	154,821	17.2
Two or more races	36,271	4.0
White alone	410,348	45.6
Total	900,696	100.0

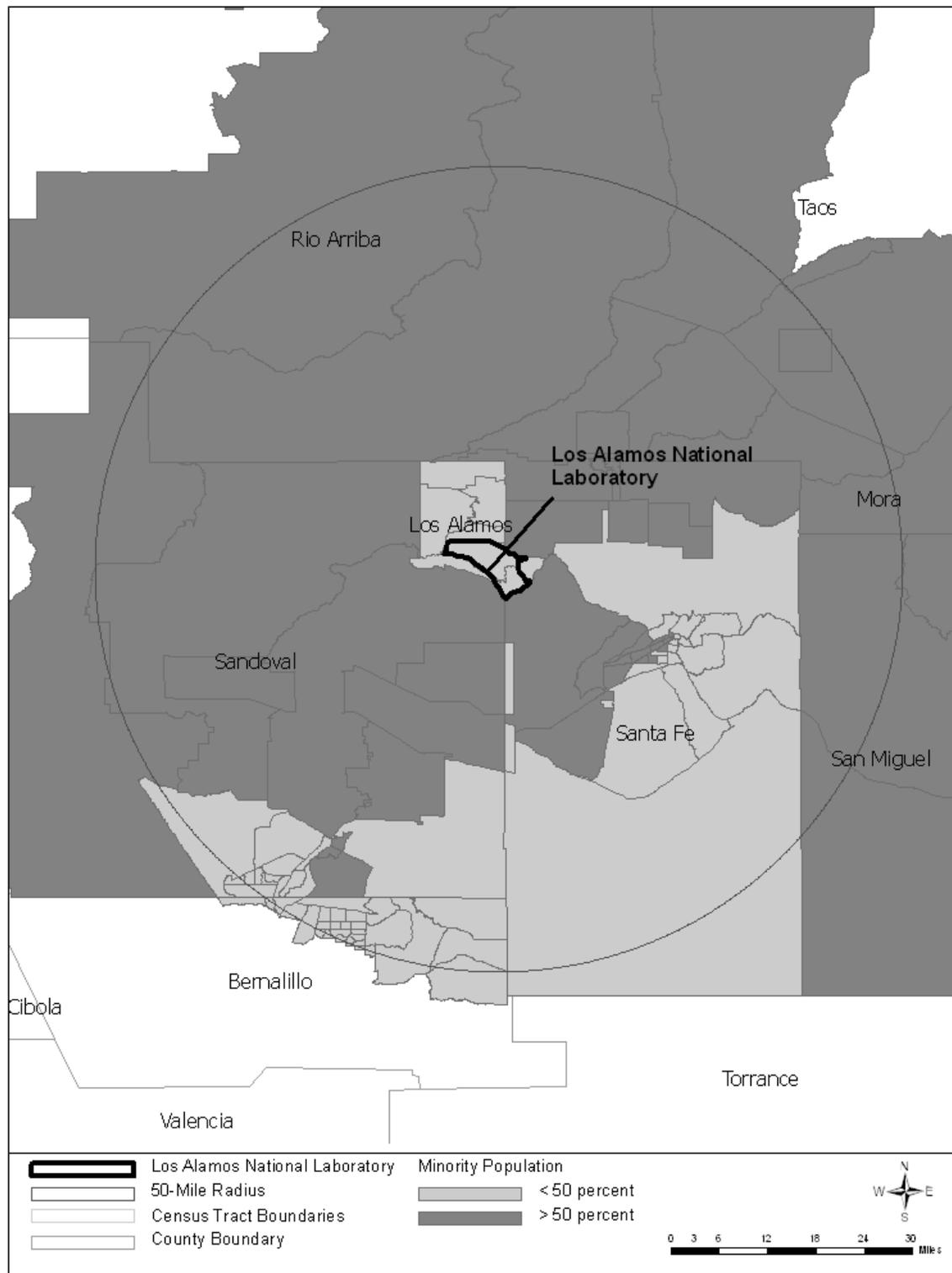
Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 54.4 percent of the total population. This minority population is composed largely of Hispanic or Latino residents. As a percentage of the total resident population in 2000, New Mexico had a minority population of 55 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts with minority populations exceeding 50 percent were considered minority census tracts. Based on 2000 census data, Figure 4.1.10-2 shows minority census tracts within the 50-mile radius where more than 50 percent of the census tract population is minority.

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.1.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tract population is living below the Federal poverty threshold.

According to 2000 census data, there were no census tracts within the 50-mile radius of LANL where more than 50 percent of the census tract population was identified as living below the Federal poverty threshold. In 2000, 18.4 percent of individuals for whom poverty status is determined were below the poverty level in New Mexico and 12.4 percent in the U.S. (USCB 2007).



Source: USCB 2007.

Figure 4.1.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of LANL



Source: USCB 2007.

Figure 4.1.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of LANL

4.1.11 Health and Safety

Current activities associated with routine operations at LANL have the potential to affect worker and public health. The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at LANL. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.1.11.1 Public Health

4.1.11.1.1 Radiological

Releases of radionuclides to the environment from LANL operations provide a source of radiation exposure to individuals in the vicinity of LANL. During 2005, LANL's environmental radiological monitoring program was conducted according to DOE Orders 450.1, "Environmental Protection Program," and 5400.5, "Radiation Protection of the Public and the Environment." The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public. The program monitored for the principal radionuclides associated with plant operations.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem above natural background. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to DCGs listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual (MEI) member of the general public. This individual is a person who resides near LANL, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Plant operations. Calculations are performed using the EPA's CAP88-PC model (EPA 1992).

Based on the 2004 operational data, the total dose to the offsite MEI in 2004 was estimated at 1.68 millirem. This includes 1.52 millirem that would come from LANSCE stack emissions, 0.12 millirem from emissions at other LANL stacks, and 0.04 millirem from the radionuclides

measured at the AIRNET station. The higher emissions and subsequent dose in 2004 are due to operations requiring higher beam power and increased radioactive gas production occurring in the water used to cool the beam target (LANL 2006a).

The 2005 collective population dose attributable to LANL operations to persons living within 50 miles of the site was 2.46 person-rem, which is significantly higher than the dose of 0.90 person-rem reported for 2004 (LANL 2006b). Tritium contributed about 17 percent of the dose, and short-lived air activation products such as carbon-11, nitrogen-13, and oxygen-15 from LANSCE contributed about 83 percent. The increase in the 2005 collective population dose was attributable to a longer beam operation time at LANSCE (over twice that of 2004) and a malfunction in the LANSCE air emissions control system. LANSCE has historically been the major contributor to the population dose. Until 2005, population doses for the past 12 years had declined from a high of about 4 per-rem in 1994 to less than 1 person-rem in 2004. The collective population dose is expected to decrease in 2006 to the 2004 level (LANL 2006b).

Tritium concentrations near the LANL perimeter are measurably higher than regional concentrations, but the resulting doses from food stuffs grown there are far below 0.1 millirem per year. The concentrations of other radionuclides are either consistent with global fallout or below levels that would result in a dose of 0.1 millirem per year per pound consumed. The LANL contribution to the food dose is therefore too small to measure and is less than 0.1 millirem per year (LANL 2006b). In summary, the total annual dose to an average resident from all pathways is less than 0.1 millirem. This includes doses from inhalation, ingestion of food and water, and direct exposure. No observable health effect is expected from these doses.

4.1.11.2 Worker Health

Occupational radiation exposures for workers at LANL from 1999 to 2005 are summarized in Table 4.1.11-1. The collective Total Effective Dose Equivalent (TEDE) for the LANL workforce during 2005 was 156 person-rem, considerably lower than the workforce dose of 704 person-rem (LANL 2006a).

Table 4.1.11-1 — Radiological Exposures of LANL Workers

Parameter	Units	1999	2000	2001	2002	2003	2004	2005
Collective TEDE (external plus internal)	person-rem	131	196	113	164	241	125	156
Number of workers with measurable dose	Number	1,427	1,316	1,332	1,696	1,989	1,710	2,169
Average measurable dose (external plus internal)	Millirem	92	149	85	96	121	73	72
Average measurable dose (external only)	Millirem	90	65	83	95	111	68	69

TEDE = Total Effective Dose Equivalent
 Source: LANL 2006a.

Table 4.1.11-2 summarizes the highest individual dose data for 1999 through 2005. The highest individual doses in 2005 were 2.051, 1.603, 1.398, 1.285, and 1.146 rem. There were no doses that exceeded DOE's 5 rem per year Radiation Protection Standard. With one exception, all

worker doses were below the 2 rem per year performance goal set by the as low as reasonably achievable Steering Committee in accordance with LANL procedures (LANL 2006a).

The collective TEDE for 2005 is 75 percent of the 208 person-rem for 1993 through 1995 used as a baseline in 1999. Several offsetting factors can be responsible for helping keep the dose below the 1999 baseline. The primary factor is that pit manufacturing has not become fully operational while other factors include: (1) changes in work load and types of work, and (2) improvements in the as low as reasonably achievable program (LANL 2006a).

Table 4.1.11-2 — Highest Individual Doses to Los Alamos National Laboratory Workers (rem)

1999	2000	2001	2002	2003	2004	2005
1.910	1.048	1.284	2.214	3.0	1.539	2.051
1.866	1.013	1.225	1.897	1.8	1.510	1.603
1.783	0.905	1.123	1.813	1.710	1.500	1.398
1.755	0.828	1.002	1.644	1.569	1.148	1.285
1.749	0.815	0.934	1.619	1.214	1.061	1.146

Source: LANL 2006a.

4.1.11.3 Nonradiological

Arsenic was identified as having a hazard index near 1 in groundwater that supplies Los Alamos County and San Ildefonso Pueblo. Excess latent cancer fatality (LCF) risk from arsenic greater than 1 in one million per year was also estimated for consumption of soils, sediments, and surface water, by some residents and recreational users of LANL. While the risk associated with arsenic ingestion was greater than 1 in one million per year, the arsenic was not associated with discharges at LANL. Arsenic is endemically present in the geology, soils, groundwater, and surface waters in the region in which New Mexico is located (LANL 2006a).

Beryllium has no hazard index for ingestion exceeding 1. However, excess LCF rates greater than 1 in one million are estimated in several pathways. Beryllium concentrations in waters, soils, and sediments are typical of those in background readings in the northern New Mexico region. Based on the environmental surveillance data from LANL, the portion of beryllium associated with LANL operations is not a significant contributor to beryllium concentrations in the immediate area of LANL (LANL 2006a).

4.1.12 Transportation

Motor vehicles provide the predominant mode of transportation utilized at LANL. The regional highway system and major roads in the vicinity of LANL are shown in Figure 4.1.12-1. Only two major roads, NM 502 and NM 4, access Los Alamos County. Traffic volume on the Los Alamos County segments of these roads is primarily associated with LANL activities. Most commuter traffic originates from Los Alamos County or east of the county. Less than 5 percent of commuters commute to LANL from the west along NM 4. The average daily traffic flow at LANL’s main access points are provided in Table 4.1.12-1.

Most commuter traffic originates from Los Alamos County or east of Los Alamos County (Rio Grande Valley and Santa Fe) as a result of the large number of LANL employees that live in

these areas. The passenger rate assumed is three passengers per vehicle, mainly due to park and ride services offered at many communities between Albuquerque and Los Alamos.

Table 4.1.12-1 — Los Alamos National Laboratory Main Access Points

Location	Average Daily Vehicle Trips
Diamond Drive across the Los Alamos Canyon Bridge	24,545
Pajarito Road at State Route 4	4,984
East Jemez Road at State Route 4	9,502
West Jemez Road at State Route 4	2,010
DP Road at Trinity Drive	1,255
Total	42,296

Source: LANL 2006a.

Average traffic volumes on the four at various points in the vicinity of NM 502 and State Road 4 were measured in September 2004 and are presented in Table 4.1.12-2.

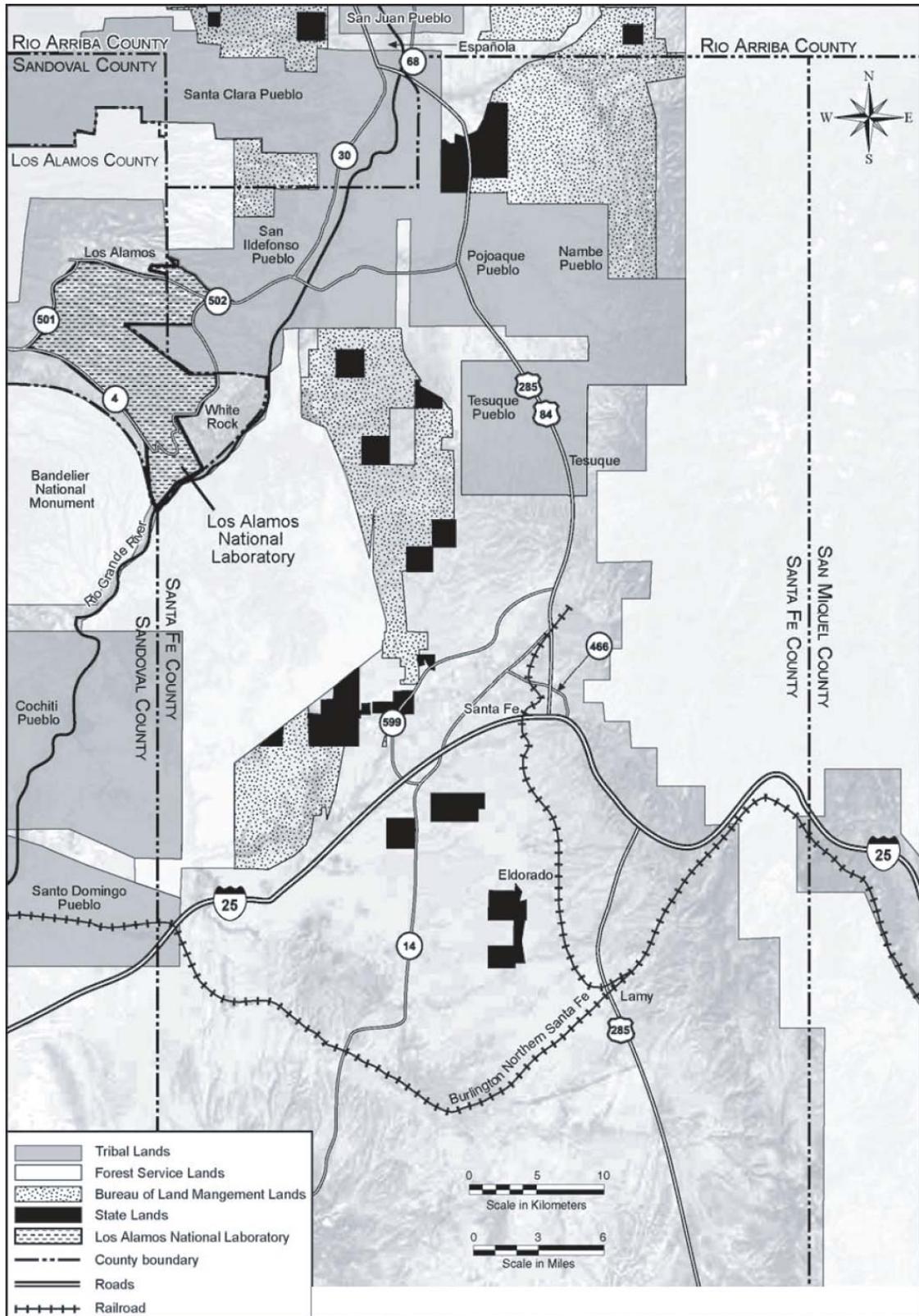
Table 4.1.12-2 — Average Weekday Traffic Volume in the Vicinity of NM 502 and State Road 4

Location	Average Daily Vehicle Trips
Eastbound on New Mexico 502 east of the intersection with New Mexico 4	10,100
Westbound on New Mexico 502 east of the intersection with New Mexico 4	7,765
Eastbound on New Mexico 502 west of the intersection of New Mexico 502 and New Mexico 4	6,540
Westbound on New Mexico 502 west of the intersection of New Mexico 502 and New Mexico 4	4,045
Eastbound on State Route 4 between East Jemez Road and the New Mexico 502/4 intersection	6,665
Westbound on State Route 4 between East Jemez Road and the New Mexico 502/4 intersection	6,505
Transition road from northbound State Route 4 to eastbound New Mexico 502	5,170
Transition road from eastbound New Mexico 502 to southbound State Route 4	1,610

Source: LANL 2006a

4.1.12.1 Aircraft Operations

The primary commercial international airport in New Mexico is located in Albuquerque. The small Los Alamos County Airport is owned by the Federal Government, and the operations and maintenance are performed by the County of Los Alamos. The airport is located parallel to East Road at the southern edge of the Los Alamos community. The airport has one runway running east-west at an elevation of 7,150 feet. Takeoffs are predominantly from west to east, and all landings are from east to west. The airport is categorized as a private use facility; however, U.S. Federal Aviation Administration-licensed pilots and pilots of transient aircraft may be issued permits to use the airport facilities.



Source: LANL 2006a.

Figure 4.1.12-1 — LANL Regional Highway System and Major Roads

4.1.12.2 *Transportation Accidents*

Motor vehicle accidents in Los Alamos County and nearby counties are reported in Table 4.1.12-3. In 2005, there were over 5,100 motor vehicle accidents in Los Alamos, Rio Arriba, and Santa Fe Counties resulting in 53 fatalities.

Table 4.1.12-3 — New Mexico Traffic Accidents in Los Alamos and Nearby Counties, 2005

County	Total Accidents	Fatalities	Injuries
Los Alamos	300	2	105
Rio Arriba	588	18	356
Santa Fe	4,217	33	2,323
New Mexico	49,023	488	24,001

Source: NMDOT 2006.

4.1.13 *Waste Management*

A significant portion of waste management operations take place in facilities designed for and dedicated to waste management. Liquid wastes are treated in the Sanitary Wastewater Systems Plant, the High Explosives Wastewater Treatment Facility, and the Radioactive Liquid Waste Treatment Facility. Specialized facilities in TA-50 and TA-54 house a variety of chemical and radioactive waste management operations, including size reduction, compaction, assaying, and storage. Many hazardous wastes are now accumulated for up to 90 days at consolidated storage facilities and are then shipped directly offsite. Four of these consolidated storage facilities exist at LANL and two more are planned (LANL 2003d).

DOE achieved an overall rating of 97 percent towards the DOE 2005 Pollution Prevention goals for fiscal year 2005. In 2004, DOE established a prevention-based Environmental Management System at LANL based on the International Standards Organization 14001 standard to meet DOE Order 450.1. The Environmental Management System is a systematic method for assessing mission activities, determining environmental impacts of those activities, prioritizing improvements, and measuring results (LANL 2004p). Environmental Management System action plans have been developed to address environmental issues, including objectives for pollution prevention, compliance and continual improvement.

4.1.13.1 *Low-Level Wastes*

Most low-level radioactive waste generated at LANL is disposed onsite at TA-54, Area G. Disposal operations were expanded into Zone 4, providing sufficient capacity for operational wastes for the long term. Although there were several instances of individual facilities exceeding 1999 projections, overall LANL low-level radioactive waste generation was well below those levels predicted in the 1999 for five years of the six-year period (LANL 2006a).

4.1.13.2 *Mixed Low-Level Wastes*

Typical waste streams include; contaminated lead shielding bricks and debris, spent chemical solutions, fluorescent light bulbs, copper solder joints, and used oil. The largest single contributor to mixed low-level radioactive waste generation was the remediation of material

disposal area (MDA) P (LANL 2004h). Overall LANL mixed low-level radioactive waste generation was below the 1999 projections for each year of the six-year period (LANL 2006a).

4.1.13.3 *Hazardous Waste*

Non-Key Facilities exceeded 1999 projections for the years 2000 through 2004; these exceedances are all attributable to the Offsite Source Recovery Program (LANL 2003g, LANL 2004h, LANL 2005g). Overall transuranic waste generation at LANL was well below the 1999 projections for 5 years of the 6-year period. In 2003, transuranic waste quantities exceeded the LANL-wide 1999 projection due to repackaging of legacy waste for shipment to WIPP and receipt and storage of waste by the Offsite Source Recovery Program (LANL 2004h). On August 27, 2007, the New Mexico Environmental Department issued for comment a draft hazardous waste facility permit for LANL.

In the year 2000, Non-Key Facilities generated 82 cubic yards of mixed transuranic waste compared to a 1999 projection of zero; the mixed transuranic waste generation for this category is solely attributable to the Transuranic Waste Inspection and Storage Project drum retrieval project (LANL 2001e). The Solid Radioactive and Chemical Waste Facilities generated mixed transuranic waste beyond that projected for the years 2000 through 2004, most notably in 2003 due to increased rates of transuranic waste repackaging for shipment to WIPP (LANL 2003g, LANL 2004h, LANL 2005g). The increasing trend, through 2003, in mixed transuranic waste generation for the Plutonium Complex and the Chemistry and Metallurgy Research Building reflect operations scaling toward full-scale production of war reserve pits (LANL 2004h). In 2004, mixed transuranic waste generation rates at the Plutonium Complex and Chemistry and Metallurgy Research Building were lower due to the 2004 work suspension and less than full-scale production (LANL 2005g).

From 1999 through 2001, large quantities of chemical wastes were generated by environmental restoration activities through cleanups in TA-16, including MDA P, PRS 3-056(c) in TA-03, and MDA R (LANL 2003g). Wastes generated by the environmental restoration project generally are shipped offsite for treatment and disposal and do not directly impact LANL waste management resources.

Radioactive liquid waste treatment takes place at two facilities located at TA-53, and TA-50. Treatment facilities are connected to source facilities by 22,000 feet of piping. The treatment facility at TA-50 handles the vast majority of radioactive liquid waste, receiving liquid waste from about 1,800 points across LANL. The Radioactive Liquid Waste Treatment Facility at TA-50 is over 40 years old, and many systems are at the end of their design life.

Projections made in 1999 were exceeded for individual treatment activities in several instances, all related to quantities of sludge to be dewatered or solidified; the liquid waste treatment increases due to these activities are small compared to radioactive liquid treatment capacity. The overall radioactive liquid waste treatment rates at LANL were consistent with the 1999 projections for each year of the 6-year period.

4.1.13.4 *Other Waste*

DOE continues to operate the TA-46 Sanitary Wastewater System Plant to treat liquid sanitary wastes. Treated liquid effluent from the Sanitary Wastewater System Plant is pumped to storage tanks near the TA-3 Power Plant before being discharged to Sandia Canyon through NPDES permitted outfall. The Sanitary Effluent Reclamation Facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation. Sanitary sludge from the Sanitary Wastewater System Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as New Mexico Special Waste at an authorized, permitted landfill (LANL 2006a).

Industrial effluent is discharged to a number of NPDES-permitted outfalls across LANL. Currently, LANL discharges wastewater to a total of 21 outfalls, down from the 55 outfalls. An effort to reduce the number of outfalls was initiated in 1997, with significant reductions realized in 1997 and 1998. Most of these reductions resulted from changes at the High-Explosives Processing Key Facility and High Explosives Testing Key Facility, with the redirection of some flows to the sewage plant at TA-46, and the routing of high explosives-contaminated flows through the High Explosives Wastewater Treatment Facility (LANL 2003g).

Solid waste is excess material that is not radioactive or hazardous and can be disposed in a solid waste landfill. Solid waste includes paper, cardboard, plastic, glass, office supplies and furniture, food waste, brush, and construction and demolition debris. Through an aggressive waste minimization and recycling program, the amount of solid waste at LANL requiring disposal has been greatly reduced. In 2004, 6,380 tons of solid waste was generated at LANL, of which 4,240 tons was recycled (LANL 2004p). The per capita generation of routine solid waste (for example food, paper, plastic) at LANL has decreased by about 58 percent over the 10-year period from 1993 through 2003 (LANL 2004h). Nonroutine solid waste is generated by construction and demolition projects, and also includes waste generated by Cerro Grande Rehabilitation Project cleanup activities. Rates for the recycled portion of sanitary waste have steadily increased from about 10 percent in 1993 to about 67 percent in 2004 (LANL 2005g).

Previously, solid waste and construction waste generated at LANL was disposed at the Los Alamos County Landfill, located within LANL boundaries, but operated by Los Alamos County. The County operates a new transfer station, which would transport that waste to other commercially available solid waste landfills within the state.

Construction and demolition debris is regulated as a separate category of solid waste under the New Mexico Solid Waste Regulations. Construction and demolition debris is not hazardous and may be disposed in a municipal landfill or a construction and demolition debris landfill (NMED 1995).

4.1.13.5 *Waste Generation from Routine Operations*

Radioactive and chemical wastes are generated by research, production, maintenance, construction and environmental cleanup activities. Radioactive wastes are divided into the following categories: low-level; mixed low-level; transuranic; and mixed transuranic. Chemical

wastes are a broad category including hazardous waste (designated under the RCRA regulations), toxic waste, construction and demolition debris, and special waste. Waste quantities vary with level and type of operation, construction activities, and implementation of waste minimization activities. Waste minimization efforts have resulted in overall waste reduction across most categories, due to process improvements and substitutions of nonhazardous chemicals for commonly used hazardous chemicals (LANL 2004h).

Table 4.1.13-1 presents a summary, by waste type, of radioactive and chemical waste quantities generated from 1999 through 2004. The quantities include contributions across LANL, including Key Facilities, Non-Key Facilities and the LANL environmental restoration project.

Table 4.1.13-1 — Los Alamos National Laboratory Waste Types and Generation

Waste Type	Units	1999 SWEIS ROD Projection	1999	2000	2001	2002	2003	2004	2005
Low-Level Radioactive Waste	yd ³ /year	16,000	2,190	5,530	3,400	9,560	7,640	19,400	7,080
Mixed Low-Level Radioactive Waste	yd ³ /year	830	30	780	80	30	50	50	90
Transuranic Waste	yd ³ /year	440	190	160	150	160	530	50	100
Mixed Transuranic Waste	yd ³ /year	150	110	120	60	110	210	30	130
Chemical Waste	10 ³ lbs/year	7,160	34,000	61,000	60,800	3,820	1,520	2,460	4,340

ROD = Record of Decision.
Source: LANL 2006a.

4.2 LAWRENCE LIVERMORE NATIONAL LABORATORY AND SANDIA NATIONAL LABORATORIES/CALIFORNIA

This section describes the environmental setting and existing conditions associated with the current operations of LLNL and Sandia National Laboratories, California (SNL/CA).

Established in 1952, the LLNL consists of two sites—the main Livermore site located in Livermore, California in Alameda County, and the rural Experimental Test Site, Site 300 (Figure 4.2-1) located approximately 12 miles east, near Tracy, California, in San Joaquin and Alameda Counties. The main LLNL site occupies approximately 821 acres, while Site 300 occupies approximately 7,000 acres. For NNSA, LLNL conducts research and development of nuclear weapons; designs and tests advanced technology concepts; designs weapons; maintains a limited capability to fabricate plutonium components; and provides safety and reliability assessments of the stockpile. LLNL also maintains Category I/II quantities of SNM associated with the weapons program and material no longer needed by the weapons program (See section 3.7 regarding proposed consolidation of this SNM).

SNL/CA was established in 1956 by Sandia Corporation to provide a closer relationship with LLNL and their nuclear weapons design work. The SNL/CA facility evolved into an engineering research and development laboratory by the early 1960s, and into a multiprogram engineering and science laboratory during the 1970s. As international arms control efforts increased in the late 1970s and throughout the 1980s, the U.S. emphasized treaty monitoring, safety, security, and control of the national nuclear weapons stockpile. With the end of the Cold War in the late 1980s, the role of SNL/CA to support stockpile stewardship ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

4.2.1 Land Resources

4.2.1.1 *Onsite Land Uses*

4.2.1.1.1 Livermore Site

Onsite land uses at the 821-acre Livermore Site include offices, laboratory buildings, support facilities such as cafeterias, storage areas, maintenance yards, and a fire station; roadways, parking areas, buffer zones, and landscaping. The site also includes internal utility and communication networks. A 500-foot-wide security buffer zone lies along the northern and western borders of the Livermore Site. There are no prime farmlands on the Livermore Site (DOE 2005a).

4.2.1.1.2 Site 300

Site 300 comprises approximately 7,000 acres of largely undeveloped land. Site 300 is primarily a non-nuclear explosives and other non-nuclear weapons component test facility. The site has four remote explosive testing facilities supported by a chemistry processing area, a weapons test area, maintenance facilities, and a General Services Area (GSA) at the site entrance. Approximately 160 acres at Site 300 have been set aside as the large-flowered fiddleneck

(*Amsinckia grandiflora*) reserve” to protect this species’ natural habitat. The existing land uses surrounding Site 300 are agricultural, primarily used for grazing cattle and sheep. There are no prime farmlands on Site 300 (DOE 2005a).

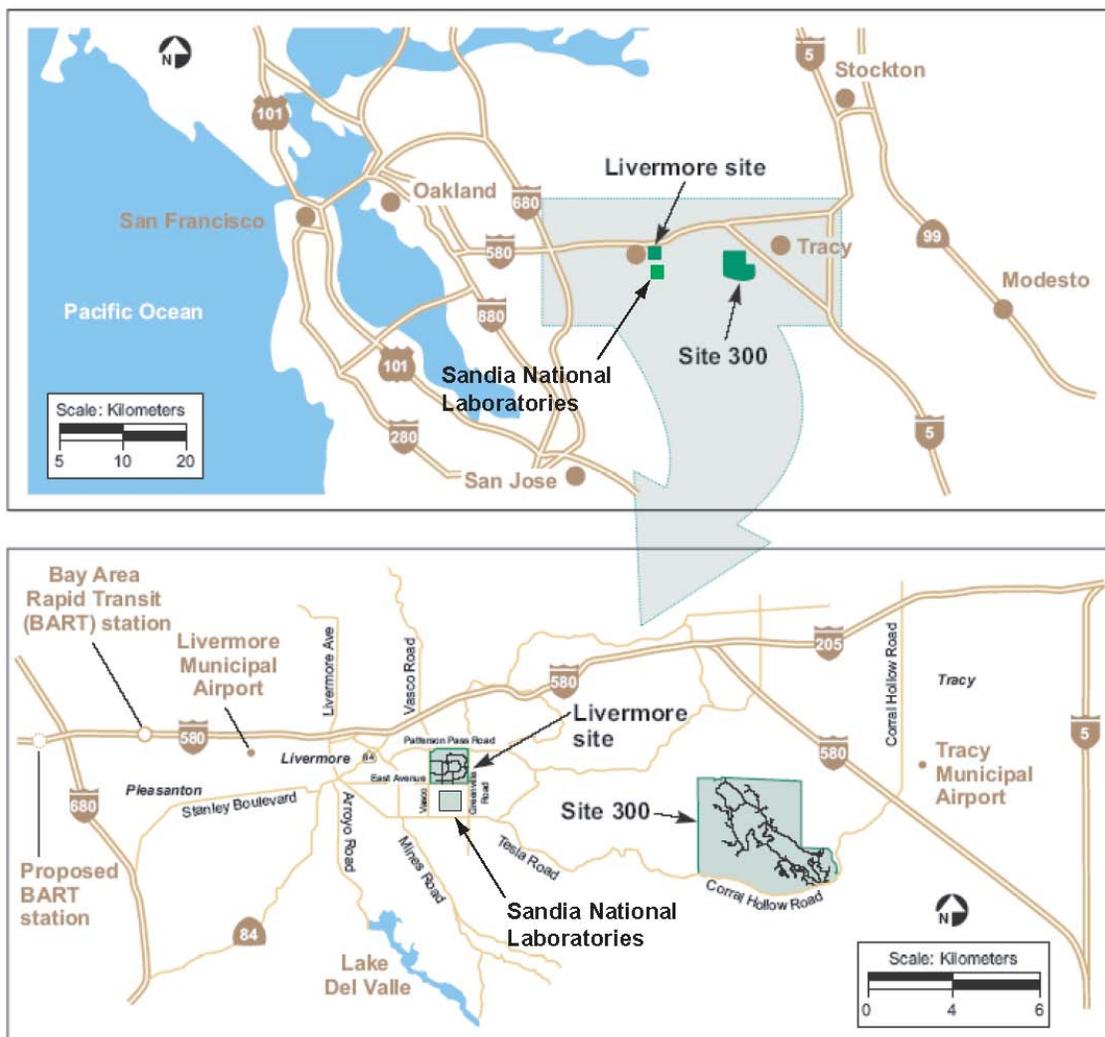


Figure 4.2-1 — Livermore Site, Site 300, and SNL/CA

4.2.1.1.3 SNL/CA

The site comprises 410 acres to the south LLNL. Primary land use at SNL/CA fits into the category of industrial/research park uses, although not all facilities are industrial in nature (for example, administrative offices). Land use at the site includes buildings and structures, infrastructure systems (water, sewer, gas, and electrical), a firing range, roadways, parking areas, and landscaping. Spaces between buildings are landscaped or used as paved service areas, roads, or sidewalks. Parking areas are positioned along the perimeter of the developed area and cluster along East Avenue. Open space within the developed area is set aside for future construction use, with the exception of Arroyo Seco. A security buffer surrounding the western, southern, and eastern edges of the developed area ranges in width from 600 to 1,200 feet and represents approximately 175 acres (SNL/CA 2007). There are no prime farmlands on SNL/CA.

4.2.1.2 *Surrounding Land Uses*

4.2.1.2.1 **Livermore Site**

Livermore site lies just east of Livermore. Adjoining the site border to the south is Sandia National Laboratories/California (SNL/CA), operated by Lockheed-Martin under DOE contract. To the south of the LLNL and SNL/CA sites are mostly low-density residential areas and agricultural areas devoted to grazing, orchards, and vineyards. Farther south, property is primarily open space and ranchettes with some agricultural use. Residential developments, including houses and apartments, abut the property immediately to the west of the Livermore site. A small business park lies to the southwest.

A small amount of very low density residential development lies to the east of the Livermore site, and agricultural land extends to the foothills that define the eastern margin of the Livermore Valley. An extensive business park is located to the north, and a 500 acre parcel of open space to the northeast has been rezoned to allow development of light industry. Land uses farther north include vacant land, industrial, and Interstate 580 (I-580). Land northeast of the site is agricultural and used primarily for grazing. Wind turbines are installed on the hills of the Altamont Pass, northeast of the site. The closest residences to the boundaries of the Livermore Site are 0.25 mile to the east, 0.35 mile to the west, 1.2 mile to the north, and 0.5 mile to the south.

Figure 4.2.1–1 illustrates land uses near the Livermore Site.



Figure 4.2.1-1 — Livermore Site Surrounding Land Use

4.2.1.2.2 Site 300

Figure 4.2.1-2 shows the existing land uses surrounding Site 300, the majority of which are agricultural, primarily for grazing cattle and sheep. Two other smaller, privately operated research and testing facilities are located near Site 300. The property east of and adjacent to Site 300 is now owned by Fireworks America and is currently being used to store pyrotechnics. A portion of the property is leased to Reynolds Initiator Systems, Inc., and is used to manufacture initiators, which are agents that cause a chemical reaction to commence. A facility operated by SRI International, that conducts explosives tests, is approximately 0.6 mile south of Site 300.

Corral Hollow Road borders Site 300 on the south. The Carnegie State Vehicular Recreation Area is south of the western portion of Site 300, across Corral Hollow Road. It covers approximately 5,000 acres and is operated by the California Department of Parks and Recreation, Off-Highway Motor Vehicle Recreation Division, for the exclusive use of off-highway vehicles. The nearest urban area is the city of Tracy, approximately 2 miles northeast of Site 300. Rural residences are located along Corral Hollow Road, west of Site 300 and the Carnegie State Vehicular Recreation Area. Power-generating wind turbines occupy the land northwest of the site.

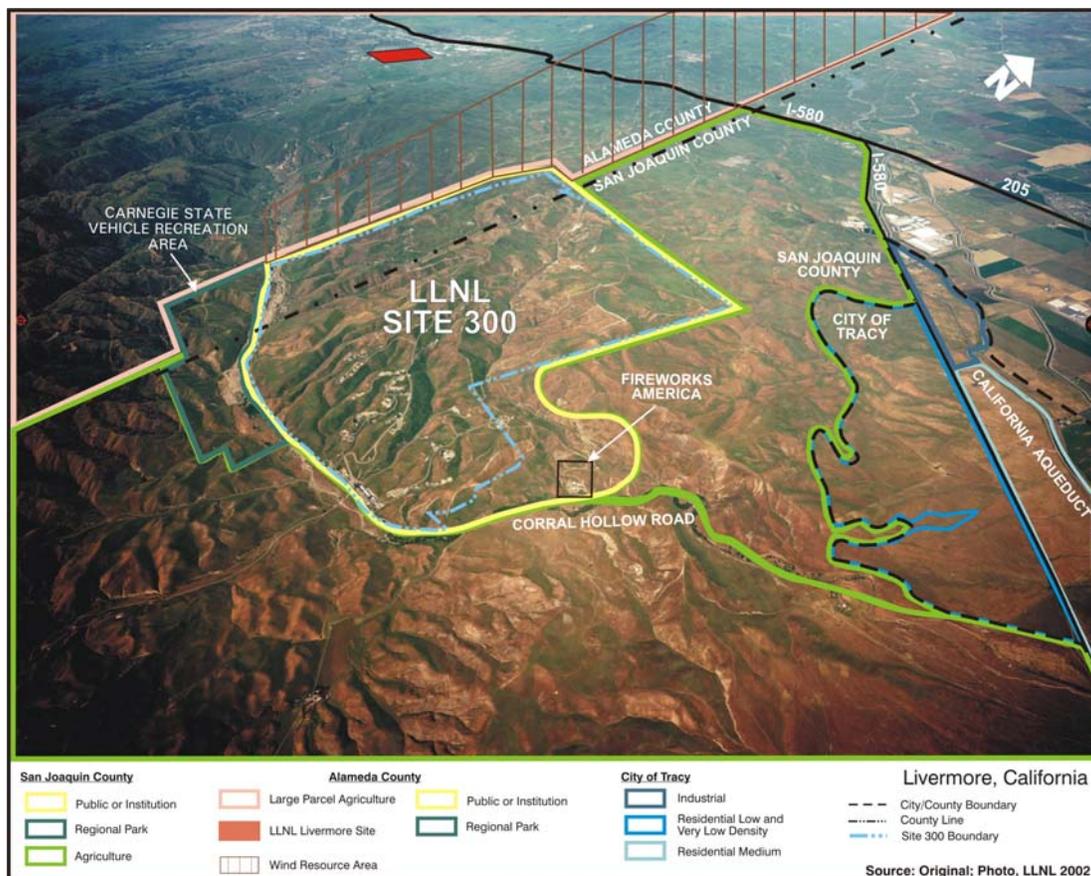


Figure 4.2.1-2 — Site 300 Surrounding Land Uses and Land Use Designations

4.2.1.2.3 SNL/CA

Land use in the region surrounding SNL/CA is a result of city and county planning and zoning regulations. The City of Livermore and the County of Alameda do not have planning jurisdiction over SNL/CA. SNL/CA is situated within the sphere of influence of the City of Livermore, but not within the incorporated area of the city. The area to the west of the site, including Vasco Road, is within the City of Livermore (DOE 2003).

To the north across East Avenue is LLNL. To the east and south is agricultural and low-density residential (as discussed in section 4.2.1.2.1). East of SNL/CA are Greenville Road and a hilly area used for cattle grazing. The South Bay Aqueduct is located between the SNL/CA boundary and Greenville Road. A private residence is located near the southeastern corner of the site, between the aqueduct and the site boundary fence. The area south of the site is primarily vineyards with residences or buildings. West of SNL/CA is the City of Livermore and Vasco Road. Various private landowners own the property on this side of the site. In the area between Vasco Road and the west boundary of SNL/CA is a mix of rural residential and agricultural use. To the west of Vasco Road, the present and proposed uses are residential and light industrial (DOE 2003). Figure 4.2.1-1 illustrates land uses near the SNL/CA.

4.2.2 Visual Resources

4.2.2.1 *Livermore Site*

The Livermore Site has a campus-like or business park-like setting with buildings, internal roadways, pathways, and open space. Portions of the site along the western and northern boundaries remain largely undeveloped and serve as security buffer zones. A row of eucalyptus and poplar trees surrounds much of the developed portion of the Livermore Site and screens most ground-level views of the facility. Onsite buildings range in height from 10 to approximately 110 feet. The entire site is surrounded by a security fence. The most prominent buildings in the public viewshed are the administrative buildings off of East Avenue in the southwest corner of the site, the Sunshine building in the western portion of the site, and the National Ignition Facility (NIF) in the northeast corner. These buildings are visible from locations along adjacent roads.

The area surrounding the Livermore Site is a mixture of rural and pastoral uses and urban development. SNL/CA is located immediately south of the Livermore Site. Rural residences and grazing land are the primary visual features to the east. Detached residences occupy the area west of the Livermore Site, giving the area a suburban character. A small area of commercial use occupies lands immediately southwest of LLNL. A mixture of vineyards and residential uses surrounds the commercial area, although residential development is currently underway and the visual character of the area is shifting from pastoral to suburban. The area north of the Livermore Site to I-580 is industrial, primarily one-and two-story industrial buildings, business parks, and the Union Pacific railroad line that traverses the area. This area is visually similar with the research, business, and industrial character of the Livermore Site.

4.2.2.2 *Site 300*

The main gate and the General Services Area (GSA) of Site 300, including a number of buildings, roads, and infrastructure are foreground and middle-ground features in view from Corral Hollow Road, which forms the southern boundary of Site 300. Vegetative screening and topography partially obscure many of the features associated with the GSA. The majority of Site 300 is obscured from view by topography.

The surrounding area is primarily undeveloped open space or rural, with some exceptions. Fireworks America is adjacent to and northeast of Site 300. Although the sign at the entrance to the facility is visible from Corral Hollow Road, structures associated with this facility are obscured by topography. The SRI International Testing Facility is approximately 0.6 mile south of Site 300 and is not visible from Corral Hollow Road.

Carnegie State Vehicular Recreation Area, located south of the western portion of Site 300, is used by off-road vehicles. The park includes dirt trails on the surrounding hillsides and a ranger station, picnic areas, and several contoured riding areas in the valley floor adjacent to Corral Hollow Road. These features are all visible from Corral Hollow Road. The highly developed area is substantially out of character with the surrounding open space and rural features of the area.

4.2.2.3 SNL/CA

SNL/CA is situated on mostly flat terrain that provides little or no public views of the site from locations a mile or more away. The site has 72 buildings used for offices, laboratories, facilities, and storage. Views of the site are limited to immediately adjacent areas (DOE 2003).

The view of SNL/CA from East Avenue consists of the built portion of SNL/CA in the middle and the buffer zones at the west and east ends. The view of SNL/CA from Vasco Road includes the northwest portion of the buffer zone and at one point, a view of the Micro and Nano Technologies Laboratory's (MANTL's) building shape, roof, and exhaust stacks. The view of SNL/CA from Tesla Road includes South Portal Road and the gated entrance, and the water towers on the hills at the south end of the site. Greenville Road is on terrain higher than SNL/CA, but there are hills between the road and the site. Thus, views of the site are available from the road only between these hills (DOE 2003).

4.2.3 Site Infrastructure

Site infrastructure available at LLNL and SNL/CA is used to support the current missions. To support these missions an infrastructure exists as shown in Table 4.2.3-1.

Table 4.2.3- 1 — Baseline Characteristics for LLNL and SNL/CA

LLNL		
Characteristics	Current Value	
Land	Main Site	Site 300
Area (acres)	820.4	6,918.9
Roads (miles)	14.9	24.9
Railroads (miles)	0	0
Electrical		
Energy consumption (MWh/yr)	415,759 ^a	15,661
Peak Load (MWe)	57.2	2.6
Fuel		
Natural Gas (yd ³ /yr)	2.4 x 10 ⁷	NA
Liquid (L/yr)	31,688	43,527
Coal (t/yr)	0	0
SNL/CA		
	Usage (2000)	Percent of Capacity
Water (million gallons)	54	6 ^b
Wastewater (million gallons)	15	19 ^c
Electricity (MWh)	22,434	9 ^d
Natural Gas (yd ³ /yr)	2.2	14 ^e

Sources: DOE 2005a, DOE 2005a, DOE 2003

^a2007 data

^bEstimate based on 14" water main with 8,000 gallons per minute, 8 hours per day, 5 days per week, 48 weeks per year (922 million gallons). A 16" water main is also available.

^cEstimate based on 10" wastewater with 700 gallons per minute, 8 hours per day, 5 days per week, 48 weeks per year (81 million gallons).

^dEstimate based on 27.2 Megawatt feeder, 8,760 hours per year (239,000 Megawatt hours). Another 27.2 Megawatt feeder is also available.

^eEstimate based on 49,140 cubic feet per hour, 8,760 hours per year (430 million cubic feet).

4.2.3.1 *Electricity*

Electricity consumption for the Livermore Site and Site 300 remained relatively flat from 1998 to 2000. Electricity use at the Livermore Site decreased in 1999 and 2000, and increased in 2001 and 2002. Electricity consumption at Site 300 remained relatively constant during the same period. The estimated electrical consumption for 2007 is 415,759 MWh per year at the Livermore Site and 15,661 MWh per year for Site 300. The peak load for the Livermore site is 57.2 MWe and 206 MWe for Site 300. The electrical load at Site 300 averages 2.7 megawatts and is projected to increase to 2.8 megawatts as site improvements are completed. The peak electrical load in 2002 was 3.4 megawatts (DOE 2005a).

Pacific Gas and Electric and the Western Area Power Administration supply electrical power to the Livermore Site. Pacific Gas and Electric supplies the electrical power to Site 300. The peak electrical load at the Livermore Site was 57 megawatts (MWe) and 3.4 MWe at Site 300 (DOE 2005a). Pacific Gas and Electric also supplies natural gas to the Livermore Site. In 2002 the annual natural gas consumption at the Livermore Site totaled 24 million yd³. At Site 300, fuel oil consumption averages 16,600 gallons per year (DOE 2005a).

4.2.3.2 *Natural Gas*

PG&E supplies natural gas to the Livermore Site by way of the meter station at the south end of Southgate drive. Natural gas is used mostly for comfort heating in the building category. In the metered process category, natural gas is used mostly for programmatic experiments and comfort heating. Continuing efforts to decrease energy use include modification to HVAC controls, the design of more efficient buildings, boiler tune-ups, and other site energy conservation efforts.

At Site 300, fuel oil is used mostly for backup electric power generation in the building category. In the metered process category, fuel oil is used for comfort heating and in some experiments. Fuel oil consumption at Site 300 averages 16,600 gallons per year (DOE 2005a) a 79-percent decrease from the 1992 average of 78,100 gallons per year (DOE 2005a). This substantial decrease in fuel oil consumption is primarily due to completion of HVAC retrofit and modernization projects.

4.2.3.3 *Water Consumption*

Water consumption rates at the Livermore Site have decreased from an average of 261.8 million gallons per year in 1986, to 212 million gallons per year (581,000 gallons per day) in 2002 (DOE 2005a). Currently, peak water usage is approximately 1.2 million gallons per day. The capacity of the domestic water system is 2.88 million gallons per day (DOE 2005a).

Site 300 is supplied with water from a system of wells. The existing capacity of usable wells is approximately 930,000 gallons per day. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch Hetchy water supply system would add an estimated 648,000 gallons per day to the current capacity, with the capability of expanding to 1.2 million gallons per day (DOE 2005a).

4.2.4 Air Quality and Noise

4.2.4.1 Air Quality

4.2.4.1.1 Meteorology and Climatology

The climate at the Livermore Site, Site 300, and the surrounding region is classic Mediterranean with hot dry summers and cold wet winters. Temperatures typically range from 25°F during the coldest winter mornings to 104°F during the warmest summer afternoons at the Livermore site. The typical temperature range at Site 300 is somewhat smaller, ranging from 30°F during the coldest winter mornings to 100°F during the warmest afternoons. The average annual temperature at the Livermore Site is 54.5°F. The highest and lowest annual precipitations on record are 30.8 inches and 5.4 inches, respectively. Prevailing winds at the Livermore Site are from the west and southwest. The climate at Site 300, while similar to the Livermore Site, is modified by higher elevation and more pronounced relief. Topography significantly influences surface wind patterns at Site 300 with prevailing winds from the west-southwest (DOE 2005a).

4.2.4.1.2 Ambient Air Quality

Ambient air pollutant measurements are used in determining an area's status with respect to NAAQS or State Ambient Air Quality Standards (SAAQS) (i.e., as an attainment or nonattainment area). Ozone and nitrogen dioxide are measured locally in Livermore and Tracy. Particulate matter and carbon monoxide are also measured in Livermore, as well as some toxic air contaminants. While attaining and maintaining compliance with NAAQS or SAAQS is a primary goal of all air pollution control agencies, both the Bay Area and San Joaquin Valley have been designated as nonattainment areas with respect to both the Federal ozone standard and the more stringent state standard. The Bay Area air district is classified as nonattainment with respect to California standards for particulates, attainment for the Federal PM₁₀ annual standard, and unclassified for both PM_{2.5} and 24-hour PM₁₀ standards. The San Joaquin Valley air district is classified as nonattainment for state particulate matter standards and as a serious nonattainment area for Federal PM₁₀ standards. The designation for the Federal PM_{2.5} standard has not yet been determined. Although particulates are not measured in Tracy, it is recognized as a regional problem. The Bay Area has been a nonattainment area for carbon monoxide; however, in 1998, the Bay Area was redesignated as an attainment area for carbon monoxide, and further problems are not anticipated (DOE 2005a).

Regionally, the most complex air quality problem has been ozone. Ozone is not regulated directly because it is formed in the atmosphere by photochemical reactions (i.e., in the presence of sunlight). Nitrogen oxides and many organic compounds are precursors to the formation of ozone. For this reason, air districts are particularly interested in reducing precursor organic compounds and nitrogen oxides. The local topography, meteorology, and proximity to large metropolitan areas upwind, contribute to the buildup of air pollutants in the Livermore Valley. This area, in fact, experiences a disproportionate number of exceedances of NAAQS. Because it takes some time for the photochemical reactions to occur, emissions of precursors, primarily from motor vehicles and the morning commute, are transported away from their sources and

affect ozone concentrations in downwind areas. Although the Bay Area's highest ozone levels can fluctuate from year to year depending on weather conditions, ambient ozone standards are exceeded most often in the Santa Clara, Livermore, and Diablo valleys. These same locations typically register the highest particulate matter levels as well, although in this case, the high levels are due to the dry conditions and limited mixing within the sheltered terrain.

With the goal of expeditiously attaining conformance with NAAQS, the *California Clean Air Act* requires air districts to reduce emissions of nonattainment pollutants or precursors by 5 percent per year, and requirements are adopted within each air district's clean air plan. The stringency of requirements within each local clean air plan and subsequent implementing air regulations is based on the severity of the problem and projected timeframe when the area is expected to achieve attainment. As part of this process, both the Bay Area Air Quality Management District (BAAQMD) and San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) have adopted "no net increase" provisions within their clean air plans. The "no net increase" programs require that, as a precondition to the issuance of an air permit for a significant new or modified emission source, any increases in emissions of nonattainment pollutants or precursors be offset by mandatory reductions in emissions of other sources onsite or potentially at other facilities. In the BAAQMD, the offset requirement is triggered for mid-size facilities (emissions of 15 tons per year or more of nonattainment pollutants), and a greater burden is placed on large facilities (emissions of 50 tons per year or more). These large facilities must offset any proposed emission increases by a slightly greater decrease, at a ratio of 1.15 to 1.0. The added 15-percent in part satisfies the 5-percent annual emission reduction requirement of nonattainment areas.

The Livermore Site falls into the mid-size facility category and must abide by the requirements of the BAAQMD for emission offsets. Site 300, the majority of which lies within San Joaquin County, is under the jurisdiction of the SJVUAPCD. In SJVUAPCD, offset requirements are triggered at 10 tons per year. Although this level is much lower than that established by the BAAQMD, emissions at Site 300 are substantially less than the offset trigger level (DOE 2005a).

Several PSD Class I areas have been designated in the vicinity of the Livermore Site, including Point Reyes National Wilderness Area, approximately 55 mi to the northwest; and Desolation National Wilderness Area, Mokelumne National Wilderness Area, Emigrant National Wilderness Area, Hoover National Wilderness Area, and Yosemite National Park, approximately 100 to 120 mi, respectively, to the east and northeast. Since the promulgation of the PSD regulations (40 CFR 52.21) in 1977, no PSD permits have been required for any emission sources at the Livermore Site.

4.2.4.1.3 Nonradiological Air Emissions

The Livermore site currently emits approximately 332 pounds/day of regulated air pollutants as defined by the Clean Air Act, including nitrogen oxides, sulfur oxides, particulate matter (PM-10), carbon monoxide, and reactive organic gases/precursor organic compounds (ROGs/POCs) (see Table 4.2.4-1). The stationary emission sources that release the greatest amount of regulated pollutants at the Livermore site are natural gas fired boilers, internal combustion engines (such as diesel generators), solvent cleaning, and surface coating operations (such as painting) (DOE 2005a).

**Table 4.2.4-1 — Nonradioactive air emissions,
 Livermore Site and Site 300, 2006**

Pollutant	Estimated releases (lbs/day)	
	Livermore Site	Site 300
ROGs/POCs	54.9	0.90
Nitrogen oxides	151.2	1.15
Carbon monoxide	110.0	0.25
Particulates (PM-10)	12.3	0.62
Sulfur oxides	3.7	0.07

Source: LLNL 2007

LLNL air pollutant emissions are very low compared with daily releases of air pollutants from all sources in the entire Bay Area. For example, the total emissions of nitrogen oxides released in the Bay Area for 2005 were approximately 1.1×10^6 pounds/day, compared with the estimated release from the Livermore site of 151 pounds/day, which is 0.014 percent of total Bay Area source emissions for nitrogen oxides. The 2005 BAAQMD estimate for ROGs/POCs emissions was 7.9×10^5 pounds/day, while the estimated releases for 2005 from the Livermore site were 54.8 pounds/day, or 0.007 percent of the total Bay Area source emissions for ROGs/POCs (DOE 2005a).

The total estimated air pollutant emissions during 2005 from operations (permitted and exempt stationary sources) at Site 300 are presented in Table 4.2.4-1. The stationary emission sources that release the greatest amounts of regulated air pollutants at Site 300 include internal combustion engines (such as diesel generators), a gasoline-dispensing facility, paint spray booths, drying ovens, and soil vapor extraction equipment. Overall, the emissions for all pollutant categories at Site 300 decreased in 2005 (DOE 2005a).

LLNL monitors ambient air to determine if radionuclides or beryllium are being released by Laboratory operations, what the concentrations are, and what the trends are in the environs. Beryllium is the only nonradiological emission from LLNL that is monitored in air. Normally for nonradiological emissions, LLNL obtains permits from local air districts (i.e., BAAQMD or SJVAPCD) that require monitoring of equipment usage, material usage, and record keeping during operations. The BAAQMD has exempted LLNL from the permitting process because LLNL can demonstrate that monthly average beryllium concentrations in air are well below regulatory limits at perimeter locations (DOE 2005a).

SNL/CA does not have any major sources of air pollutants (as defined in 40 CFR Part 70.2) present on site. SNL/CA works with the BAAQMD and CARB to permit or register all regulated emission sources. For the 2005/2006 permit period, SNL/CA had 15 permitted emission sources. The number of permits remained at 15 for the 2006/2007 permit period (SNL/CA 2007).

4.2.4.1.4 Radiological Air Emissions

Some LLNL facilities discharge low quantities of radionuclides to the air. These releases can be evaluated according to the individual and population dose they create. The degree of hazard to the public is directly related to the type and quantity of the radioactive materials released. Dose estimates are modeled from emissions determined at each facility or, in the case of diffuse

sources such as soil resuspension, from air sample measurements. Separate doses are calculated for the Livermore Site and Site 300 because of their spatial separation and are compared to regulatory dose limits for the protection of public health. Historically, doses have never exceeded regulatory limits. Recent annual doses to the hypothetical site-wide maximally exposed individual have been less than 2 percent of a chest x-ray (DOE 2005a).

LLNL monitors the stack effluent from its principal facilities and measures concentrations of radionuclides in ambient air both on and offsite, to determine if radionuclides are being released and in what concentrations. LLNL performs research using a variety of radioactive materials, including tritium, uranium, plutonium and other transuranic radionuclides, biomedical tracers, and mixed fission products. The contribution to the offsite dose is predominated by tritium from the Livermore Site and depleted uranium from Site 300. Although even less important than these, other radionuclides such as carbon-14, strontium-90 and other beta emitters, and transuranics such as plutonium-239, americium-241 and other alpha emitters can also be released.

Ambient air is monitored by a network of air particulate and tritium samplers located on the Livermore Site (7 particulate samplers and 12 tritiated water vapor samplers), in the Livermore Valley (9 and 6, respectively), at Site 300 (8 and 1, respectively), and in Tracy (1 particulate sampler) (LLNL 2006). There were no releases from the HEPA-filtered monitored stacks at the Livermore site. Stack releases of tritium from the Tritium Facility and the Decontamination and Waste Treatment Facility contributed 85 percent of the estimated of 40.5 Curies of tritium released from the Livermore site in 2005. The 2005 tritium release rate is essentially equal to the release rate in 2004, but, in 2005, the fraction of total tritium contributed by diffuse area sources was greater than in 2004. The 2005 LLNL SWEIS projected that tritium emissions would increase to 210 Curies/year. At Site 300, only very small quantities of gross alpha and gross beta radiation associated with particles (fewer than 1.6×10^{-6} Curies each) were estimated very conservatively to have been released from the Contained Firing Facility during 2005. Overall, LLNL operations involving radioactive materials had minimal impact on ambient air during 2005. Radionuclide particulate concentrations in air at the Livermore site and in the Livermore Valley were well below the levels that would cause concern for the environment or public health. Section 4.2.11 explains the public health effects (LLNL 2006).

SNL/CA does not currently have any radionuclide emission sources that are subject to the monitoring requirements of 40 CFR Part 61. To comply with national emission standards, SNL/CA evaluates individual projects with the potential to release radionuclide emissions to determine the worst-case dose to the public. Additionally, dose calculations are compared to the requirements to determine the need for annual monitoring. During 2006, SNL/CA evaluated one project with the potential to produce radionuclides through nuclear fission in a non-sealed source. Conservative estimates based on the rate of fission indicated that the amount of radionuclides produced would be several orders of magnitude below the annual possession quantities in 40 CFR 61 (SNL/CA 2007).

4.2.4.2 *Noise*

Noise sources at LLNL are, for the most part, common to other local industrial/commercial settings, although on a somewhat larger scale. Construction and demolition activities are similar,

however, because of the size of the site, perimeter buffer zone, and intervening roads. The contribution of these activities to noise levels offsite is small. The contribution of mobile noise sources associated with heavy-duty trucks and employee vehicles is greater, due to the relatively large number of shipments of materials and waste to and from the site and the large employment base; i.e., compared with other area businesses. Occasionally, noise may also be heard from the pistol and rifle firing range located at Site 300. These activities are not in conflict with land use compatibility guidelines.

LLNL is somewhat unique in the category of impulse (short-blast) noise associated with explosives research testing. High explosive tests are conducted regularly (daily and/or weekly) at both the Livermore Site, in the High Explosives Application Facility (HEAF), Building 191; and at Site 300, within the Contained Firing Facility and on open firing tables. The maximum allowable sound pressure level of 126 decibels (db) would not be exceeded in populated areas.

A field survey was conducted in January 2003 to characterize typical daily maximum noise levels in the vicinity of the Livermore Site. Measurements were taken for 1-hour periods using standard sound-level meters during the heart of the morning and evening commute. The monitors were placed at eight locations surrounding and just outside the Livermore Site perimeter, in regions of maximum activity (intersections and site entrance and exit locations). Results of the survey indicated that, as expected, vehicular traffic was the dominant noise source at most monitored locations. Rail operations and light aircraft overflights were minor contributors. The only recognizable noise sources from site activities within LLNL were some heavy equipment backup warning beepers, which were detectable during low traffic intervals at the monitoring sites on Patterson Pass Road. All levels were within the acceptable range established by the city of Livermore and Alameda County (DOE 2005a).

4.2.5 Water Resources

4.2.5.1 *Surface Water*

4.2.5.1.1 Surface Water and Water Use

Livermore Site

As shown on Figure 4.2.5-1, the four major intermittent streams that drain into the eastern Livermore Valley are Arroyo Mocho, Arroyo Seco, Arroyo Las Positas, and Altamont Creek. Arroyo Seco and Arroyo Las Positas pass through the Livermore Site, while Altamont Creek and Arroyo Mocho flow offsite to the north and southwest, respectively. Arroyo Las Positas drains in the hills directly east and northeast of the Livermore Site and usually flows only after storms. Arroyo Seco flows through the very southwest corner of the Livermore Site. Arroyo Las Positas flows into Arroyo Seco west of the site. Both stream channels are dry for most of the year. Nearly all surface water runoff at the Livermore Site is discharged into Arroyo Las Positas; only surface water runoff along the southern boundary and some storm drains in the southwest corner of the Livermore Site drain into Arroyo Seco. Although surface drainage and natural surface infiltration at the Livermore Site are generally good, drainage decreases locally with increasing clay content in surface soils. Surface flow may occur intermittently from October to April, during the valley's wet season. Only intermittent streams flow into the eastern Livermore Valley from the surrounding uplands and low hills, where they merge on the valley floor (DOE 2005a).

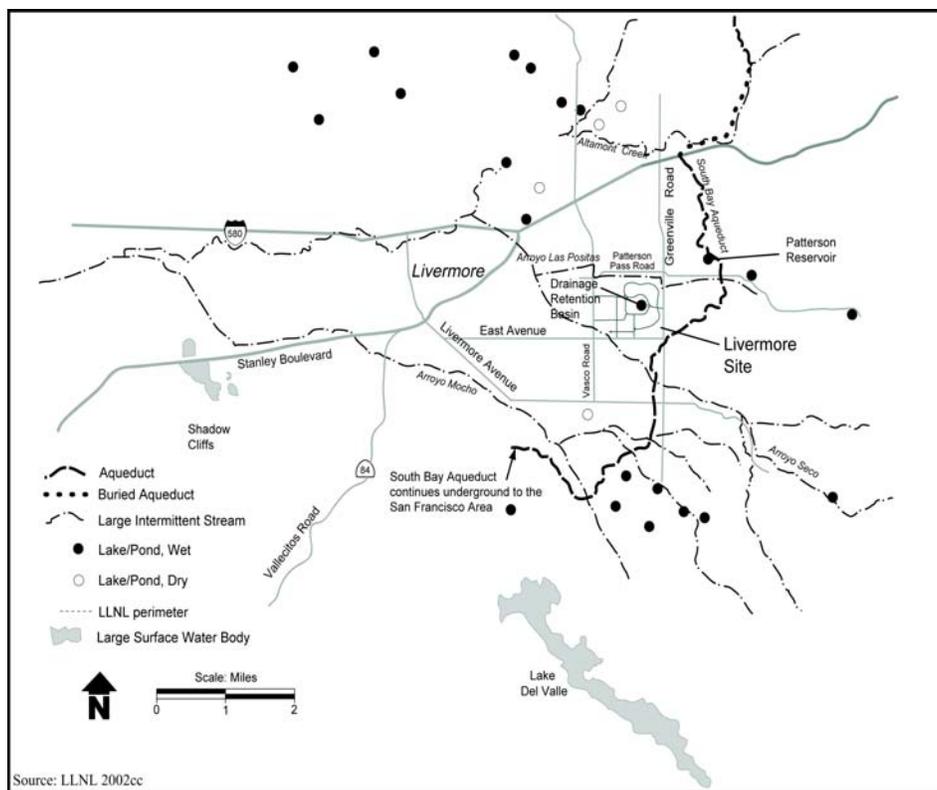


Figure 4.2.5-1 — Livermore Valley Surface Water Features

The headwaters of the Arroyo Seco drainage are in the hills southeast of the Livermore Site. Arroyo Seco has a drainage length of approximately 12 miles and a watershed area of approximately 8,960 acres upstream of SNL/CA. The Arroyo Seco flows through SNL/CA before crossing over the southwest corner of the Livermore Site and continuing southwesterly. Flow only occurs in the arroyo during rainfall because discharge to the stream is from storm runoff only. The channel is well defined in the section that passes directly through the Livermore Site and is dry for at least 6 months of the year. In fact, during dry years, it may flow only 10 to 15 days per year in the vicinity of the Livermore Site vicinity.

Arroyo Las Positas is an intermittent stream that drains from the hills directly east of the Livermore Site with a watershed area of approximately 3,300 acres. This channel enters the Livermore Site from the east, is diverted along a storm ditch around the northern edge of the site, and exits the site at the northwest corner. Discharge from the onsite Drainage Retention Basin (DRB), discussed below, keeps the arroyo flowing perennially. Additionally, water from springs and runoff in the nearby hills feed into Arroyo Las Positas (LLNL 2002b). Flow has increased in the arroyo over the past several years, due to treated groundwater discharges (DOE 2005a).

The Livermore Site’s primary water source is the San Francisco Hetch Hetchy Aqueduct system. This system obtains its water from a reservoir in the Hetch Hetchy Valley of Yosemite National Park. The secondary or emergency water source is the Alameda County Flood and Water Conservation District, Zone 7. This water is a mixture of groundwater and water from the South Bay Aqueduct of the state water project. In 2002, 1.2 million gallons per day were derived from the Hetch Hetchy Aqueduct and Zone 7 for use at the Livermore Site. Water is primarily used for

industrial cooling processes, sanitary systems, and irrigation at the Livermore Site. Minor amounts of water are used for drinking, manufacturing, washing, system filters, boilers, and a swimming pool.

In 2005, the Livermore site discharged an average of 285,306 gallons per day of wastewater to the City of Livermore sewer system, 4 percent of the total flow into the city's system. This volume includes wastewater generated by SNL/CA and very small quantities (26,420 gallons in 2005) of Site 300 wastewater, which is discharged to the LLNL collection system and combines with LLNL sewage before it is released at a single point to the municipal collection system. LLNL's wastewater contains both sanitary sewage and process wastewater and is discharged in accordance with permit requirements and the City of Livermore Municipal Code. LLNL also compares annual discharges with historical values to evaluate the effectiveness of ongoing discharge control programs.

During 2005, a total of 0.08 Curies of tritium was discharged to the sanitary sewer, an amount that is well within environmental protection standards and is comparable to the amounts discharged during the past 10 years. During 2005, no discharges exceeded any discharge limits for release of radioactive materials to the sanitary sewer. The data are comparable to the lowest historical values. All the values reported for radiological releases are a fraction of their corresponding limits. For nonradiological releases, LLNL achieved near perfect compliance with the provisions of its wastewater discharge permit; there were only two releases of pH outside permissible limits. The data demonstrate that LLNL continues to have good control of radiological and nonradiological discharges to the sanitary sewer. Monitoring results for 2005 reflect an effective year for LLNL's wastewater discharge control program and indicate no adverse impact to the LWRP or the environment from LLNL sanitary sewer discharges (DOE 2005a).

Site 300

There are no perennial streams at or near Site 300. The canyons that dissect the hills and ridges at Site 300 drain into intermittent streams. The majority of these onsite streams drain to the south into Corral Hollow Creek, also intermittent, which flows east along the southern boundary of Site 300 in the San Joaquin Valley. In addition to these streams, 24 springs and 2 vernal pools exist onsite. Some surface water discharge occurs from cooling towers and other process runoff areas.

Site 300 draws drinking water from two onsite groundwater production wells in the southeastern part of Site 300. Therefore, water is subject to the *Safe Drinking Water Act* of 1974 regulations. The system operates under Water Supply Permit No. 03-10-94-001. The system includes a primary drinking water supply well (well 20) and a backup well (well 18), several holding tanks, and a distribution network. Both are deep, high-production wells that can produce up to 23,700 gallons per hour of potable water (LLNL 20031). Water production from these wells has declined from a peak of 32.7 million gallons in 1992 to 25 million gallons in 2002. LLNL disinfects well water with chlorine and monitors the quality of this water at the well and throughout the distribution system. In addition, the Hazards Control Department reviews the data to ensure that drinking water standards are met. Site 300 Plant Engineering submits the required reports to the California State Department of Health Services. In the near future, it is expected that Site 300

will obtain its drinking water from the Hetch Hetchy Aqueduct system. LLNL will maintain the onsite drinking water wells as a backup supply and will be responsible for the Site 300 Drinking Water Permit requirements (DOE 2005a).

At Site 300, stormwater, cooling tower water, and groundwater that has been treated to remove contaminants are discharged to onsite or adjacent drainages in accordance with NPDES permit conditions. Approximately 1.3 million gallons per year of wastewater is discharged to the wastewater sewage pond. The maximum capacity of the sanitary wastewater sewage pond in the General Services Area is 3.2 million gallons per year.

SNL/CA

SNL/CA does not operate a public water system, and is not involved in any environmental restoration activities for which Safe Drinking Water Act standards are being applied. Drinking water at SNL/CA is purchased through LLNL and obtained from the San Francisco Water District or the Alameda County Flood Control and Water Conservation District, Zone 7. The San Francisco Water District and Zone 7 are responsible for monitoring the quality of the incoming water. SNL/CA is not required to treat or sample the drinking water. LLNL maintains the drinking water distribution system for both sites and screens for water quality (SNL/CA 2007).

4.2.5.1.2 Surface Water Quality

Livermore Site

Offsite surface water bodies in the vicinity of the Livermore Site are routinely monitored for radioactive parameters. In addition, stormwater runoff at the Livermore Site is routinely monitored for radioactive and nonradioactive parameters.

Tritium activities at effluent locations were less than 1 percent of the MCL. No gross alpha, gross beta, or tritium activities were above the LLNL site-specific thresholds in 2002 (Table 4.2.5-1). Radioactivity in the stormwater samples collected during 2002 had medians around background levels (DOE 2005a).

Table 4.2.5-1 — Drinking Water Maximum Contaminant Levels and Livermore Site-Specific Threshold Comparison Guidelines for Radioactive Stormwater Constituents

Parameter	EPA Drinking Water MCL (pCi/L)	LLNL Comparison Guideline ^a (pCi/L)
Tritium	20,000	973
Gross alpha	15	9.19
Gross beta	50	13

Sources: LLNL 2002c, EPA 2003a.

^a Site-specific value calculated from historical data and studies.

EPA = Environmental Protection Agency; MCL = maximum contaminant levels; pCi/L = picocuries per liter.

Site 300

Site 300 stormwater monitoring continues to show that most contaminants (including dioxins and furans, naturally occurring lead and uranium) are transorbed to suspended sediments in the water; however, these concentrations pose no threat to the environment (DOE 2005a).

SNL/CA

Wastewater generated at SNL/CA is discharged to the City of Livermore Water Reclamation Plant, a publicly owned treatment works (POTW). The Livermore POTW maintains an NPDES permit, and then regulates industry discharges into their sewer system. A Wastewater Discharge Permit issued by the Livermore POTW regulates SNL/CA's wastewater discharges. The permit is updated annually and includes discharge limits for the site sanitary sewer outfall and for processes subject to EPA pretreatment standards. During 2006, SNL/CA did not exceed established discharge limits at the sewer outfall as shown (SNL/CA 2007).

SNL/CA has three categorical processes that are subject to EPA's pretreatment standards: two metal finishing operations, and a semiconductor manufacturing operation. The two metal finishing operations are closed-loop processes and do not discharge any effluents. Wastewater generated from the semiconductor manufacturing process is sampled and monitored as part of the Environmental Monitoring Program. There were no exceedances of the discharge limits from this source during 2006 (SNL/CA 2007).

SNL/CA's storm water management program also incorporates the six minimum control measures required by the California Small Municipal Separate Storm Sewer System (MS4) General Permit. The MS4 General Permit was adopted in 2003 to meet EPA Phase II storm water regulations. Although the MS4 General Permit is not yet a regulatory requirement for SNL/CA, the site anticipates that it will be regulated as a non-traditional small MS4 when notification is provided by the regulating agency.

In 2006, SNL/CA visually monitored 21 storm water discharge locations and sampled nine locations. The result of monitoring and sampling activities conducted in 2006 did not identify any issues of concern.

4.2.5.1.3 Surface Water Rights and Permits

LLNL holds several permits pertaining to local, state, and Federal regulations: NPDES permits; Waste Discharge Requirements permits for any discharge of wastes that could adversely affect the beneficial uses of water; a city of Livermore Water Reclamation Plant permit for wastewater discharges to the city sanitary sewer system; and California Department of Fish and Game permits for streambed alteration for any work that may disturb or impact rivers, streams, or lakes.

4.2.5.2 *Groundwater*

4.2.5.2.1 *Groundwater Quality*

Livermore Site

LLNL conducts surveillance monitoring of groundwater in the Livermore Valley and at Site 300 through networks of wells and springs that include private wells off site and DOE Comprehensive Environmental Response, Compensation, Liability Act (CERCLA) wells on site. Groundwater from wells downgradient from the Livermore site is analyzed for pesticides, herbicides, radioactivity, nitrates and hexavalent chromium. To detect any offsite contamination quickly, the well water is sampled in the uppermost water-bearing layers. As in other years, all contaminants in groundwater away from the Livermore site were well below allowable limits for drinking water (LLNL 2006).

Groundwater at both the Livermore site and Site 300 is contaminated from historical operations; both are undergoing CERCLA cleanup. Within LLNL site boundaries, groundwater surveillance monitoring has detected that mostly volatile organic compounds (VOCs) exist in groundwater at various locations in concentrations above drinking water quality standards: trichloroethylene, perchloroethylene, 1,1-dichloroethylene, chloroform, 1,2-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane (1,2-DCA), trichlorotrifluoroethane (Freon 113), trichlorofluoromethane (Freon 11), and carbon tetrachloride (DOE 2005a). Cleanup began in 1989. LLNL removes contaminants from groundwater at the Livermore Site through a system of 27 treatment facilities located throughout the 6 hydrostratigraphic units containing contaminants of concern. Since remediation began in 1989, approximately 1,960 million gallons of groundwater have been treated. Contaminated groundwater is pumped from individual wells and sent to a treatment facility (LLNL 2006).

In 2005, concentrations continued to decrease in most of the Livermore site VOC plumes due to active remediation and the removal of over 267 kilograms of VOCs from both groundwater and soil vapor. VOC concentrations on the western margin of the site continued their gradual decline, indicating effective hydraulic control of the boundary plumes. Within the interior of the site, remediation activities, including soil vapor extraction, dual extraction, and groundwater extraction, have resulted in declines of VOC concentrations in numerous source areas. Of special interest is the significant five-fold increase in the mass of VOCs removed from soil vapor during the past four years (LLNL 2006).

Groundwater monitoring at the Livermore site and Site 300 and their environs indicates that LLNL operations have minimal impact on groundwater beyond the site boundaries. During 2005, neither radioactivity nor concentrations of elements or compounds detected in groundwater were confirmed to be above potable water MCLs (LLNL 2006).

Tritium measurements of Livermore Valley groundwater continue to show very low and decreasing activities compared with the 20,000 picocuries per liter MCL established for drinking water in California. The maximum tritium activity measured off site was in the groundwater at well 12A2, located about 9 kilometers west of LLNL. The measured activity there was 116 picocuries per liter in 2005, less than 1 percent of the MCL (LLNL 2006).

Groundwater near the Livermore Site is generally suitable for use as a domestic, municipal, agricultural, and industrial supply; however, use of some shallower groundwater may be limited by its marginal quality. Groundwater less than 300 feet deep is usually unsuitable for domestic use without treatment (LLNL 1992).

Site 300

Near Site 300, monitored constituents for offsite groundwater include explosives residue, nitrate, perchlorate, metals, volatile and semivolatile organic compounds, tritium, uranium, and other (gross alpha and beta) radioactivity. Historically, the surveillance and compliance monitoring programs have detected higher than natural background concentrations of various metals, nitrate, perchlorate, and depleted uranium in groundwater at Site 300. Subsequent CERCLA studies have linked several of these contaminants, including depleted uranium, to past operations, while the sources of other contaminants, such as nitrate and perchlorate, are the objects of continuing study.

One groundwater sample collected from an offsite private well about 3.7 miles to the west of Site 300 had nitrate concentrations slightly above the drinking water limit (45 milligrams per liter). This result appears to be unrelated to LLNL activities. No other constituent reached any drinking water limit in offsite wells near Site 300. Site 300 cleanup began in 1991. VOCs are the main contaminant found at the eight Site 300 Operable Units (OUs). In addition, nitrate, perchlorate, tritium, high explosives, depleted uranium, organosilicate oil and metals are found at one or more of the OUs.

In 2005 at Site 300, perchlorate, nitrate, the high explosive RDX (cyclotrimethylenetrinitamine), and organosilicate oil were removed from groundwater in addition to about 90 kilograms of VOCs. Each OU has a different profile of contaminants, but, overall, groundwater and soil vapor extraction and natural attenuation at Site 300 continue to reduce the mass of contaminants in the subsurface. The cleanup of volatile organic compounds was completed at the Site 300 GSA. An additional four areas are under investigation and have not yet reached a final CERCLA remedy to address environmental contamination.

All discharges from the Site 300 sewage evaporation pond to the percolation pond, as well as discharges to the surface impoundments from the Explosives Process Area, chemistry buildings, and photographic processes were in compliance with discharge limits. Wastewater discharges to surface impoundments were discontinued in June 2005 in anticipation of their closure in November 2005 (DOE 2005a). Groundwater monitoring related to these areas indicates that there were no measurable impacts to the groundwater from the surface impoundment operations. However, the groundwater quality is generally poor and yields are low, and these perched water-bearing zones do not meet the State of California criteria for aquifers that are potential water supplies (DOE 2005a).

SNL/CA

SNL/CA has seven groundwater monitoring wells. Sandia monitors groundwater at two former restoration areas and along Arroyo Seco. Three groundwater monitoring wells are used to

monitor residual contamination at former restoration areas under a 1989 site clean-up order issued by the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). Two of these wells are located at the Fuel Oil Spill site, and one at the Navy Landfill. Four monitoring wells are located along Arroyo Seco to monitor the effect of site operations on groundwater quality. Well AS-4 is located upgradient of the developed area of the site and provides background data about local groundwater quality. SNL/CA discontinued monitoring at this location in 2005, but will continue to report the result of LLNL's monitoring efforts that occur every two years (SNL/CA 2007).

4.2.5.2.2 Groundwater Availability

Livermore Site

The majority of Livermore Valley sediments is water bearing and transmits groundwater in varying degrees. In contrast, the uplands generally do not yield groundwater in sufficient quantities to constitute a groundwater resource. The Livermore Valley has been divided into a series of 12 groundwater subbasins based on the locations of faults, topography, and other hydrogeological barriers that affect groundwater occurrence, movement, and quality (Figure 4.2.5-2). The Livermore Site lies primarily within the Spring and Mocho I subbasins. The water-bearing sediments in the Livermore Valley include late-Pleistocene to Holocene-age alluvial sediments, generally less than 200 feet thick, which overlie Plio-Pleistocene alluvial and lacustrine Livermore Formation sediments, up to 4,000 feet thick. The Livermore Formation consists of beds of gravel, sand, silt, and clay of varying permeabilities. Sandy gravelly layers alternate with fine-grained, relatively impermeable layers, and groundwater can be both confined and semiconfined.

Stream runoff from precipitation, controlled releases from the South Bay Aqueduct, direct rainfall, irrigation, and treated groundwater infiltration recharge the Livermore Valley groundwater basin. In addition, stream channels, ditches, and gravel pits west of the city of Livermore are important sources for shallow, alluvial aquifer recharge. Groundwater is naturally discharged from the basin at Arroyo de la Laguna, located over 11 miles southwest of the Livermore Site. Some minor discharges also occur at springs, including those along Arroyo Las Positas near its confluence with Altamont Creek. Natural recharge occurs primarily along the fringes of the Livermore Valley groundwater basin and through the arroyos during periods of winter flow. Artificial recharge, if needed to maintain groundwater levels, is accomplished by releasing water from Lake Del Valle or from the South Bay Aqueduct into arroyo channels in the east (DOE 2005a).

Groundwater generally moves east to west within the Livermore Valley, westward through the Amador Subbasin, eventually terminating in a large groundwater depression near two gravel mining areas located west of the city of Livermore. A former gravel mining company had extracted deep groundwater, causing the large groundwater depression. Current gravel mining is not as deep as in the past, decreasing the need for deep groundwater pumping. Subsequently, the groundwater depression has decreased. At the eastern edge of the Livermore Site, groundwater gradients are relatively steep, but under most of the site and farther to the west, the contours flatten.

Pumping of groundwater for agricultural uses has historically accounted for the major withdrawal of groundwater from the Livermore Valley groundwater basin. As the valley has become increasingly urbanized, a shift in groundwater users has caused the amount of pumping for municipal use and gravel quarrying to exceed agricultural withdrawals. Agricultural use, namely vineyards and a few ranches, account for approximately 1,000 acre-feet per year of water in the Livermore Site vicinity. Although agricultural withdrawals are still a major source of drawdown, agriculture is increasingly using more surface water from the state water project than groundwater.

Site 300

Site 300 lies on the eastern flank of the Diablo Range. Most surface runoff and most groundwater flow toward the San Joaquin Valley. Runoff that concentrates in the Elk Ravine and Corral Hollow Creek recharges local bedrock aquifers. The regional groundwater table beneath Site 300 largely occurs within sandstone and conglomerate beds of the Neroly Formation, and groundwater moves through both pores and fractures. A deep confined aquifer (400 to 500 feet deep) is present beneath the southern part of Site 300 within the lower Neroly Formation sandstones. This confined aquifer provides the Site 300 water supply. Pumping tests performed in Site 300 water supply wells affirm the integrity of the aquitard separating the shallow and deeper aquifers within the lower Neroly Formation. In addition to the regional aquifers, local perched aquifers containing small amounts of water occur in some deposits within the Neroly Formation and the marine Tertiary sequence. Because the water quality is generally poor and yields are low, these perched water-bearing zones do not meet the State of California criteria for aquifers that are potential water supplies (DOE 2005a).

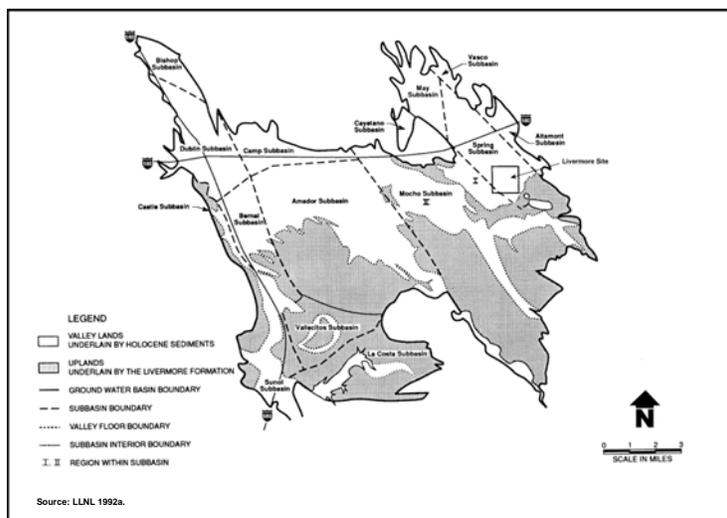


Figure 4.2.5- 2 — Location of Subbasins and Physiographic Features of the Livermore Valley

4.2.6 Geology and Soils

The Livermore Site and Site 300 are located within the California Coast Ranges, an area of north-northwest trending low, rugged mountains and narrow intervening valleys. The Livermore

Site is located in the southeastern portion of the Livermore Valley, an east-west structural basin defined by branches of the San Andreas fault system. The Livermore Site occupies a smooth land surface that slopes gently to the northwest. The Livermore site ranges in elevation from 676 feet in the southeast corner to 571 feet in the northwest corner. Site 300 is located in the Altamont Hills near the western boundary of San Joaquin County. The site occupies approximately 7,000 acres of steep ridges and canyons with a decrease in elevation toward the southeast. Slopes vary greatly in the canyons and can exceed 45 degrees in places. The slopes are much gentler in the GSA, located in the southeastern portion of the site and can be as slow as 2 or 3 degrees (DOE 2005a). Site elevations range from 1,722 above mean sea level in northwest portions of the site to approximately 500 feet above mean sea level along the southern boundary.

4.2.6.1 Geology

4.2.6.1.1 Livermore Site

The Livermore Site is underlain by late Tertiary and Quaternary rocks that lie on basement rocks of the Franciscan assemblage, which consist of severely deformed sandstone, shale, and chert. In the Livermore area, this unit is mainly sandstone. The Livermore Valley topographic and structural basin was formed in Pliocene time by movements along faults to the east and west. The basin is filled with 4,000 feet of Pliocene to Holocene alluvial gravels, sands, and lacustrine clays of the Livermore Formation. Late Quaternary alluvial deposits immediately underlie the Livermore Site.

Four late Pleistocene vertebrate fossils were discovered in the peripheral parts of the excavation for the NIF: two of the locations yielded fragmentary remains of *Equus* or horse, the third location included remains of proboscidean or elephant order, probably *Mammuthus* or mammoth, and the fourth location yielded remains of Columbian Mammoth or *Mammuthus columbi*. The geologic unit in which all four localities occur is a geographically restricted fluvial valley fill deposit (DOE 2005a). The fossil localities were found 20 to 30 feet below the present surface. The only vertebrate fossil deposits in the vicinity of the Livermore Site, other than those from the NIF excavation mentioned above, are in the Quaternary deposits of the surrounding low hills of the east Livermore Valley. These fossils are few in number and quite scattered. They have been tentatively identified as Pleistocene age, specifically Rancho La Brea and Blancan, and consist of bone fragments of the mammoth and giant sloth. Invertebrate shells and leaf and stem fossils have also been found. These appear to be randomly dispersed, mainly within the Neroly Formation. No invertebrate or botanical fossil deposits of significance are believed to be present in the eastern Livermore Valley (DOE 2005a).

4.2.6.1.2 Site 300

Sedimentary rocks at Site 300 are generally older than the alluvial sediments that underlie the Livermore Site in the eastern Livermore Valley. This hilly terrain contains sedimentary units that dip 5 degrees or more to the east and southeast. The site lies in an area of northwest-trending steep hills and ridges separated by ravines and are underlain by Eocene to Pliocene sedimentary rocks that rest on a basement of the Cretaceous Great Valley Sequence. Late Miocene to Pliocene interbedded sandstones, siltstones, and claystones are exposed in much of

the site. Cretaceous, Eocene, and Early Miocene rocks are also present along the northern and southern borders of the site. These rocks are locally overlain by Quaternary alluvial and terrace deposits and Holocene colluvium, alluvium, and valley fill deposits.

Several vertebrate fossil deposits have been found on Site 300 and in the vicinity of Corral Hollow. Most finds have been a result of road improvement or erosion along stream banks. Nearly all bone fragments found are considered to be Miocene age, specifically Clarendonian, and are scattered within the Neroly Formation. An assortment of mammalian groups is represented: camelids, mastodon, assorted early horses, shrews, beavers, and squirrels. Fossil finds are generally widely scattered, and none consist of more than one or a few fragments of bone. The eroded terraces of exposed Neroly Formation rocks on the south side of Corral Hollow Creek adjacent to Site 300 are the only locations where numerous fragments have been recovered (Hansen 1991).

4.2.6.1.3 SNL/CA

SNL/CA is located in the California Coast Ranges geologic province characterized by low rugged mountains and relatively narrow intervening valleys. Specifically, SNL/CA is located in the southeastern portion of the Livermore Valley. The valley forms an irregularly shaped lowland area about 16 miles-long east-to-west and 7 miles to 10 miles-wide north-to-south. The floor of the valley slopes to the west at about 20 ft per mile. In general, the site consists of relatively flat foothills that have low relief and slope gently northwest and north. Slopes at SNL/CA vary from 1 to 3 degrees. The southern area of SNL/CA is situated on the north side of a ridge (the Altamont Hills) approximately 150 ft above the surrounding land. The SNL/CA property ranges in elevation from 849 ft above MSL at the south end of the SNL/CA ridge top to 615 ft MSL at the northwest corner of the site (DOE 2003).

4.2.6.2 Soils

4.2.6.2.1 Livermore Site

The soils in the Livermore Valley beneath the Livermore Site are formed primarily upon sediments deposited by local streams. Most of the deposits in the eastern part of the valley are relatively young, and thus, the soils are only moderately developed. These soils, generally loam, have minimal horizon or development of layers and can be locally several meters thick. The soils are used for crop production when provided with sufficient water and nutrients or minerals. Four soils cover most of the Livermore Site vicinity. In order of decreasing extent, they are Rincon loam, Zamora silty clay loam, San Ysidro loam, and Yollo gravelly loam. These soils are primarily Alfisols, or moderately developed soils, and grade into Mollisols, which are grassland soils. At the Livermore Site, there is generally little potential for non-seismically induced landslides because the site is situated on gently sloping to nearly flat topography (DOE 2005a).

4.2.6.2.2 Site 300

Site 300 soils have developed on marine shales and sandstones, uplifted river terraces, and fluvial deposits. They are classified as loamy Entisols. Entisols are young soils that have little or no horizon development. Clay-rich soils, known as Vertisols, are also present and have been mapped as the Alo-Vaquero Complex. Vertisols are mineral soils characterized by high clay content that display shrink/swell capability. The remaining soil types identified at Site 300 occur only in limited areas. These units are mixtures of the soils described and are not readily separable, including grassland Mollisols, or are poorly developed Inceptisols (DOE 2005a). The Wisfiat-Arburnia-San Timoteo Complex soils cover most of Site 300, differing slightly depending upon slope. The Alo-Vaquero Complex and Vaquero-Carnea Complex soils cover most of the rest the site. All Site 300 soil types are potentially useful for limited agriculture but are constrained by location and steepness of the slopes. The loamy soils easily erode, and vegetation can be churned into the soil by moderate livestock or other traffic during wet periods. Vertisols exhibit low permeability and are subject to moderate erosion. Wildlife habitat and limited grazing by livestock are the best uses of these soils.

At Site 300, the topography ranges from gently sloping to nearly vertical in places. The potential for nonseismically initiated landslides is great along the canyon walls, especially where soils consist of deep loams and clay loams. During periods of extended wet weather, the saturated soils can become structurally weakened and expand, with resulting slope failure. The potential for localized slope instability greatly increases if slopes are made steeper by road cutting or building excavation. The presence of landslide deposits and colluvium or other historic evidence of slope failure increases the probability of a failure in the future.

4.2.6.2.3 SNL/CA

Typically, surface soils and arroyo sediments cover the site. The soils beneath the site are formed primarily upon sediments deposited by local streams. Most of the deposits in the eastern part of the valley are relatively young, and thus soils are only moderately developed. These soils (generally loam) have minimal horizon, or development of layers, and can be several meters thick locally. Three soils cover most of SNL/CA: Rincon clay loam, Positas gravelly loam, and Livermore gravelly loam (DOE 2003).

4.2.6.3 *Seismology*

4.2.6.3.1 Livermore Site

The Livermore Site is located near the boundary between the North American and Pacific tectonic plates, and the structural geology of the area is characterized by the San Andreas Fault system, which trends northwest southeast. As depicted in Figure 4.2.6-1, the two regional structural features located closest to the Livermore Site are the Greenville and Las Positas fault zones. Local plate interaction generally results in the accumulation of strain along fault structures, which may be released during an earthquake event. The high level of seismicity has resulted in the area's classification of Seismic Risk Zone 4, the highest risk zone in the California Building Code (DOE 2005a).

Major earthquakes have occurred in the region in the past and can be expected to occur again in the future. The greatest probability for large earthquakes is associated with the San Andreas Fault zone. However, the large earthquakes that have occurred in the San Francisco Bay Area such as the 1906 Great San Francisco Earthquake, with an estimated magnitude of 8.3 on the Richter Scale, produced limited structural damage in the Livermore Valley.

The local faults in the Livermore Valley region are still the main seismic hazard to the Livermore Site. The potential for local, damaging earthquakes was highlighted by the January 1980 Livermore earthquake sequence on the Greenville Fault, which produced two earthquakes of magnitudes 5.5 and 5.6 on the Richter Scale. The first earthquake caused discontinuous surface displacements along 3.9 miles of the fault and produced a maximum peak ground acceleration of 0.26 *g* at nearby Lake Del Valle. The unit *g* is equal to the acceleration due to the Earth's gravity or 32 feet/second/second. The earthquake caused structural and nonstructural damage to the Livermore Site. Seismic hazard analyses have been performed for the Livermore Site to quantify the hazard. The analyses identify the probability of exceeding a given peak ground acceleration. Maximum horizontal peak ground accelerations at the Livermore Site for return periods of 500, 1,000, and 5,000 years are 0.38 *g*, 0.65 *g*, and 0.73 *g*, respectively.

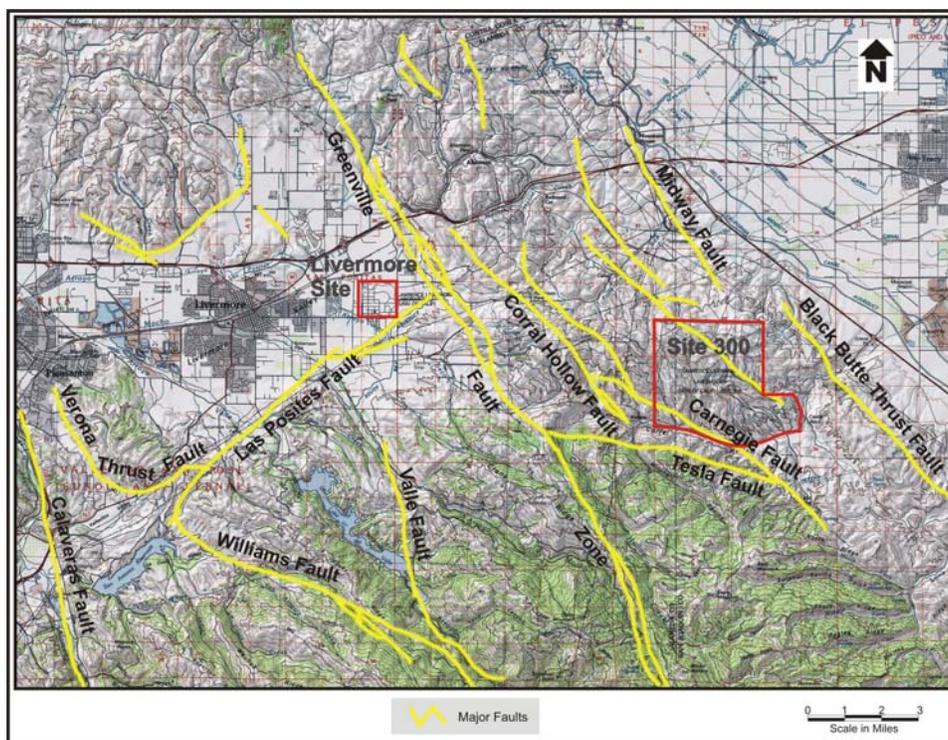


Figure 4.2.6-1 — Location of the Major Faults Adjacent to the Livermore Site and Site 300

Faults that show evidence of Holocene and earlier activity in Quaternary time comprise the source of potential seismic hazard to the Livermore Site. Regionally significant structures are associated with the San Andreas Fault system, including the Hayward and Calaveras faults east of the San Francisco Bay Area. The closest structure to the Livermore Site associated with the San Andreas Fault system, the Calaveras Fault, is situated approximately 15 miles west of the

site. The San Andreas, Hayward, and Calaveras faults have produced the majority of significant historical earthquakes in the Bay Area, and accommodate the majority of slip along the Pacific North American plate boundary. These structures will likely continue generating moderate to large earthquakes more frequently than other faults in the region (DOE 2005a).

4.2.6.3.2 Site 300

Site 300 is located near the eastern edge of the Coast Range Province, which is characterized by northwest trending, strike-slip faults of the San Andreas Fault system. The boundary between the Coast Ranges and the San Joaquin Valley lies immediately east of Site 300 and is characterized by east-northeast compression, resulting in reverse and thrust faulting and folding. The principal faults in the vicinity of Site 300 are the Corral Hollow-Carnegie, Black Butte, Midway, and the San Joaquin, all are sources of seismic hazard in the area. (Figure 4.2.6–2). These faults are further described in Appendix H. The active Carnegie Fault of the Corral Hollow-Carnegie Fault zone crosses the southern portion of the site. The Elk Ravine Fault, a complex structure composed of pre-Holocene strike-slip faults, reverse faults, normal faults, and local folds, crosses Site 300 from the northwest corner to the southeast corner. No significant recorded earthquakes have occurred on any of the local faults.

The region surrounding Site 300 has experienced strong ground shaking during historic earthquakes. In 1906 the Great San Francisco Earthquake on the San Andreas Fault produced structural damage a few miles west of Site 300 (DOE 2005a). Potential sources for future ground motion at Site 300 include major regional faults such as the San Andreas, Hayward, and Calaveras, as well as smaller faults including the Greenville, Las Positas, Corral Hollow-Carnegie, Black Butte, and Midway (DOE 2005a).

4.2.6.3.3 SNL/CA

The two regional northwest-southeast trending fault zones located closest to SNL/CA are the Greenville fault zone and the Tesla-Ortogonalita fault zones, both shown in Figure 4-3. To the west, the San Ramon Valley fault is located approximately 10 mi. The South Branch Las Positas fault traverses the southern most section of SNL/CA. The North Branch Las Positas fault cuts through the center of the SNL/CA site (DOE 2003).

SNL/CA is located near the boundary between the North American and Pacific tectonic plates, and the area is characterized by the San Andreas Fault system, which trends southeast northwest. Three principal components of the San Andreas Fault system, the San Andreas, Hayward, and Calaveras faults, have produced the majority of significant historical earthquakes in the Bay Area. These three faults also accommodate the majority of slip along the Pacific and North American plate boundary and they would likely continue to generate moderate to large earthquakes more frequently than other faults in the region. The potential for local, damaging earthquakes was highlighted by the January 1980 Livermore earthquake sequence on the Greenville fault, which produced two earthquakes of magnitudes 5.5 and 5.6 on the Richter Scale. The earthquake caused structural and nonstructural damage to the SNL/CA facilities (DOE 2003).

In most cases, Calaveras fault earthquakes in the Livermore Valley region have occurred on strike-slip faults, generally indicating north-south-oriented compression. The fault segment nearest SNL/CA may be capable of generating a magnitude 6 to 6.5 earthquake (DOE 2003).

These local faults in the Livermore Valley region are the main seismic hazard to the region. Due to the level of active seismic results this region is classified as Seismic Risk Zone 4, the highest risk zone in the California Building Code (DOE 2005a). Adverse impacts to structures, infrastructures, and surrounding communities could occur from hazardous materials release and/or structural failure of buildings and facilities following a major seismic event.

4.2.7 Biological Resources

The following section describes biotic resources at the Livermore Site and Site 300 including terrestrial resources, wetlands, aquatic resources, and threatened and endangered species.

4.2.7.1 Terrestrial Resources

4.2.7.1.1 Livermore Site

The Livermore Site covers 821 acres of which approximately 640 acres are developed. Vegetation surveys at the Livermore Site have been conducted as part of previous projects. In June 2002, an additional survey was conducted. This survey confirmed that site conditions and species composition have changed relatively little during the past 10 years. The developed areas at the Livermore Site are planted with ornamental vegetation and lawns. There are also small areas of disturbed ground with early successional plant species. The undeveloped land in the security zone is an introduced grassland plant community dominated by nonnative grasses such as wild oat, brome grasses, foxtail barley, curly dock, and wild radish. The tree canopy consists of both native and nonnative species including willows, oaks, California buckeye, glossy privet, and black locust. Vegetation along the arroyo's channel includes perennial peppergrass, sweet fennel, and common cocklebur. Common species in the annual grassland along the upper channel bank of the arroyo include wild oats, brome grasses, alkali mallow, and yellow star-thistle (DOE 2005a).

Wildlife includes species that live in the undeveloped grassland in addition to a number of species that live in the developed areas of the site or along the arroyo. Representative species observed in the undeveloped grassland areas include the fence lizard, black-tailed hare, California ground squirrel, red fox, and western meadowlark. The California red-legged frog has been observed in the Arroyo Las Positas and the Drainage Retention Basin (DRB). The bullfrog, a known predator of the California red-legged frog, has been observed since 1997. Nesting birds include the American crow, American robin, house finch, mockingbird, and house sparrow. These species nest in the planted trees onsite. Canada geese and muskrats have been observed at the DRB. A raven's nest was observed among some pipes at the Livermore Site. Some bird species observed include the mourning dove, Nuttall's woodpecker, Cooper's hawk, and turkey vulture. Catfish, mosquito fish, goldfish, and sculpin have been observed in the DRB. Recent studies have provided new information about raptor activity at the Livermore Site. In 1996, the red-shouldered hawk, not previously known to occur on LLNL property, nested at the Livermore

Site. Between 1994 and 2003, the white-tailed kite, a state-protected bird of prey, was observed foraging, nesting, and fledging young at the Livermore Site. The kites were marked with aluminum leg bands in 1999 to initiate long-term studies of the species in a semi-urban edge habitat. In 2000, a pair of white-tailed kites attempted to nest, but the nesting was unsuccessful, possibly due to climatic conditions or low incidence of prey. This reduced nesting trend was observed in other parts of California in 2000. Breeding success improved in 2003 with nine young fledged from two nests (DOE 2005a).

4.2.7.1.2 Site 300

Site 300, with large areas of wildland vegetation, interspersed with various plant community types, and availability of water at springs, provides habitat for a diversity of wildlife. Twenty amphibian and reptile species have been observed at Site 300. Aquatic habitat is available at some of the drainages containing aquatic vegetation supported by underground springs and seeps and in a seasonal pool in the northwest portion created to mitigate for the closure of the two Class II surface impoundments. In addition, aquatic species may opportunistically use existing wastewater treatment facilities like the domestic sewage oxidation ponds. Two species of salamanders were observed: the California slender salamander and the California tiger salamander. The former species was observed during 1986 biological surveys, but not during 1991 surveys, although both species are currently known to occur onsite. Frog and toad species known to occur onsite are the western toad, western spadefoot toad, Pacific treefrog, and California red-legged frog. No exotic bullfrogs have been observed onsite to date. Conditions are far more favorable for reptiles than for amphibians at Site 300. Grassland provides ideal habitat for racers and gopher snakes. Rocky sites provide suitable habitat for such species as the western fence lizard, western skink, common kingsnake, and the western rattlesnake. Seeps and springs provide excellent habitat for the northern alligator lizard. Side-blotched lizards and California horned lizards frequent areas with vegetation that is more open and sandy soils (DOE 2005a).

Earlier avian surveys reported 70 bird species present at Site 300 on either a resident or transient basis. In 2002, an extensive survey was conducted using variable circular plot point counts and constant effort mist netting. During the 2002 survey, 90 bird species were observed, representing 73 genera and 32 families. Site 300 also supports nesting raptors. A breeding raptor survey conducted at Site 300 in April and July 2002 identified four species of diurnal raptors and four species of owls. The raptors included the turkey vulture, red-tailed hawk, golden eagle, and American kestrel (the most frequently observed raptor on Site 300). Owls observed included the barn owl, western screech owl, great horned owl, and western burrowing owl (DOE 2005a).

A 1986 botanical survey identified four upland major plant community types that are located within Site 300: (1) introduced grassland, (2) native grassland, (3) coastal sage scrub, and (4) oak woodlands. A recent survey (Jones and Stokes 2002a) expanded that number to eight major upland plant-type categories. The revised list of major communities was further divided into the following vegetation types: annual grassland, native grassland, coastal scrub, coastal sage scrub oak, poison oak scrub, cottonwood riparian forest/woodland, Great Valley willow scrub, Mexican elderberry, blue oak woodland, valley oak forest/woodland, juniper-oak woodland/scrub, juniper-oak cismontane woodland, disturbed land, and urban habitat (DOE 2005a).

Annual grassland covers more than 5,000 acres, and is dominated by annual grasses introduced from Mediterranean Europe during the Spanish Colonial Era (e.g., slender oat and ripgut brome); native grassland covers more than 700 acres, and is dominated primarily by one-sided bluegrass and purple needlegrass. The coastal sage scrub plant community type is dominated by California matchweed, California sagebrush, *Eriogonum fasciculatum*, and black sage. Oak woodland, dominated by blue oak, occurs in scattered areas on steep slopes in the southern half of the site and covers approximately 150 acres. The understory is dominated by grassland species such as brome grass and slender oat. Controlled burning takes place every year on approximately 2,000 acres of land during late May to early June depending on weather conditions (DOE 2005a).

4.2.7.1.3 SNL/CA

SNL/CA is located on 410 acres, with approximately 130 acres currently developed for use as research facilities, offices, support facilities, roadways, and parking areas (SNL/CA 2002c). Undeveloped areas on the east, south, and west sides of the facility provide a security buffer zone and areas for future development. The following three terrestrial habitat areas have been identified in the undeveloped areas: grassland, coyote brush scrub, and riparian woodland (DOE 2003).

Grasslands comprise 226 acres at SNL/CA and represent the predominant habitat in the open, undeveloped areas. Although both native and nonnative species are present, nonnative species are dominant. Common nonnative grasses include ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), wild oats (*Avena* sp.), and Mediterranean barley (*Hordeum marinum*). Common nonnative herbs include red maids (*Calandrinia ciliata*), bur clover (*Medicago polymorpha*), and cheeseweed (*Malva* sp.). Scattered patches or individual native wildflowers can be observed in the grassland habitat including Brodiaea (*Brodiaea* sp.), California poppy (*Escholzia californica*), blue dicks (*Dishelostemma capitatum*), and farewell to spring (*Clarkia purpurea*) (DOE 2003).

Two small areas of coyote brush scrub occur onsite. One is in the southwest corner of SNL/CA and the second is near the Arroyo Seco on the eastern property boundary. The total coyote brush scrub habitat is approximately 1.5 acres in size. It is located in steep and generally inaccessible areas where disturbance from site activities would be unlikely (DOE 2003).

At SNL/CA, willow riparian woodland of approximately 2.4 acres is present along the eastern portion of the Arroyo Seco. This habitat has increased from just a few isolated patches in 1975 to a more dense and uniform cover along the arroyo (SNL/CA 2002b). A recent survey determined that dominant species include Goodding's black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and narrow-leaved willow (*Salix exigua*). Other common plant species include Fremont cottonwood (*Populus fremontii*), western sycamore (*Plantanus racemosa*), and valley oak. A few immature trees were tentatively identified as northern California black walnut, although positive identification will not be possible for several years (DOE 2003).

4.2.7.2 Wetlands and Floodplains

4.2.7.2.1 Wetlands

Wetlands were mapped at LLNL using the methodology provided in the *United States Army Corps of Engineers Wetland Delineation Manual* (USACE 1987). The following subsections provide a summary of the results of the analysis.

Livermore Site

Wetlands, although very limited in the developed areas of the Livermore Site, do occur along Arroyo Las Positas at the northern perimeter of the site. These wetlands occur in three distinct areas and are associated with culverts that channel runoff from the surrounding area into this arroyo. In 1992, three areas totaling 0.36 acre were determined to qualify as jurisdictional wetlands. The wetlands were dominated by salt grass and a third by cattails. Since 1992, wetlands along Arroyo Las Positas have increased due to the release of water associated with environmental restoration activities at the Livermore Site. In 1997, an additional wetland delineation study was performed along Arroyo Las Positas. That study determined that the size of jurisdictional wetlands had expanded to 1.96 acres. Approximately 1,800 feet of Arroyo Seco is on the Livermore Site. In July 2001, a wetland delineation survey was performed. Within the arroyo, six vegetated areas were determined to be potential jurisdictional wetlands, totaling 0.04 acre (DOE 2005a) which would expand jurisdictional wetlands to 2.0 since the 1997 survey.

Site 300

A study for the 1992 LLNL Environmental Impact Statement/Environmental Impact Report (EIS/EIR) delineated 6.76 acres of wetlands at Site 300 (LLNL 1992). In August 2001, another wetland delineation study was conducted identifying 46 wetlands and determining that the total size of wetlands had increased to 8.61 acres. A total of 4.39 acres were found to meet criteria for jurisdictional wetlands. These wetlands are small and include freshwater seeps, cooling tower discharges from some of the buildings, vernal pools, and seasonal ponds. Many of the wetlands occur at springs in the bottom of deep canyons in the southern half of the site. These springs occur where water-bearing sandstone units outcrop in the canyon or valley bottoms. The wetlands that have developed at these springs are confined by the steep-sided canyon wall. They typically range in width from 5 to 30 feet wide with most being 10 to 20 feet wide. Most are relatively short, 100 to 600 feet; the longest, in Oasis Canyon, is approximately 2,800 feet long (DOE 2005a).

SNL/CA

The wetland area of SNL/CA is approximately 1,370 feet of the Arroyo Seco channel starting several hundred feet east of Thunderbird Lane and extending east to the SNL/CA boundary. The wetland is approximately 8 feet wide except near the property boundary where it averages 20 to 30 feet wide; it occupies 0.44 acres. The wetland area is a seasonal marsh (SNL/CA 2007).

Within the riparian woodland habitat are 0.44 acre of seasonal wetlands associated with Arroyo Seco, almost entirely in the east buffer zone. These delineated wetlands are present along 1,370

feet of the arroyo running from the eastern boundary to 200 feet east of the fence surrounding the developed part of the installation. Along this portion of arroyo are a number of obligate (limited to certain conditions) wetland species including Goodding's black willow, willow dock (*Rumex salicifolius*), southern cattail (*Typha domingensis*), and water cress (*Rorippa nasturtium-aquaticum*). Facultative (capable of living under varying conditions) wetland species include arroyo willow, red willow, mugwort (*Artemisia douglasiana*), rush, rabbit's foot grass (*Polypogon monspeliensis*), stinging nettle, and nutsedge (*Cyperus eragrostis*). Pepperweed (*Lepidium latifolium*), an invasive exotic species, is also present (DOE 2003).

4.2.7.2.2 Floodplains

Two areas on the Livermore Site are within the 100-year floodplains of the Arroyo Las Positas and Arroyo Seco. However no existing onsite structures are within the 100-year floodplain. The channels routing Arroyo Las Positas and Arroyo Seco through the Livermore Site would be able to contain a 100-year flood. The 500-year flood levels have not been delineated.

Based on the flow and stream channel widths at Site 300, 100-year flood events would be contained within the channels except for portions of Greenville Road. There is no information available for delineating the 500-year floodplain at Site 300. The lined drainage retention basin at Site 300 mitigates effects from significant flooding.

Upstream, in the upper two-thirds of the Arroyo Seco, there is a functional floodplain. In the lower one-third, the effects of channel incision become apparent as both banks are elevated 6 to 10 ft above the channel and there is no functional floodplain. Floodplain maps indicate that along most of the channel on SNL/CA property, the entire 100-year discharge is contained within the existing channel. Between A Street and Thunderbird Lane, however, FEMA mapping indicates that flood flows would spill out of the channel; this likelihood appears to be associated primarily with the culverts at a manmade land bridge, which was in place when the FEMA study was conducted. In 1998, during a period of heavy flow, the discharge did spill out of the channel at this location (SNL/CA 2007).

4.2.7.3 Aquatic Resources

4.2.7.3.1 Livermore Site

Potential aquatic habitat on the Livermore Site consists of an intermittent drainage system, seeps, springs, ditches, and a groundwater retention basin. The intermittent drainage system comprises westward-flowing arroyos that contain water during the winter months. Arroyos on the site include Arroyo Las Positas, located along the northern edge of the Livermore Site, and Arroyo Seco, which crosses the southwest corner of the site. Because of their temporary nature, the arroyos do not support fish. The seeps, springs, and ditches also do not support fish; however, the groundwater retention basin contains a population of mosquito fish (*Gambusia affinis*) (DOE 2005a). There are no federally designated Wild and Scenic Rivers onsite.

4.2.7.3.2 Site 300

Potential aquatic habitat on Site 300 consists of vernal pools, ponds, springs, and drainages. There is one perennial stream on the site. A sewage lagoon is located on the property, but it does not support any fish populations. Ponds located in the southeast-central portion of the site, and springs and drainages located throughout the site, do not support fish populations (DOE 2005a). There are no federally designated Wild and Scenic Rivers onsite.

4.2.7.3.3 SNL/CA

Aquatic habitat of about 2.7 acres is present at the LLNL recharge basin on SNL/CA land in the west buffer. The recharge basin consists of two cells (or percolation ponds) to which water can be discharged into one or both cells simultaneously. Cattail (*Typha* sp.) and rush (*Juncus* sp.) are among the most common plant species in the recharge basin. Much of the vegetation is removed during annual summer maintenance by LLNL when the cells are drained, with plant growth generally returning the following spring (DOE 2003). There are no federally designated Wild and Scenic Rivers onsite.

4.2.7.4 *Threatened and Endangered Species*

No sensitive plants, invertebrates, reptiles, or mammals were observed during the 1992 or recent biological surveys at the Livermore Site (DOE 2005a). The California red-legged frog (a federally listed threatened species) occurs at the Livermore Site. This species is the largest native frog in California, growing to more than 5 inches in length. Critical habitat was determined for the California red-legged frog species in March 2001. Critical habitat for this species was designated in the North Buffer Zone and eastern edge of the Livermore Site.

Although the California tiger salamander (a federally proposed threatened species and a state species of special concern) is not presently found at the Livermore Site; it has been observed on nearby lands (DOE 2005a).

At Site 300, five species are listed under the Federal or California Endangered Species Act including two amphibians – the California tiger salamander and California red-legged frog; one reptile – the Alameda whipsnake; one insect – the valley elderberry longhorn beetle; and one plant –the large-flowered fiddleneck. The California red-legged frog is also known to occur at the Livermore site. The federally endangered San Joaquin kit fox is not known to occur at Site 300, however, it is known to occur in adjacent areas and is included since potential impacts may occur during activities at Site 300. California threatened Swainson's Hawks and California endangered Willow Flycatchers have been observed at Site 300 but breeding habitat for these species is not known to occur at Site 300.

Several other species considered rare or of special interest are tabulated including California Species of Special Concern (CASCS), species protected by the Migratory Bird Treaty Act (MBTA), and plant species included in the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants. Monitoring programs are performed for the Tricolored Blackbird at Site 300 and for the White-tailed Kit at the Livermore site.

Four rare plant species are known to occur at Site 300 including the federally endangered large-flowered fiddleneck, the big tarplant, the diamond-petaled poppy and the round-leaved filaree.

4.2.7.4.1 Livermore Site

The California red-legged frog (a federally listed threatened species) occurs at the Livermore Site. This species is the largest native frog in California, growing to more than 5 inches in length. It was listed as a threatened species in June 1996 (61 FR 25813). The California red-legged frog is found in the Arroyo Las Positas and in the DRB at the Livermore Site. A single adult California red-legged frog was also found in the West Perimeter Drainage Ditch during the 2002 nocturnal surveys. No sensitive plants, invertebrates, reptiles, or mammals were observed during the 1992 or recent biological surveys at the Livermore Site.

Critical habitat was determined for the California red-legged frog species in March 2001 (66 FR 14626). Critical habitat for this species was designated in the North Buffer Zone and eastern edge of the Livermore Site. As a result of a court order in November 2002, critical habitat for this species at the Livermore Site was rescinded. In April 2004, the U.S. Fish and Wildlife Service (USFWS) issued a proposed rule to reinstate formerly designated critical habitat for the California red-legged frog at the Livermore Site (69 FR 19620, 69 FR 32966). The DRB was drained in 2000 and 2001 in an effort to eliminate bullfrog larvae, because this species is a known predator of the California red-legged frog. Bullfrogs were first detected at the Livermore Site in 1997. The USFWS was consulted and approved this management technique.

Although the California tiger salamander (a federally proposed threatened species and a state species of special concern) is not presently found at the Livermore Site; it has been observed on nearby lands (69 FR 47212). In August 2004, the USFWS issued a proposed rule to designate critical habitat for the California tiger salamander in the vicinity of the Livermore Site, but not on the facility itself (DOE 2005a)

The loggerhead shrike (a Federal species of concern and a state species of special concern) has recently been reported in the vicinity of the Arroyo Las Positas (LLNL 2003a). Over 60 species of migratory birds have been observed in surveys at the Livermore Site and their status is monitored by LLNL wildlife biologists (DOE 2005a).

4.2.7.4.2 Site 300

Forty-four special status species are currently known to occur at Site 300 including five federally threatened or endangered species (Table 4.2.7-1) (LLNL 2007). Of these five, only the Large-flowered fiddleneck is classified as endangered, and a 160-acre portion of Site 300 has been designated as critical habitat for this plant. The large-flowered fiddleneck was considered one of the most endangered plant species in California and perhaps the Nation. This species is known to exist naturally in only three locations; two are at Site 300, and one is on a nearby ranch. The largest onsite population (Drop Tower population), located in designated critical habitat, was discovered in the 1960s. It fluctuates between as many as 355 individual plants and historic lows during the past 3 years with 14 plants observed in 2001, 40 plants observed in 2000, and 6 plants observed in 1999. The number of fiddleneck plants observed in the original experimental population area

(59 plants) is similar to that observed during the past 2 years (45 plants in 2000 and 42 plants in 1999). A dramatic increase in seed predation by small rodents in 1998 and 1999 may be responsible for the reduction in Site 300's original experimental large-flowered fiddleneck population (DOE 2005a).

The valley elderberry longhorn beetle (a federally listed threatened species) is the only sensitive insect that has been observed at Site 300. This species occurs almost exclusively on elderberry bushes, so elderberries that grow within the range of this species are considered potential habitat. The California red-legged frog, a federally listed threatened species and a state species of special concern, occurs at Site 300. This amphibian was listed as a federally threatened species in June 1996 (61 FR 25813). Critical habitat was determined for the species in March 2001 (66 FR 14626). As a result of a court order in November 2002, critical habitat for this species at Site 300 was rescinded. In April 2004, the USFWS issued a proposed rule to reinstate formerly designated critical habitat for the California red-legged frog at Site 300 (69 FR 19620, 69 FR 32966). The final rule designating critical habitat for the California red-legged frog issued on April 23, 2005, did not include any habitat at the Livermore site or Site 300.

The California tiger salamander (a federally listed threatened species and a state species of special concern) is present at Site 300. In August 2004, the USFWS issued a proposed rule to designate critical habitat for the California tiger salamander in parts of Alameda and San Joaquin Counties, but not at Site 300 (69 FR 4580). The final rule designating critical habitat for the California tiger salamander issued on August 23, 2005, did not include any habitat at the Livermore site or Site 300. The Western spadefoot toad is a Federal species of concern and state species of special concern. During wet years, this amphibian has been observed at the Overflow Pond located in the GSA of Site 300. The Alameda whipsnake (a federally listed and state listed threatened species) was observed onsite in 1986 (DOE 2005a). Proposed critical habitat for the Alameda whipsnake issued on October 18, 2005 includes the southwestern portion of Site 300. At Site 300, the Alameda whipsnake (*Masticophis lateralis euryxanthus*) is classified as the California whipsnake (*M. lateralis*) because it more closely resembles an intergrade between two species: the Alameda whipsnake and the Chapparral whipsnake (*M. lateralis lateralis*) (DOE 2005a).

**Table 4.2.7- 1 — Species of Special Interest to Federal and State Resource Agencies
Known to Occur at the Livermore Site and Site 300**

Common Name		Scientific Name	Federal Status	State Status
Plants				
Big tarplant	a	<i>Blepharizonia plumosa plumosa</i>	-	CNPS List 1B
Large-flowered fiddleneck	a	<i>Amsinckia grandiflora</i>	FE (CH)	SE; CNPS List 1 B
Diamond-petaled poppy	a	<i>Eschschozia rhombipetala</i>	FSC	CNPS List 1B
Round-leaved filaree	a	<i>Erodium macrophyllum</i>	-	CNPS List 2
Gypsum-loving larkspur		<i>Delphinium gypsophilum gypsophilum</i>	-	CNPS List 4
California androsace		<i>Androsace elongata acuta</i>	-	CNPS List 4
Stinkbells		<i>Fritillaria agrestis</i>	-	CNPS List 4
Hogwallow starfish		<i>Hesperevax caulescens</i>	-	CNPS List 4
Mammals				
Pallid bat		<i>Antrozous pallidus</i>	-	CASCS
California pocket mouse		<i>Chaetodipus californicus</i>	-	CASCS
San Joaquin kit fox	a	<i>Vulpes macrotis mutica</i>	FE	ST
American badger		<i>Taxidea taxus</i>	-	CASCS
Amphibians				
California tiger salamander	a	<i>Ambystoma californiense</i>	FT	CASCS
California red-legged frog	a,b	<i>Rana aurora draytonii</i>	FT	CASCS
Western spadefoot toad		<i>Spea hammondi</i>	-	CASCS
Reptiles				
Alameda whipsnake	a,e	<i>Masticophis lateralis euryxanthus</i>	FT (CH)	ST
San Joaquin coachwhip		<i>Masticophis flagellum</i>	-	CASCS
Coast horned lizard		<i>Phrynosoma coronatum</i>	-	CASCS
California legless lizard		<i>Anniella pulchra</i>	-	CASCS
Birds				
Cooper's Hawk		<i>Accipiter cooperii</i>	MBTA	CASCS
Sharp-shinned Hawk		<i>Accipiter striatus</i>	MBTA	CASCS
Golden Eagle		<i>Aquila chrysaetos</i>	MBTA	CAFPS,CASCS
Red-tailed Hawk		<i>Buteo jamaicensis</i>	MBTA	-
Rough-legged Hawk		<i>Buteo lagopus</i>	MBTA	-
Red-shouldered Hawk		<i>Buteo lineatus</i>	MBTA	-
Ferruginous Hawk		<i>Buteo regalis</i>	MBTA	CASCS
Swainson's Hawk	a	<i>Buteo swainsoni</i>	MBTA	ST
Northern Harrier		<i>Circus cyaneus</i>	MBTA	CASCS
White-tailed Kite	b,d	<i>Elanus leucurus</i>	MBTA	CAFPS
Osprey		<i>Pandion haliaetus</i>	MBTA	CASCS
Bushtit		<i>Psaltriparus minimus</i>	MBTA	-
Horned Lark		<i>Eremophila alpestris</i>	MBTA	CASCS
Northern Shoveler		<i>Anas clypeata</i>	MBTA	-
Cinnamon Teal		<i>Anas cuamptera</i>	MBTA	-
Mallard		<i>Anas platyrhynchos</i>	MBTA	-
Bufflehead		<i>Blucephala albeola</i>	MBTA	-

**Table 4.2.7- 1 — Species of Special Interest to Federal and State Resource Agencies
Known to Occur at the Livermore Site and Site 300 (continued)**

Common Name		Scientific Name	Federal Status	State Status
Common Goldeneye		<i>Bucephala clangula</i>	MBTA	-
White-throated Swift		<i>Aeronautes saxatalis</i>	MBTA	-
Great Egret		<i>Ardea alba</i>	MBTA	-
Virginia Rail		<i>Rallus limicola</i>	MBTA	-
Cedar Waxwing		<i>Bombycilla garrulus</i>	MBTA	-
Common Poorwill		<i>Phalaenoptilus nuttallii</i>	MBTA	-
Blue-grosbeak		<i>Guiraca caerulea</i>	MBTA	-
Black-headed Grosbeak		<i>Pheucticus melanocephalus</i>	MBTA	-
Lazuli Bunting		<i>Passerina amoena</i>	MBTA	-
Turkey Vulture		<i>Cathartes aura</i>	MBTA	-
Killdeer		<i>Charadrius vociferus</i>	MBTA	-
Mourning Dove		<i>Zenaida macroura</i>	MBTA	-
Western Scrub Jay		<i>Aphelocoma californica</i>	MBTA	-
American Crow		<i>Corvus brachyrhynchos</i>	MBTA	-
Common Raven		<i>Corvus corax</i>	MBTA	-
Greater Roadrunner		<i>Geococcyx californianus</i>	MBTA	-
Bell's Sage Sparrow		<i>Amphispiza belli</i>	MBTA	CASCS
Black-throated Sparrow		<i>Amphispiza bilineata</i>	MBTA	-
Rufous Crowned Sparrow		<i>Aimophila ruficeps</i>	MBTA	-
Grasshopper Sparrow		<i>Ammodramus savannarum</i>	MBTA	-
Lark Sparrow		<i>Chondestes grammacus</i>	MBTA	-
California Towhee		<i>Carpodacus mexicanus</i>	MBTA	-
Oregon Junco		<i>Junco hyemalis</i>	MBTA	-
Lincoln's Sparrow		<i>Melospiza lincolni</i>	MBTA	-
Song Sparrow		<i>Melospiza melodia</i>	MBTA	-
Vesper Sparrow		<i>Pooecetes gramineus</i>	MBTA	-
Fox Sparrow		<i>Passerella iliaca</i>	MBTA	-
Savannah Sparrow		<i>Passerculus sandwichensis</i>	MBTA	-
Golden-crowned Sparrow		<i>Zonotrichia atricapilla</i>	MBTA	-
White-crowned Sparrow		<i>Zonotrichia leucophrys</i>	MBTA	-
American Kestrel		<i>Falco sparverius</i>	MBTA	-
Prairie Falcon		<i>Falca mexicanus</i>	MBTA	CASCS
House Finch		<i>Carpodacus mexicanus</i>	MBTA	-
Lesser Goldfinch		<i>Carduelis psaltia</i>	MBTA	-
Cliff Swallow		<i>Petrochelidon pyrrhonota</i>	MBTA	-
Northern Rough Winged Swallow		<i>Stelgidopteryx serripennis</i>	MBTA	-
Tree Swallow		<i>Tachycineta bicolor</i>	MBTA	-
Red-winged Blackbird		<i>Agelaius phoeniceus</i>	MBTA	-
Tricolored Blackbird	c	<i>Agelaius tricolor</i>	MBTA	CASCS
Brewer's Blackbird		<i>Euphagus cyanocephalus</i>	MBTA	-
Bullock's Oriole		<i>Icterus bullockii</i>	MBTA	-
Brown-headed Cowbird		<i>Molothrus ater</i>	MBTA	-
Western Meadowlark		<i>Sturnella magna</i>	MBTA	-
Loggerhead Shrike		<i>Lanius ludovicianus</i>	MBTA	CASCS

Table 4.2.7- 1 — Species of Special Interest to Federal and State Resource Agencies Known to Occur at the Livermore Site and Site 300 (continued)

Common Name		Scientific Name	Federal Status	State Status
Northern Mockingbird		<i>Mimus polyglottos</i>	MBTA	-
California Thrasher		<i>Toxostoma redivivum</i>	MBTA	-
Oak Titmouse		<i>Baeolophus inornatus</i>	FSC, MBTA	-
Yellow-rumped Warbler		<i>Dendroica coronata</i>	MBTA	-
Black-throated Gray Warbler		<i>Dendroica nigrescens</i>	MBTA	-
Yellow Warbler		<i>Dendroica petechia</i>	MBTA	CASCS
Common Yellowthroat		<i>Geothlypis trichas</i>	MBTA	CASCS
MacGillivray's Warbler		<i>Oporornis tolmiei</i>	MBTA	-
Orange-crowned Warbler		<i>Vermivora bachmanii</i>	MBTA	-
Wilson's Warbler		<i>Wilsonia pusilla</i>	MBTA	-
Double-crested Cormorant		<i>Phalacrocorax auritus</i>	MBTA	CASCS
Northern Flicker		<i>Colaptes auratus</i>	MBTA	-
Nuttall's Woodpecker		<i>Picoides nuttallii</i>	MBTA	-
Acorn Woodpecker		<i>Melanerpes formicivorus</i>	MBTA	-
Pied-billed Grebe		<i>Podilymbus podiceps</i>	MBTA	-
Phainopepela		<i>Phainopepla nitens</i>	MBTA	-
Ruby-crowned Kinglet		<i>Regulus calendula</i>	MBTA	-
Common Snipe		<i>Gallinago gallinago</i>	MBTA	-
Greater Yellowlegs		<i>Tringa melanoleuca</i>	MBTA	-
Burrowing Owl		<i>Athene cunicularia</i>	MBTA	CASCS
Short-eared Owl		<i>Asio flammeus</i>	MBTA	CASCS
Great horned Owl		<i>Bubo virginianus</i>	MBTA	-
Western Screech Owl		<i>Otus kennicottii</i>	MBTA	-
Western Tanager		<i>Piranga ludoviciana</i>	MBTA	-
Anna's Hummingbird		<i>Calypte anna</i>	MBTA	-
Costa's Hummingbird		<i>Calypte costae</i>	MBTA	-
Rufous Hummingbird		<i>Selasphorus rufus</i>	MBTA	-
Allen's Hummingbird		<i>Selasphorus sasin</i>	MBTA	-
Rock Wren		<i>Salpinctes obsoletus</i>	MBTA	-
Bewick's Wren		<i>Thyothorus ludovicianus</i>	MBTA	-
House Wren		<i>Troglodytes aedon</i>	MBTA	-
Hermit Thrush		<i>Catharus guttatus</i>	MBTA	-
Swainson's Thrush		<i>Catharus ustulatus</i>	MBTA	-
Varied Thrush		<i>Ixoreus naevius</i>	MBTA	-
Mountain Bluebird		<i>Sialia currucoides</i>	MBTA	-
Western Buebird		<i>Sialia mexicana</i>	MBTA	-
American Robin		<i>Turdus migratorius</i>	MBTA	-
Pacific-slope Flycatcher		<i>Empidonax difficillis</i>	MBTA	-
Willow Flycatcher	a	<i>Empidonax traillii</i>	MBTA	SE
Ash-throated Flycatcher		<i>Myiarchus cinerascens</i>	MBTA	-
Western Wood-pewee		<i>Contopus sordidulus</i>	MBTA	-
Black Phoebe		<i>Sayornis nigricans</i>	MBTA	-
Say's Phoebe		<i>Sayornis saya</i>	MBTA	-
Western Kingbird		<i>Tyrannus verticalis</i>	MBTA	-

Table 4.2.7- 1 — Species of Special Interest to Federal and State Resource Agencies Known to Occur at the Livermore Site and Site 300 (continued)

Common Name		Scientific Name	Federal Status	State Status
Cassin's Kingbird		<i>Tyrannus vociferans</i>	MBTA	-
Barn Owl		<i>Tyto alba</i>	MBTA	-
Insects				
Valley elderberry longhorn beetle	a	<i>Desmocerus californicus dimorphus</i>	FT	-

Source: DOE 2005a.

a: Species of particular interest known to occur at Site 300 or in adjacent area (San Joaquin kit fox)(2005 LLNL Env Report).

b: Species of particular interest known to occur at Livermore site (2005 LLNL Env Report)

c: Monitoring program developed at Site 300 (2005 LLNL Env Report)

d: Monitoring program developed at Livermore site (2005 LLNL Env Report)

e: At Site 300, Alameda whipsnake is classified as California whipsnake (*Masticophis lateralis*) because it resembles intergrade between Alameda and Chaparral whipsnake.

CAFPS = California Department of Fish and Game Fully Protected Species (CA Dept. of Fish and Game 2006)

CASCS = California Special Concern species (CA Dept. of Fish and Game 2006)

CH = Critical habitat within Site 300 (the USFWS may establish critical habitat for threatened or endangered species consisting of a geographic area determined essential for the conservation of the species).

FE = Endangered under the Federal Endangered Species Act

FT = Threatened under the Federal Endangered Species Act

MBTA = Migratory Bird Treaty Act

SE = Endangered under the State Endangered Species Act

ST = Threatened under the State Endangered Species Act

FSC = Federal Species of Concern for Alameda and San Joaquin Counties. May be endangered or threatened.

Not enough biological information has been gathered to support listing at this time (U.S. Fish and Wildlife Service 1-1-03-SP-0162).

CNPS List 1B = Plants rare or endangered throughout range in California and elsewhere.

CNPS List 2 = Plants rare or endangered in California and elsewhere.

CNPS List 4 = Plants are uncommon enough to warrant monitoring but not considered rare.

4.2.7.4.3 SNL/CA

Thirteen Federal and state listed species have been reported at or near SNL/CA (DOE 2003). The California red-legged frog (*Rana aurora draytonii*) is the only Federally threatened or endangered species that has been found in close proximity to SNL/CA. The California red-legged frog is known to occur at LLNL and in the farm stock pond on adjacent property on the east side of SNL/CA. It was not sighted during a 2001 survey of the Arroyo Seco drainage and the recharge basin on the west side of the site. This survey concluded that although the recharge basin provides suitable habitat for part of the year, the irregular drainage during the breeding season of the California red-legged frog minimizes the use of this habitat on a year-round basis (DOE 2003).

4.2.7.5 Biological Monitoring and Abatement Programs

LLNL monitors several aspects of the terrestrial environment. LLNL measures the radioactivity present in soil, sediment, vegetation, and wine, and the absorbed gamma radiation dose at ground

level receptors from terrestrial and atmospheric sources and monitors wildlife and plants at both the Livermore Site and Site 300. The LLNL terrestrial radioactivity monitoring program is designed to measure any changes in environmental levels of radioactivity and to evaluate any increase in radioactivity that might have resulted from LLNL operations (DOE 2005a).

Some terrestrial monitoring and research programs are required by existing permits, while additional monitoring programs are designed to track the distribution and abundance of rare species. In addition, baseline surveys are conducted to determine the distribution and abundance of rare and/or special status species on LLNL property. Monitoring and research of biota on LLNL property is conducted to ensure compliance with requirements of the U.S. Endangered Species Act, the California Endangered Species Act, the Eagle Protection Act, the Migratory Bird Treaty Act, and the California Native Plant Protection Act as they pertain to endangered or threatened species and other special status species, their habitat, and designated critical habitats that exist at the LLNL sites (DOE 2005a).

Details and results of LLNL and SNL/CA biological monitoring and abatement programs are updated annually in each site's environmental reports (LLNL 2007, SNL/CA 2007).

4.2.8 Cultural and Archaeological Resources

4.2.8.1 *Archaeological Resources*

4.2.8.1.1 Livermore Site

Field surveys and records searches conducted prior to and for the 1992 LLNL Environmental Impact Statement/Environmental Impact Report (EIS/EIR) did not reveal the presence of prehistoric resources on the Livermore Site. Previous work included archival reviews conducted at the Northwest Information Center at Sonoma State University; the Central California Information Center at California State, Stanislaus; a records search at Basin Research Associates in San Leandro, California; and review of the archaeological files at LLNL. In addition, field surveys conducted by Holman & Associates in the undeveloped western and northern perimeter areas, including a 500-foot-wide buffer, and an undeveloped area survey conducted in 1991 did not reveal the presence of prehistoric resources. Because most of the Livermore Site is developed, the likelihood of finding unrecorded and undisturbed prehistoric sites is low; however, there is still the possibility that undisturbed prehistoric sites lay buried under the modern landscaping (DOE 2005a).

4.2.8.1.2 Site 300

Archaeological surveys undertaken at Site 300 over the past thirty years have resulted in the recordation of eight prehistoric archaeological sites (DOE 2005a). The area was used by early populations for hunting, and for collecting and processing seasonal plant foods. This use is evidenced by small lithic scatters, and rockshelters that contain bedrock mortars and possible small midden deposits.

Of the eight prehistoric archaeological resources recorded at Site 300, the DOE/NNSA, as the Federal agency responsible for historic properties at LLNL, concluded that two qualify for listing in the National Register of Historic Places (NRHP) because of their ability to yield information important in prehistory. The California SHPO concurred with this determination (California Office of Historic Preservation 2005).

LLNL prepared a draft archaeological resources treatment plan in July 2005 that described specific resource management and treatment strategies that could be implemented by DOE/NNSA, in cooperation with LLNL, to ensure that these properties are managed in a manner that considers their historic values. At the end of fiscal year 2007, this document was under consideration by DOE/NNSA and SHPO. Development or ground disturbing activities are not permitted in or within 300 feet of the delineated area of the National Register Eligible sites unless the activity was approved or monitored by LLNL archaeologists.

4.2.8.1.3 SNL/CA

In 2001, SNL/CA completed an historic building survey. None of the buildings onsite are identified as historically significant or eligible for the National Register of Historic Places (SNL/CA 2007). The results of the historic building survey were submitted to NNSA/SSO. In December 2004, NNSA transmitted the survey results to the California State Historic Preservation Officer (SHPO). In April 2005, NNSA/SSO received concurrence from the California SHPO that none of the properties located at SNL/CA are eligible for inclusion in the National Register of Historic Places (SNL/CA 2007).

On September 22, 2004, DOE issued updated guidelines for developing cultural resource management plans (CRMP) for all DOE facilities. These guidelines are intended to assist each facility in meeting the statutory and regulatory requirements applicable to cultural resources. In 2005, SNL/CA prepared a site-specific CRMP following DOE guidance (SNL/CA 2007).

4.2.8.2 *Historic Resources*

4.2.8.2.1 Livermore Site

As with prehistoric archaeological resources, the results of the record searches and field surveys indicates that there are no known historic archaeological sites at the Livermore Site. Because most of the Livermore Site is developed, the likelihood of finding unrecorded and undisturbed historic sites is low; however, there is still the possibility that undisturbed historic sites lay buried under the modern landscaping (DOE 2005a).

The Livermore Site has a number of buildings associated with historic events or significant LLNL achievements. These include buildings from the World War II-era Livermore Naval Air Station as well as buildings built after 1952 that are associated with the Cold War. An assessment of LLNL's buildings, structures, and objects for potential historic significance was undertaken in 2004 (Sullivan and Ullrich 2004). As a result of this assessment, DOE/NNSA, in consultation with the SHPO, determined that four individual buildings and objects within one other building at the Livermore Site are eligible for listing in the NRHP because of their

association with important research and development that was undertaken within the context of the Cold War.

LLNL prepared a draft historic buildings treatment plan in September 2005 that described specific resource management and treatment strategies that could be implemented by DOE/NNSA, in cooperation with LLNL, to ensure that these properties are managed in a manner that considers their historic values. At the end of fiscal year 2007, this document was under consideration by DOE/NNSA and the SHPO (DOE 2005a).

4.2.8.2.2 Site 300

Archaeological surveys undertaken at Site 300 over the past thirty years have resulted in the recordation of 23 historic archaeological sites (DOE 2005a). These sites provide evidence that homesteading, ranching, and mining were the predominant activities in the area during the historic period. The historic sites include an early 20th century homestead site; remnants of water and sewer lines; possible remnants of a small wood bridge; small trash dumps; a historic power/telegraph line; and a mine adit and associated features. Site 300 also contains remnants of the residential section of the former town of Carnegie. Carnegie was the location of a brick and pottery plant and town from 1895 to 1912.

Of the 23 historic archaeological resources recorded at Site 300, the DOE/NNSA concluded that 3 qualify for listing in the NRHP because of their ability to yield important information in history. The California SHPO concurred with this determination (California Office of Historic Preservation 2005).

4.2.8.2.3 SNL/CA

SNL/CA has conducted two comprehensive studies of cultural resources on the site. The goal of the assessment was to identify any potentially important cultural resources located on SNL/CA, including prehistoric, historic, and Native American resources. The field inventories included all areas outside of the central building compound. Within the compound, the field inventories included all open or otherwise undeveloped areas. An assessment of the existing buildings was also conducted. Finally, the Native American Heritage Commission, and a person knowledgeable of resources important to the tribe that inhabited the area historically, was consulted to identify any religious resources and sacred sites important to Native Americans. The only resources identified on the site were the buildings and structures associated with SNL/CA—no prehistoric resources, Native American resources, or historic archaeological sites were identified. As a result of the assessment the buildings or structures identified were eligible or potentially eligible for the NRHP.

4.2.8.3 *Native American Consultation*

Native American groups known to have used Alameda and San Joaquin counties include the Costanoans (or Ohlone), Northern Yokuts, and Eastern Miwok. These groups were hunters and gatherers who relied on a variety of resources including deer, elk, antelope, fish, birds, nuts, and fruits. Individual tribes usually had a permanent village and occupied smaller campsites on a

seasonal basis. These groups were decimated after European contact due to disease and acculturation. It is estimated that there are approximately 500 people of Costanoan (Ohlone) descent still living in the San Francisco Bay region. Yokut and Miwok tribal members are also increasing in number in recent years.

Sacred and important Native American resources that might be found in the vicinity of the Livermore Site and Site 300 include burials, cremations, vision quest sites, and traditional use areas. Initial consultation with identified local Native American groups to determine important resources has begun. In 2006, the DOE/NNSA conferred with the California Native American Heritage Commission to define a list of appropriate Native American representatives to contact and subsequently consulted with 11 representatives of the Ohlone/Costanoan groups concerning the continued operation of the Livermore Site and Site 300. No traditional cultural resources have been identified on either the Livermore Site or Site 300 (LLNL 2007)

4.2.9 Socioeconomic Resources

Socioeconomic characteristics addressed at LLNL and SNL/CA include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current LLNL and SNL/CA employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

LLNL and SNL/CA are located in Alameda County, California. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Alameda, Contra Costa, San Joaquin, and Stanislaus Counties. Figure 4.2.9-1 presents a map of the counties composing the LLNL and SNL/CA ROI.

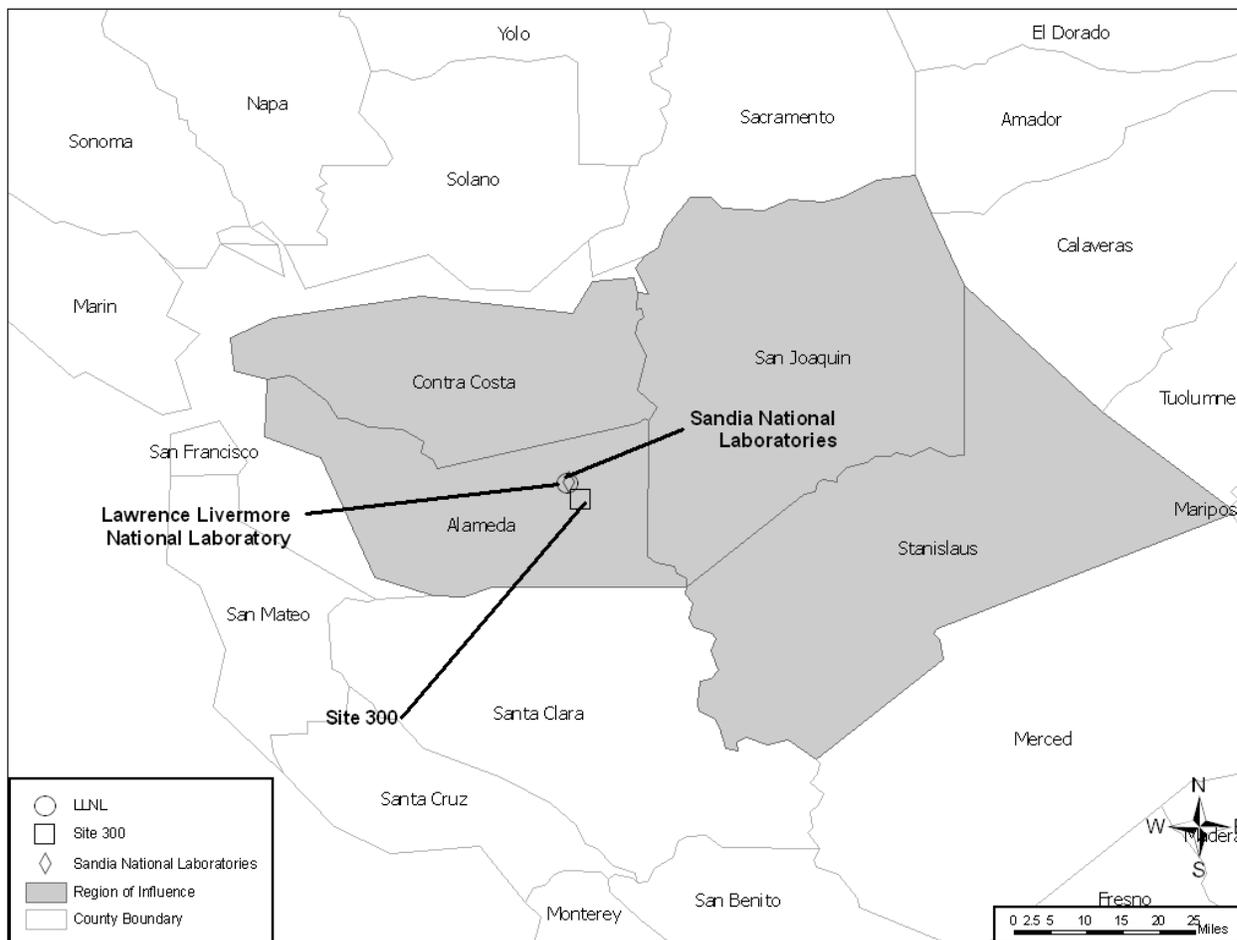


Figure 4.2.9-1 — Region of Influence for LLNL and SNL/CA

4.2.9.1 *Employment and Income*

LLNL employs approximately 8,220 workers, including DOE employees and multiple contractors while SNL/CA employs approximately 1,040 employees.

Labor force statistics are summarized in Table 4.2.9-1. The civilian labor force of the ROI grew by approximately 2 percent from 1,736,690 in 2000 to 1,775,645 in 2005. The overall ROI employment experienced a growth rate of 1 percent with 1,657,064 in 2000 to 1,670,539 in 2005 as presented in Figure 4.2.9-2 (BLS 2007).

The ROI unemployment rate was 5.9 percent in 2005 and 4.6 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 4.9 percent in Contra Costa County to a high of 8.4 percent in Stanislaus County. The unemployment rate in California in 2005 was 5.4 percent (BLS 2007).

Table 4.2.9-1 — Labor Force Statistics for the ROI and California

	ROI		California	
	2000	2005	2000	2005
Civilian Labor Force	1,736,690	1,775,645	16,857,578	17,740,379
Employment	1,657,064	1,670,539	16,024,341	16,782,260
Unemployment	79,626	105,106	833,237	958,119
Unemployment Rate	4.6	5.9	4.9	5.4

Source: BLS 2007.

Income information for the LLNL and SNL/CA ROI is provided in Table 4.2.9-2. Stanislaus County is at the lower end of the ROI with a median household income in 2004 of \$43,072 and a per capita income of \$25,915. Contra Costa had the highest median household income in the ROI at \$65,459 and a per capita income of \$46,995 (BEA 2007a).

Table 4.2.9-2 — Income Information for the LLNL and SLN/CA ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Alameda	40,737	57,659
Contra Costa	46,995	65,459
San Joaquin	25,570	44,814
Stanislaus	25,915	43,072
California	35,380	49,894

Source: BEA 2007.

4.2.9.2 *Population and Housing*

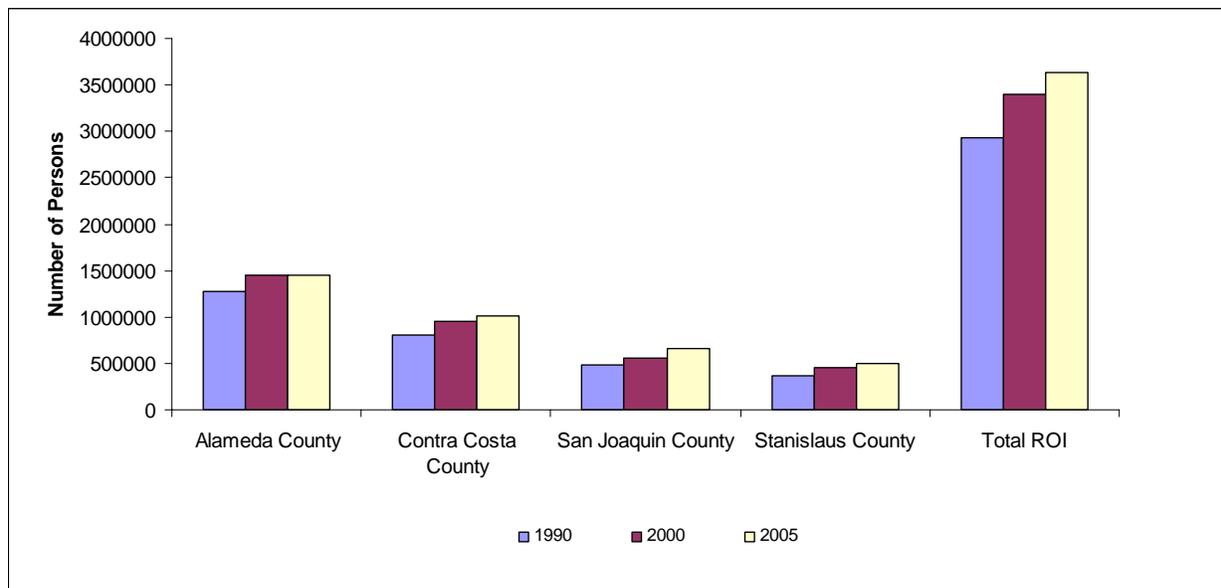
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-3 presents historic and projected population in the ROI and the state.

Table 4.2.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Alameda	1,279,182	1,443,741	1,451,065	1,550,133	1,663,481
Contra Costa	803,732	948,816	1,017,644	1,075,931	1,237,544
San Joaquin	480,628	563,598	664,796	741,417	965,094
Stanislaus	370,522	446,997	505,492	559,708	699,144
ROI	2,934,064	3,403,152	3,638,997	3,927,189	4,565,263
California	29,760,021	33,871,648	36,154,147	39,135,676	44,135,923

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 16 percent from 2,934,064 in 1990 to 3,403,152 in 2000. From 2000 to 2005, the population of the ROI increased 7 percent to 3,638,997 in 2005. San Joaquin County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 18 percent. Alameda County had a 0.5 percent increase from 1,443,741 in 2000 to 1,451,065 in 2005 (USCB 2007). Figure 4.2.9-2 presents the trends in population within the LLNL ROI.



Source: USCB 2007.

Figure 4.2.9-2 — Trends in Population for LLNL ROI, 1990-2005

Table 4.2.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 1,234,727 with 1,194,270 occupied (97 percent). There were 724,279 owner-occupied housing units and 469,991 rental units. The median value of owner-occupied units in Alameda County was the greatest of the counties in the LLNL ROI (\$303,100). The vacancy rate was the smallest in Contra Costa County (2.9 percent) with the highest in San Joaquin County (4.0 percent).

Table 4.2.9-4 — Housing in the LLNL ROI

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Alameda	540,183	523,366	286,277	237,089	16,817	3.1	303,100
Contra Costa	354,577	344,129	238,449	105,680	10,448	2.9	267,800
San Joaquin	189,160	181,629	109,667	71,962	7,531	4.0	142,400
Stanislaus	150,807	145,146	89,886	55,260	5,661	3.8	125,300
ROI	1,234,727	1,194,270	724,279	469,991	40,457	3.3	245,080

Source: USCB 2007.

4.2.9.3 Community Services

Community services in the ROI include public schools, law enforcement, fire suppression, and medical services.

There are 94 school districts which serve the LLNL ROI. Educational services are provided for approximately 623,077 students by an estimated 30,654 teachers in the ROI (IES 2006b). The student-to-teacher ratio in the ROI is 20:1.

The counties within the ROI employ approximately 287,000 firefighters and law enforcement officers. The Alameda County Sheriff's Department employs a total of 1,481 employees, 909 sworn and 572 civilian (DOJ 2004). The employs a total of 154 employees, 111 sworn and 43 civilian (DOJ 2004). Thirty two hospitals serve the LLNL ROI. These hospitals have a total bed capacity of approximately 7,489 (ESRI 2007).

4.2.10 Environmental Justice

The study area considered for environmental justice analysis is the area within a 50-mile radius of LLNL. Figure 4.1.10-1 shows counties potentially at risk from the current missions performed at LLNL. There are nine counties are included in the potentially affected area. Table 4.1.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

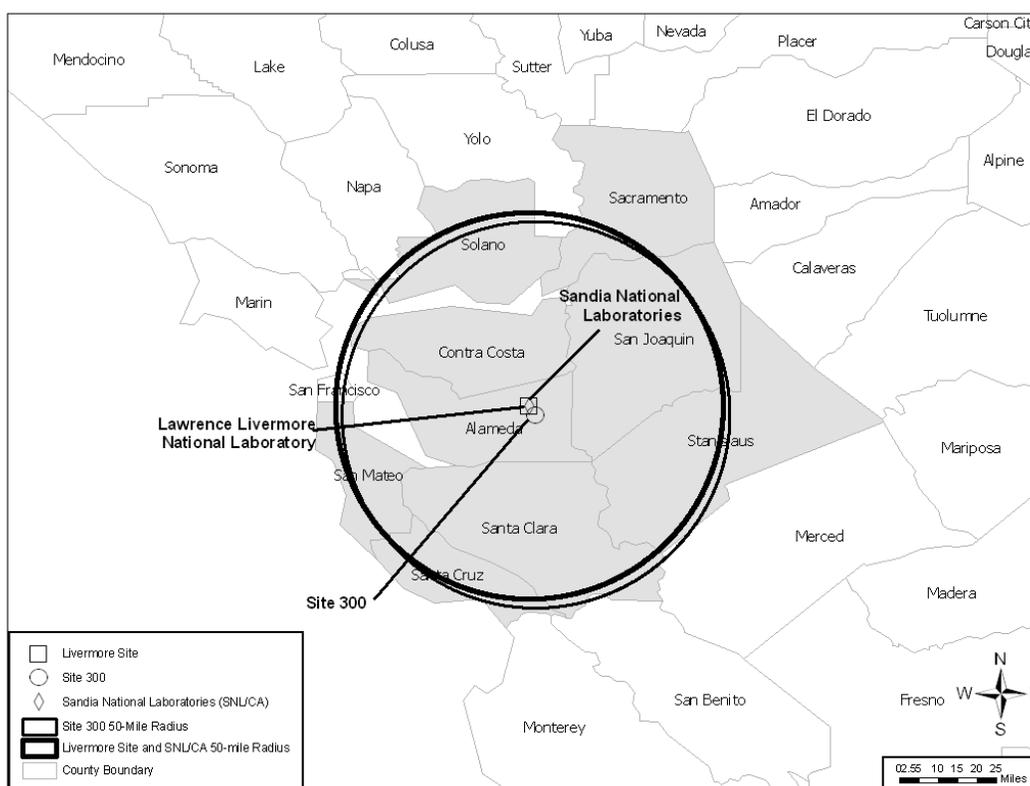


Figure 4.2.10-1 — Potentially Affected Counties Surrounding LLNL

Table 4.2.10-1 — Demographic Profile of the Potentially Affected Area Surrounding LLNL and SNL/CA, 2000

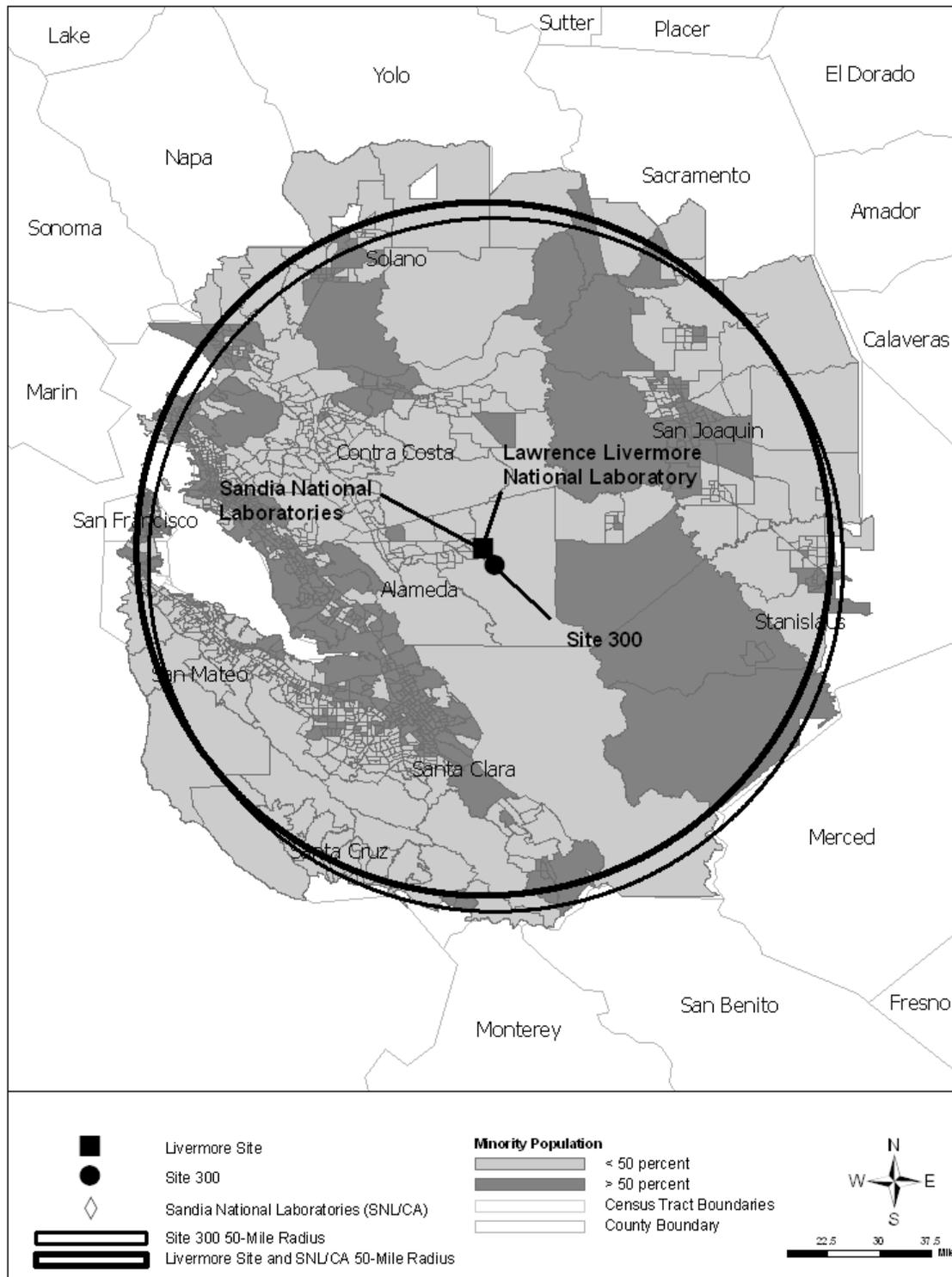
Population Group	Population	Percent
Minority	3,837,996	50.1
Hispanic alone	658,688	8.6
Black or African American	608,751	7.9
American Indian and Alaska Native	60,449	0.8
Asian	1,248,108	16.3
Native Hawaiian and Other Pacific Islander	41,992	0.5
Some other race	809,931	10.6
Two or more races	410,077	5.3
White alone	3,828,545	49.9
Total Population	7,666,541	100.0

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 50.1 percent of the total population. This minority population is composed largely of Asian residents. As a percentage of the total resident population in 2000, California had a minority population of 53.3 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

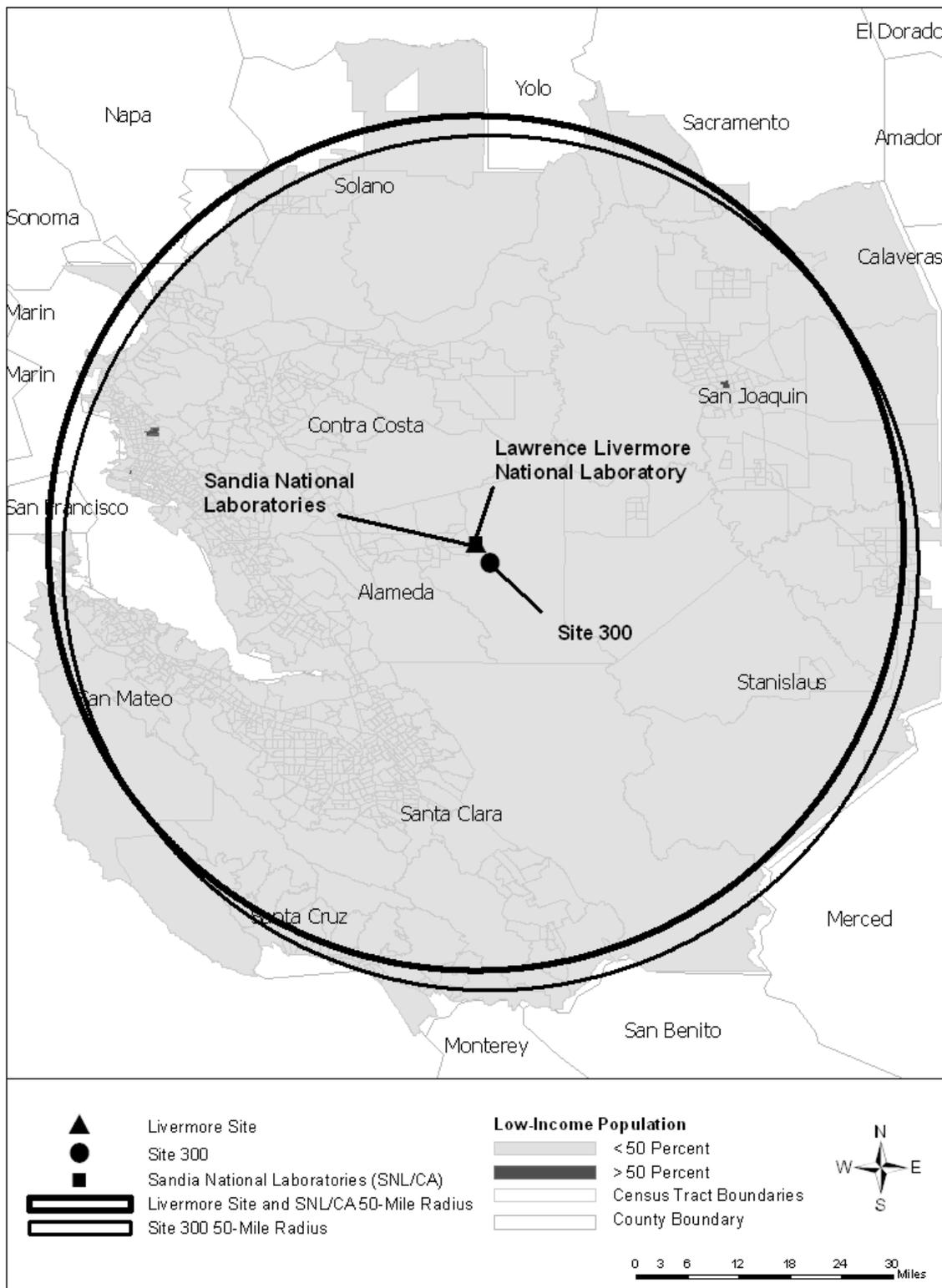
Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.2.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tract population is living below the Federal poverty threshold.

According to 2000 census data, approximately 554,074 individuals residing within census tracts in the 50-mile radius of LLNL were identified as living below the Federal poverty threshold, which represents approximately 9.8 percent of the census tract population in the 50-mile radius. This percentage is lower than the 2000 national average of 12.4 percent and the statewide figure of 14 percent. There were five census tracts located in Alameda and San Joaquin counties with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 14.2 percent of individuals for whom poverty status is determined were below the poverty level in California and 12.4 percent in the U.S. (USCB 2007).



Source: USCB 2007.

Figure 4.2.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of LLNL



Source: USCB 2007.

Figure 4.2.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of LLNL

4.2.11 Health and Safety

Current activities associated with routine operations at LLNL and SNL/CA have the potential to affect worker and public health. The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at LLNL. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.2.11.1 Public Health

4.2.11.1.1 Radiological

Releases of radionuclides to the environment from LLNL operations provide a source of radiation exposure to individuals in the vicinity of LLNL. During 2005, LLNL's environmental radiological monitoring program was conducted according to DOE Order 5400.5, "Radiation Protection of the Public and the Environment." The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to derived concentration guide (DCG) listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual member of the general public. This individual is a person who resides near LLNL, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Plant operations. Calculations are performed using the EPA's CAP88-PC model (EPA, 1992).

As shown in Table 4.2.11-1, the total dose to the MEI from Livermore site operations in 2005 was 0.0065 millirem per year (LLNL 2007). Of this, the dose attributed to diffuse emissions (area sources) totaled 0.0038 millirem or 59 percent; the dose due to point sources was 0.0027 millirem or 41 percent of the total. The point source dose includes Tritium Facility elemental

tritium gas (HT) emissions modeled as tritiated water (HTO), as directed by EPA Region IX. As shown on Table 4.2.11-1 presents the total dose to the Site 300 MEI from operations in 2005 was 0.018 millirem. Point source emissions from firing table explosives experiments totaled 0.0088 millirem accounting for 48 percent of the dose, while 0.0094 millirem, or about 52 percent was contributed by diffuse emission sources (LLNL 2007).

Table 4.2.11-1 — Calculated Radiation Doses to the General Public from Normal Operations at LLNL Main Site, 2005 (Committed Effective Dose Equivalent)

Affected Environment	Atmospheric Releases		Liquid Releases		Total	
	Standard	Actual	Standard	Actual	Standard	Actual
Maximally exposed individual (mrem)	10	0.0038	4	0.0027	100	0.0065
Population within 50-miles (person-rem)	None	0.68	None	0.49	100	1.17
Average individual within 50-miles (mrem)	None	1.1×10^{-7}	None	6.9×10^{-8}	None	1.8×10^{-7}

Source: LLNL 2007.

Dominant radionuclides at the two sites were the same as in recent years. Tritium accounted for about 91 percent of the Livermore site's calculated dose. At Site 300, practically the entire calculated dose was due to the isotopes uranium-238, uranium-235, and uranium-234 from depleted uranium. Collective dose for both LLNL sites was calculated out to a distance of 50 miles in all directions from the site centers. Population centers affected by LLNL emissions include the nearby communities of Livermore and Tracy; the more distant metropolitan areas of Oakland, San Francisco, and San Jose; and the San Joaquin Valley communities of Modesto and Stockton. Within the 50 miles outer distance specified by DOE, there are 7.1 million residents included for the Livermore site collective dose determination, and 6.2 million for Site 300. The result for potential collective dose attributed to 2005 Livermore site operations was 1.17 person-rem, the corresponding collective EDE from Site 300 operations was 1.71 person-rem. These values are both within the normal range of variation seen from year to year. Collective doses from LLNL operations in 2005 are about 700,000 times smaller than ones from natural background radiation. The estimated maximum potential doses to individual members of the public from operations at the two LLNL sites (combined) in 2005 are nearly 12,000 times smaller than ones received from background radiation in the natural environment.

Table 4.2.11-2 — Calculated Radiation Doses to the General Public from Normal Operations at Site 300, 2005 (Committed Effective Dose Equivalent)

Affected Environment	Atmospheric Releases		Liquid Releases		Total	
	Standard	Actual	Standard	Actual	Standard	Actual
Maximally exposed individual (mrem)	10	0.0094	4	0.0088	100	0.018
Population within 50-miles (person-rem)	None	0.89	None	0.82	100	1.71
Average individual within 50-miles (mrem)	None	1.4×10^{-7}	None	1.3×10^{-7}	None	2.7×10^{-7}

Employees working in the radioactive materials area are the site personnel most likely to be exposed to radiation either internally or externally. Exposure pathways for internal dose include inhalation and dermal absorption. Internal exposure is typically monitored by bioassays (e.g., urinalysis, whole-body scans, lung counts). Routine bioassays are done on workers who, under typical conditions, are likely to receive a dose from occupational exposures of 0.1 rem or more in

a year. Others who would be assayed include occupationally exposed minors, members of the public, and pregnant workers who are likely to receive an internal dose of at least 0.05 rem (or, in the case of pregnant workers, an equivalent dose to the embryo/fetus). Internal exposures are minimized in keeping with the concept of as low as reasonably achievable, which is applied through the use of engineering devices (e.g., high-volume air hoods), administrative controls, and personal protective equipment such as gloves, protective clothing, and respirators. All work areas are sampled periodically, and areas susceptible to internal exposures are monitored continuously.

The total radiation dose for workers is the sum of internal and external exposure. The total radiation dose to all workers during 2005 was 10.0 person-rem. The maximum individual dose to a worker was less than 2 rem. This is within the regulatory standard for radiological workers, those given unescorted access to radiation areas, of 5 rem per year.

Worker doses from occupational exposure to radiation are projected based on recent experience with continuing operations and projections of specific additional operation impacts on involved workers. The bulk of the dose to involved workers from current operations (approximately 90 percent of total worker dose) is from operations at Building 332.

Prior to 1994, SNL/CA had only one radiological emission source requiring monitoring under the requirements of the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61, Subpart H), the Tritium Research Laboratory. Tritium operations ceased at SNL/CA in 1994. Under an agreement with the EPA, Region IX, SNL/CA continued stack monitoring and ambient air monitoring for tritium for one year after cessation of tritium operations. This monitoring showed no remaining airborne tritium and was discontinued in 1995 with EPA approval. Therefore, there are no SNL/CA sources of radioactive air emissions and thus no exposure to the offsite population from SNL/CA operations (DOE 2003).

SNL/CA employs an Integrated Safety Management System (ISMS) to control hazards associated with site operations, including hazards related to the management and use of hazardous materials. The ISMS process includes project planning, hazard assessment, identification and feedback, and continuous improvement planning. SNL/CA also follows specific management processes to ensure adequate security and accountability requirements are met for radioactive and high-hazard materials. Inventory controls are implemented to ensure that material quantities are maintained at mission-essential levels (DOE 2003).

SNL/CA worker doses have typically been well below DOE worker radiological exposure limits. DOE set administrative exposure guidelines at a fraction of the exposure limits to help enforce doses that ALARA (DOE 2003).

4.2.11.1.2 Non-radiological

Adverse health impacts to the public can be minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operation at LLNL via inhalation of air containing hazardous chemicals

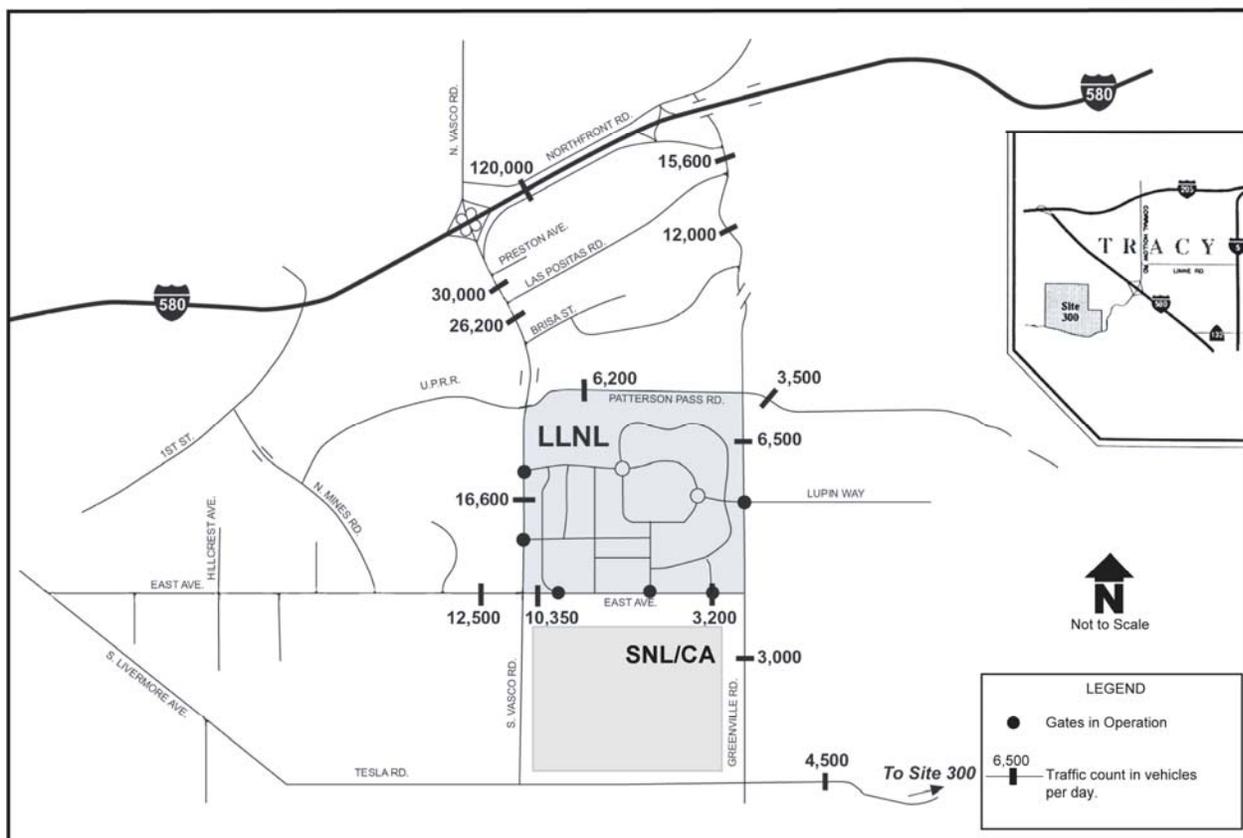
released to the atmosphere by LLNL operations. Risks to public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. LLNL workers are also protected by adherence to Occupational Safety and Health Administration (OSHA) and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals utilized in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at LLNL are expected to be substantially better than required by standards.

A worker protection program is in place at SNL/CA to protect the health of all workers. To prevent occupational illnesses and injuries and to preserve the health of all workers involved in site-related activities (construction and operations), DOE-approved health and safety programs have been implemented (DOE 2003).

4.2.12 Transportation

Regional access to the Livermore Site and SNL/CA by motor vehicle is from I-580, which runs east and west approximately 1 mile north of the Livermore Site. As depicted in Figure 4.2.12-1, the Vasco Road/I-580 interchange provides access to the western site boundary, and the Greenville Road/I-580 interchange provides access to the eastern site boundary.



Source: DOE 2005a.

Figure 4.2.12-1 — Regional Transportation Network with Traffic Counts

As shown in Figure 4.2.12-1, the major street system in the vicinity of LLNL and SNL/CA includes I-580, South Vasco Road, Greenville Road, East Avenue, and Patterson Pass Road. Most of these are primarily located in the city of Livermore, but with portions of all streets lying in unincorporated portions of Alameda County. Table 4.2.12-1 provides a summary of traffic volumes along the major streets in the LLNL and SNL/CA vicinity.

In addition to serving the Livermore Site and SNL/CA and existing residential districts west of the Livermore Site, South Vasco Road provides key access to the large industrial/business parks located north of the area extending from Greenville Road to west of South Vasco Road. South Vasco Road also provides access to the existing Altamont Commuter Express (ACE) commute train station located near the southwest quadrant of the intersection of South Vasco Road and Brisa Street.

Table 4.2.12-1— Daily Traffic Volumes in the LLNL and SNL/CA Vicinity

Location	Average Daily Vehicle Trips
I-580 in the Livermore and SNL/CA vicinity	120,000
South Vasco Road between I-580 and Las Positas Road	30,000
South Vasco Road between Las Positas Road and Patterson Pass Road	26,200
South Vasco Road between Patterson Pass Road and East Avenue along the western border of the Livermore Site	16,600
Greenville Road near Southfront Road	15,600
Greenville Road between Las Positas Road and Patterson Pass Road	12,000
Greenville Road between Patterson Pass Road and East Avenue along the eastern border of the Livermore Site	6,500
Greenville Road between East Avenue and Tesla Road	3,000
East Avenue between South Vasco Road and the South Gate	10,350
East Avenue Between Greenville Road and the South Gate	3,200
Patterson Pass Road between South Vasco Road and Greenville Road	6,200
Patterson Road east of Greenville Road	3,500
Tesla Road East of Greenville Road (towards Site 300)	4,500

Source: DOE 2005a.

The northern section of South Vasco Road, generally between I-580 and Las Positas Road, experiences the greatest degree of congestion in this corridor due to higher traffic volumes and a greater density of intersections with traffic signals.

Regional access to Site 300 is from I-580 to Corral Hollow Road. Alternately, travel between the Livermore Site and Site 300 is by way of Tesla Road. Tesla Road changes to Corral Hollow Road at the Alameda-San Joaquin county line. There is one primary access gate to Site 300 from Corral Hollow Road plus another gate for the pistol range. Between Site 300 and Greenville Road, the daily traffic on Tesla Road averages approximately 4,500 vehicles per day.

Approximately 35 percent of the Livermore Site employees live within 12 miles of the Laboratory (DOE 2005a). The remaining employees come to work from greater distances, mostly from the counties of Alameda, San Joaquin, Contra Costa, and Stanislaus. Many of these commuters travel in personal vehicles and arrive either on local roads or on I-580. Trucks carrying radioactive or hazardous material shipments almost exclusively arrive from or depart to the east on I-580 and I-5, except for local deliveries from the Bay Area.

Regional access to Site 300 is from I-580 to Corral Hollow Road. Alternately, travel between the Livermore Site and Site 300 is by way of Tesla Road as shown in Figure 4.2.12-1. Tesla Road changes to Corral Hollow Road at the Alameda-San Joaquin county line. There is one primary access gate to Site 300 from Corral Hollow Road plus another gate for the pistol range.

4.2.12.1 Aircraft Operations

The Livermore Municipal Airport is located just south of I-580 at Airway Boulevard. The airport occupies 400 acres and has been in operation at its existing location since 1965. The airport has approximately 570 based aircraft and 250,000 annual aircraft operations. LLNL leases aircraft for research and conducts research while on aircraft managed by others. The manned and unmanned aircraft fly in the Livermore Valley and around Site 300, as well as other sites outside of the area (DOE 2005a).

4.2.12.2 *Transportation Accidents*

NNSA reviewed the California Statewide Integrated Traffic Records System accident reports for 1999, 2000, and 2001. The information was for all streets near the Livermore Site and Site 300 and included South Vasco Road, Greenville Road, Patterson Pass Road, East Avenue, and Tesla Road. The accidents are summarized in Table 4.2.12-2. The accident rates on the main roads serving the Livermore Site are also compared with the average accident rates for similar roads in the State of California. Average accident rates in California on urban four-lane divided roadways are 2.18 accidents per million vehicle miles (MVM). For two- and three-lane urban roadways, the average rate is 1.93 accidents per MVM. For two-lane rural roadways, the average rate is 1.21 accidents per MVM.

Overall, the accident history near the Livermore Site and SNL/CA is good, with 8 of the 10 sections analyzed having accident rates considerably below statewide averages, while 2 of the 10 sections had rates up to 14 percent higher than the statewide averages. The rates that are above the averages are either expected to be improved or are not considered to be significant (DOE 2005a).

**Table 4.2.12-2 — Three-Year Accident Rates for Roads Adjacent to the Livermore Site, Site 300, and SNL/CA
(1999 through 2001)**

Segment Location	Segment Distance (miles)	Number of Accidents	ADT	3-Year Volumes	Vehicle Miles of Travel	Accidents per MVM	Average Statewide Accidents per MVM
S. Vasco Rd (South of I-580 to Las Positas) ^a	0.5	39	30,000	31,455,901	15,727,951	2.48	2.18 ^a
S. Vasco Rd (South of Las Positas to Patterson Pass) ^a	0.6	40	26,200	27,471,487	16,482,892	2.43	2.18 ^a
S, Vasco Rd (South of Patterson Pass to East Ave) ^a	1.0	7	16,600	17,405,599	17,405,599	0.40	2.18 ^a
Greenville Rd (South of I-580 to Las Positas) ^a	0.3	3	15,600	16,357,069	4,907,121	0.61	2.18 ^a
Greenville Rd (South of Las Positas to Patterson Pass) ^b	1.2	11	12,000	12,582,361	15,098,833	0.73	1.93 ^b
Greenville Rd (South of Patterson Pass to East Ave) ^b	1.1	2	6,500	6,815,445	7,496,990	0.27	1.93 ^b
Patterson Pass Rd (East of S Vasco to West of Greenville) ^b	1.2	6	6,200	6,500,886	7,801,064	0.77	1.93 ^b
East Ave (East of S. Vasco to West of Greenville) ^b	1.2	1	7,000	7,339,710	8,807,652	0.11	1.93 ^b
Greenville Rd (South of East Ave to Tesla Rd) ^c	1.0	0	3,000	3,145,590	3,145,590	0.00	1.21 ^c
Tesla Rd (Greenville to Site 300 Entrance) ^c	13.1	55	4,500	4,718,385	661,810,846	0.89	1.21 ^c

Source: DOE 2005a

^a Urban four-lane divided roadway.

^b Two- and three-lane urban roadway.

^c Two-lane rural roadway.

ADT = average daily traffic; MVM = million vehicle miles.

4.2.13 Waste Management

Radioactive waste generated at LLNL includes low level waste (LLW), mixed low level waste (MLLW), transuranic (TRU) waste, and mixed TRU waste. LLNL does not manage or generate high-level waste (a highly radioactive material that results from the reprocessing of spent nuclear fuel). LLW, MLLW, and TRU waste are produced primarily in laboratory experiments and component tests.

DOE O 435.1 permits onsite storage of LLW and TRU wastes until appropriate disposal becomes available. Currently, there are no regulatory restrictions on the length of time this waste may be stored onsite, provided that disposal or offsite storage options are being pursued and the waste is stored in accordance with all applicable regulations. LLNL maintains the capability to treat solid radioactive wastes onsite. LLNL has treated liquid radioactive wastes at the Area 514 Tank Farm. This Area 514 has undergone D & D and no longer exists. The Decontamination and Waste Treatment Facility (DWTF) has replaced Area 514 (LLNL 2002a). LLNL disposed of solid LLW offsite primarily at the Nevada Test site. Available storage space for LLW and TRU waste is limited by exposure considerations (i.e., radiation exposure to personnel) at a given storage location. However, radioactive wastes, unlike RCRA-regulated wastes, can be stored at various locations onsite provided that the wastes are properly packaged, labeled, and monitored. Radioactive waste management facilities are listed in Table 4.2.13-1. Waste generation rates are listed in Tables 4.2.13-2 through 4.2.13-5. A discussion of the waste management activities associated with each of these waste categories follows.

Table 4.2.13- 1 — Livermore Site Waste Management Facilities and Capacities^a

Facility	Unit Type	Waste Type	Capacity
Area 612 Facility			
Building 625 CSU	S	H, M, R, TSCA, CT	42,416 gal
Area 612 Tank Trailer Storage Unit	S	CT, H, M, R	5,000 gal
Area 612 Portable Tank Storage Unit	S	CT, H, M, R	10,000 gal
Area 612-1 CSU	S	CT, H, M, R	38,400 ft ³
Area 612-2 CSU	S	CT, H, M, R	10,560 gal
Area 612-4 Receiving, Segregation, and CSU	S	H, M, R, TSCA, CT	NA
Area 612-5 CSU	S	CT, H, M, R	26,900 ft ³
Building 612 Size Reduction Unit	T	CT, H, M, R	250 short tons/yr
Building Lab Packing/Packaging	T	CT, H, M, R	NA
Building 612 CSU	T	CT, H, M, R	7,150 gal
Building 614 West Cells CSU	S	CT, H, M, R	168 gals/cell (4 cells)
Building 614 East Cells CSU	S	CT, H, M, R	880 gals/cell (4 cells)
DWTF Complex			
Building 693 CSU	S	CT, H, M, R	141,240 gal
Building 693 Annex	S	CT, H, M, R	3,060 ft ³
Building 693 Yard—Freezer Storage Unit	S	CT, H, M, R	30 gal
Building 693 Yard—Roll-Off Bin Storage Unit	S	CT, H	2,160 ft ³
Building 695 Airlock	S	H, M	12,000 gal
Building 695 LWPA Waste Blending Station, Tank Blending Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Waste Blending Station, Portable Blending Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Cold Vapor Evaporation Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Centrifuge Unit	T	CT, H, M, R	55,000 gal/yr
Building 695 LWPA Solidification Unit	T	CT, H, M, R	115 short tons/yr
Building 695 LWPA Shredding Unit	T	CT, H, M, R	180 short tons/yr
Building 695 LWPA Filtration Unit	T	CT, H, M, R	2,750 gal/yr
Building 695 LWPA Drum Rinsing Unit, Bulking Station	T	CT, H, M, R	182 short tons/yr
Building 695 LWPA Debris Washer Unit	T	CT, H, M, R	45 short tons/yr
Building 695 LWPA Gas Adsorption Unit	T	CT, H, M, R	0.09 short tons/day

Table 4.2.13-1 — Livermore Site Waste Management Facilities and Capacities^a (continued)

Facility	Unit Type	Waste Type	Capacity
Building 695 LWPA Radwaste Evaporator	T (non RCRA)	R	
Building 695 LWPA Air Lock	(non RCRA)	R	
Building 695 RWPA/SSTL Water Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Pressure Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Amalgamation Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Uranium Bleaching Unit			0.09 short tons/day
Building 696, Drum/Container crushing unit	T	CT, H, M, R	600 short tons/yr
Small Scale Treatment Laboratory	T	H, M, R	0.04 short tons/day
Reactive Waste Storage Room	S	CT, H, M, R	12,400 gal
DWTF Tank Farm	S, T	CT, H, M, R	45,000 gal (storage), 325,000 gals/yr (treatment)
DWTF Portable Tank Storage Pad	S	CT, H, M, R	22,000 gal
Building 513 CSU	S	H, M, R	NA ^c
Building 513 Shredding Unit	T	H, M, R	NA ^c
Building 513 Solidification Unit	T	H, M, R	
EWTF-Site 300			
Open Burn Unit –Pan	T	H	150 lb/event
Open Burn Unit –Cage	T	H	260 lb/event
Open Detonation Unit	T	H	350 lb/event
S1	S	H	275 gal
S2	S	H	110 gal
EWSF-Site 300			
Magazine 1	S	H	1,622 lb (net explosive weight)
Magazine 2	S	H	3,209 lb (net explosive weight)
Magazine 3	S	H	5,592 lb (net explosive weight)
Magazine 4	S	H	4,291 lb (net explosive weight)
Magazine 5	S	H	2,744 lb (net explosive weight)
Magazine 816	S	H	9,240 gal (no liquids)
Building 883-Site 300			
Building 883 CSU	S	H	3,300 gal

Table 4.2.13-1 — Livermore Site Waste Management Facilities and Capacities^a (continued)

Facility	Unit Type	Waste Type	Capacity
Building 804-Site 300			
Building 804	Staging and Storage Area	R – only	N/A

^a Typically an operational limit including a combination of hazardous, radioactive, and mixed waste unless otherwise restricted by permit or LLNL management practice.

^b Under all alternatives, this facility would undergo RCRA closure and operational capabilities would be transferred to the Decontamination and Waste Treatment Facility (DWTF).

^c Values are included with those for B-695 Part B Permit.

CSU = container storage unit; CT = California Toxic (A non-RCRA hazardous waste defined by State of California, pursuant to Title 22, California Code of Regulations); R = radioactive (may include LLW and TRU); S = storage; T = treatment; TSCA = *Toxic Substance Control Act*; H = hazardous; M = mixed; NA = not available; EWTF = Explosive Waste Treatment Facility; ft³ = cubic feet; gal = gallons; lbs = pounds; N/A = not applicable; SWSF = Solid Waste Storage Facility; RWPA/SSTL = Reactive Waste Packing Area / Small Scale Treatment Laboratory; DWTF = Decontamination and Waste Treatment Facility; LWPA = Liquid Waste Processing Area; RCRA = *Resource Conservation and Recovery Act*.

Radioactive waste generated at SNL/CA includes LLW and LLMW. SNL/CA does not manage or generate transuranic waste (TRU) or mixed transuranic waste. SNL/CA does not manage or generate high-level waste. LLW and LLMW are produced primarily in laboratory experiments and component tests.

As part of the effort to minimize the total quantity of radioactive waste that is generated at SNL/CA, facilities that generate this type of waste are designated as Radioactive Materials Management Areas (RMMA). An RMMA is an area where the reasonable potential exists for contamination due to the presence of unconfined or unencapsulated radioactive material or an area that is exposed to sources of radioactive particles (such as neutrons and protons) capable of causing activation. Managers of facilities must document the location of all RMMAs. Procedures to minimize the generation of radioactive wastes are then developed. SNL/CA does not maintain the capability to treat or dispose mixed wastes onsite. SNL/CA treats and disposes LLMW offsite under the Federal Facility Compliance Order issued jointly to Sandia Corporation and the DOE (SNL/CA 2007).

In 2006, Waste Management revised its Hazardous Waste Operation Plan to reflect current administrative conditions, to update processes, and to correct informational and typographical errors. SNL/CA also continued the process of transferring management of radioactive waste to SNL New Mexico, which is expected to be completed by winter 2007. Radioactive waste generated at SNL/CA will continue to be tracked locally and reported in the site annual reports. Waste Management supported the site-wide campaign for chemical inventory reduction and continued its efforts to minimize routine hazardous waste generation at SNL/CA (SNL/CA 2007).

4.2.13.1 *Routine Hazardous and Radioactive Waste*

Routine waste described in Table 4.2.13-2 includes waste from ongoing operations produced by any type of production, analysis, and/or research and development taking place at LLNL. Periodic laboratory or facility clean-outs and spill cleanups as a result of these processes are also considered normal operations. Residues, resulting from the treatment of routine waste, are not included to avoid double counting.

Table 4.2.13-2 — Routine Hazardous and Radioactive Waste at LLNL, FY 2004–2006

Waste Category	FY2004	FY2005	FY2006
Routine hazardous waste generated	141.3 metric tons	127 metric tons	153 metric tons
Routine low-level waste generated	151.3 m ³	54 m ³	66 m ³
Routine mixed waste generated	18.8 m ³	16 m ³	18 m ³
Routine TRU/mixed TRU waste generated	1.2 m ³	1 m ³	1 m ³

Source: LLNL 2007.

The hazardous waste generated at SNL/CA is predominantly chemical laboratory trash generated from experiments, testing, other R&D activities, and infrastructure fabrication and maintenance. Table 4.2.13-3 contains a summary of hazardous waste generated for all operations from 1996 through 2000. Biohazardous (medical) waste and D&D wastes were included in the totals for all hazardous waste categories.

Table 4.2.13-3 — Hazardous Waste Generated from 1996 through 2000 (in kg)

Hazardous Waste Generated	RCRA	California Toxic ^a	TSCA	Biohazardous	Total
1996	15,003	10,792	15,451	219	41,465
1997	23,294	26,088	55,730	1,773	106,885
1998	23,468	39,841	13,782	296	77,387
1999	22,962	20,084	27,473	248	70,767
2000 ^b	28,354	32,765	79,477	220	140,816
5-Year Average	22,616	25,914	38,383	551	87,464

Source: DOE 2003

^aA non-RCRA waste identified in Title 22 CCR

^bExcept for biohazardous, large increases in waste in year 2000 can be attributed to the demolition of Building 913.

4.2.13.2 Routine Nonhazardous Waste

Together, the Livermore site and Site 300 generated 4,107 metric tons of routine nonhazardous solid waste in FY 2006. This volume includes diverted waste (e.g., material diverted through recycling and reuse programs) and landfill waste. Both sites diverted a combined total 2,601 metric tons of routine nonhazardous waste in 2006, which represents a diversion rate of 63 percent. The diverted routine nonhazardous waste includes waste recycled by Radioactive and Hazardous Waste Management (RHWM) and materials diverted through the surplus sales program. The portion of routine nonhazardous waste sent to landfill was 1,506 metric tons (Table 4.2.13-3).

Table 4.2.13-4— Routine Nonhazardous Waste in FY 2006, Livermore Site and Site 300

Destination	Waste Description	Amount in FY 2006 (metric tons)
Diverted	Batteries, small ^a	1
	Batteries, lead-acid ^a	31
	Beverage containers	5
	Cardboard	135
	Compost	504
	Cooking grease	2
	Magazine, newspapers, phone books	19
	Metals	1,412
	Paper	207
	Street sweepings	93
	Tires and scrap	20
	Toner cartridges	12
	Wood	160
	Total Diverted	2,601
Landfill	Compacted (landfill)	1,506
		Total Landfill
	Total Routine Nonhazardous Waste	4,107

^aBatteries are managed as universal waste.

Source: LLNL 2007.

Solid waste consists predominantly of office and laboratory nonhazardous trash. Nonhazardous building debris generated from D&D activities may also be considered solid waste. All solid waste is currently disposed of at the Vasco Road Landfill in Livermore, California (SNL/CA 2002b). In calendar year (CY) 2000, SNL/CA generated 247.54 metric tons.

4.2.13.3 *Nonroutine Hazardous Waste*

Hazardous waste refers specifically to nonradioactive waste, including RCRA chemical and explosives waste, state-regulated hazardous waste, biohazardous (for this document medical is included) waste, and TSCA waste (primarily asbestos and PCBs). Almost all buildings at LLNL generate hazardous wastes, ranging from common household items such as fluorescent light bulbs, batteries, and lead-based paint to solvents, metals, cyanides, toxic organics, pesticides, asbestos, and PCBs.

RCRA allows onsite management of hazardous waste at the point of generation or in designated waste accumulation areas or storage in permitted storage facilities. There are regulatory restrictions on the length of time that waste may be stored onsite and it must be stored in accordance with all applicable regulations. LLNL does maintain the capability to treat certain hazardous wastes onsite. LLNL treats explosive wastes at Site 300. Except for empty-container crushing, hazardous wastes are usually not treated before offsite shipment to a licensed treatment, storage, and disposal facility. Hazardous wastes are shipped offsite through licensed commercial transporters to various permitted treatment, storage, and disposal facilities. See Appendix B for a more detailed description of hazardous waste-related topics.

Non-routine nonhazardous solid wastes include excavated soils, wastes and metals from construction, and decontamination and demolition activities. The Livermore site and Site 300 generated a total of 15,992 metric tons of non-routine non-hazardous solid waste in 2006. In FY 2006, 14,323 metric tons of non-routine nonhazardous solid waste was diverted through reuse or recycling, which represents a diversion rate of 90 percent. Diverted non-routine nonhazardous solid waste includes soil reused either on site for other projects or as cover soil at Class II landfills, and metals recycled through the metals recycling programs. Only 10 percent of non-routine nonhazardous waste was sent to landfill (Table 4.2.13-4).

Table 4.2.13-5 — Nonroutine Nonhazardous Waste in FY 2006, Livermore Site and Site 300

Destination	Waste Description	Amount in FY 2006 (metric tons)
Diverted	Class II cover (soil reused at landfill)	1,234
	Asphalt/concrete	10,545
	Nonroutine metals	2,544
	Total Diverted	14,323
Landfill	Construction demolition (noncompacted landfill)	1,502
	Industrial (Haz Track) ^a	159
	Non-friable asbestos	8
	Total Landfill	1,669
Total Non-routine Nonhazardous waste		15,992

^aRHWM Waste Data Management Systems
Source: LLNL 2007

4.2.13.3.1 Historic and Current Hazardous Waste Generation

The hazardous waste generated at LLNL is predominantly chemical laboratory trash generated from experiments, tests, other R&D activities, and infrastructure fabrication and maintenance. Figure 4.2.13–3 illustrates the quantities of routine and nonroutine hazardous waste generated for all operations from CY1993 through FY2001. From CY1993 to FY2002, annual total (routine plus nonroutine) RCRA hazardous waste generation ranged from 124 to 506 tons. During the same period, total annual state-regulated and total annual TSCA waste ranged from 152 to 712 tons and 8 to 507 tons, respectively.

4.2.13.3.2 Biohazardous Wastes

Division 104, Part 14, Sections 117600-118360 of the California Health and Safety Code is known as the *California Medical Waste Management Act*. This Act is a comprehensive program for regulating the management, transport, and treatment of medical wastes. The California Department of Health Services (known as DHS) administers the *California Medical Waste Management Act* and has given authority to Alameda County Health Care Services Agency/Dept. of Environmental Health to oversee LLNL's medical waste management practices.

The Livermore Site is considered a large-quantity generator of medical waste, which means that 200 or more pounds of medical waste are generated in any month of a 12-month period. Therefore, the Livermore Site is subject to annual inspections conducted by Alameda County, annual waste generator/treatment permit fees, and maintenance of the Medical Waste Management Plan that contains emergency plans for each program at LLNL that generates and treats medical waste.

Medical waste containing hazardous waste is designated as hazardous waste and is subject to regulation as specified in the statutes and regulations applicable to hazardous waste. Medical waste plus radioactive waste is designated as radioactive waste and is subject to regulation as specified in the statutes and regulations applicable to radioactive waste.

Site 300 is considered a small-quantity generator of medical waste, which means that less than 200 pounds of medical waste is generated per month. Therefore, Site 300 is not subject to medical waste generator and treatment permit fees and is not subject to annual inspections by San Joaquin County. In the past, Site 300 submitted a minimal annual fee for a Limited Quantity Hauling Exemption. However as of February 9, 2007 Site 300 notified San Joaquin County that it would no longer renew the application, as the facility no longer needs the option of transporting medical waste to the LLNL Main Site. Instead Site 300 medical waste is shipped directly offsite for treatment.

4.2.13.4 Waste Management Capacities

The affected environment considered in this SPEIS is limited to those facilities that generate waste under normal (routine) operations at LLNL. Normal operations encompass all current operations that are required to maintain R&D at LLNL facilities. Table 4.2.13-5 displays nonhazardous waste sent to landfills in FY 2005.

Table 4.2.13-6 — Total Nonhazardous Waste Sent to Landfills in 2006

Nonhazardous Waste	Waste Volume (metric tons)
Routine	
Compacted (landfill)	1,506
Nonroutine	
Total Diverted	14,323
Total Landfill	1,669
Total	15,992

Source: LLNL 2007.

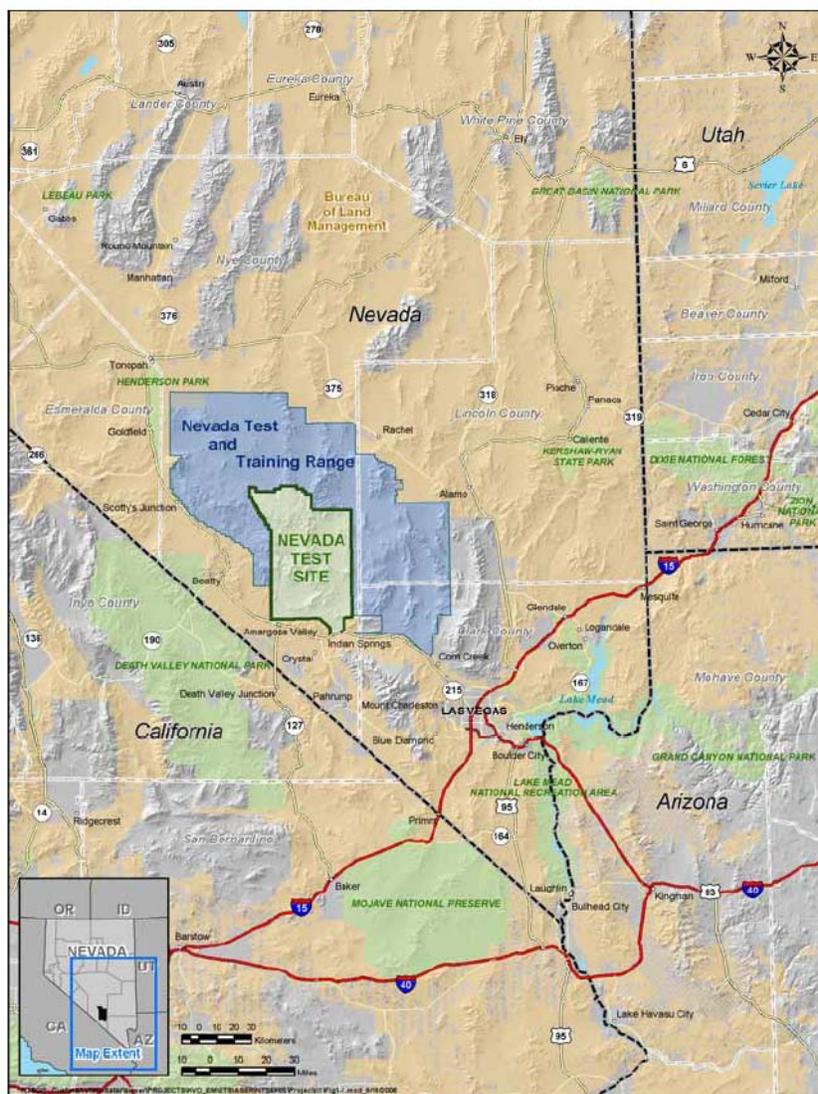
4.2.13.5 Waste Management Facilities

Generally, wastes generated at individual buildings are accumulated at the point of generation in satellite accumulation areas. Generators, with support from RHWM staff, must segregate, identify, characterize, separate, package, label, document, and transfer waste to designated waste accumulation areas (DOE 2005a). These wastes (with the exception of medical waste) are collected in waste accumulation areas or retention tanks and then transferred to waste accumulation areas where hazardous and mixed wastes may be stored for up to 90 days. The wastes are then either transferred to onsite waste management facilities for treatment, storage, and/or preparation for offsite disposal or to various offsite permitted treatment, storage, and disposal facilities. Some LLW and all TRU radioactive wastes are currently being stored awaiting shipment to the Nevada Test Site, the Waste Isolation Pilot Plant, or another DOE-approved facility for storage or disposal. LLNL legacy mixed wastes are being managed in accordance with the *Federal Facility Compliance Act* Site Treatment Plan. With the exception of pharmaceutical wastes, medical wastes are typically collected at the generator facility before being treated onsite.

Most waste management facilities manage both radioactive and hazardous wastes. However, certain facilities are restricted to only one waste type (for example the EWTF). The DWTF, and Area 612, are the primary waste management facilities.

4.3 NEVADA TEST SITE

NTS is located on approximately 880,000 acres in southern Nye County, Nevada. The site is located 65 miles to the northwest of Las Vegas and 10 miles northeast of the California state line (see Figure 4.3-1). All of the land within NTS is owned by the Federal Government and is administered, managed, and controlled by DOE's NNSA. At NTS, NNSA maintains the capability to: conduct underground nuclear testing; conduct experiments involving nuclear material and high explosives; dispose of a damaged nuclear weapon or improvised nuclear device; conduct non-nuclear experiments; and conduct conventional weapons tests (as part of the hardened deeply buried target program), research and training on nuclear safeguards, criticality safety, and emergency response. NNSA also maintains Category I/II quantities of SNM associated with the nuclear weapons program at NTS and NTS is the only nuclear weapons complex site capable of LLW disposal from other DOE sites.



Source: NTS 2006a.

Figure 4.3- 1 — Location of NTS

4.3.1 Land Use

4.3.1.1 Onsite Land Use

Existing land use at NTS is summarized in Table 4.3.1-1 and shown on Figure 4.3.1-1. Within the land use zones are various sites such as Waste Management, Industrial, Research, and Support.

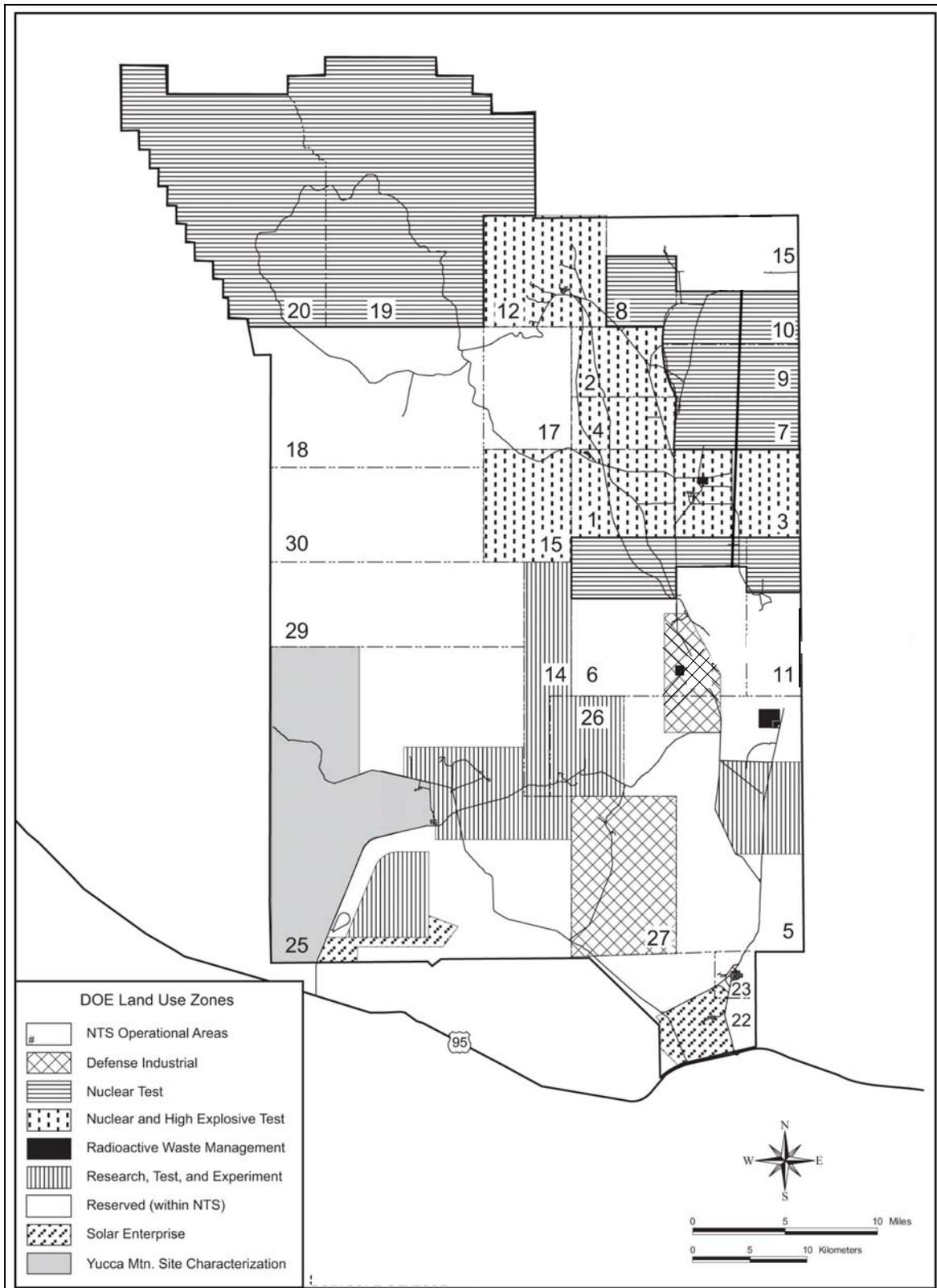
Table 4.3.1- 1 — NTS Land Use Zones

Zone	Description of Land Use
Nuclear Test Zone	Underground hydrodynamic tests, dynamic experiments, and underground nuclear weapons and weapons effects tests.
Nuclear and High Explosive Test Zone	Land within the Nuclear Test Zone for additional underground and aboveground high-explosive tests or experiments.
Research, Test, and Experiment Zone	Small-scale research, development projects, pilot projects, and outdoor tests and experiments for the development, quality assurance, or reliability of materials and equipment under controlled conditions.
Radioactive Waste management Zone	Shallow land burial of low-level and mixed wastes.
Defense Industrial Zone	Land designated for stockpile management of weapons including production, assembly, disassembly, modification, staging, repair, retrofit, surveillance and possible weapons storage.
Spill Test Facility Impact Zone	A downwind geographic area that would confine the impacts of the largest planned tests of materials released at the NPTEC Facility.
Solar Enterprise Zone	Land designated for development of a solar energy power-generation facility.
Reserved Zone	Controlled-access land area that provides a buffer between non-defense research, development, and testing activities. Includes areas and facilities that provide widespread flexible support for diverse short-term non-defense research, testing, and experimentation. Also used for short-duration exercises and training, such as Nuclear Emergency Search Team and Federal Radiological Monitoring and Assessment Center training, and DoD land navigation exercises and training.

Source: DOE 1996b.

In most cases, an area is assigned to a land use category based on the environmental characteristics it exhibits. Environmental characteristics, especially geography and geology, generally determine how suitable an area is for a particular use. Approximately 45 percent of NTS is currently unused or provides buffer zones for ongoing programs or projects, while about 7-10 percent (60,000-86,500 acres) of the site has been disturbed.

The NTS is surrounded on all sides by the Nevada Test and Training Range (NTTR) Complex (Figure 4.3-1). The Yucca Mountain Project Area is on the southwest corner of the site, which is bordered on the west and north by the NTTR, on the east by an area used by both the NTTR and the Desert National Wildlife Range, and on the south by undeveloped BLM lands. The combination of the NTTR and the NTS represents one of the larger unpopulated land areas in the United States, comprising some 3,500,786 acres. There are no agricultural activities present at NTS, nor are there any prime farmlands. Beyond the Federal lands surrounding NTS, principal land uses in Nye County in the vicinity of the site include mining, grazing, agriculture, and recreation. Of the total land area within the county, only a small number of isolated areas are under private ownership and, therefore, are subject to general planning guidelines.



Source: DOE 1996b.

Figure 4.3.1-1 — Land Use at NTS

4.3.1.2 *Surrounding Land Uses*

Other Federal lands surround the NTS, including the U.S. Air Force (USAF) NTTR Complex on the north, east, and west and BLM lands on the south and southwest. Approximately 93 percent of the land area in Nye County is federally owned and managed. Federally managed areas include the NTS, the NTTR, the Toiyabe and Humboldt National Forests, the Duckwater Indian Reservation, Railroad Valley and Wayne E. Kirsch Wildlife Management Areas, a portion of Death Valley National Park, and the Ash Meadows National Wildlife Refuge. The communities within southern Nye County are widely scattered and separated by vast tracts of public lands managed by the BLM. The four nearest communities to the NTS are Amargosa Valley, Beatty, Indian Springs, and Pahrump. The nearest town to the NTS is Amargosa Valley, which is about 26 miles to the southwest, and supports a population of about 760.

Private land use in Nye County consists of residential, commercial, and industrial uses, primarily within the boundaries of unincorporated towns, and agricultural and mining uses both within and outside the boundaries of the towns. Much of the land within communities is subject to mixed use; it is common to find residential, commercial, industrial, and even agricultural uses on adjacent or even the same properties. The use of private land in Nye County has few county level regulations, thereby offering few impediments to development for most types of residential and commercial uses. Nye County has established certain ordinances regarding the subdivision of land; and some community design standards and zoning ordinances are in the planning stages.

4.3.2 **Visual Resources**

NTS is located in a transition area between the Mojave Desert and the Great Basin. Vegetation characteristic of both deserts is found on the site. The topography of the site consists of a series of north-south oriented mountain ranges separated by broad, low-lying valleys and flats. Site topography is impacted by numerous subsidence craters resulting from past nuclear testing. The southwestern Nevada volcanic field, which includes portions of NTS, is a nested, multi-caldera volcanic field. The facilities of NTS are widely distributed across this desert setting.

The region surrounding NTS ranges from unpopulated to sparsely populated desert and rural land. Access to areas that would have views of the site is controlled by NTS or the U.S. Air Force. Therefore, few viewpoints are accessible to the general public. Public viewpoints of NTS along U.S. 95, the principal highway between Tonopah and Las Vegas, include Mercury Valley and southwestern portions of the site. The primary viewpoint in Mercury Valley is a roadside turnoff containing Nevada Historical Marker No. 165 of the Nevada State Park System, entitled "Nevada Test Site". NTS facilities within 5 miles are visible from this viewpoint. The main base camp at Mercury, located in Area 23, is well defined at night by facility lighting. Lands within NTS have a BLM Visual Resource Management rating of Class II or III (see Table 4.3.2-1 for definitions of each class). Changes to the landscape within these classes may be seen, but should not dominate the view. Developed areas within the site are consistent with a Visual Resource Management Class IV rating in which management activities dominate the view and are the focus of viewer attention.

Table 4.3.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention
Class II	To retain the existing character of the landscape. The level of change to the characteristic landscape should be low
Class III	To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Source: BLM 1980.

4.3.3 Site Infrastructure

An extensive network of existing infrastructure provides services to NTS activities and facilities as shown in Table 4.3.3-1. Transportation access includes roads, and railroads (currently unutilized) while utilities include electricity and fuel (e.g., natural gas, gasoline, and coal).

Table 4.3.3-1 — Baseline Characteristics for NTS

Resource	Current Usage	Site Capacity
Land		
Area (acres)	86,500	880,000
Roads (miles)	700	NA
Railroads (miles)	12	NA
Electrical		
Energy (MWh/yr)	101,377	176,844
Peak Power (MWe)	27	45
Steam		
Natural gas (yd ³ /yr)	0	NA
Fuel		
Natural gas (yd ³ /yr)	0	NA
Liquid fuels (L/yr)	4,201,805	Not limited
Coal (t/yr)	0	NA
Water		
Annual Maximum Production Capacity (billion gal/yr)	<2.1	2.1
Sustainable site capacity (billion gal/yr)	<1.36	1.36

NA = not applicable.

Source: NNSA 2007.

Water

In the last several years, NTS has been provided power under contracts with Nevada Power Company and Western Area Power Administration. Table 4.3.3-1 shows that electrical capacity at NTS is approximately 177,000 million megawatt hours per year (MWh per year) and peak load capacity, approximately 45 megawatts (MWe). In 2000, NTS electrical usage was approximately 101,000 MWh per year and peak load usage was 27 MWe (DOE 2002).

Unleaded gasoline, diesel fuels, and E-85 fuels are used at NTS. NTS has 2 service stations each capable of storing 10,000 gallons of unleaded gasoline and 9,500 gallons of biodiesel, and each has an E-85 fueling station. The bulk storage tanks in Area 6 can store approximately 100,000 gallons of biodiesel and 40,000 gallons of unleaded gasoline.

The NTS water system consists of 8 water systems, 2 wildlife preservation reservoirs, and 2 isolated environmental sampling wells. Three of the water systems are permitted by the State of Nevada as public water systems. Five of the systems are non-permit required systems. The water system includes 12 wells, 36 water storage tanks, and 12 booster pump stations. NTS receives its water from a water system divided into 3 service areas with 6 wells for potable water, 3 wells for nonpotable (construction) water, approximately 30 usable storage tanks, 13 usable construction water sumps, and 6 water transmission systems. Potable water is transported to support facilities not connected to the potable water supply system. The annual maximum production capacity of site potable supply wells is approximately 2.1 billion gallons per year. Sustainable site capacity is estimated to be approximately 1.36 billion gallons per year (DOE 2002I). Groundwater is the only local source of potable water on NTS.

4.3.4 Air Quality and Noise

4.3.4.1 Air Quality

4.3.4.1.1 Meteorology and Climatology

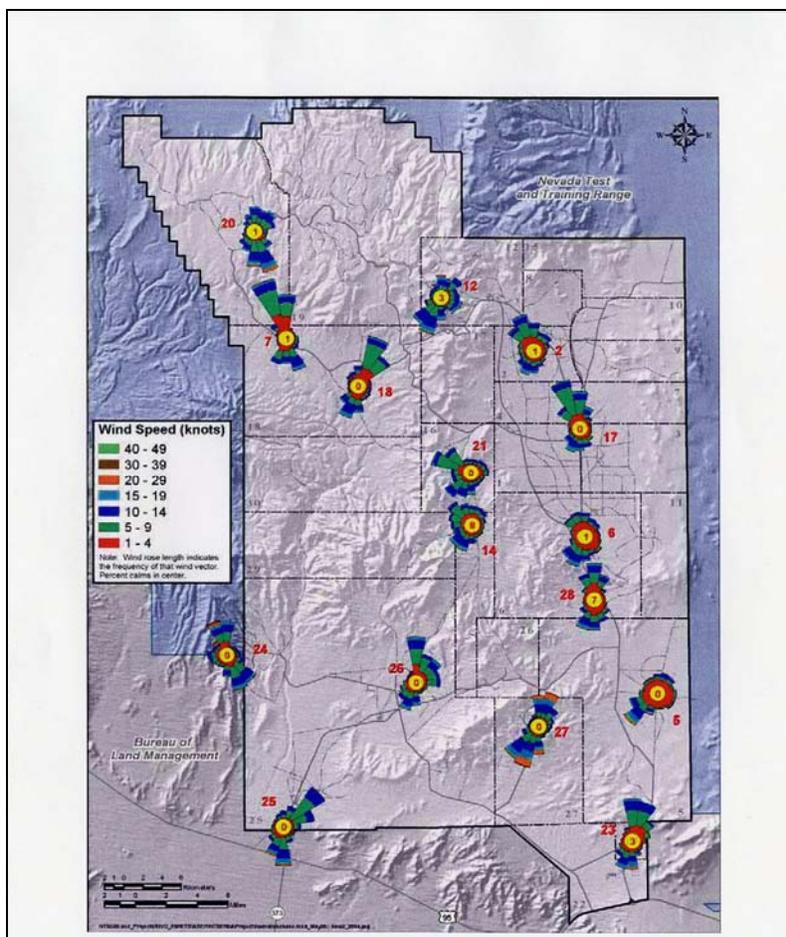
The NTS is located in the extreme southwestern corner of the Great Basin. The climate is characterized by limited precipitation, low humidity, large daily temperature ranges, and intense solar radiation during the summer months (NTS 2006a). Areas in the lower elevations are characterized by hot summers and mild winters, which are typical of other Great Basin areas. As elevation increases, precipitation increases and temperatures decrease.

On average, annually, only 4.8 inches of precipitation are measured at the lower elevation while an annual average of 12.82 inches occurs on Rainier Mesa with a higher elevation (NTS 2006a). Annual climatological wind rose patterns within the site region are shown in Figure 4.3.4-1.

Additional severe weather in the region includes occasional thunderstorms, lightning, tornadoes, and sandstorms. Severe thunderstorms may produce high precipitation that continues for approximately 1 hour and may create a potential for flash flooding. Few tornadoes have been observed in the region, and they are not considered a significant event. The estimated probability of a tornado striking a point at NTS is extremely low (3 in 10 million years).

4.3.4.1.2 Ambient Air Quality

NTS is located in the Nevada Intrastate Air Quality Control Region (AQCR) 147. The region is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and particulate matter) under the NAAQS. The nearest non-attainment area is the Las Vegas area, located 65 miles southeast of NTS. Las Vegas Valley Hydrographic Area 212, located in Clark County, is in serious non-attainment for carbon monoxide and fugitive dust (PM₁₀) (EPA 2007). The remaining portion of Clark County is designated as unclassifiable/attainment for these pollutants.



Source: NTS 2006a.

Figure 4.3.4-1 — Annual Climatological Wind Rose Patterns at 11 NTS MEDA Stations from Wind Data Gathered, 1984 to 2004

Ambient air quality monitoring is currently conducted at the NTS for particulate matter, a non-radiological criteria pollutant, during Big Explosives Experimental Facility and Non-proliferation Test and Evaluation Center experiments. Elevated levels of criteria pollutants at the NTS may occasionally occur because of construction, aggregate production, surface disturbances, and fugitive dust from vehicles traveling on unpaved roads; various pollutants from fuel-burning equipment, and open burning; and volatile organics from fuel storage facilities.

The NTS has been issued a Class II air quality operating permit from the state of Nevada. Class II permits are issued to facilities which emit small quantities of air pollutants within a year (less than 100 tons of each criteria air pollutant, or 10 tons of any one Hazardous Air Pollutant (HAP), or 25 tons of any combination of HAPs). An estimated 4.57 tons of criteria air pollutants were released on the NTS in 2006 (NTS 2007). They included particulate matter equal to or less than 10 microns in diameter, carbon monoxide, nitrogen oxides, sulfur dioxide, and VOCs. The majority of these emissions (2.01 tons) were nitrogen oxides. The quantity of HAPS released in 2006 was 1.87 tons (NTS 2007). No emission limits for any criteria air pollutants or HAPS were exceeded (NTS 2007).

As shown on Table 4.3.4-1, measured concentrations of criteria pollutants at NTS sources are below regulatory requirements.

Table 4.3.4-1 — NTS Nonradiological Annual Air Emissions

Pollutant	Total Emissions (tons/yr)					
	2001	2002	2003	2004	2005	2006
PM10	2.05	3.61	2.39	0.94	0.84	0.69
CO	4.84	4.6	1.79	0.24	0.15	0.43
NO _x	22.23	21.09	8.11	1.01	0.69	2.02
SO ₂	1.68	1.62	0.76	0.12	0.04	0.03
VOC	2.01	2.1	1.21	4.6	1.94	1.40
HAPs	0.03	0.01	0	0.41	0.05	1.87 ^a

^a 92 percent of HAPs were emitted during chemical spill tests at NPTEC. <0.006 percent were from lead from all permitted operations. Source: NTS 2007.

Radiological Releases

DOE Order 5400.5, Radiation Protection of the Public and the Environment, and the Clean Air Act (CAA) National Emission Standards for Hazardous Air Pollutants (NESHAP) require air monitoring for radiological emissions at the NTS. Radiological air monitoring is conducted to ensure that no significant emission source that contributes to calculable offsite exposures is ignored and that the NTS is in full compliance with the requirements of DOE Order 5400.5 and the CAA. Emission sources identified in 2005 were:

- The release of tritium during the calibration of equipment at Building 650, Area 23;
- The evaporation of tritiated water discharged from E Tunnel and a post-shot well (U-20n PS #1DD-H);
- The evaporation and transpiration of tritiated water from soil and vegetation, respectively, at sites of past nuclear tests and from the Area 3 and Area 5 Radioactive Waste Management Sites (RWMSs); and
- The re-suspension of surface soil contaminated by past nuclear testing at NTS (NTS 2006b).

For data reported for 2006, the estimated annual dose to the public from radiological emissions from current and past NTS activities is well below the 10 millirem per year dose limit (NTS 2007). Table 4.3.4-2 presents the radionuclide emission rates (in curies per year) at the identified source locations. In the last row of the table, the total amounts of Americium-241, Plutonium-239, and Plutonium-240 emissions from soil re-suspension are presented. They are the sum of emission rates computed for each area of the NTS with surface contamination. Other radionuclides, although found in surface soils during past radiation surveys, were not included since combined, they contributed only ten percent or less to the total MEI dose (NTS 2006a).

Table 4.3.4-2 — Radiological atmospheric releases from NTS for 2005

Source	Radionuclide	Emission Rate (Ci/yr)
Area 23 Building 650	³ H	0.000014 ^a
Area 12 E Tunnel Ponds	³ H	17 ^b
Well U-20n PS #1DD-H	³ H	3.5 ^b
Area 5 Sewage Lagoon	³ H	0.00037 ^b
Area 3 RWMS	³ H	57 ^c
Area 5 RWMS	³ H	8.9 ^c
Area 10 Sedan	³ H	45 ^c
Area 20 Schooner	³ H	40 ^c
All Sources Total	³ H	170
Grouped NTS Areas Total	²⁴¹ Am	0.047 ^d
Grouped NTS Areas Total	^{239 + 240} Pu	0.29 ^d

Source: NTS 2006a

^a Quantity of tritium gas released during the calibration of laboratory equipment.

^b Estimated from ³H concentration in water discharged into containment ponds or open tanks, assuming all water completely evaporated.

^c Estimated from calculations with CAP88-PC and annual mean concentration of ³H in air measured by air sampling at a location near the emission source.

^d Calculated from inventory of radionuclides in surface soil determined by Radionuclide Inventory and Distribution Program (McArthur, 1991), a re-suspension model (NRC, 1983), and equation parameters derived at the NTS (DOE, 1992).

4.3.4.2 *Noise*

The major noise sources at NTS include equipment and machines (e.g., cooling towers, transformers, engines, pumps, boilers, steam vents, paging systems, construction and material-handling equipment, and vehicles), blasting and explosives testing, and aircraft operations. During periods of human activity, such as construction, localized sound levels on the NTS could vary from loud (70 A-weighted decibels [dB(A)]) to painful (140 dB(A)) to deafening (160 dB(A)) depending on the distance between the noise source and receptor (NTS 2006a).

The acoustic environment in areas adjacent to NTS can be classified as either uninhabited desert or small rural communities. In the uninhabited desert, the major sources of noise are natural physical phenomena such as wind, rain, and wildlife activities, and an occasional airplane. The wind is the predominant noise source. Desert noise levels as a function of wind have been measured at an upper limit of 22 dBA for a still desert and 38 dBA for a windy desert.

A background sound level of 30 dBA is a reasonable estimate. This is consistent with other estimates of sound levels for rural areas. The rural communities' day-night average sound level has been estimated in the range of 35-50 dB (EPA 1974). A background sound level of 50 dB is a reasonable estimate for Mercury.

Except for the prohibition of nuisance noise, neither the State of Nevada nor local governments have established specific numerical environmental noise standards.

4.3.5 *Water Resources*

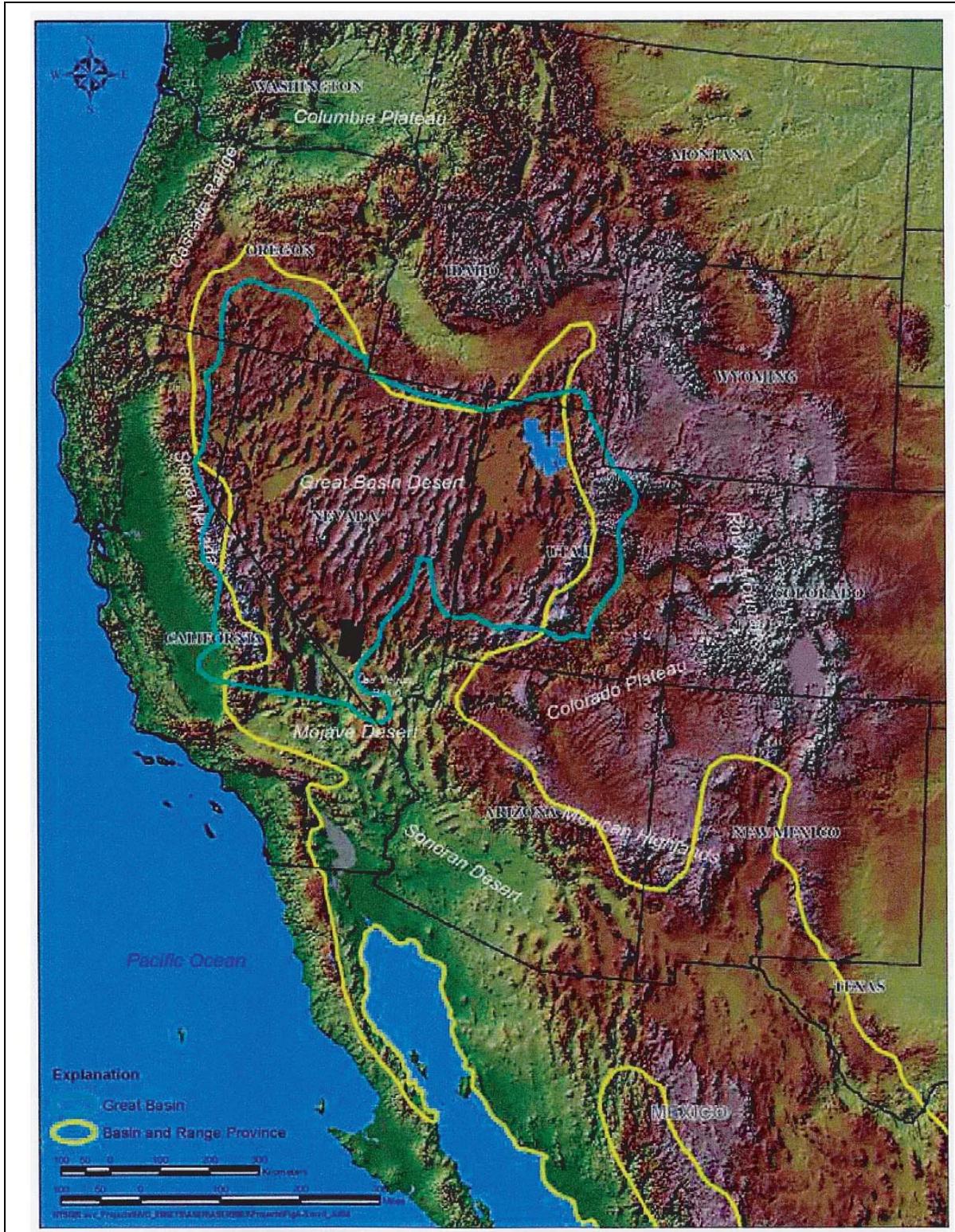
4.3.5.1 *Surface Water*

NTS is located within the Great Basin, a closed hydrographic basin from which no surface water leaves except by evaporation (Figures 4.3.5-1 and 4.3.5-2). There are no perennial streams or other naturally occurring surface waterbodies at NTS. Those streams (arroyos) existing in the

region are ephemeral and are shown in Figure 4.3.5-3. Runoff results from snowmelt and from precipitation during storms that occur most commonly during winter and occasionally during fall and spring, as well as during localized thunderstorms that occur primarily in the summer. Much of the runoff quickly infiltrates rock fractures or the surface soils before being lost by evapotranspiration. Some runoff is carried down alluvial fans in arroyos, and some drains onto playas (dry, barren areas in the lowest part of an undrained desert basin that may be marked by an ephemeral lake) where it may stand for weeks as a lake. Runoff in the eastern half of the site ultimately collects in the playas Yucca and Frenchman Lakes of Yucca Flat and Frenchman Flat, respectively.

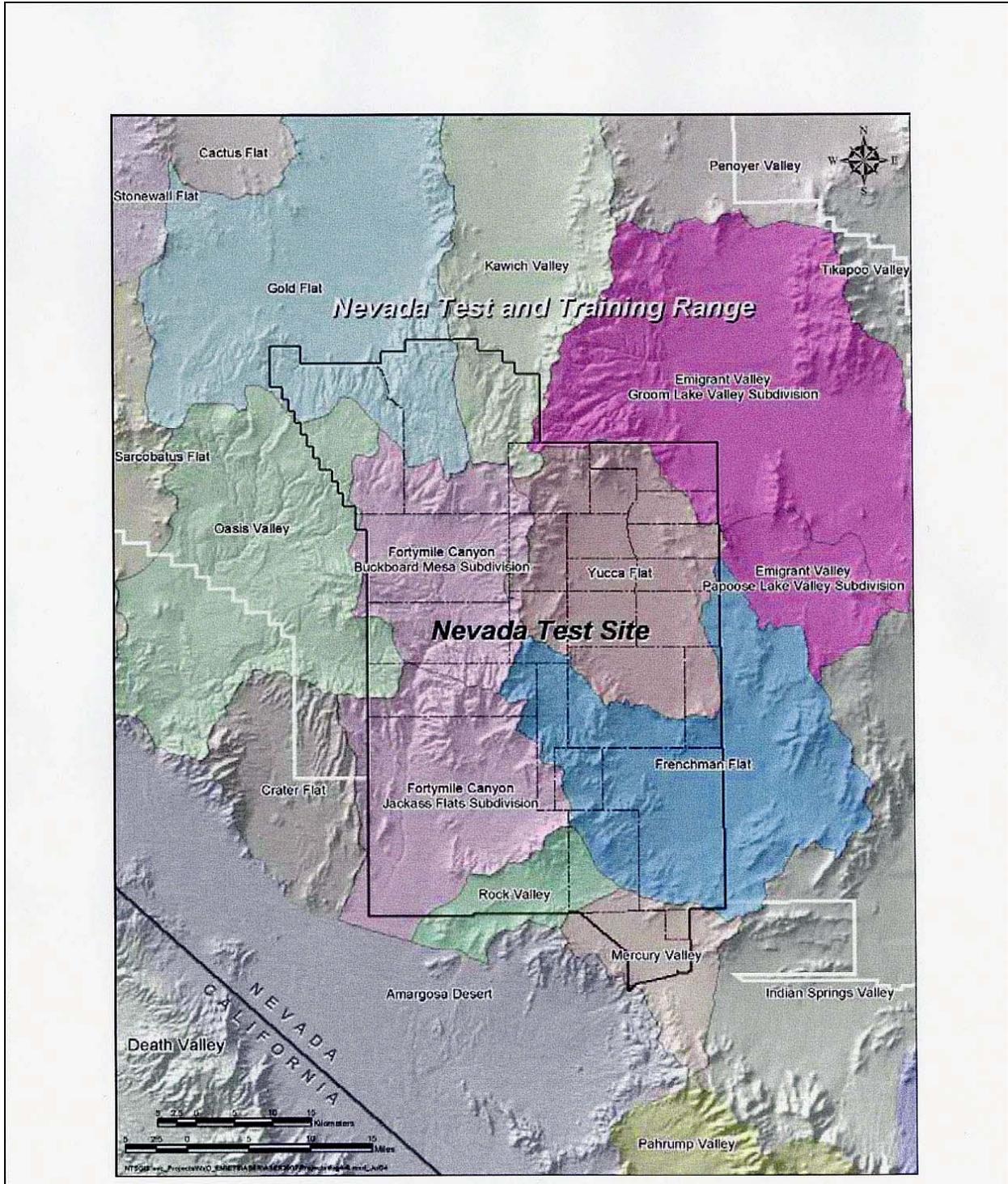
In the northeastern portion, runoff drains off the site and onto the NTTR Complex. In the western half and southernmost part of NTS, runoff is carried toward the Amargosa Desert (DOE 2002). There are a number of springs on NTS, but seepage from springs travels only a short distance from the source before evaporating or infiltrating into the ground. In addition, there are a number of engineered ponds and open reservoirs for industrial water on the site.

Intermittent streams for sheet flow and channelized flow through arroyos cause localized flooding throughout NTS. However, because of the size of NTS, no comprehensive floodplain analysis has been conducted to delineate the 100- and 500-year floodplains. Nevertheless, a rise in the surface elevation of any standing water on a playa creates a potential flood hazard. Playas in the Yucca Flat weapons test basin and Frenchman Flat in the northeastern and eastern part of NTS, respectively, collect and dissipate runoff from their respective hydrographic basins. Several arroyos in the Yucca Flat weapons test basin pose a potential flood hazard to existing facilities, as do arroyos on Frenchman Flat. Ground-surface disturbance and craters associated with underground nuclear tests have rerouted parts of natural drainage paths in areas of nuclear testing. Some craters have captured nearby drainage, and headward erosion of drainage channels is occurring, however, this is considered to be negligible. In some areas of NTS, the natural drainage system has been all but obliterated by the craters. The western half and southmost parts of NTS have arroyos that carry runoff beyond NTS boundaries during intense storms. Fortymile Wash, the largest of these arroyos and prone to flooding, originates on Pahute Mesa and intersects the Amargosa River in the Amargosa Desert about 20 miles southwest of NTS. The Amargosa River continues to Death Valley, California. Topopah Wash, which runs southwesterly across Jackass Flats from Jackass Divide in the south-central part of NTS, is a major tributary of the Amargosa River (DOE 2002).



Source: NTS 2006a

Figure 4.3.5-1 — Basin and Range Physiographic Province and Great Basin Hydrologic Province



Source: NTS 2006a.

Figure 4.3.5-2 — Closed Hydrographic Subbasins on the NTS

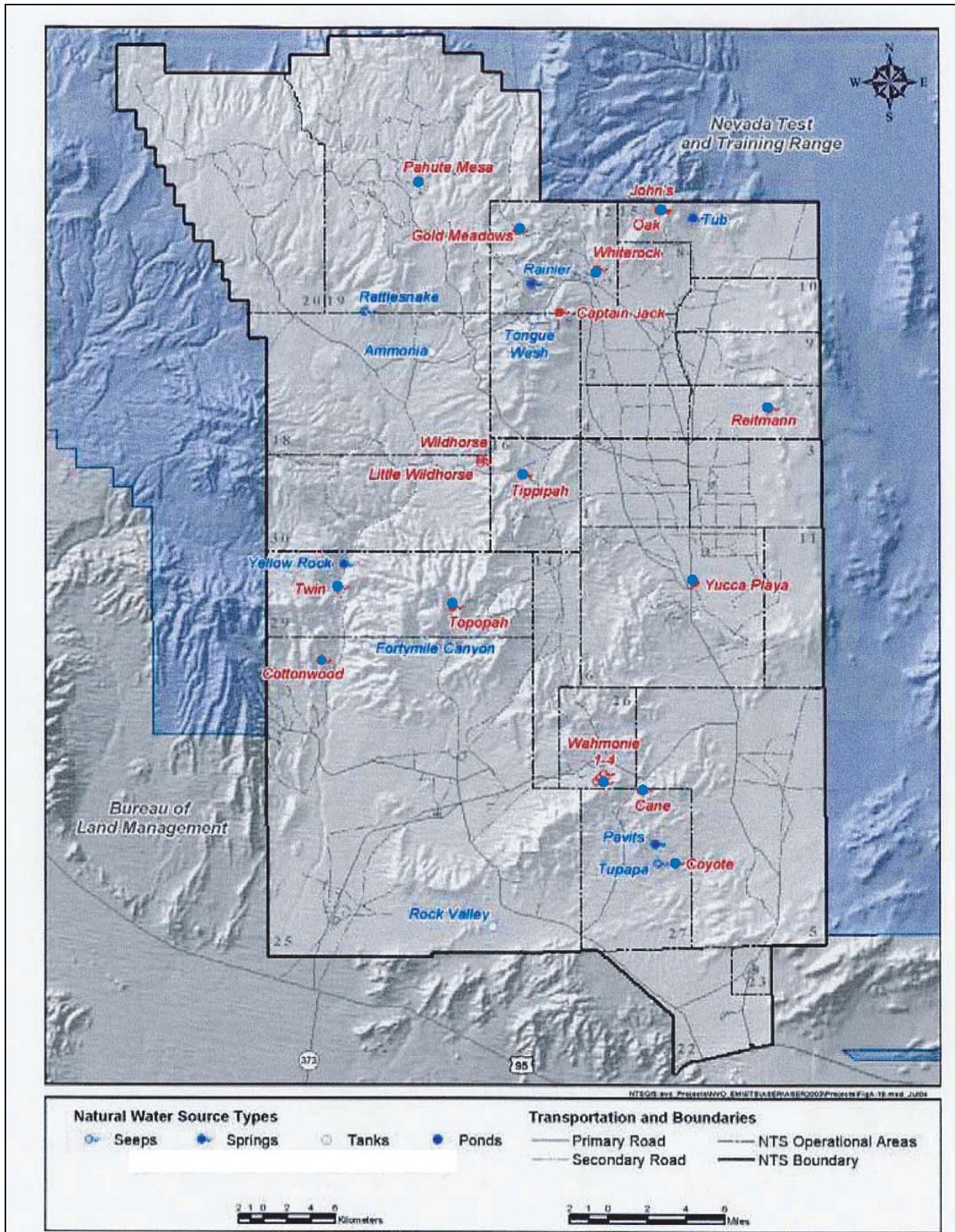


Figure 4.3.5-3 — Natural Water Sources on the NTS

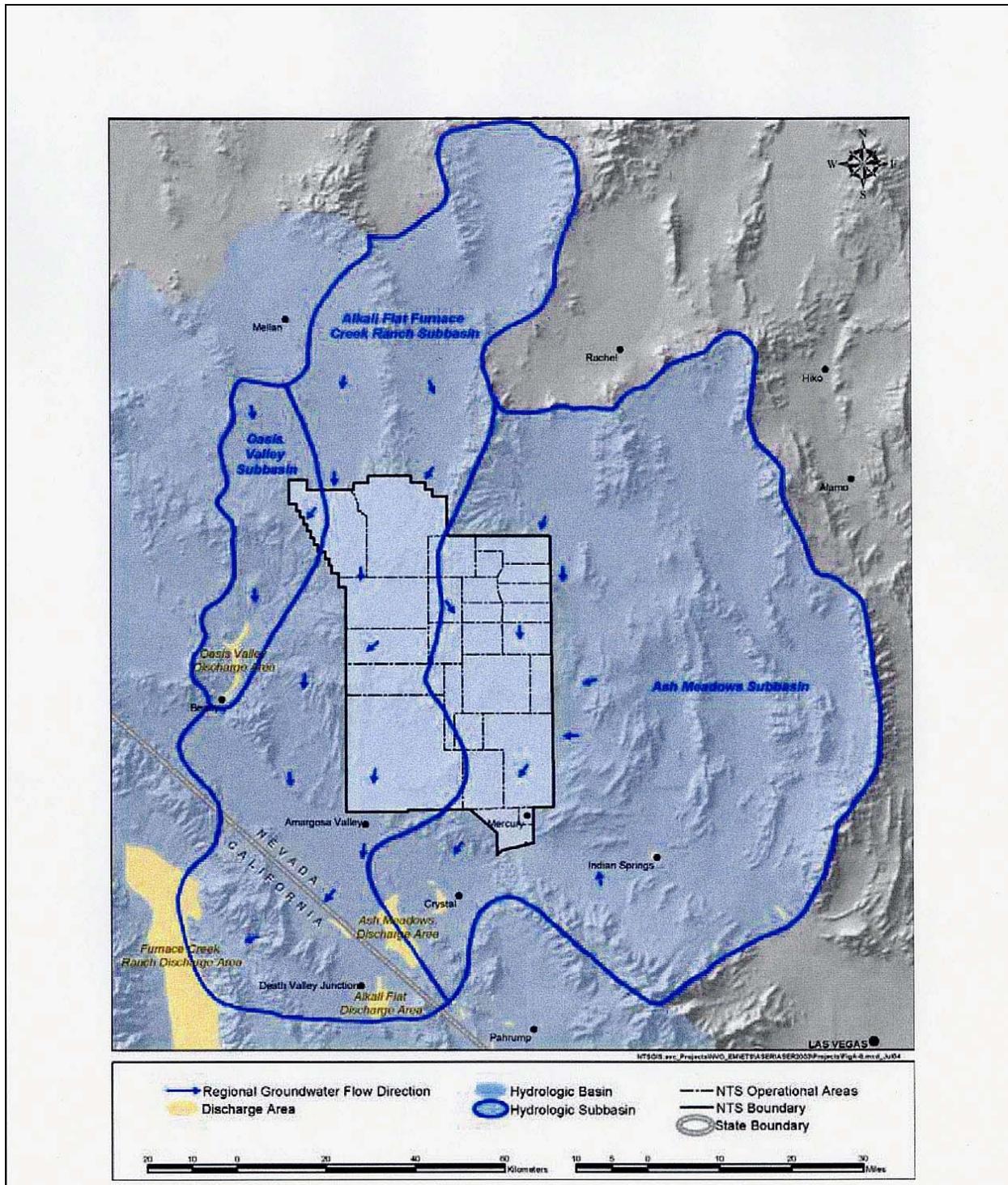
4.3.5.2 *Groundwater*

Groundwater beneath NTS exists within three groundwater subbasins of the Death Valley Basin flow system as shown in Figure 4.3.5-4. This flow system encompasses about 16,000 square miles of the Great Basin. In particular, the eastern half of NTS is located within the Ash Meadows Subbasin, and the western half of the site lies largely within the Alkali Flat Furnace Creek Ranch Subbasin. In addition, a small section of the northwest corner of the site is located within the Pahute Mesa Oasis Valley Subbasin (DOE 2002I). Hydrographic areas are mapped on the basis of topographic divides and are the geographic unit used by the State of Nevada for the purposes of water appropriation and management. NTS lies within at least part of 10 of these areas (i.e., Gold Flat, Buckboard Mesa, Kawich Valley, Emigrant Valley, Oasis Valley, Yucca Flat, Jackass Flats, Frenchman Flat, Rock Valley, and Mercury Valley) (DOE 2002I).

Three principal groundwater subbasins have been identified within the NTS region: the Ash Meadows, Oasis Valley, and Alkali Flat-Furnace Creek Ranch subbasins. The depth to groundwater at NTS varies from about 260 feet below land surface in the extreme northwest part of the site, and 525 to greater than 1,500 feet (Sweeney 1984) below land surface in portions of Frenchman Flat and Yucca Flat weapons test basin, to more than 2,000 feet under the upland portions of Pahute Mesa. Perched groundwater is known to occur in some parts of NTS, mainly in the volcanic rocks of the Pahute Mesa area. Groundwater flows generally south and southwest. The flow system extends from the water table to a depth that may exceed 4,900 feet.

4.3.5.3 *Groundwater and Surface Water Quality*

There have been 828 underground nuclear tests conducted at the NTS. Approximately one third of these tests were detonated near or below the water table. This legacy of nuclear testing has resulted in the contamination of groundwater in some areas. Detonations conducted near the water table have contaminated groundwater near underground nuclear test cavities with 43 residual radionuclides, with tritium being the most prevalent radionuclide. Radionuclides considered are residual and unburned fissile fuel and tracer material, such as uranium isotopes, plutonium isotopes, americium isotopes and curium-244; fission products such as cesium-137 and strontium-90; tritium, and activities induced by neutrons in device parts, in external hardware, and in the surrounding geologic medium (such as carbon-14, chlorine-16, and calcium-41).



Source: NTS 2006a.

Figure 4.3.5-4 — Groundwater Subbasins of the NTS and Vicinity

The Federal Facilities Agreement and Consent Order established Corrective Action Units (CAUs) that delineated and defined areas of concern for groundwater contamination on the NTS. Figure 4.3.5-5 shows the locations of underground nuclear tests and areas of potential groundwater contamination. To safeguard the public’s health and safety and comply with applicable federal, state, and local environmental protection regulations as well as DOE

directives, groundwater on and near the NTS is monitored for radioactivity. Monitoring in the past was conducted by the U.S. Public Health Service, U.S. Geological Survey (USGS), the EPA, and others. In 1998, NNSA/NSO established an NTS integrated and comprehensive radiological environmental monitoring program. The purpose of radiological water monitoring is to determine whether concentrations of radionuclides in groundwater and surface water bodies at the NTS and its vicinity pose a threat to public health or the environment.

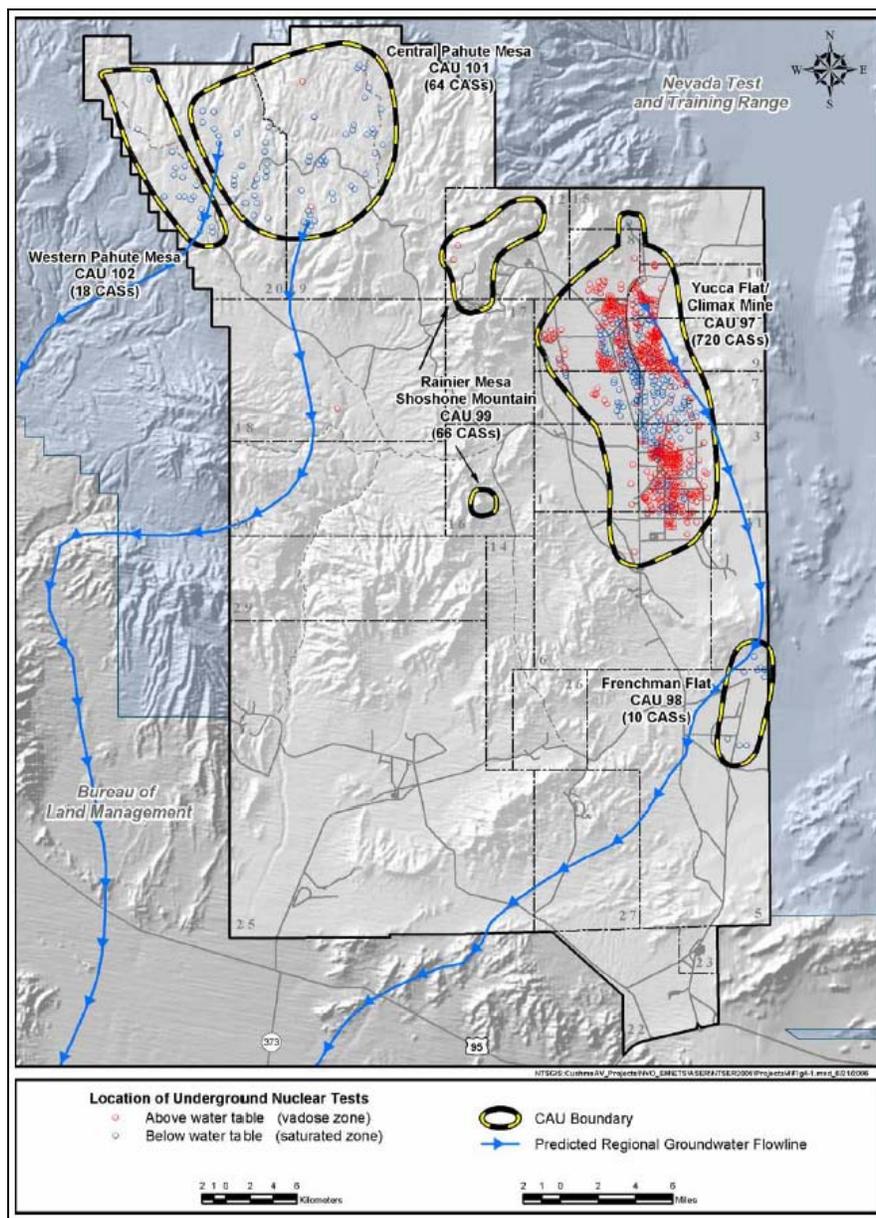


Figure 4.3.5-5 — Areas of potential groundwater contamination on the NTS

In 2005, a network of 55 groundwater locations was sampled and included: 27 offsite wells; 10 onsite water supply wells (9 of which are permitted); and 18 onsite monitoring wells (3 are compliance wells for the Area 5 RWMS and 1 was a compliance well for the Area 23 sewage lagoon). The 27 offsite locations sampled in 2005 included 9 private domestic wells, 6 community wells, and 12 NNSA wells related to NTS activities. The 2005 data indicate that

groundwater at the offsite locations has not been significantly impacted by NTS nuclear testing operations. All but two of the tritium levels in samples from offsite wells were less than the minimum detectable concentration (MDC) (NTS 2006a).

Results from the nine NTS water supply wells and one water monitoring well sampled in 2005 continue to indicate that nuclear testing has not impacted the NTS potable water supply network. All 2005 water samples from the supply wells had non-detectable concentrations of tritium. Analytical results from the network of onsite monitoring wells indicate that migration of radionuclides from the underground test areas is not significant. Four onsite monitoring wells are known to have detectable concentrations of tritium, although they are all well below the EPA MCL of 20,000 picocuries per liter (NTS 2006a).

The surface water monitoring locations sampled in 2005 included 3 offsite springs; 3 onsite springs; 1 NTS operations-related containment pond system (E Tunnel ponds); and 2 onsite sewage lagoons. Peacock Ranch Spring, Spicer Ranch Spring, and Revert Spring were sampled in 2005. All three springs are near Beatty, Nevada. Detectable concentrations of gross alpha and gross beta were present in water collected from the springs, although all concentrations are below the EPA MCL for drinking water. No detectable concentrations of tritium were found in any of the samples. Three onsite springs, Gold Meadows Spring, Tub Spring, and White Rock Spring, were sampled in 2005. These springs are derived from perched water tables resulting in highly variable discharge rates. These perched water tables result from surface infiltration of precipitation and are not discharge points from a regional aquifer. Detectable concentrations of gross alpha and gross beta were present in water collected from the springs, although all concentrations are below the EPA MCL for drinking water. The measured levels of gross alpha and gross beta radioactivity are likely from natural sources. No detectable concentrations of tritium were found in samples from Gold Meadows Spring or Tub Spring, but tritium was detected in the sample from White Rock Spring. Tritium has been detected previously in a vegetation sample from White Rock Spring. Although the exact source of tritium in White Rock Spring is unknown, this spring is located near areas of known surface contamination from previous nuclear testing (NTS 2006a).

The sewage lagoon water samples were analyzed for tritium using standard (un-enriched) analyses and by gamma spectroscopy for other radionuclides. No tritium was detected at concentrations above MDCs in the lagoon water samples and no man-made gamma-emitting radionuclides were detected (NTS 2006a).

There are no NPDES permits for the site because there are no wastewater discharges to onsite or offsite surface waters. However, the State of Nevada has issued one general discharge permit that covers all of the sewage lagoons and has issued permits for the septic systems for NTS facilities.

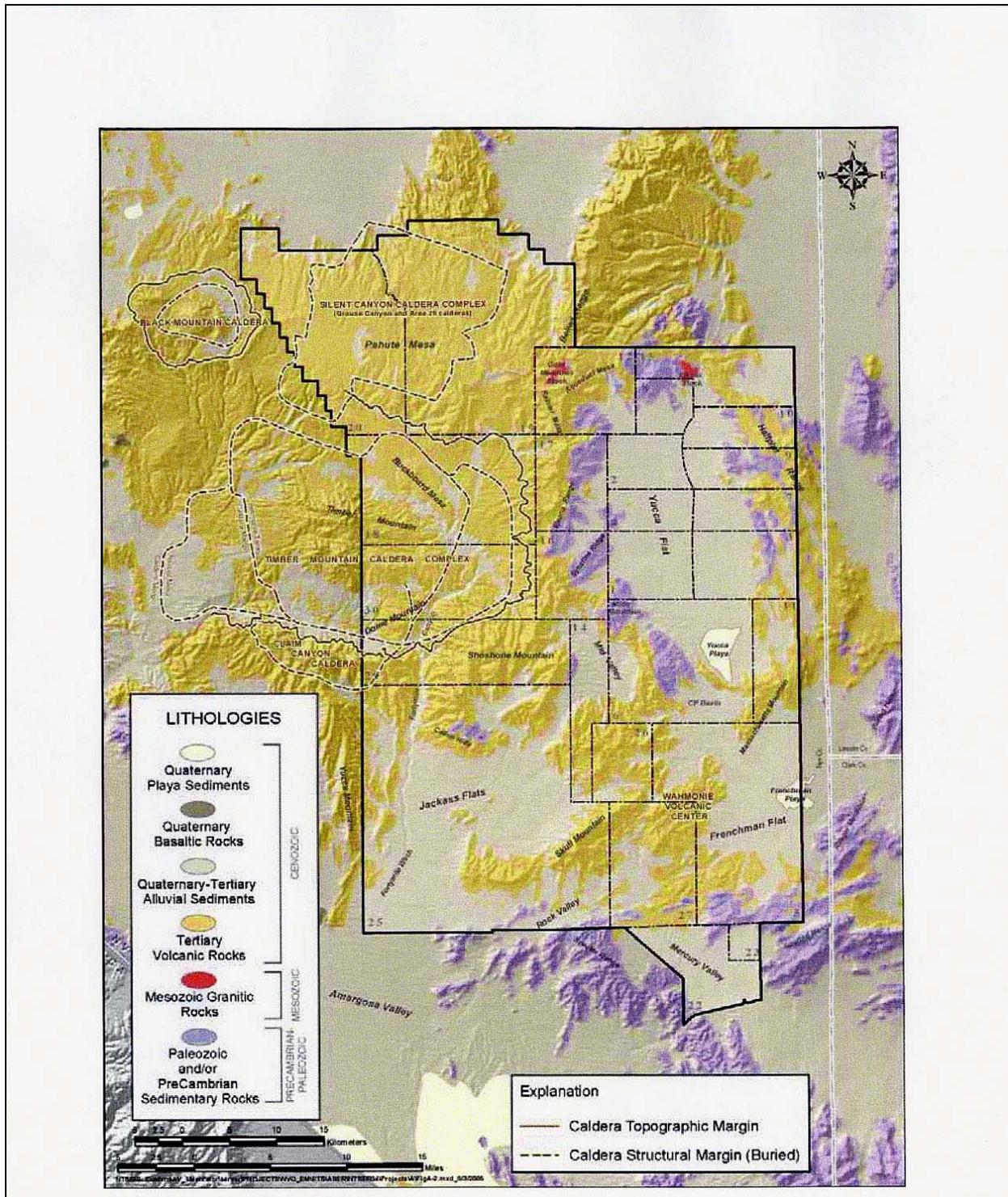
4.3.6 Geology and Soils

NTS lies within the southern part of the Great Basin, the northern-most subprovince of the Basin and Range Physiographic Province. The topography of the site consists of a series of north-south oriented mountain ranges separated by broad, low-lying valleys and flats.

4.3.6.1 *Geology*

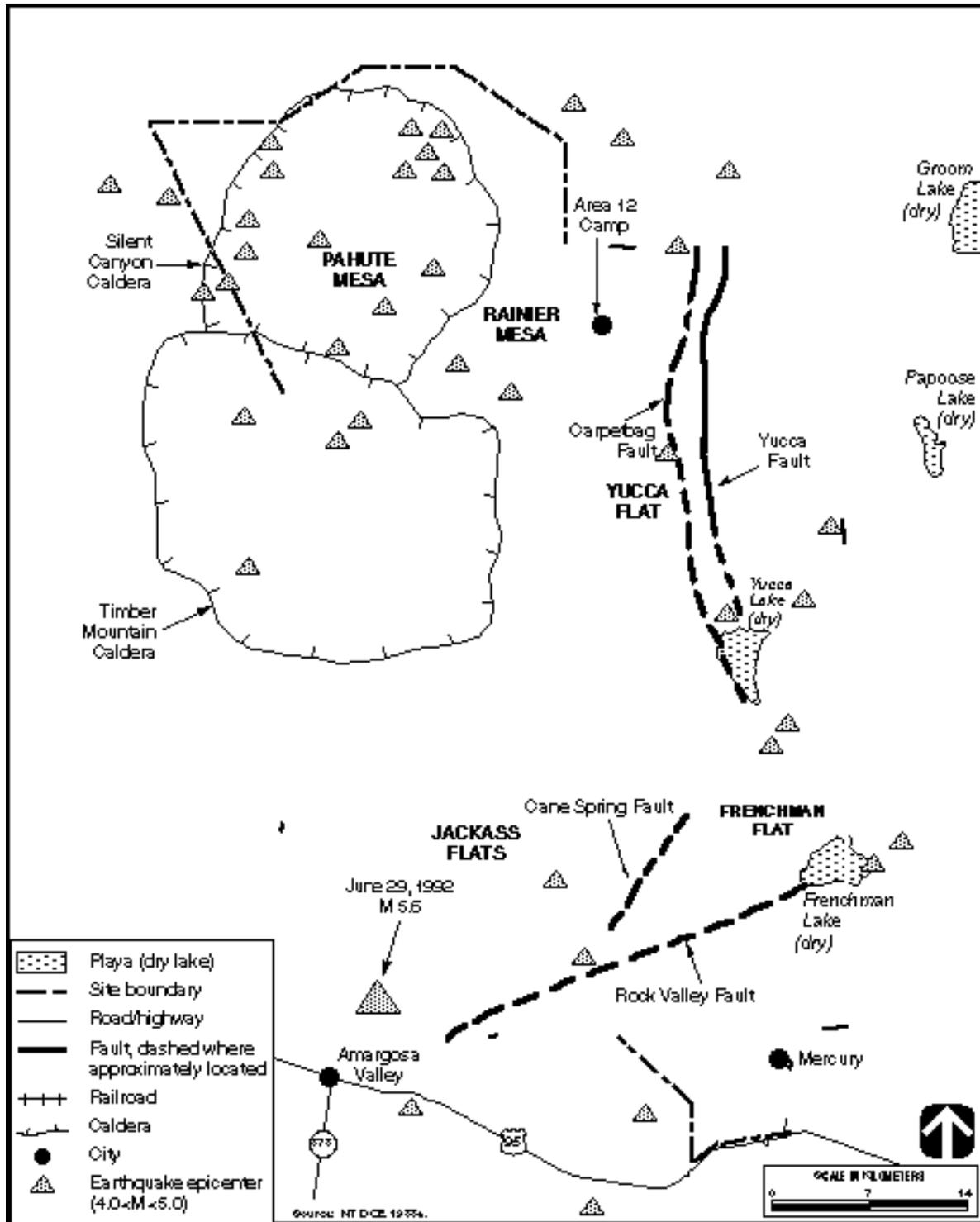
NTS is located about 65 miles northwest of Las Vegas, Nevada, and lies within the southern part of the Great Basin, (Figure 4.3.5-1). The site features desert and mountainous terrain. NTS is generally characterized by more or less regularly spaced, generally north-south trending mountain ranges separated by alluvial basins that were formed by faulting. The relief of NTS ranges from less than 3,280 feet above sea level in Frenchman Flat and Jackass Flats to about 7,675 feet on Rainier Mesa and about 7,216 feet on Pahute Mesa. There are three primary valleys on NTS: Yucca Flat, Frenchman Flat, and Jackass Flats. Figure 4.3.6-1 depicts the topography of the NTS.

The geology of NTS consists of a thick section (more than 34,768 feet) of Paleozoic and older sedimentary rocks, locally intrusive Cretaceous granitic rocks, a variable assemblage of Miocene volcanic rocks, and locally thick deposits of postvolcanic sands and gravels that fill the present day valleys as shown in Figure 4.3.6-1 (DOE 1996b).



Source: NTS 2006a.

Figure 4.3.6-1 — Topography at NTS and Vicinity



Source: DOE 1996b.

Figure 4.3.6-2 — Major Fault Systems and Historic Earthquakes in NTS Region

4.3.6.2 Soils

In general, the soils of NTS are similar to those of surrounding areas and include aridisols and entisols. The degree of soils development reflects their age, and the soils types and textures

reflect their origin. Entisols generally form on steep mountain slopes where erosion is active. The aridisols are older and form on more stable fans and terraces.

The soils of the southern NTS reflect the mixed alluvial sediments upon which they form (NTS 2001). These soils are generally young in profile development and show only weak evidence of leaching. In general, soils texture is gradational from coarse-grained soils near the mountain fronts to fine-grained soils in the playa areas of the Yucca Flat and Frenchman Flat. Most soils are underlain by a hardpan of caliche. Soil salinity generally increases dramatically in the direction of the playa areas, with the highest level of soluble salts having accumulated in the deeper soil profile horizons in Frenchman Flat. The soils at NTS are considered acceptable for standard construction techniques.

4.3.6.2.1 Soil Radiologic Contamination

As discussed in the Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada (ERDA, 1977), underground nuclear testing resulted in unavoidable adverse impacts to land resources that render the resources unusable for most purposes. Underground nuclear tests were begun in November 1951, and through 1992 there were 828 underground tests conducted at the NTS with yields ranging from zero to 1,300 kilotons. Underground testing, for the purposes of discussion, can be divided into three broad categories; shallow borehole tests, deep vertical tests, and tunnel tests.

Shallow borehole tests were conducted between 1960 and 1968. The shallow tests resulted in the development of some large ejection craters, most notably the Sedan Crater in the northern end of the Yucca Flat testing area. Sedan, a 104-kiloton nuclear device detonated 194 meters (635 feet) underground, displaced about 1.2×10^7 tons of earth and created a crater 390 meters (1,280 feet) in diameter and 98 meters (320 feet) deep. McArthur (1991) estimates that the remaining inventory of surficial radioactivity at the Sedan Crater is 344 curies. The total estimate for all releases from shallow borehole tests to the surficial soil horizon at the NTS is 2,000 curies.

Deep vertical underground nuclear tests have been completed in Frenchman Flat, Yucca Flat, Pahute Mesa, Rainier Mesa, Shoshone Mountain, Buckboard Mesa, and Dome Mountain. The tunnel complex at Rainier Mesa has been extensively used for special experiments and tests that require access to materials and monitoring equipment left near the point of detonation. The historic tests have left their mark on the NTS both in terms of physical disruption and a large subsurface inventory of remaining radioactive isotopes.

Historic deep vertical underground testing has resulted in the formation of hundreds of craters at the NTS, leaving Yucca Flat with a "pockmarked" appearance that is even visible on satellite images of the area. The craters generally range in diameter from 61 to 610 meters (200 to 2,000 feet) and range in depth from a few meters to 60 meters (a few feet to 200 feet) depending on the depth of emplacement and the explosive energy yield. The development of craters has been the principal consequence of nuclear testing on the terrain of the NTS (DOE 1996b).

In addition to the cavity, chimney, and subsidence crater, pressure ridges and small displacement faults may occur at the surface. The surface fracturing and faulting are the result of the sudden uplift of the earth at the time of detonation and the collapse during the formation of the chimney and crater. Another permanent consequence of testing has been vertical displacement along

existing faults, particularly along Yucca Fault and Carpetbagger Fault in Yucca Flat. Vertical displacement of as much as 2 meters (8 feet) has occurred along portions of the Carpetbagger Fault. Cratering has occurred on Pahute Mesa but, because of the greater competency of the rocks in that area and the depths of most tests, cratering in this test area has been infrequent. Fracturing has occurred on the top of Rainier Mesa as a result of the loss of strength in the rocks in that area.

Another consequence of past underground testing has been the formation of pockets of radioactive contamination surrounding each underground test. The total amount of radioactivity released into the underground environment during a test is called the radionuclide source term. The source term includes numerous isotopes that are both short- and long-lived. For the example used for atmospheric testing of a 1-kiloton nuclear weapon, an initial release of 41 billion curies decays to about 10 million curies in just 12 hours. According to information presented in Borg et al. (1976), the quantity of radioactivity remaining from a 1-kiloton underground detonation 180 days after detonation is about 45,000 curies (including 18,570 curies of tritium).

It should be noted that there is considerable uncertainty concerning these estimates. It is indicated that the actual tritium activity after 180 days (expressed in this EIS on a per-kiloton-basis) could range from 5,570 to 55,770 curies (DOE 1996b). The radionuclide inventories that have been referred to are an order of magnitude estimate to illustrate the dominance of short-lived radionuclides soon after a nuclear detonation and the effect of radioactive decay in reducing that inventory if no level of remedial work is conducted.

4.3.6.2.2 Atmospheric Testing

Above ground nuclear weapons tests were initiated on January 27, 1951, with the detonation of a 1-kiloton air-dropped weapon over Frenchman Flat, and a total of 100 atmospheric tests were conducted prior to the signing of the Limited Test Ban Treaty in August 1963. Atmospheric testing included weapons that were dropped by planes, those detonated from towers constructed to heights of 30 to 213 meters (100 to 700 feet), tests conducted on land surface, and tests where the weapon was lofted using helium-filled balloons 137 to 457 meters (450 to 1,500 feet) above the ground.

Typical isotopes formed during the historic atmospheric testing included strontium, cesium, barium, tritium, and iodine. Of these, strontium-90 and cesium-137 are of the most concern because of their longer half-lives of 28 and 30 years, respectively.

The vast majority of radioactivity released during atmospheric testing decayed very quickly after each test was conducted. For example, for a 1-kiloton atmospheric test, the initial release after 1 minute is about 4.1×10^{10} curies. This activity is reduced to 1.0×10^7 curies just 12 hours after the detonation. If the activity remaining after 12 hours is used as the basis for estimates, then about 6.0×10^{10} curies were released during atmospheric testing between 1951 and 1963 at the NTS (DOE 1996).

Many of the fission products released during the detonations were dispersed into the atmosphere, and much of the residual radioactivity decayed in the more than 40 years since the last atmospheric test. Nonetheless, some of the longer-lived radionuclides remain in the soil and physical structures. The primary radioactive isotopes that remain on the NTS from historic

atmospheric testing include americium, plutonium, cobalt, cesium, strontium, and europium. According to the Desert Research Institute (1988), the remaining radioactivity in NTS soils within 6,000 to 10,000 feet of the Able test (a 1-kiloton airdrop) totaled almost 15 curies. Based on the most recent estimates for Frenchman Lake (McArthur 1991), about 20 curies of radioactivity remain in this area. Most, if not all, of this remaining activity can be attributed to historic atmospheric testing. Residual contamination from atmospheric testing may also be present in Yucca Flat in Areas 1, 2, 3, 4, 7, 8, 9, and 10 of the NTS and in Buckboard Mesa in Area 18. However, because of the number of underground tests that were conducted in these areas, it is not possible to discriminate what residuals are remaining from atmospheric tests.

4.3.6.2.3 Safety Tests

Portions of the NTS were used between 1954 and 1963 for chemical explosion tests of plutonium-bearing materials. The safety experiments were conducted to evaluate the safety of nuclear weapons in accident scenarios. Concurrent with and after these detonations, extensive studies were conducted to understand the dispersal and transport of these isotopes in the environment, including uptake by plants and animals. These studies were documented in a benchmark series of papers by the Nevada Applied Ecology Group, a panel of scientists chartered by the DOE to investigate the effects of testing at the NTS (NTS 1996, ERDA 1977).

The immediate effects of the tests included the dispersal of plutonium and uranium over significant areas. To determine the area impacted by these tests, inventories were conducted by the Nevada Applied Ecology Group. These inventories were later augmented by extensive field-sampling efforts conducted under the Radionuclide Inventory and Distribution Program. These studies resulted in the definition of affected areas (NTS 1996, ERDA 1977).

The primary isotopes remaining from the tests are plutonium, uranium, and americium, with lesser amounts of cesium, strontium, and europium. These long-lived radionuclides remain today in the surficial soils in the vicinity of the test areas and are available to be transported by wind and uptake by plants and animals. Extensive research into the mobility of the isotopes has found that wind can transport the contaminants and concentrate them in mounds around desert shrubs, and water can cause plutonium to migrate deeper into the soils with time; however due to the fact that the evapotranspiration rate exceeds the precipitation rate at NTS, significant downward migration is not expected. The isotopes are now relatively immobile unless the soils are disturbed (NTS 1996, ERDA 1977).

4.3.6.2.4 Nuclear Rocket and Related Tests

A number of activities were conducted at the Nuclear Rocket Development Station in Area 25 of the NTS. From 1959 through 1973, the area was used for a series of open-air nuclear reactor, nuclear engine, and nuclear furnace tests and for the High Energy Neutron Reactions Experiment. Equipment and facilities remain from some of these activities, and there are some limited areas of contaminated soils. The total estimated inventory of isotopes remaining in the soils in this area of the NTS has been estimated to be about 1 curie (McArthur 1991). The primary soil contaminants in this area are isotopes of strontium, cesium, cobalt, and europium. The disposition of this contamination will be addressed as part of the Industrial Sites Corrective Action Unit under the ER Program.

Over the past two decades, the DOE has conducted many different types of surveys and research projects concerning these soils. A long-term data baseline has been established, the areas of contamination have been delineated, air monitoring and radiological surveying continue for key indicator parameters (plutonium, noble gases, and tritiated water vapor), and an extensive research and development project has evaluated alternative methods for remediating the soils for possible future land uses. The final disposition of the remaining isotope inventory in these soils will be determined as part of the ER Program. Appropriate corrective action level of total radionuclides is being formalized with the USAF and Nevada Division of Environmental Protection (NDEP) and negotiations with NNSA and USAF to address surface soil sites on the NTTR. Appropriate corrective action levels for radionuclides will be based on a 25 millirem per year dose rate, and will be compatible with future land use scenarios. The negotiated corrective action level will be based on site-specific parameters and as-low-as reasonably-achievable (ALARA) determinations. Confirmatory sampling of cleanup results will be done in conjunction with the U.S. Air Force.

4.3.6.3 *Seismology*

The general region has been tectonically active in the near past and has numerous faults (Figure 4.3.6-2). Since about 1848, more than 4,000 earthquakes have been recorded within a 150 mile radius of NTS. Most of these earthquakes were minor events with Richter magnitudes of less than 5.5. The largest event on record, which took place 100 miles west in Owens Valley, CA, had an estimated magnitude of 8.3. In 1992, an earthquake of 5.6 magnitude occurred in the southwest corner of the site under Little Skull Mountain. The maximum acceleration from this earthquake was approximately 0.21 g (g is the acceleration due to gravity) at Amargosa Valley. This is the largest earthquake recorded within the boundaries of NTS and may have been associated with the approximate Richter magnitude 7.5 earthquake near Landers, California, which occurred less than 24 hours earlier. Although there was no surface rupture, the Little Skull Mountain earthquake was the first to cause significant damage to facilities on NTS. These facilities, however, were built prior to the more stringent building codes presently followed on NTS. NTS is Seismic Zone 2B (NTS 2001).

The most recent volcanic activity in the immediate area was 3.7 million years ago, and the likelihood for renewed activity in the next 10,000 years is slight. NTS lies approximately 150 miles southeast of the Long Valley area of California, an area with potential volcanic eruption of the Mount St. Helens type (DOE 1996b).

4.3.7 **Biological Resources**

4.3.7.1 *Terrestrial Resources*

NTS is located along the transition zone between the Mojave Desert ecosystem and the Great Basin Desert ecosystem. As a result, elements of both deserts are found in the Transition Zone. All three zones extend far beyond the boundaries of NTS, so the range of almost all species found onsite also extends beyond the site. There are 20 rare or endemic species present. In terms of total area, the Mojave Desert occupies the southern 22 percent of the NTS, the Great Basin Desert – the northern 40 percent, and the Transition Zone – the middle 37 percent. Extensive floral collections have identified 752 taxa of vascular plants within the boundary of the NTS. A third of the species belong to three families – the Sunflower (Asteraceae), Grass

(Poaceae), and Buckwheat (Polygonaceae) families. Vegetation types that occur in the NTS are classified into plant assemblages or groupings called alliances and associations. Plant alliances may contain several plant associations. Of the ten plant alliances at NTS, nine are shrublands and one is woodland (in the Great Basin Desert).

Plant alliances on NTS are shown in Figure 4.3.7-1. Plant associations characteristic of the Mojave Desert are dominated by the creosote bush (*Larrea tridentata*). The largest and most important plant association in the Transition Zone is a shrubland dominated by blackbrush (*Coleogyne ramosissima*) and the Nevada jointfir (*Ephedra nevadensis*). This association covers 21.6 percent of the total area of the NTS. Much of this association has been disturbed on the NTS by testing and fires. These disturbed areas appear to be returning to a shrubland dominated by Nevada jointfir not blackbrush.

Above 5,000 feet (1,524 meters) in the Great Basin Desert, there are four alliances consisting of cold desert species. The sagebrush (*Artemisia spp.*) shrubland alliance represents 18.1 percent of the area of NTS. The dominant species in this alliance are basin big sagebrush (*A. tridentata*), black sagebrush (*A. nova*), Mormon tea (*E. viridis*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). At elevations above 6,000 feet (1,829 meters) where there is suitable moisture for trees, the singleleaf pinyon (*Pinus monophylla*) and sagebrush (*Artemisia spp.*) shrub woodland alliance occurs. This alliance covers 13.3 percent of the area of NTS.

Adjacent to the playas (temporary rain-filled lakes) in Frenchman and Yucca flats of the Great Basin Desert ecoregion is a shrubland plant alliance dominated by either shadscale (*Atriplex confertifolia*) or four-winged saltbush (*A. canescens*). This alliance covers only 3.1 percent of the NTS. The smallest alliance, covering only 0.4 percent of the NTS, is a thorn shrubland occurring in Frenchman Flat around the edge of Frenchman Playa. This alliance contains Shockley's desert thorn (*Lycium shockleyi*) and rabbit thorn (*L. pallidum*) (Wills and Ostler, 2001).

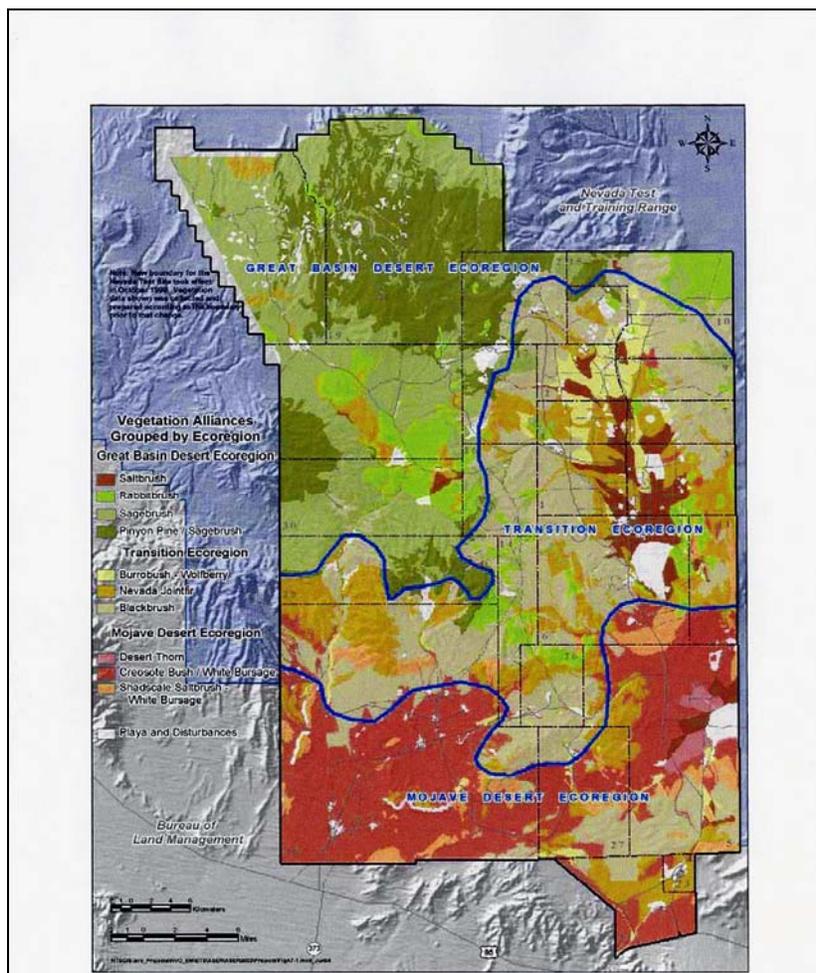
Three hundred thirty-three species of terrestrial vertebrates have been recorded at NTS, including 60 species of terrestrial mammals (including 16 species of bats), 239 species of birds, 34 species of reptiles (1 tortoise, 16 lizards, and 17 snakes) (Wills and Ostler, 2001). Typical Mojave Desert species found at the site include kit fox (*Vulpes velox macrotis*), Merriam's kangaroo rat (*Dipodomys merriami*), desert tortoise (*Gopherus agassizii*), chuckwalla (*Sauromalus obesus*), western shovelnose snake (*Chionactis occipitalis*), and sidewinder snake (*Crotalus cerastes*).

Typical Great Basin Desert species include Townsend's ground squirrel (*Spermophilus townsendii*), Great Basin pocket mouse (*Perognathus parvus*), mule deer (*Odocoileus hemionus*), northern flicker (*Colaptes auratus*), scrub jay (*Aphelocoma coerulescens*), Brewer's sparrow (*Spizella breweri*), western fence lizard (*Sceloporus occidentalis*), and striped whipsnake (*Masticophis taeniatus*). About 40 wild horses (*Equus caballus*) live on the northern part of NTS. Water holes, both natural and manmade, are important to many species of wildlife, including game animals such as pronghorn (*Antilocapra americana*) and mule deer. Hunting is not permitted anywhere on NTS.

Raptors such as the turkey vulture (*Cathartes aura*) and rough-legged hawk (*Buteo lagopus*), and carnivores such as the coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*) and bobcat (*Lynx rufus*) are two ecologically important groups on the site. A variety of migratory birds have been found at NTS (DOE 2002).

4.3.7.2 Wetlands

There are 30 natural water sources found at NTS, approximately 20 of which support wetland vegetation such as cattail (*Typha latifolia*), sedges (*Carex* spp.), and rushes (*Juncus* spp.). One newly identified wetland, a historic borrow pit that catches water in large enough quantities and for long enough periods of time to sustain wetland vegetation, has been identified (DOE 2002l).



Source: NTS 2006a.

Figure 4.3.7-1 — Distribution of Plant Alliances on the NTS

4.3.7.3 Aquatic Resources

Known natural water sources on NTS consist of 15 springs, 9 seeps, 4 tanks (natural rock depressions that catch and hold surface runoff), and 2 ephemeral ponds (Pahute Mesa and Yucca Lake). There are no federally designated Wild and Scenic Rivers onsite. Ten water sources were unvegetated pools of water (four cave pools, four rock depressions and two ephemeral ponds). Eleven of the 24 springs and seeps have been observed to have surface flow of water sometime during the year. Man-made impoundments on NTS, that are scattered throughout the eastern half of the site and maintained by well water, support three introduced species of fish: bluegill (*Lepomis macrochirus*), goldfish (*Carassius auratus*), and golden shiners (*Notemigonus crysoleucas*). Eighty-one species of plants and 138 species of animals have been documented at or near aquatic sites on NTS (Wills and Ostler, 2001). Passerine birds (perching birds and

songbirds) comprise the majority of birds using the NTS wetlands. Waterfowl use is negligible due to the small surface area of open water (Wills and Ostler, 2001).

4.3.7.4 *Threatened and Endangered Species*

The only federally-threatened species found at NTS is the Mojave Desert population of the desert tortoise (*Gopherus agassizii*) (NTS 2007). The desert tortoise inhabits the southern one-third of the NTS at fairly low estimated densities. In December 1995, the Nevada Site Office (NSO) completed consultation with the USFWS concerning the effects of NNSA/NSO activities on the desert tortoise. A final Biological Opinion (Opinion) was received from the USFWS in August 1996. The Opinion concluded that the proposed activities on the NTS were not likely to jeopardize the continued existence of the Mojave population of the species and that no critical habitat would be destroyed or adversely modified. The Opinion established compliance limits for the numbers of accidentally injured and killed tortoises, captured and displaced tortoises, and amount of tortoise habitat that can be disturbed. All terms and conditions listed in the Opinion must be followed when activities are conducted within the range of the desert tortoise on the NTS.

The Desert Tortoise Compliance Program was developed to implement the terms and conditions of all Opinions issued to NSO by the USFWS, to document compliance actions taken, and to assist NSO in USFWS consultations.

The abundance of tortoises at NTS is low to very low compared to other areas within the range of this species. NTS contains less than 1 percent of the total desert tortoise habitat of the Mojave Desert population (DOE 2002l). A cumulative total of 265.70 acres (107.6 hectares) of tortoise habitat on the NTS has been disturbed since the desert tortoise was listed as threatened in 1992 (NTS 2006a).

Mitigation for the loss of tortoise habitat is required under the terms and conditions of the 1996 Opinion. Two mitigation options are available: (1) payment of a mitigation fee to the Clark County Desert Tortoise Habitat Conservation Fund for habitat disturbed or (2) revegetate disturbed habitat following specific revegetation criteria. The current cost for the prepayment fee is \$1,741 per hectare (\$705 per acre) (NTS 2007).

All but five of the 239 bird species observed on the NTS are migratory birds protected under the Migratory Bird Treaty Act or are regulated by the state of Nevada as game birds. Two are currently included in active long-term population monitoring activities – the western burrowing owl (*Athene cunicularia hypugaea*) and Swainson's hawk (*Buteo swainsoni*). In 2005, there were 126 known western burrowing owl locations (30 owl sightings and 96 burrow sites) on the NTS. Most non-rodent mammals of the NTS are protected by the State of Nevada and managed as either game or furbearing mammals. Recently, two rodents were added to the list of Nevada Protected species – the dark kangaroo mouse (*Microdipodops megacephalus*) and the pale kangaroo mouse (*M. pallidus*). Six of 16 bats on the NTS are considered state-protected species. Nineteen species of vascular plants and one moss that are considered sensitive species are known to occur at the NTS. These species are not listed as threatened or endangered under the Endangered Species Act, but are on either a “watch-list” (19 species) or are considered as threatened (1 species) by the Nevada Natural Heritage Program (NTS 2007). All 20 of these species are under long-term monitoring by NTS biologists in order to maintain an accurate

assessment of the distribution of each plant species and to evaluate their status.

4.3.7.5 *Biological Monitoring and Abatement*

DOE Order 450.1, *Environmental Protection Program* requires ecological monitoring and biological compliance support for activities and programs conducted at the DOE facilities. The Ecological Monitoring and Compliance Program (EMAC) provides this support for the NTS and results are contained in the *Nevada Test Site Environmental Report for 2005* (NTS 2006a). The major sub-programs and tasks within EMAC include: (1) the Desert Tortoise Compliance Program, (2) biological surveys at proposed construction sites, (3) monitoring important species and habitats, (4) the Habitat Restoration Program, (5) ecosystem mapping and data management, and (6) biological impact monitoring at the Non-Proliferation Test and Evaluation Complex (NPTEC). The EMAC program goals are to ensure compliance with all state and federal regulations and stakeholder commitments pertaining to NTS flora, fauna, wetlands, and sensitive vegetation and wildlife habitats; delineate NTS ecosystems; and provide ecological information that can be used to evaluate the potential impacts of proposed projects and programs on NTS ecosystems and important plant and animal species. Information specific to the Desert Tortoise Compliance Program is contained in Section 4.3.7.4 above.

4.3.8 *Cultural and Paleontological Resources*

4.3.8.1 *Paleontological Resources*

Alluvium-filled valleys surrounded by ranges composed of Precambrian and Paleozoic sedimentary rocks and Tertiary volcanic tuffs and lavas characterize the surface geology of NTS. Although the Precambrian deposits contain only a few poorly preserved fossils, the Paleozoic marine limestones are moderately to abundantly fossiliferous, and can contain trilobites, conodonts, ostracods, corals, brachiopods, cephalopods, algae, gastropods, and archaic fish. These fossils are relatively common and have low research potential. The Tertiary volcanic deposits were not conducive to preservation when deposited and thus are not expected to contain fossils.

Late Pleistocene terrestrial vertebrate fossils could be expected in the Quaternary alluvial deposits. Discovery of mammoth, horse, camel, and bison remains could be expected since these types of remains have been found near NTS. Although no known fossil localities have been recorded on NTS, Quaternary deposits with paleontological materials may occur onsite (DOE 2002i).

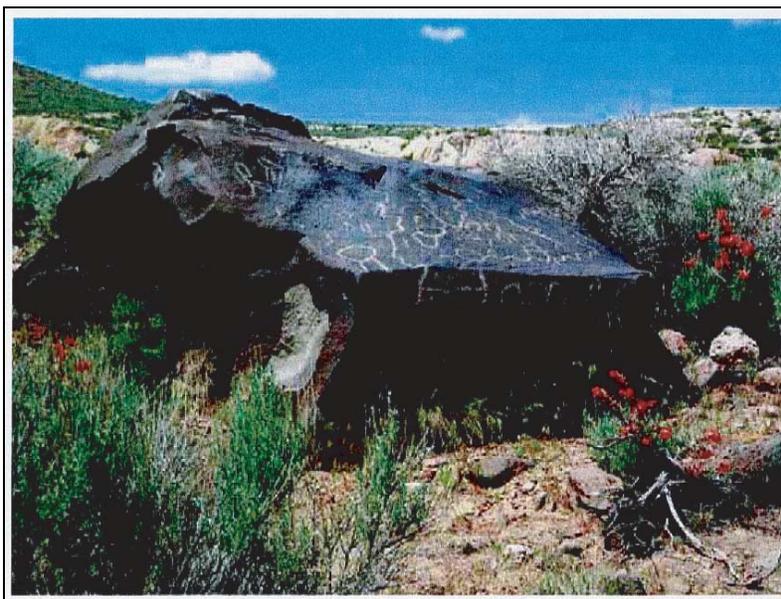
4.3.8.2 *Prehistoric Cultural Resources*

Prehistoric sites found on NTS include habitation sites with wood and brush structures, wind breaks, rock rings, rock shelters, rock art, hunting blinds, rock alignments, quarries, temporary camps, milling stations, roasting pits, water caches, and limited activity locations (DOE 2002i). An example of a prehistoric petroglyph from Fortymile Canyon found on NTS is shown in Figure 4.3.8-1. Areas of NTS that appear to have the highest prehistoric site density are the northwest part, on and around Pahute and Rainier Mesas, and in the southwest part, on and around Jackass Flats, Yucca Mountain, and Shoshone Mountain. However, the distribution information is preliminary. The high number of cultural resources in these areas is somewhat

related to the numerous NTS activities that have taken place there, as most cultural resource investigations are conducted in response to planned NTS activities (DOE 2002i).

4.3.8.3 *Historic Resources*

Historic sites found include mines and prospects, trash dumps, settlements, campsites, ranches and homesteads, developed springs, roads, trails, and nuclear weapon development sites. At least 600 buildings, structures, and objects dating to the Cold War era have been identified at NTS, but many have not been recorded or evaluated for significance. Frenchman Flat and Yucca Flat are rich in significant Cold War resources and have been documented as historic districts (DOE 2002i).



Source: NTS 2006a.

Figure 4.3.8-1 — Prehistoric Petroglyph from Fortymile Canyon on NTS

4.3.8.4 *Native American Resources*

DOE has an extensive record of consultation with interested tribes concerning new, existing, and proposed activities at NTS. The NSO has been consulting with Native Americans since 1988. These consultations have led to the establishment of the Consolidated Group of Tribes and Organizations (CGTO), which includes members from 16 tribes, representing 3 ethnic groups which were found to have prehistoric and historic ties to NTS: Western Shoshone, Southern Paiute, and Owens Valley Shoshone Paiute. Consultations with the CGTO are ongoing and follow the policies set forth by DOE and the current executive orders (DOE 2002i).

The CGTO has identified several sites at NTS that are important to Native American people, including storied rocks, rock shelters, wooden lodges, rock rings, springs, and certain archaeological sites. In addition, 107 plant and more than 20 animal species resident on NTS have been identified by Native American elders as part of their traditional resources (DOE 2002i).

4.3.9 Socioeconomic Resources

Socioeconomic characteristics addressed at NTS include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current NTS employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

NTS is located in Nye County, Nevada. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Nye and Clark Counties. Figure 4.3.9-1 presents a map of the counties composing the NTS ROI.

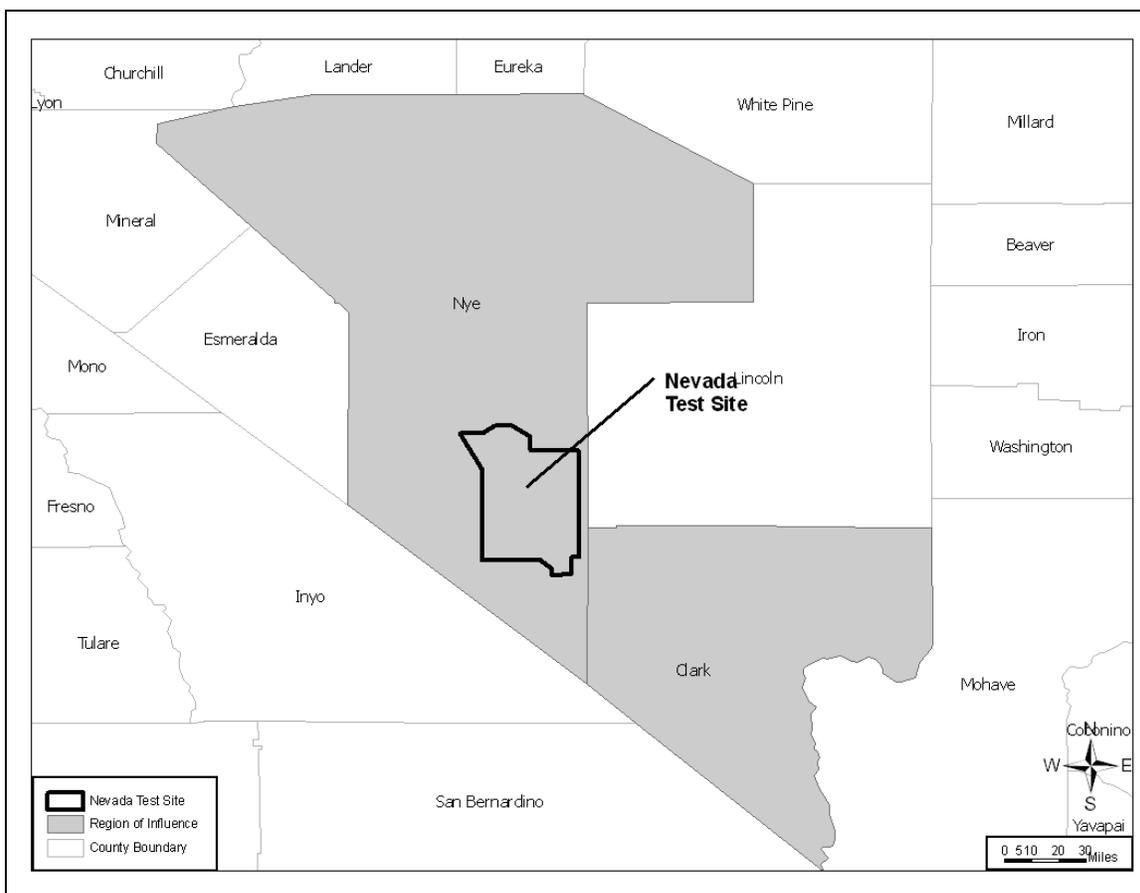


Figure 4.3.9-1 —Region of Influence for NTS

4.3.9.1 *Employment and Income*

Although there have been fluctuations in these estimates, the available labor force (i.e., those more than 16 years of age and capable of work) of the ROI grew by approximately 29 percent from 824,109 in 2000 to 1,066,542 in 2006. The overall ROI employment experienced a comparable growth rate of 30 percent with 770,305 in 2000 and 1,003,912 in 2006 (USCB 2007).

Labor force statistics are summarized in Table 4.3.9-1. The civilian labor force (i.e., those more than 16 years of age and capable of work) of the ROI grew by approximately 20 percent from

741,583 in 2000 to 889,803 in 2005. The overall ROI employment experienced a growth rate of nearly 21 percent with 707,037 in 2000 to 852,496 in 2005 as presented in Figure 4.3.9-2 (BLS 2007).

The ROI unemployment rate was 4.7 percent in 2000 and 4.2 percent in 2005. In 2005, unemployment rates within the ROI were 4.2 percent in Clark County and 5.6 percent in Nye County. The unemployment rate in Nevada in 2005 was 5.3 percent (BLS 2007).

Table 4.3.9-1 — Labor Force Statistics for ROI and Nevada

	ROI		Nevada	
	2000	2005	2000	2005
Civilian Labor Force	741,583	889,803	852,293	915,489
Employment	707,037	852,496	810,024	867,317
Unemployment	34,546	37,307	42,269	48,172
Unemployment Rate	4.7	4.2	5.0	5.3

Source: BLS 2007.

Income information for the NTS ROI is provided in Table 4.3.9-2. Nye County is at the low end of the ROI with a median household income in 2004 of \$41,025, and at the high end of the ROI with a per capita income of \$33,049. Clark County had a median household income of \$45,793 and a per capita income of \$27,910 (BEA 2007).

Table 4.3.9-2 — Income Information for the NTS ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Nye	33,049	41,025
Clark	27,910	45,793
Nevada	34,021	49,894

Source: BEA 2007.

4.3.9.2 Population and Housing

The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-2 presents historic and projected population in the ROI and the state.

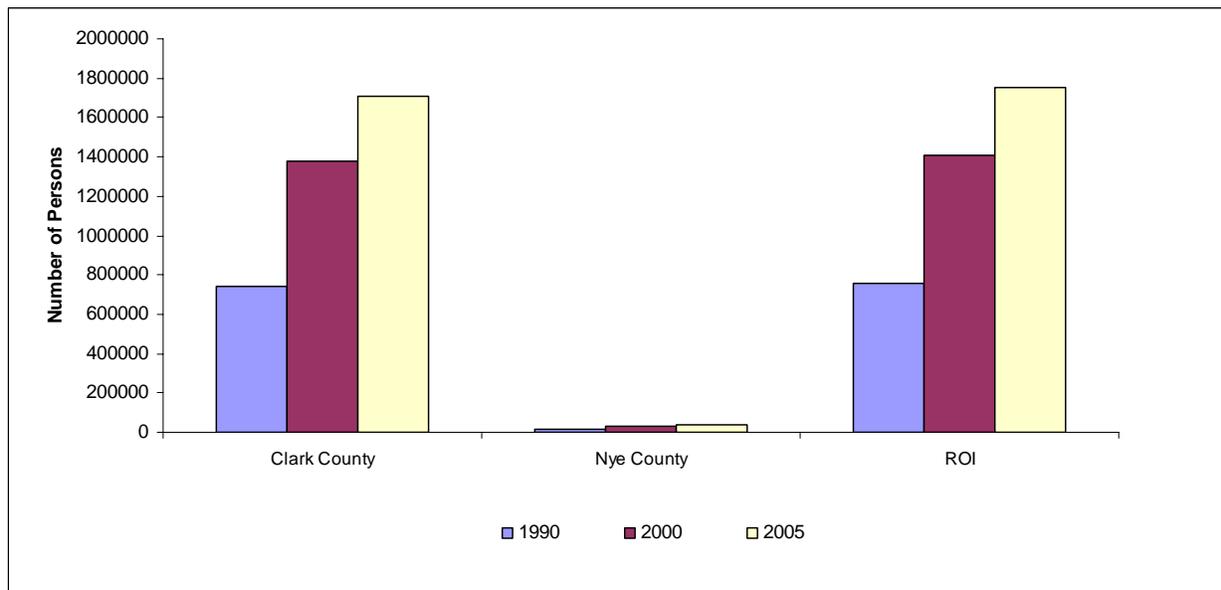
Table 4.3.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Clark	741,459	1,375,765	1,709,364	1,969,348	2,123,277
Nye	17,781	32,485	40,395	44,985	51,283
ROI	759,240	1,408,250	1,749,759	2,014,333	2,174,560
Nevada	1,515,069	1,819,046	1,925,985	2,690,078	2,910,959

Source: USCB 2007.

Between 1990 and 2005, population growth in the ROI was significantly higher than population growth in the State of Nevada. The ROI population increased by 85 percent between 1990 and 2000. Clark and Nye Counties both experience a population growth of approximately 24 percent between 2000 and 2005 (USCB 2007). Clark County is the largest in the ROI with 1,709,364

people, while Nye County had 40,395 people in 2005 (USCB 2007). Figure 4.3.9-2 presents the trends in population within the NTS ROI.



Source: USCB 2007.

Figure 4.3.9-2 — Trends in Population for NTS ROI, 1990-2005

Table 4.3.9-3 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 575,733 with 525,562 occupied (91 percent). There were 313,001 owner-occupied housing units and 212,561 rental units. The median value of owner-occupied units in Clark County was the greatest of the counties in the NTS ROI (\$139,500). The vacancy rate in Clark County was 8.5 percent and 16.5 in Nye County (USCB 2007).

Table 4.3.9-4 — Housing in the NTS ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Clark	559,799	512,253	302,834	209,419	47,546	8.5	139,500
Nye	15,934	13,309	10,167	3,142	2,625	16.5	122,100
ROI	575,733	525,562	313,001	212,561	50,171	8.7	138,935

Source: USCB 2007.

4.3.9.3 Community Services

Community services in the ROI include public schools, law enforcement, fire suppression and medical services. Educational services are provided for approximately 300,256 students by an estimated 15,228 teachers in the ROI (IES 2006c). The student-to-teacher ratio in the Nye County School District was 17:1 during the 2005 to 2006 school year, while the Clark County School District had a student-to-teacher ratio of 20:1. The student-to-teacher ratio in the ROI was 20:1 (IES 2006c).

The counties within the ROI employ approximately 18,700 firefighters and law enforcement officers. There are approximately 13 hospitals that serve residents of the ROI with the majority located in Clark County near Las Vegas (ESRI 2007).

4.3.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of NTS. Figure 4.3.10-1 shows counties potentially at risk from the current missions performed at NTS. There are three counties included in the potentially affected area. Table 4.3.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

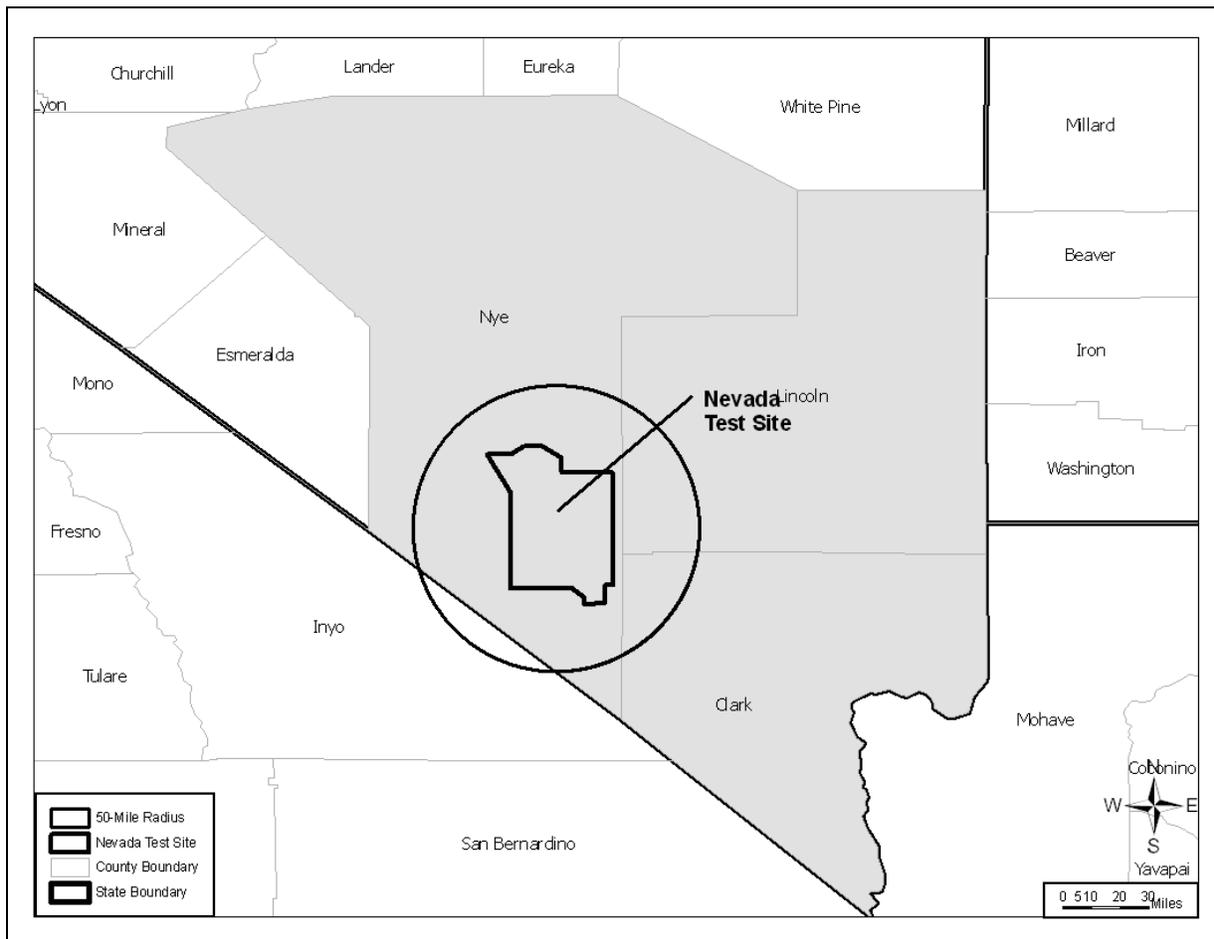


Figure 4.3.10-1 — Potentially Affected Counties Surrounding NTS

Table 4.3.10-1 — Demographic Profile of the Potentially Affected Counties Surrounding NTS, 2000

Population Group	Population	Percent
Minority	552,526	39.1
Hispanic alone	157,835	11.2
Black or African American	125,342	8.9
American Indian and Alaska Native	11,604	0.8
Asian	72,814	5.2
Native Hawaiian and Other Pacific Islander	6,518	0.5
Some other race	119,546	8.5
Two or more races	58,867	4.2
White alone	859,889	60.9
Total Population	1,412,415	100

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 39.1 percent of the total population. Hispanic residents are the largest group within the minority population. As a percentage of the total resident population in 2000, Nevada had a minority population of 34.8 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts with minority populations exceeding 50 percent were considered minority census tracts. Based on 2000 census data, Figure 4.3.10-2 shows minority census tracts within the 50-mile radius where more than 50 percent of the census tract population is minority.

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.3.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tract population is living below the Federal poverty threshold.

According to 2000 census data, approximately 2,213 individuals residing within census tracts in the 50-mile radius of LANL were identified as living below the Federal poverty threshold, which represents approximately 13 percent of the census tract population within the 50-mile radius. There were no census tracts within the 50-mile radius where more than 50 percent of the census tract population was identified as living below the Federal poverty threshold. In 2000, 10.5 percent of individuals for whom poverty status is determined were below the poverty level in Nevada and 12.4 percent in the U.S. (USCB 2007).

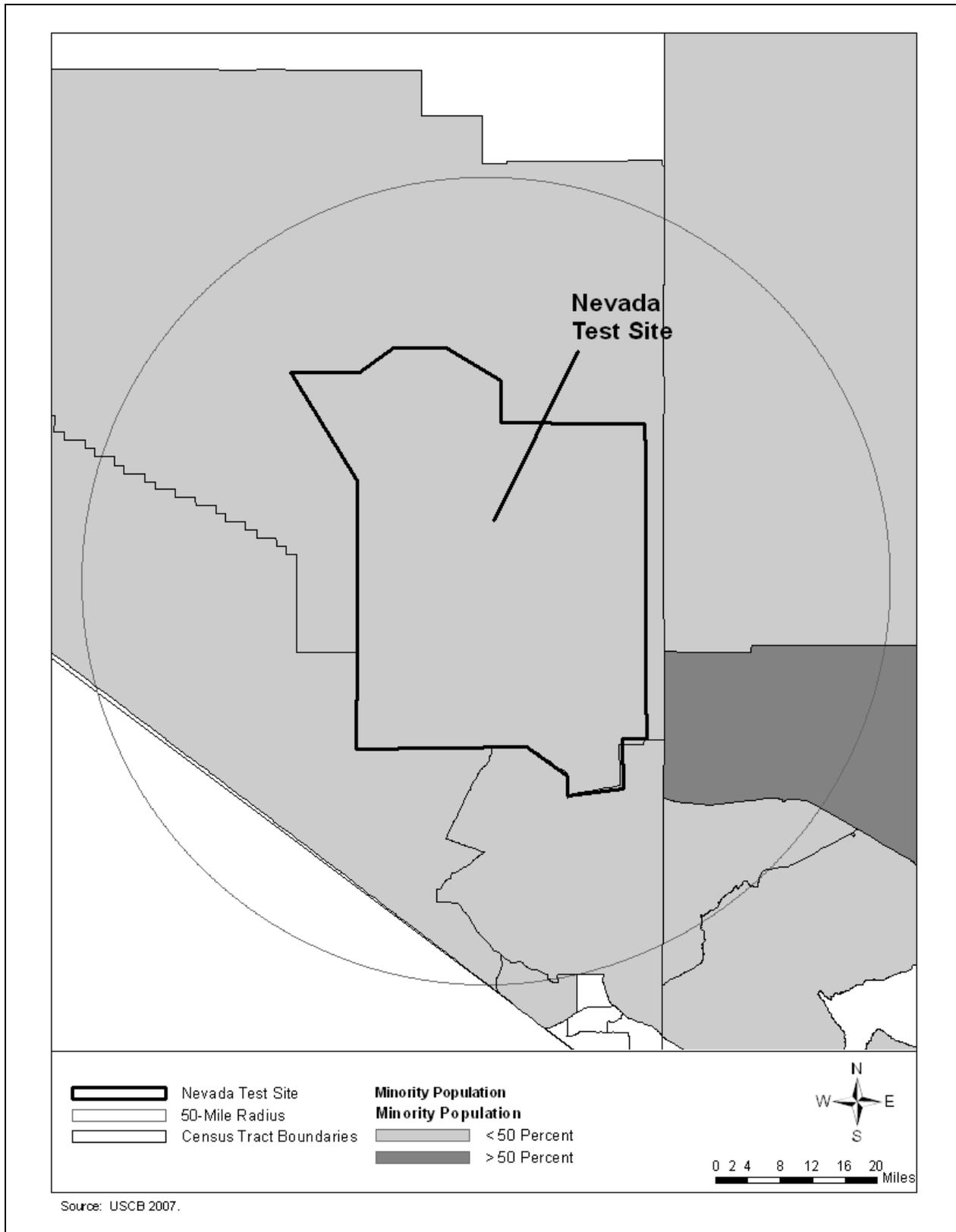


Figure 4.3.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of NTS

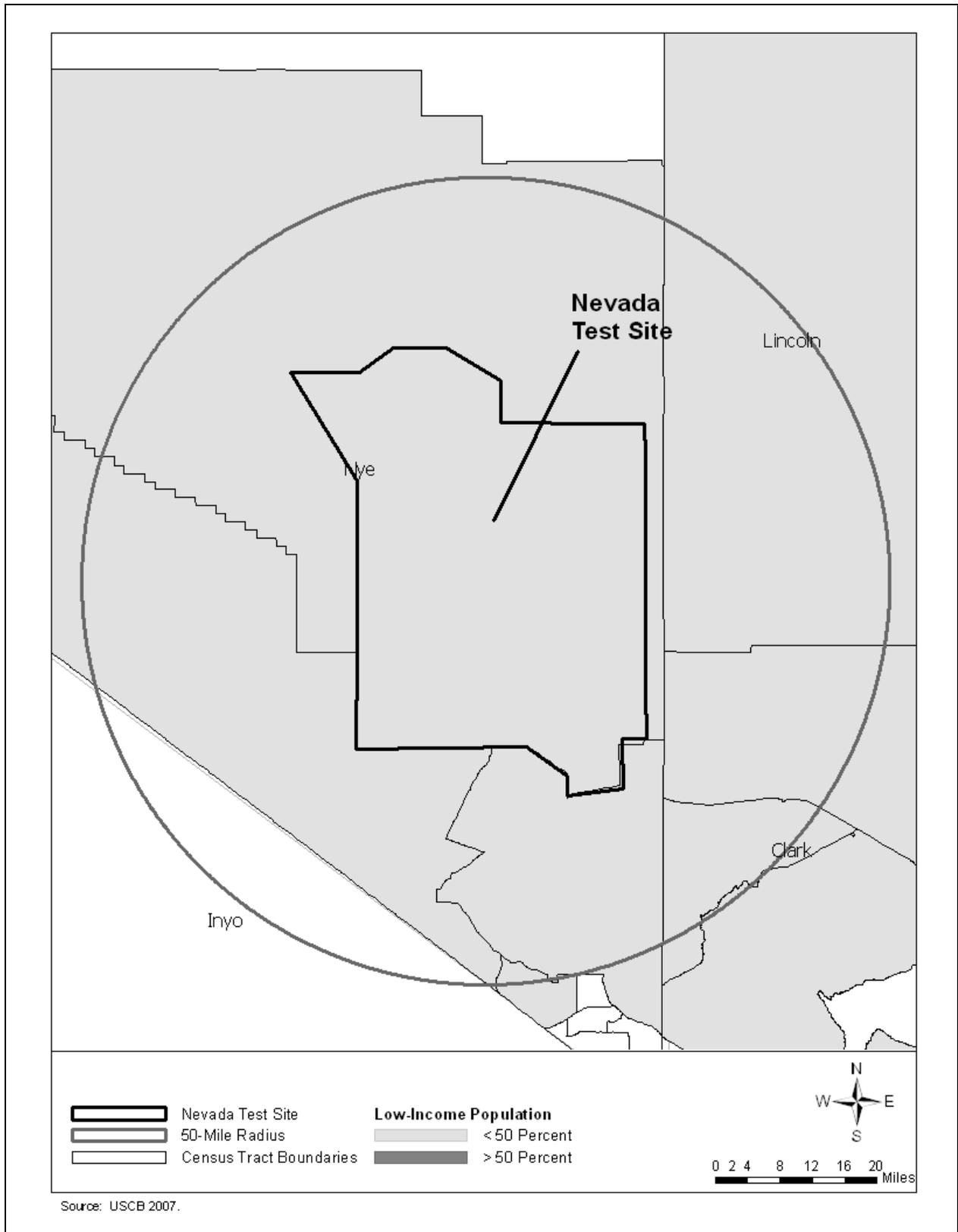


Figure 4.3.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of NTS

4.3.11 Health and Safety

4.3.11.1 Public Health

4.3.11.1.1 Radiological

Releases of radionuclides to the environment from NTS operations provide a source of radiation exposure to individuals in the vicinity of NTS. During 2005, NTS' environmental radiological monitoring program was conducted according to U.S. DOE Orders 450.1, "Environmental Protection Program,"¹ 5400.5, "Radiation Protection of the Public and the Environment", and the CAA NESHAP. The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to DCGs listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the MEI member of the general public. This individual is a person who resides near NTS, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Site operations. Calculations are performed using the EPA's CAP88-PC model (EPA 1992).

The doses received by the MEI are tabulated in Table 4.3.11-1. Based on the 2006 operational data, NTS caused a MEI dose of 0.32 millirem per year. This dose is significantly below the EPA maximum permissible exposure limit to the public (and the DOE "air pathway" limit) of 10 millirem per year. The monitoring and analysis results demonstrate that no adverse effects occurred from NTS operations in 2006. The collective population dose to residents within 50 miles of NTS emission sources was not estimated in 2006 because this assessment depends upon CAP88-PC estimations which were not calculated (NTS 2007). Based upon the same CAP88-PC modeling results, the collective population dose received by those living within 50 miles of NTS would have been less than 0.6 person-rem per year in 2005. The radionuclide emissions contributing the majority of the dose to the offsite MEI were tritium, isotopes of plutonium, and americium-241 (NTS 2006a).

Table 4.3.11- 1 — Estimated Radiological Dose to the General Public from NTS Operations, 2006

Pathway	Dose to MEI (mrem/yr)	Percent of DOE 100-mrem/yr Limit
Air ^a	0.2	0.2
Water ^b	0	0
Wildlife ^c	0.12	0.12
Direct ^d	0	0
All Pathways	0.32	0.32

^a Assumed from historical data from 1992 to 2004.

^b Based on all offsite groundwater sampling in 2006

^c Assumes that the MEI consumes 20 jackrabbits from the NTS

^d Based on 2006 gama radiation monitoring data, 2006 property release tracking information, and previous year's CAP88-PC dose estimates
Source: NTS 2007.

NTS workers receive the same dose as the general public from background radiation, but they also may receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker and the cumulative dose to all workers at NTS from operations in 2005 are presented in Table 4.3.11–2. These doses fall within the radiological regulatory limits of 10 CFR 835.

Table 4.3.11- 2 — Radiation Doses to Workers from Normal NTS Operations in 2005 (Total Effective Dose Equivalent)

Occupational Personnel	Standard	Actual
Average radiation worker dose (mrem)	5,000 ^a	50.1
Collective radiation worker dose ^b (person-rem)	No Current Standard	3.6

^a DOE's goal is to maintain radiological exposure as low as is reasonably achievable. Therefore, DOE has recommended an administrative control level of 500 mrem/yr (DOE 1999e); the site must make reasonable attempts to maintain individual worker doses below this level.

^b There were 71 workers with measurable doses in 2001.
Source: DOE 2006.

4.3.11.1.2 Non-Radiological

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (e.g., soil through direct contact or via the food pathway).

Appropriate monitoring, which reflects the frequency and amounts of chemicals used in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm.

Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at NTS via inhalation of air containing hazardous chemicals released to the atmosphere by NTS operations. Risks to the public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

4.3.12 Transportation

NTS is approximately 65 miles northwest of Las Vegas, Nevada (Figure 4.3.12-1). The route to NTS from many locations east goes through the Las Vegas metropolitan area. Interstate highway I-15 passes through Las Vegas in a southwest to northeast direction. The Las Vegas Beltway encircles all but the east side of Las Vegas. This 53-mile beltway project is in interim status, with a targeted completion of upgrades in 2013. To relieve congestion over the Hoover Dam, a bypass project is in the works, with the Colorado River Bridge planned to be completed by late 2008.

Ninety-five percent of all commuters and shipments to the NTS arrive from the Las Vegas area on U.S. 95, a four-lane highway. The Mercury Interchange on U.S. 95 provides the principal access to NTS. Traffic is light and free flowing once clear of the Las Vegas area. Commuters, however, can experience gridlock within the beltway, especially at the interchanges of U.S. 93, U.S. 95, I-15, and I-515. With approximately 3,800 employees, the NTS contribution to the traffic congestion is minimal. Table 4.3.12-1 summarizes the daily traffic volume for the main access road to NTS. Information is based on best data available.

Table 4.3.12- 1 — Traffic Volume at the Main Access Road to NTS

Access Road	Average Vehicle Daily Trips	Peak Hourly Traffic	Volume to Capacity Ratio
U.S 95 near the Mercury Interchange	3,110	199	0.14

Source: DOE 2003a.

4.3.12.3 Aircraft Operations

NTS has four airstrips (including the Desert Rock Airport with a runway capable of accepting jet aircraft in Area 22 in the south of the NTS and Yucca Lake Airstrip, Pahute Air Strip and Area 6 Aerial Operations Facility), and is adjacent to the Nevada Test and Training Range Complex. NTS also benefits from ready access to McCarran International Airport in Las Vegas.

4.3.12.4 Transportation Accidents

Incidents, issues, and corrective actions regarding transportation of radioactive waste to and from NTS are tracked in the NTS Annual Reports. These reports can be accessed via the DOE/NNSA Nevada Site Office webpage. In 2003, there were no incidents reported; two in 2004; and one in 2005. There were no serious injuries or loss of containment in any of the three incidents listed (DOE 2004a, 2005b).

Table 4.3.12-2 provides crash statistics for the three-county area in the vicinity of NTS. The data provided is for Calendar Year 2002.

Table 4.3.12- 2 — Nevada Traffic Accidents in Clark and Nearby Counties, 2002

County	Total Crashes	Total AVM	Crash Rate in MVM	Total Injuries	Total Fatalities
Clark	45,748	12,108,907,355	3.78	24,666	213
Lincoln	163	118,543,162	1.38	69	11
Nye	587	349,626,311	1.68	323	23
Total for Nevada	62,237	19,219,813,538	3.24	31,522	381

AVM=automated vehicle monitoring; MVM=motor vehicle miles

Source: NVDOT 2006

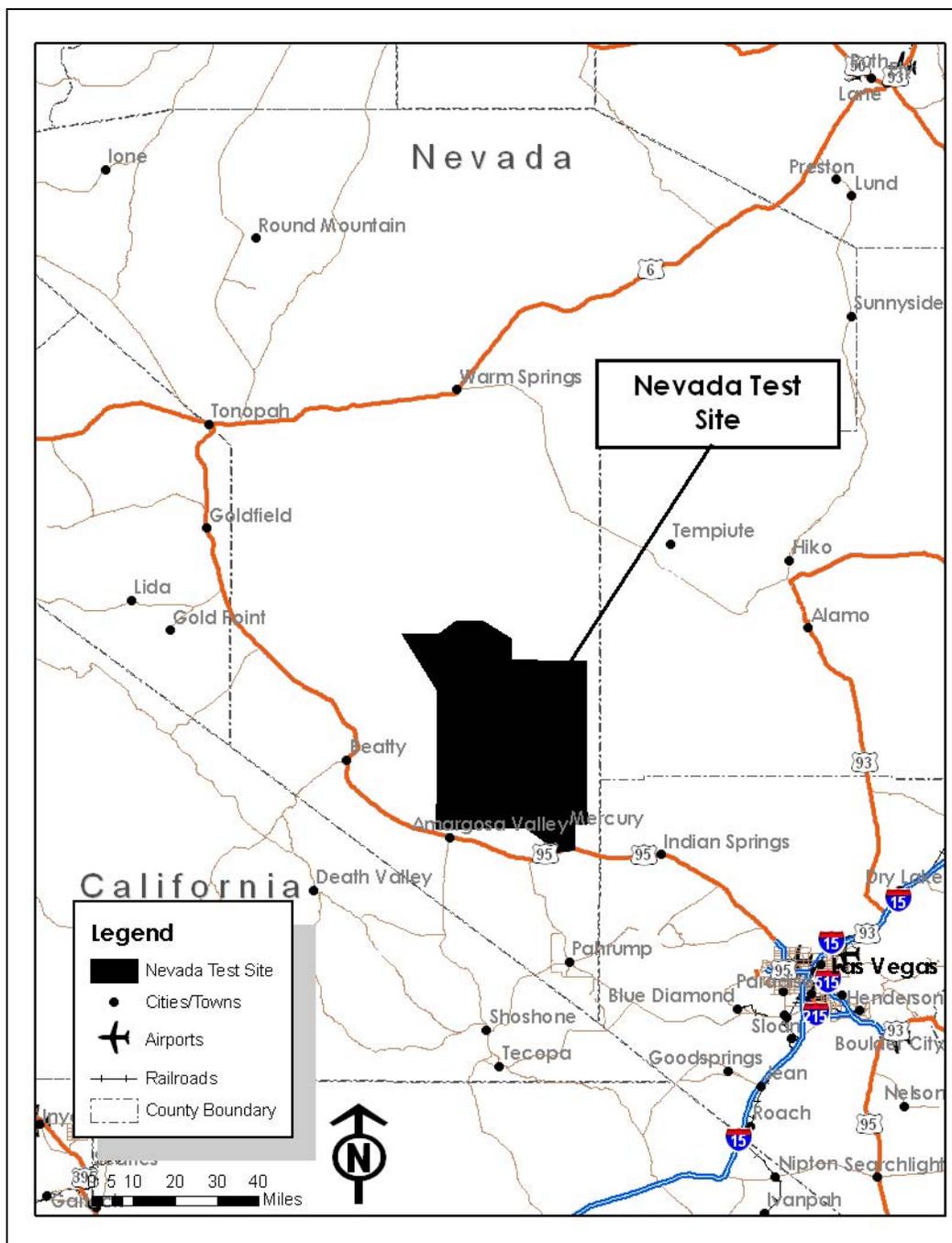


Figure 4.3.12-1 — Roads in the Vicinity of NTS

4.3.13 Waste Management

DOE Order 435.1, Radioactive Waste Management, requires that DOE radioactive waste management activities be systematically planned, documented, executed, and evaluated. NTS is a designated receiving site for LLW under the Waste Management ROD. Radioactive waste is managed to protect the public, the environment, and workers from exposure to radiation from radioactive materials and to comply with all applicable federal, state, and local laws and

regulations; Executive Orders; and DOE directives. The major tasks within Radioactive Waste Management include:

- Characterization of LLW and LLMW that has been generated by the DOE within the state of Nevada;
- Disposal of LLW and LLMW at the Area 5 RWMS; and
- Characterization, visual examination and repackaging of TRU waste at the Waste Examination Facility (WEF) at the Area 5 Radioactive Waste Management Complex (RWMC) (i.e., the WEF and the Area 5 RWMS combined);

NTS manages the following types of waste: TRU waste, including mixed TRU waste; LLW; mixed LLW; hazardous waste; and sanitary waste. Annual routine waste amounts are presented in Table 4.3.13-1.

Table 4.3.13-1 — Annual Routine Waste Amounts

Waste Type	1996	1997	1998	1999	2000	2001	2005
Transuranic	0	0	0	0	0	0	0
Low-level	0	0	0	7.1	0.46	0	1,055
Mixed	0	0	0	0	0	0	0
Hazardous ^a (tons)	46	11	50.2	14	24.5	4.86	NA
Non-Hazardous Sanitary ^b (tons)	4,550	2,280	6,460	7,460	5,080	4,550	NA

^aIncludes state-regulated waste. Hazardous waste reported in metric tons.

^bFrom DOE 2002o (1996 data) and DOE's Central Internet Database. Sanitary waste reported in metric tons.

Source: DOE 2002o.

4.3.13.1 Low-Level Waste and Mixed Low-Level Waste

The Mixed Waste and LLW facilities are designed and operated to perform three functions:

- Dispose of LLW from NNSA/NSO activities performed on and off the NTS and from other offsite generators in the state of Nevada;
- Dispose of DOE LLW from around the DOE complex, primarily from the cleanup of sites associated with the manufacture of weapons components; and
- Dispose of LLMW from around the DOE complex.

All generators of waste streams must first request to dispose of waste, submit a request to NNSA/NSO requesting to ship waste to the NTS for disposal, submit profiles characterizing specific waste streams, meet the NTS Radioactive Waste Acceptance Criteria, and receive programmatic approval from NNSA/NSO. The NTS Radioactive Waste Acceptance Criteria are based on how well the site is predicted to perform in containing radioactive waste and ensuring that the environment and the public will not be exposed to significant radiation. The NNSA/NSO assesses and predicts the long-term performance of LLW disposal sites by conducting a Performance Assessment (PA) and a Composite Analysis (CA). A PA is a systematic analysis of the potential risks posed by a waste disposal site to the public and to the environment. A CA is an assessment of the risks posed by all wastes disposed in a LLW disposal site and by all other sources of residual contamination that may interact with the disposal site. PA and CA documents are developed as a result of these activities.

The RWMS receives LLW generated within the DOE complex from numerous DOE sites across the United States, LLW from Department of Defense (DOD) sites that carry a national security classification, and LLMW generated within the DOE complex for disposal or indefinite storage. Disposal consists of placing waste in unlined cells and trenches. Soil backfill is applied over the waste in a single lift, which is approximately 8 feet thick, as rows of containers reach approximately 4 feet below the original grade. The Area 5 RWMS includes 200 acres of existing and proposed disposal cells for burial of both LLW and LLMW, and approximately 500 acres of land available for future radioactive disposal cells. Waste disposal at the Area 5 RWMS has occurred in a 92 acre portion of the site since the early 1960s. The Area 5 RWMS consists of 31 disposal cells (pits and trenches) and 13 Greater Confinement Disposal (GCD) boreholes. This site is used for disposal of waste in drums or boxes. Existing cells are expected to be filled and closed by 2010, and new cells extending to the north and west are expected to close by 2021. LLW and LLMW disposal services are expected to continue at Area 5 RWMS as long as the DOE complex requires the disposal of wastes from the weapons program (NTS 2006a).

In 2005, the Area 5 RWMS received shipments containing 48,169 cubic yards of LLW for disposal. The Area 3 RWMS received shipments containing 12,576 cubic yards of LLW. The majority of disposed LLW was shipped from offsite. A total of 1,055 cubic yards of LLW disposed in 2005 was generated onsite.

4.3.13.2 *Transuranic Waste*

The Transuranic Pad Cover Building (TPCB) at the Area 5 RWMC is a RCRA Part B interim status facility designed for the safe storage of TRU waste generated by Lawrence Livermore National Laboratory in the 1970s. The TPCB accepts no other wastes. The TPCB stores TRU waste until it is characterized, visually examined, and repackaged at the WEF at the Area 5 RWMC. Once repackaged, the TRU waste is loaded at the mobile loading unit for shipment either to the WIPP at Carlsbad, New Mexico for disposal or to INL for further processing.

4.3.13.3 *Hazardous Waste*

NTS has a permit to store hazardous wastes that have been generated at the NTS in containers on a pad specifically designed for waste storage. The Hazardous Waste Storage Unit (HWSU) is a pre-fabricated, rigid steel framed, roofed shelter which is permitted to store a maximum of 16,280 gallons of approved waste at a time. In 2005, a total of 38,228 pounds of hazardous wastes were received at the HWSU for temporary storage and 27,172 pounds were shipped offsite from the HWSU. The hazardous wastes managed at the HWSU in 2005 included drums of liquid polychlorinated biphenyls. In 2005, a total of 27,140 pounds of hazardous wastes were shipped offsite from SAAs. No hazardous wastes storage limits were exceeded (NTS 2006a).

The RCRA Hazardous Waste Operating Permit also covers operations at the Explosive Ordnance Disposal Unit (EODU) in Area 11. Conventional explosive wastes are generated at the NTS from tunnel operations, the NTS firing range, the resident national laboratories, and other activities. The permit allows NNSA/NSO to treat explosive ordnance wastes, which are hazardous wastes as defined under 40 CFR (Sections 261.21, 261.23, 261.24, and 261.33), by open detonation in a specially constructed and managed area designed for the safe and effective treatment of explosive hazardous wastes. The permit allows a maximum of 100 pounds of approved waste to be detonated at a time, not to exceed one detonation event per hour. In 2005,

no explosive ordnance were detonated at the EODU.

NTS also manages waste containing PCBs regulated under TSCA. Regulated PCB waste is not generated during operations, but could be generated during remediation and decommissioning activities. Currently, PCB-contaminated mixed and LLW are stored on the TRU Waste Storage Pad in a designated area outside of the TRU Pad Cover Building. PCB-contaminated hazardous waste can be stored in the HWSU. Treatment and disposal options for the PCB wastes are available; therefore, the wastes are shipped offsite when sufficient quantities have accumulated.

4.3.13.4 *Nonhazardous Waste*

The NTS has three landfills for solid waste disposal that are regulated and permitted by the state of Nevada. No liquids, hazardous waste, or radioactive waste are accepted in these landfills. They include:

- Area 6 Hydrocarbon Disposal Site – accepts hydrocarbon-contaminated wastes, such as soil and absorbents;
- Area 9 U10c Solid Waste Disposal Site – designated for industrial waste such as construction and demolition debris; and
- Area 23 Solid Waste Disposal Site – accepts municipal-type wastes such as food waste and office waste. Regulated asbestos-containing material is also permitted in a special section. The permit allows disposal of no more than an average of 20 tons/day at this area.

These landfills are designed, constructed, operated, maintained, and monitored in adherence to the requirements of their state-issued permits. An average of 2.1 tons per day was disposed at the Area 23 landfill, well within permit limits. State inspections of the three permitted landfills were conducted in March 2005. No out-of-compliance issues were noted (NTS 2006a).

Wastewater at NTS is disposed either by a septic system or a lagoon system. Sewage lagoon systems are used at Area 23 Area 6, while septic systems are used for wastewater disposal at the remaining areas. Sludge removed from the systems is disposed in the Area 23 sanitary landfill or the Hydrocarbon Disposal Site, depending on hydrocarbon content. At areas not serviced by a permanent wastewater system, portable sanitary units are provided. Review of the historic flow records and design capacities by DOE did not indicate impacts to wastewater capacity beyond permit and design limitations (DOE 2002i).

4.4 TONOPAH TEST RANGE

TTR is located on approximately 179,200 acres (280 square miles) within the boundaries of the Nevada Test and Training Range (NTTR) (Figure 4.4-1) and is used to support DOE/NNSA and USAF activities and missions.

Current DOE activities at the TTR include:

- Stockpile reliability testing,
- Research and development testing support of structural development,
- Arming, fuzing and firing testing,
- Testing nuclear weapon delivery systems (does not include nuclear devices), and
- Environmental Restoration.

SNL utilizes a wide array of instruments to characterize performance parameters on projectiles in air for artillery, missiles, rockets, and drops from aircraft. No nuclear devices are tested at TTR (TTR 2006). No Category I/II quantities of SNM are normally maintained at TTR.

4.4.1 Land Use

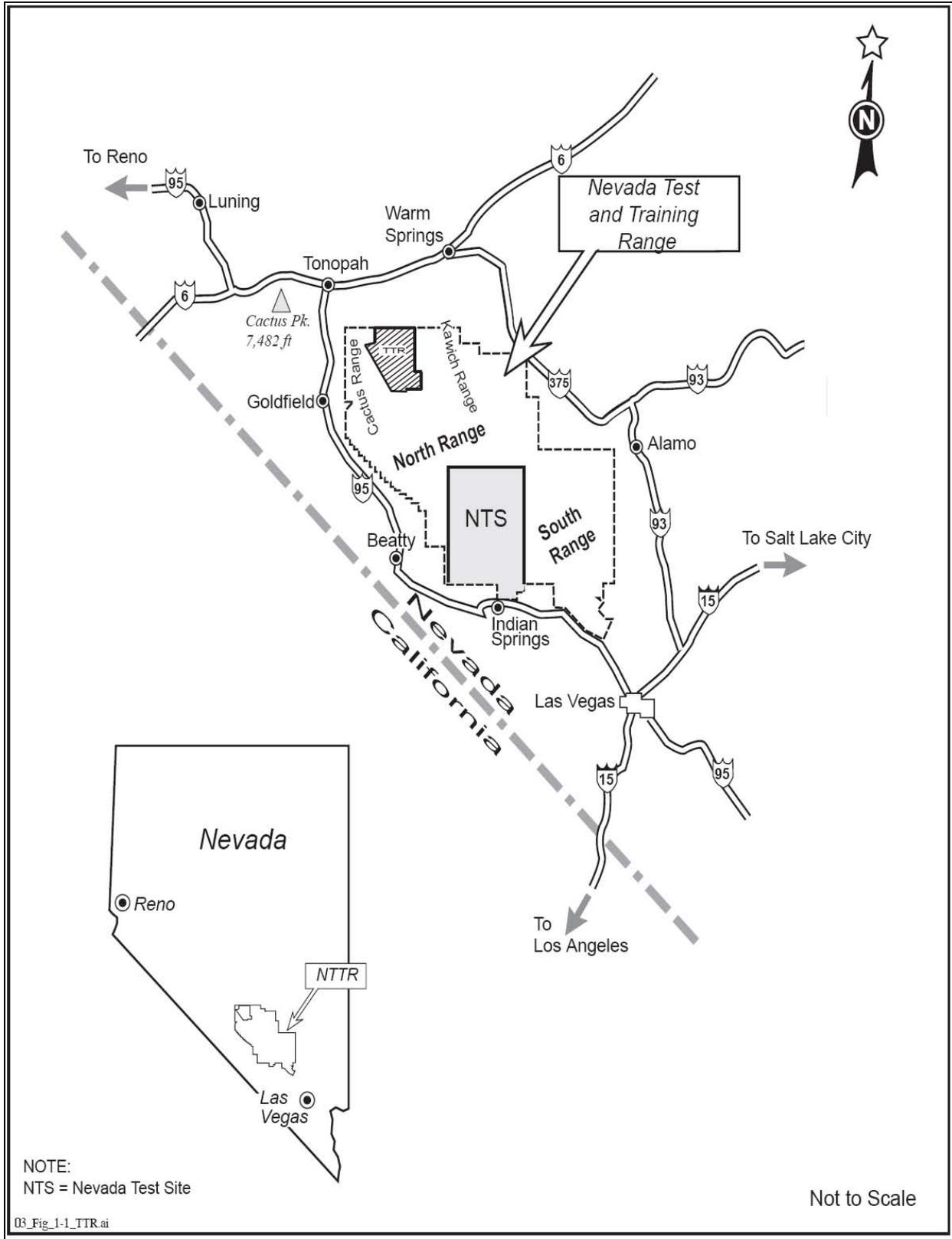
4.4.1.1 *Onsite Land Use*

In 1957, the Atomic Energy Commission (AEC) established the TTR on lands withdrawn in 1940 when President Roosevelt established the Las Vegas Bombing and Gunnery Range. During World War II, the USAF used playas and other areas in Cactus Flat for aerial gunnery and bombardment training.

In April 2002, a Land Use Permit was signed between the USAF and the NNSA entitled, “Department of the Air Force Permit to the NNSA To Use Property Located On The Nevada Test and Training Range, Nevada.” The current size of TTR is approximately 179,200 acres. Prior to the April 2002 lease agreement, the footprint was 335,655 acres (TTR 2006).

TTR is located within the NTTR at the northern boundary. With minor exception, the TTR is used by the DOE as a research, design, and testing ground for defense-related activities. The eastern portion of the TTR is designated as part of the 394,000 acres Wild Horse Range that is located in the north portion of the NTTR Complex. The Nevada Wild Horse Range is managed by the BLM under a 1974 cooperative agreement in compliance with the Wild Horse and Burro Act of 1971.

Area 3 of the TTR contains the majority of administrative and industrial facilities. Within this area is the fenced technical compound of SNL. The facilities within the compound are administrative and research-related facilities.



Source: TTR 2006.

Figure 4.4-1 — Location of the TTR

Area 9 of the TTR contains all facilities that directly support the DOE weapons testing program. Rocket launchers, Davis gun support equipment, and weapon storage facilities are located in this area. Additionally, ground-to-air related tests are initiated from this facility. Main Lake is the primary target area for missiles and air drops. There are four targets on Main Lake, all located along the flight path. The soft target is a series of concentric circles scraped on the ground located just south of Main Lake and Edwards Freeway. It has been used for air-to-ground gunnery and contains depleted uranium (DU) projectiles. The hard target is a flat circular area 700 feet in diameter and constructed of poured concrete slabs. The target is instrumented and gridded to assess targeting accuracy of bombs and missiles. Only dummy warheads are used at this site in order to minimize damage to the target. Most tests are conducted at Antelope Lake Target and Mod 11 targets and will probably be the test bed of choice once lay downs are no longer required.

Area 10 of the TTR is occupied by the USAF Northern Remote Base. These facilities include the industrial area and housing area.

The remaining land on the TTR is open and used for testing and military training programs. All uses of the TTR are coordinated activities between DOE and the USAF to ensure they are within scope of the land use of the area (DOE 1996b). There are no prime farmlands on TTR.

The TTR contains approximately 105 major buildings, providing a gross 161,505 square feet of space. The TTR facilities also include approximately 90 smaller buildings, including towers and small sheds (DOE 1996b).

4.4.1.2 *Surrounding Land Use*

The area north of the TTR boundary is sparsely populated public lands administered by both the BLM and the USFS. The land is currently used to graze cattle. There is a substantial irrigated farming operation to the north of the range as well. To the east, west, and south of TTR, and within the NTTR, is the Nevada Wild Horse Range, which is also administered by the BLM.

The nearest populated area to TTR is the town of Goldfield, approximately 22 miles west of the site boundary. The town of Tonopah is approximately 30 miles northwest of the site. Las Vegas, Nevada is 140 miles from TTR.

4.4.2 **Visual Resources**

The topography at TTR is characterized by a broad, flat, valley bordered by two north and south trending mountain ranges; the Cactus Range to the west (occurring mostly within the boundaries of TTR) and the Kawich Range to the east. Cactus Flat is the valley floor where the main operational area of TTR is located. An area of low hills outcrops in the south. Elevations within TTR range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak. The elevation within the town of Tonopah is 6,030 feet (TTR 2006).

On the south, Cactus Flat is separated from Gold Flat by the volcanic hills around Gold Mountain (about 6,000 feet) and a low topographic divide through the alluvium to the east.

Stonewall Flat is bounded on the south by Stonewall Mountain, which has a maximum elevation of 8,275 feet. On the west, Stonewall Flat is bounded by the Goldfield Hills, which rise to an elevation of almost 7,000 feet. On the valley floors of both basins, the dominant features are a number of small playas and the many washes that drain the upland areas (DOE 1996b).

Good views of the facility can be had from a hill northwest of the main entrance, on public BLM land. The access road to the facility is marked with a small missile and a sign on Route 6, ten miles east of Tonopah (DOE 1996b).

The landscape character of the TTR is similar to the higher elevation areas of the NTS. The TTR is visible only from an access road off U.S. Highway 6; therefore, visual sensitivity would be low. Lands within TTR have a BLM Visual Resource Management rating of Class II or III (see Table 4.4.2-1 for definitions of each class). Changes to the landscape within these classes may be seen, but should not dominate the view. Developed areas within the site are consistent with a Visual Resource Management Class IV rating in which management activities dominate the view and are the focus of viewer attention.

Table 4.4.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention
Class II	To retain the existing character of the landscape. The level of change to the characteristic landscape should be low
Class III	To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Source: BLM 1980.

4.4.3 Site Infrastructure

Utilities at the TTR include water systems, wastewater systems, and electrical systems. A number of water wells have been drilled on or near the TTR to supply water to the facility (DOE 1996b). The water use (for entire TTR, including Air Force) use for operations is approximately 6 million gallons per year (NNSA 2007).

Electrical System Power to DOE facilities at the TTR is supplied by the Sierra Pacific Power Company. Sierra Pacific has two supply lines to the TTR: one is 120 kilovolt (kV), and a backup line is 60 kV. Sierra Pacific transformers step the voltage down to 13.8 kV for the DOE distribution system.

Table 4.4.3-1 — Baseline Characteristics for TTR

Resource	Current Usage
Land	
Area (mi ²)	280
Electrical	
Energy consumption (MWh)	595
Peak Demand (MWe)	812
Steam	
Other process gas (ft ³)	480
Fuel	
Diesel generators	44
Water	
Usage (yearly for entire range including AF) (million gal)	6

Source: NNSA 2007.

4.4.4 Air Quality and Noise

4.4.4.1 Air Quality

The TTR is located in Nye County, Nevada, which is in attainment for all criteria pollutants except for a portion of the Pahrump Valley, near the California-Nevada border and southwest of TTR. The TTR and its surrounding area are in attainment, and meet the criteria for air quality.

4.4.4.1.1 Meteorology and Climatology

The climate at TTR is typical of high desert, mid-latitude locations, with large diurnal and seasonal changes in temperature, and little total rainfall. Temperature extremes on the test range can vary from a high near 104°F in the summer and approach -22°F in the winter. July and August are the warmest months with daily highs ranging in the 90s °F and in the 50s°F in the evenings. January conditions vary from highs in the 40s°F to lows in the teens (°F). Rainfall is dependent on elevation. Annual average rainfall on the desert floor is 4 inches, with as much as 12 inches falling in the mountains (TTR 2006).

4.4.4.1.2 Ambient Air Quality

The TTR is located within Nevada Intrastate Air Quality Control Region 147. Air Quality Compliance (AQC) at TTR is met by adherence to specific permit conditions and local, state, and federal air regulations. Ambient air quality monitoring is not currently required at TTR. Ambient air monitoring was last conducted in 1996 to ascertain the level of radiological constituents in the air (TTR 2006).

4.4.4.1.3 Radiological Air Emissions

Radiological air emissions are regulated by NESHAP under the CAA. Operations at TTR do not involve activities that release radioactive emissions from either point sources or diffuse sources such as outdoor testing. The only radionuclide sources at TTR are the three Clean Slate Sites, which are potential sources of diffused radionuclide emissions if there is re-suspension of

contaminated soils. These sites are currently being addressed by DOE/NNSA/NSO under the ER Project. The calculated dose for the MEI was 0.024 millirem per year, which is approximately 400 times less than the 10 millirem per year standard set by the EPA. Based on this value, an annual dose assessment is not required to be calculated for the TTR site. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension (TTR 2006).

The 0.024 millirem dose rate is a NESHAPs compliance calculation (e.g., 10 millirem per year limit). The calculation is based on a MEI located at the TTR Airport (the highest calculated dose for a member of the public). This calculation only accounts for radionuclide air emissions. The 1,000 picocuries per gram level equates to a less than 25 millirem per year dose to the MEI for the specific military land use scenario. This calculation includes inhalation, ingestion, and external exposure pathways.

The 0.024 millirem dose rate and the 1,000 picocuries per gram are separate numbers with no correlation to how each was developed.

4.4.4.1.4 Non-radiological Air Emissions

The TTR Class II Air Quality Operating Permit was renewed in CY 2006. There are currently two sources that are not exempt at the facility, including the screening plant and the portable screen (TTR 2006). In 2005, the reported emissions from TTR activities were 0.001 tons per year of total particulate matter from the permitted portable screen.

4.4.4.2 Noise

The acoustic environment around the TTR and the NTTR Complex can be classified as uninhabited desert or small rural communities. The primary source of noise on the TTR and the NTTR Complex is from the DOE and USAF aircraft operations and ordnance testing. The highest levels of noise are centered on the flight lines, with noise levels decreasing for sites or receptors located away from the flight line (USAF 2006). Because the public is prohibited from entering the TTR and the NTTR Complex, public exposure to these noise sources is limited to occasional sonic booms produced by supersonic overflights of military aircraft (DOE 1996b).

4.4.5 Water Resources

4.4.5.1 Surface Water

There is no permanent surface water in Cactus Flat and few springs in surrounding ranges. Surface flow occurs only during and immediately after heavy rains. Drainage is internal, direct toward playas by sandy ephemeral washes. Playas such as Antelope Lake and Main Lake may contain water for brief periods during water years, but seldom, if ever, contain water year-round. Drainage patterns within and near TTR are intermittent and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat where there is a string of north-south trending dry lakebeds (URS 2001).

There are several small springs within the Cactus and Kawich Ranges. Three springs occur within TTR boundaries: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration (TTR 2006).

4.4.5.1.1 Surface Water Quality

The quality of surface water on the TTR is generally good and is suitable for domestic purposes, livestock, wild horse, and wildlife use. Waste monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2005. However additional monitoring for Di (2-ethylhexyl) Phthalate was required by the state because it was detected above the detection limit in a sample. The result was below the MCL.

At TTR, wastewater is discharged to the sewer system connected to the USAF sewage lagoon and to six septic tank systems. There were no excursions or other permit violations in 2005 with respect to wastewater discharges.

4.4.5.1.2 Surface Water Rights and Permits

The TTR site is primarily a closed basin with runoff evaporating or infiltrating to the ground. The USAF has permitted its airfield and Area 10 for storm water runoff. Defense-related surface water rights represent approximately 148 acre-feet. Currently, Sandia Corporation has no requirement to perform storm water monitoring at TTR. All storm water issues and monitoring are managed by the USAF (TTR 2006).

4.4.5.2 Groundwater

The TTR encompasses portions of 5 hydrographic basins that comprise portions of 2 regional groundwater flow systems. Past DOE operations have been concentrated in two areas: in the lowland portions of Cactus Flat and in Stonewall Flat. Groundwater that originates as precipitation over the Kawich Range flows west and then southwest under the TTR, ultimately discharging in Death Valley as springs and evapotranspiration. Some groundwater may flow northwest off the TTR and into the Southern Marshes flow system, with discharge at Mud Lake, Alkali Flat, and Clayton Valley (DOE 1996b).

TTR obtains its water from local wells. The USGS has recorded groundwater depths from 21 to 454 feet at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 feet and at 454 feet near the TTR Airport. The depth to groundwater at the north end of the site is approximately 131 feet. Just south of the north end of the site, groundwater is encountered at 361 to 394 feet. The static water level at the main water supply well is approximately 350 feet (TTR 2006).

The shallowest groundwater known in the Cactus Flat is present at a depth of 45 feet in SNL Well 1. This appears to be a perched water table in alluvial fan sediments, since deeper sediments were dry. Well 6 serves as the potable supply well for SNL facilities. SNL Well 8, about 4 miles south of Area 3, produces water at low rates from alluvial sediments. It serves to supply water only for construction and dust control.

4.4.5.2.1 Groundwater Quality

Groundwater has not been impacted by contaminants from any of the CAUs at the TTR. The depth to ground water (100 to over 500 feet), low rainfall, and high evaporation limit infiltration. The small quantities of liquid water that may have been disposed of or released will therefore attenuate in the soil and are unlikely to affect groundwater. Soil samples were sampled for explosive residues during UXO remedial activities. No reference can be found for groundwater sampling for perchlorate.

The nuclear safety tests conducted at the Clean Slate sites have resulted in surface soil contamination. Although groundwater contamination has not been detected at these sites, there is the potential for downward migration of some contaminants into the water table. Other potential sources of groundwater contamination include french drains, septic tanks and leachfields, underground storage tanks, landfills, and sewage lagoons (DOE 1996b). Radiological contaminants found on the surface due to nuclear safety tests conducted at the Clean Slate sites include plutonium isotopes, uranium isotopes, and daughter products.

4.4.5.2.2 Groundwater Availability

Groundwater at TTR has been used for domestic, industrial, and construction purposes. Groundwater is pumped from a number of wells, depending on the location of range activities and the total demand for water.

There are about 12,500 acre-feet per year of water rights in the five hydrographic basins associated with TTR. Almost 4,000 acre-feet per year of this total are surface water rights; the remainder (about 8,500 acre-feet) represents groundwater rights. Currently, defense-related Federal water rights total 1,775 acre-feet per year, of which only 148 acre-feet are surface water rights. Table 4.4.5-1 lists the water rights status for each of the basins that encompass portions of the TTR. Federal water rights are limited to two basins, Cactus Flat and Stone Cabin Valley. Both basins are over appropriated; i.e., the appropriations exceed the perennial yield in each basin. It is unlikely that additional water rights can be obtained in the area without groundwater mining (the removal of groundwater from storage).

Table 4.4.5- 1 — Water Rights Status for Hydrographic Basins at the TTR

Hydrographic Basin Number and Name	Perennial Yield (acre-feet)	Total Committed Groundwater Resources (acre-feet)	Comments
Ralston Valley	6,000	1,917	Basin designated by Order 742, Notice of Curtailment by Order 752. No TTR water rights or use.
Stonewall Flat	100	12	No TTR water rights or use.
Gold Flat	1,900	95	Estimated TTR water use in 1988 was 40 ac-ft.
Cactus Flat	300	619	Estimated TTR water use in 1988 was 160 ac-ft.
Stone Cabin Valley	2,000	2,033	Basin designated by Order 720. Estimated TTR water use in 1998 was 240 ac-ft

Source: DOE 1996b.

4.4.6 Geology and Soils

The TTR is situated in the Basin and Range physiographic province between the elevations of 5,500 and 7,800 feet. The TTR occupies the broad, nearly flat Cactus Flat valley between the Cactus Range on the west and the Kawich Range on the east. Valley floor elevations average about 5,300 feet above mean sea level. Elevations in the Cactus Range reach nearly 7,500 feet, and the Kawich Range has peaks that reach over 9,400 feet. The ranges are rocky, rugged, with steep slopes and cliffs. Valleys are narrow and have steep gradients, but generally drain only small watersheds.

4.4.6.1 Geology

The general geology of the area is comprised of two major geologic units, alluvium and volcanic rocks. Intrusive igneous rocks and a few isolated outcroppings of Paleozoic sediments occur in the Cactus Range.

Alluvial fans are present at the mouth of the range canyons. Fans commonly coalesce to form bajadas that slope from the range to the basin center. These landforms are characterized by relatively smooth surface of uniform gradient, usually between 2 percent and 6 percent. Older fans or bajadas may be incised by ephemeral streams (washes), with younger fans forming nearer to the valley center.

The total thickness of alluvium is unknown. Exploratory drilling in Cactus Flat indicates that the thickness exceeds 1,000 feet. The alluvium is primarily coarse- to medium-grained and is derived from the volcanic rocks of the highlands that have been transported by fluvial and eolian processes from the adjacent highlands.

Volcanic rocks of the Cactus and Kawich Ranges are estimated to be as thick as 20,000 feet (TTR 2006). The Tertiary volcanics are composed of a series of welded and nonwelded ash-flow tuffs and basalts, andesites, dacites, and rhyolites. The Kawich Range is bounded on the east by normal faults. The northern part of the range (adjacent to the TTR) is primarily composed of Tertiary tuffs, lavas, and intrusions of Miocene tuff. The Cactus Range is bounded by an elliptical ring of fractures that suggests a collapsed caldera. Some of these fractured areas were subsequently intruded with stocks, sills, and dikes. The central part of the range comprises minor Paleozoic sediments, a small granite mass, and a thick sequence of widespread Tertiary volcanic rocks. The hills to the south of Mellan comprise a series of lava ridges separated by valleys of tuff. The hills are capped with rubble formed from weathering and breccias in the lava piles, and breccias formed by the structural deformation (faulting and tilting) of the lava ridges (DOE 1996b).

The central axis of the Cactus Flat basin is marked by discontinuous series of playa (dry) lakes. Main Lake lies at the north end and Antelope Lake is at the south end of this group of playas. These playas collect water during wet periods. Playas drain largely by evaporation; there is no external drainage from Cactus Flat.

The geologic resources of the TTR include metals, industrial minerals, and aggregate. The TTR has been the site of historic mining at the Silver Bow, Antelope Springs, Cactus Springs,

Wilsons, and Mellan mining districts. The TTR is also adjacent to a number of other mining districts, most notably the Goldfield, Gold Crater, Golden Arrow, Stonewall, Gold Reed, and Jamestown districts. Appreciable quantities of silver and gold have been produced from the Silver Bow district. The Antelope Springs district produced silver and minor amounts of gold. The Cactus Springs district produced small quantities of silver, and there are reports of turquoise, gold, and copper in the area. The Wilsons district produced small quantities of gold and silver in the early 1900s. Minor production of gold and silver came from the Mellan district. Of these areas, only the Silver Bow district is classified as having high potential for locatable minerals (DOE 1996b).

Immediately to the east of the Goldfield district in the area between the TTR and Goldfield, there is moderate to high potential for the occurrence of quartz-alunite gold deposits. Although gold, silver, and lead have been produced from the Gold Crater and Stonewall districts, production from these areas had ceased by the mid-1930s, and the remaining potential for mineral resources is low.

No geothermal resources have been identified at TTR, and the potential for oil and gas resources is considered low. There are no reported occurrences of coal, tar sands, or oil shale on the TTR or adjacent areas on the NTTR Complex. Similarly, no economic deposits of industrial minerals have been identified. Tertiary volcanic rocks and tuffaceous sedimentary rocks of silicic compositions occur on the TTR and NTTR Complex. Uranium host environments are located elsewhere in the Great Basin, but have not been identified at TTR (DOE 1996b).

The aggregate resources of the TTR are considerable. Sand and gravel deposits are present, and the quality and quantity of these resources are likely to be sufficient to meet future demands for construction, roads, and other uses. The aggregate resources do not have any unique value compared to other areas throughout southern Nevada (DOE 1996b).

4.4.6.2 *Soils*

Approximately 15 percent of the soil survey is comprised of mountainous terrain with the remaining portion consisting of alluvial fans, ephemeral washes, valley floors, and dry lake beds. The soil parent material consists of a variety of igneous and sedimentary rock with rhyolitic tuffs and ignimbrite being the most common rock. The soils of the TTR and adjacent areas can be separated into four general categories based primarily upon the following physiographic position (DOE 1996b);

- Valley bottoms,
- Dry lake beds (i.e. playas),
- Upper erosional portion of the alluvial fans,
- Mountains and hills.

The valley bottom and dry lake bed soils occur in the central portions of both Cactus and Stonewall Flats. These very deep, poorly drained saline and alkali, fine-textured soils occur on slopes generally less than 1 percent. These low-lying areas are usually points of groundwater discharge. Therefore, depth to groundwater is usually fairly shallow and is manifested by

discharging springs or plants that indicate in shallow water table (i.e., usually within 50 feet below ground surface). These plants are called phreatophytes with greasewood being the most common in the area. There is periodic flooding from runoff and the shrink-swell potential is generally high due to the abundance of smectitic clays. This can present problems with most construction projects. The corrosion hazard for steel and concrete is high due to the high concentrations of salts. Soil families include Typic Salorthids (e.g., Saltair soil series) and Typic Haplaquolls (e.g., Hutton soil series).

The lower, depositional portion of the alluvial fan consists of deep to very deep, well-drained, very coarse (coarse sand) to medium-textured (very fine sandy loam/loam) gravelly soils that occur on slopes ranging from gently sloping 2 to 4 percent) to strongly sloping (8 to 15 percent) slopes. The coarser-textured, very gravelly to extremely gravelly soils are located in the ephemeral washes (i.e., arroyos) and are subject to periodic flash floods.

The upper, erosional portion of the alluvial fan consists of older, very shallow (less than 10 inches thick) to moderately deep (between 20 and 40 inches in thickness) moderate to well drained, very coarse (coarse sand) to medium textured (very fine sandy loam/loam) gravelly to extremely stony soils. Some soils contain an old, well developed, fine textured (i.e., high in clay) subsoil called an argillic horizon. The presence of a duripan is common and is usually found between 15 and 30 inches) below the ground surface, however, in some areas may be exposed at the surface. Slopes range from moderately sloping (4 to 8 percent) to moderately steep (15 to 30 percent). Soil families include Xerollic Durorthids (e.g., Ursine soils series) and Xerollic Duragids (e.g., Ratto, Olson, Indian Creek, and Deer Lodge soil series) (DOE 1996b).

The upland mountains and hills consist of rock outcrops, areas with excessive stone, or very steep eroded slopes that generally contain a thin mantle of alluvial or colluvial soils usually less than 10 inches. These soils can range in texture from coarse to fine, gravelly to extremely stony, and are dependent upon primarily age and parent material for textural composition. Slopes generally range from moderately steep (15 to 30 percent slopes) to extremely steep (greater than 75 percent). These soils usually have a severe erosion hazard because of their slopes and runoff is generally rapid.

4.4.6.2.1 Past Soil Contamination

The historical impacts on soils as a result of past actions have been considerable and, in some instances, these impacts are considered significant. Lesser impacts include excavation of soils for roads and structures, alteration in nature drainages and erosion regimes, and the contamination of soils. This section describes the baseline soils conditions at the TTR.

The TTR was never used for detonation of nuclear weapons. However, in 1963 the AEC carried out project Roller Coaster. This operation involved four nuclear weapons destruction tests that dispersed plutonium in TTR soils with conventional explosives. Three of these tests were performed within the TTR boundary. The fourth was conducted at NTTR. These were formally titled Storage-Transportation tests that were conducted to evaluate the safety of nuclear weapons in storage or transportation accident scenarios. All of the Project Roller Coaster tests had zero yield. The safety tests used mixtures of plutonium and uranium that were subjected to

detonations of conventional explosives. Concurrent with and after these detonations, extensive studies were conducted to understand the dispersal and transport of these isotopes in the environment, including uptake by plants and animals. The immediate effects of the tests included the dispersal of plutonium and uranium over significant areas. On the TTR, almost 670 acres were contaminated, with an estimated remaining inventory of about 65 curies.

The three Project Roller Coaster test sites at TTR are referred to as Clean Slate 1, 2, and 3 (Figure 4.4.6-1). The fourth test site at NTTR is referred to as Double Tracks. In 1996, Double Tracks was closed after soil contamination was remediated to a level of 350 picocuries per gram and less than 25 millirem per year dose rate. The 350 picocuries per gram remediation is based on the farmer rancher land use scenario. The 25 millirem per year dose is DOE's recommended release criteria for real property.

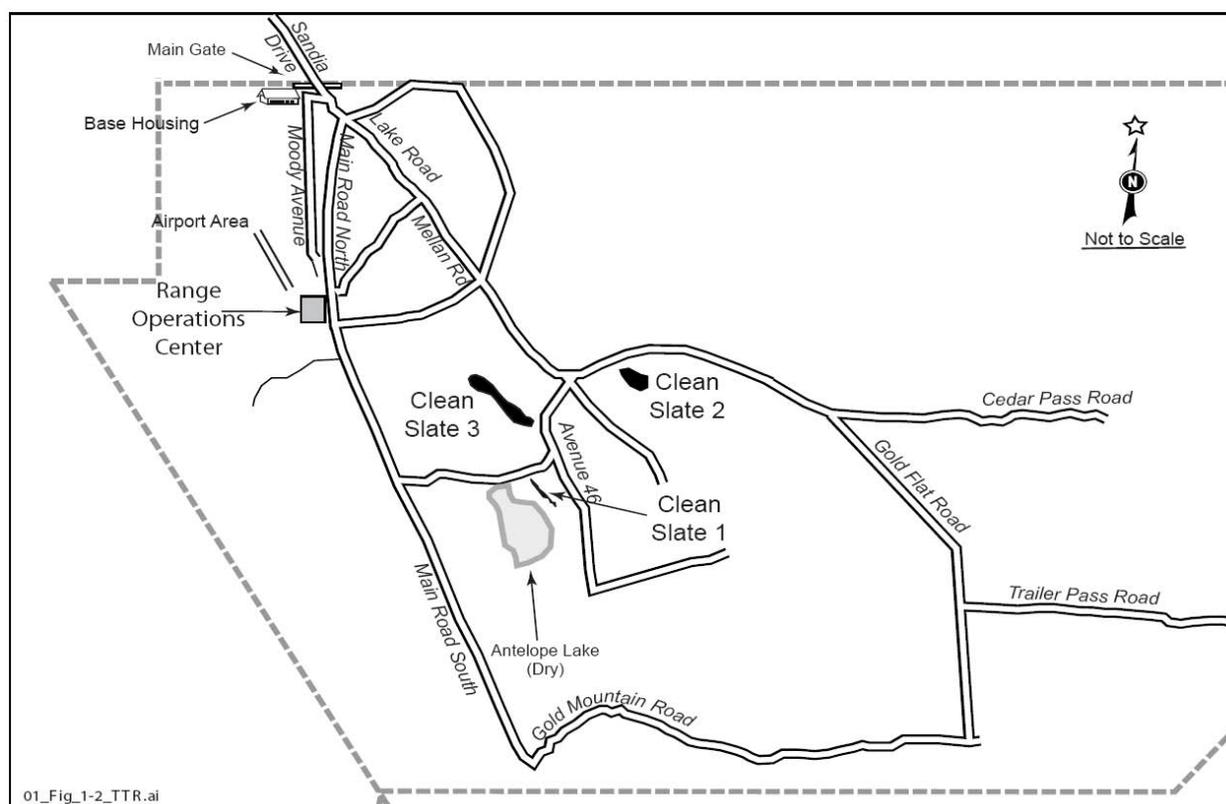


Figure 4.4.6-1 — Clean Slate 1, 2, and 3

The Double Tracks Test was conducted in the North Range of NTTR, west of TTR. An environmental assessment analyzing the potential environmental effects of four remediation alternatives was completed for the Double Tracks Site in April, 1996. During preliminary characterization at the site, several pieces of highly radioactively contaminated metal were located, retrieved, and placed in a drum at the site. Between 998 and 1,588 g (2.2 and 3.5 lbs) of plutonium were spread during the test. The recent work has shown that contamination of 200 picocuries per gram or higher, affects approximately 2.5 acres. A single plutonium dispersal test conducted in 1957, referred to as Project 57 was conducted on the NAFR Complex in Area 13 (DOE 1996b).

DOE/NNSA/NSO is responsible for the closure of these and all other ER Program sites at TTR. The initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 micrograms per square meter of plutonium. The soil survey was conducted on 61-meter grids with a hand-held survey meter or field instrument for the detection of low-energy radiation. In 1973, additional outer fences were set at 40 picocuries per gram of plutonium in soil also using the hand-held meter method. Areas are evaluated and fences inspected periodically to monitor and curtail potential migration. Horses found within the fenced areas are relocated (TTR 2006).

In 1993, an aerial radiological survey was performed by EG&G, Inc. for the Nevada Applied Ecology Group (NAEG) (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The objective was to determine the extent of surficial distribution of plutonium and other transuranic elements dispersed during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is approximately 4,900 acres. The results of the survey found transuranic contamination outside the fenced area in the downwind direction (TTR 2006). An additional radiological survey was performed in 2006. This survey showed that no additional radiological migration had occurred since the 1993 survey (TTR 2006).

These long-lived radionuclides remain today in the surficial soils in the vicinity of the test areas and are available to be transported by wind and uptake by plants and animals. Extensive research into the mobility of the isotopes has found that wind can transport the contaminants and concentrate them in mounds around desert shrubs, and water can cause plutonium to migrate deeper into the soils with time. The isotopes are now relatively immobile unless the soils are disturbed (URS 2001).

A strategy for closing the radiologically contaminated soils at TTR is in development. Appropriate corrective action levels for radionuclides will be based on a 25 millirem per year dose rate, and will be compatible with future land use scenarios.

Clean Slate 1 is located in the central area of TTR and has been cleaned up to a corrective action level of 350 picocuries per gram and less than 25 millirem per year dose rate. The 350 picocuries per gram remediation is based on the farmer rancher land use scenario. The 25 millirem per year dose is DOE's recommended release criteria for real property.

Clean Slate 2 is located in the northeaster area of TTR and is in a stable configuration awaiting completion of the closure strategy. Clean Slate 3 is located in the south central part of TTR and is in a stable configuration awaiting completion of the closure strategy. As planned, the remediation efforts will be at or below the 1,000 picocuries per gram level at completion.

The 1,000 picocurie standard was an interim clean up standard based on current land use scenarios and does not reflect final clean up requirements. Although costs estimates have been developed for the 1,000 picocuries per gram level, the requirements for cleanup have not been identified by either the Air Force or the Bureau of Land Management (BLM). If cleaned up to

this level, the remaining 17 and 18 acres, respectively, will be at or below the 1,000 picocuries per gram level (NTS 2006, TTR 2006).

Assessment activities are expected to continue through FY 2022 with an estimated remediation deadline of FY 2022 (EMIS Life Cycle Baseline Rev 7).

4.4.6.3 *Seismicity*

The eastern part of the TTR is located within Seismic Zone 2B, as defined in the Uniform Building Code (ICBO 1991). The western part of the TTR is located within Seismic Zone 3. Zone 2B is defined as an area with moderate damage potential, and Zone 3 is an area with major damage potential. Current design practices require facilities to be built to Seismic Zone 4 standards (DOE 1996b).

Seismic activity in the region has recently been characterized. Naturally occurring seismic events are associated with extensional tectonic activity characteristic of the province. Three major fault zones in the region may be currently active: Mine Mountain, Cane Spring, and Rock Valley. Small earthquakes recently occurred at or near the Cane Spring Fault zone and the Rock Valley Fault zone, although no surface displacement was associated with either of these earthquakes (DOE 1996b). A fault near Little Skull Mountain in the southwest part of the NTS was the site of a 5.6 magnitude earthquake in 1992. According to the USGS Earthquake database, since 1973 there have been 714 earthquakes within a 62 mile radius (DOE 1996b).

Additionally, the Yucca Fault in Yucca Flat weapons test basin has been active in the recent geologic past. This fault displaces surface alluvium by as much as 60 feet. Displacement of this young surface alluvium indicates that movement on Yucca Fault has occurred within the last few thousand to tens of thousands of years; subsurface displacement along this fault is 700 feet. The Carpetbagger Fault lies west of the Yucca Fault within Yucca Flat weapons test basin. In the subsurface, this fault shows about 2,000 feet of displacement in the past 7.5×10^6 years (DOE 1996b).

4.4.7 *Biological Resources*

4.4.7.1 *Terrestrial Resources*

Temperature extremes and arid conditions of the high desert limit vegetation coverage at TTR. Sparse vegetation that occurs in Cactus Flat is predominantly range grasses and low shrubs typical of the Great Basin Desert flora (TTR 2006).

Vegetation is divided into two basic types at TTR by elevation, salt desert shrub (low elevations) and northern desert shrub (higher elevations) (TTR 2006). Salt desert shrub is characteristic of poorly drained soils and is common along dry lakebeds. Table 4.4.7-1 includes common plant groups and characteristics for basic vegetation types found at TTR.

Table 4.4.7-1 — Specific Plants and Characteristics of Basic Vegetation Types at TTR

Vegetation Type	Common Species of Plants	Location Characteristics
Salt Desert Shrub	<i>Atriplex confertifolia</i> (shadscale) <i>Salsola kali</i> (Russian thistle) <i>Artemesia tridentate</i> (sagebrush)	Characteristic of poorly drained soils and is common along dry lakebeds
Northern Desert Shrub	Variety of sagebrush <i>Chrysothamnus nauseosus</i> (rabbitbrush) <i>Elymus longifolius</i> (squirrel tail) <i>Juniperus spp.</i> (juniper) <i>Poa nevadensis</i> (bluegrass)	Found in the Cactus Range

Source: TTR 2006.

The Nevada Wild Horse Range and other wild horse land-use areas compose a significant portion of Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. Hundreds of wild horses graze freely throughout TTR and activities onsite have had little effect on the horse population or their grazing habits (TTR 2006).

Other animals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*), mountain lion (*Felis concolor*) and burros (*Equus asinus*) (TTR 2006).

4.4.7.2 Wetlands and Floodplains

4.4.7.2.1 Wetlands

TTR is located in an enclosed hydrographic basin with no connections to navigable waters of the U.S. No natural surface water resources are found in the area (USAF 2006). There are no significant wetlands at TTR, however, some very limited wetlands exist in the vicinity of several springs within the Cactus and Kawich Ranges. These provide an important source of drinking water for wildlife in the area. Three springs occur within TTR boundaries; Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration (TTR 2006).

4.4.7.2.2 Floodplains

There are no floodplains at TTR (TTR 2006).

4.4.7.3 Aquatic Resources

No natural surface water resources are found in the area (USAF 2006). There are no federally designated Wild and Scenic Rivers onsite. There are several small springs within the Cactus and Kawich Ranges. Three springs occur within TTR boundaries: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration (TTR 2006). The habitat at TTR is not suitable to support aquatic species.

4.4.7.4 Threatened and Endangered Species

There are 16 species of plants, 1 species of insect, 15 species of fish, 2 species of amphibians, 2 species of reptiles, 4 species of mammals, and 35 species of birds that are Federal and/or state protected occurring within Nye County (TTR 2006). No current Federal threatened, endangered, or candidate plant or animal species have been observed on the TTR. A majority of the habitat found at TTR is not suitable for the Federal or state listed species of concern present in Nye County (TTR 2006). Bald eagles and peregrine falcons may be rare migrants. Table 4.4.7-2 displays a list of species potentially occurring in Nye County.

Table 4.4.7-2 — Federal and State Listed Species Occurring within Nye County and having the Potential to Occur at TTR

Common Name	Scientific Name	Federal Status	State of Nevada Status
PLANTS			
Sodaville Milkvetch	<i>Astragalus lentiginosus var. sesquimetralis</i>	---	State Protected
Halfring Milkvetch	<i>Astragalus mohavensis var hemigyryus</i>	SOC	State Protected
Ash Meadows Milkvetch	<i>Astragalus phoenix</i>	Threatened	State Protected
Armored Hedgehog Cactus	<i>Echinocereus engelmannii var. armatus</i>	---	State Protected
Ash Meadows Sunray	<i>Enceliopsis nudicaulis var. corrugata</i>	Threatened	State Protected
Mojave Barrel Cactus	<i>Ferocactus cylindraceus var. lecontei</i>	---	State Protected
Sunnyside Green Gentian	<i>Frasera gypsicola</i>	SOC	State Protected
Ash Meadows Gumplant	<i>Grindelia fraxinopratenensis</i>	Threatened	State Protected
Ash Meadows Mousetails	<i>Ivesia kingii var. eremica</i>	Threatened	State Protected
Ash Meadows Blazingstar	<i>Mentzelia leucophylla</i>	Threatened	State Protected
Amargosa Niterwort	<i>Nitrophila mohavensis</i>	Endangered	State Protected
Sand Cholla	<i>Opuntia pulchella</i>	---	State Protected
Williams Combleaf	<i>Polycytenium williamsiae</i>	---	State Protected
Blaine Pincushion	<i>Sclerocactus blainei</i>	SOC	State Protected
Tonopah Pincushion	<i>Sclerocactus nyensis</i>	---	State Protected
Hermit Cactus	<i>Sclerocactus polyancistrus</i>	---	State Protected
INSECTS			
Ash Meadows Naucorid	<i>Ambrysus amargosus</i>	Threatened	---
FISH			
White River Desert Sucker	<i>Catostomus clarki intermedius</i>	SOC	State Protected
Moorman White River Springfish	<i>Crenichthys baileyi thermophilus</i>	SOC	State Protected
Railroad Valley Springfish	<i>Crenichthys nevadae</i>	Threatened	State Protected
Devils Hole Pupfish	<i>Cyprinodon diabolis</i>	Endangered	State Protected
Ash Meadows Amargosa Pupfish	<i>Cyprinodon nevadensis mionectes</i>	Endangered	State Protected
Warm Springs Amargosa Pupfish	<i>Cyprinodon nevadensis pectoralis</i>	Endangered	State Protected
Pahrump Poolfish	<i>Empetrichthys latos latos</i>	Endangered	State Protected
White River Spinedace	<i>Lepidomeda albivallis</i>	Endangered	State Protected
Moapa Dace	<i>Moapa coriacea</i>	Endangered	State Protected
Lahontan Cutthroat Trout	<i>Oncorhynchus clarki henshawi</i>	Threatened	State Protected
Big Smoky Valley Speckled Dace	<i>Rhinichthys osculus lariversi</i>		State Protected
Ash Meadows Speckled Dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	State Protected
Big Smokey Valley Tui Chub	<i>Siphateles bicolor ssp. 8</i>	SOC	State Protected
Hot Creek Valley Tui Chub	<i>Siphateles bicolor ssp. 5</i>	SOC	State Protected

Table 4.4.7-2 — Federal and State Listed Species Occurring within Nye County and having the Potential to Occur at TTR (continued)

Common Name	Scientific Name	Federal Status	State of Nevada Status
Little Fish Lake Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 4	---	State Protected
Railroad Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 7	SOC	State Protected
AMPHIBIANS			
Amargosa Toad	<i>Bufo nelsoni</i>	---	State Protected
Columbia Spotted Frog	<i>Rana luteiventris</i> pop 3	Candidate	---
REPTILES			
Banded Gila Monster	<i>Heloderma suspectum cinctum</i>	SOC	State Protected
Desert Tortoise (Mojave Desert pop.)	<i>Gopherus agassizii</i>	Threatened	State Protected
MAMMALS			
Spotted Bat	<i>Euderma maculatum</i>	SOC	State Protected
Pygmy Rabbit	<i>Brachylagus idahoensis</i>	SOC	State Protected
American Pika	<i>Ochotona princeps</i>	---	State Protected
Kit Fox	<i>Vulpes macrotis</i>	---	State Protected
BIRDS			
Northern Goshawk	<i>Accipiter gentilis</i>	SOC	State Protected
Golden Eagle	<i>Aquila chrysaetos</i>	---	State Protected
Long-eared Owl	<i>Asio otus</i>	---	State Protected
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>	SOC	State Protected
Juniper Titmouse	<i>Baeolophus griseus</i>	---	State Protected
Ferruginous Hawk	<i>Buteo regalis</i>	SOC	State Protected
Swainson's Hawk	<i>Buteo swainsoni</i>	---	State Protected
Sage Grouse	<i>Centrocercus urophasianus</i>	---	State Protected
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	Threatened	State Protected
Mountain Plover	<i>Charadrius montanus</i>	Proposed Threatened	State Protected
Black Tern	<i>Chlidonias niger</i>	SOC	State Protected
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate	State Protected
Yellow Warbler	<i>Dendroica petechia</i>	---	State Protected
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	State Protected
Prarie Falcon	<i>Falco mexicanus</i>	---	State Protected
Common Yellowthroat	<i>Geothlypis trichas</i>	---	State Protected
Greater Sandhill Crane	<i>Grus canadensis tabida</i>	---	State Protected
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	---	State Protected
Yellow-breasted Chat	<i>Icteria virens</i>	---	State Protected
Western Least Bittern	<i>Ixobrychus exilis hesperis</i>	SOC	State Protected
Loggerhead Shrike	<i>Lanius ludovicianus</i>	SOC	State Protected
Lewis' Woodpecker	<i>Melanerpes lewis</i>	---	State Protected
Long-billed Curlew	<i>Numenius americanus</i>	---	State Protected
Macgillivray's Warbler	<i>Oporornis tolmiei</i>	---	State Protected
Mountain Quail	<i>Oreortyx pictus</i>	---	State Protected
Flammulated Owl	<i>Otus flammeolus</i>	---	State Protected
Osprey	<i>Pandion haliaetus</i>	---	State Protected
Phainopepla	<i>Phainopepla nitens</i>	---	State Protected
White-faced Ibis	<i>Plegadis chihi</i>	SOC	State Protected

Table 4.4.7-2 — Federal and State Listed Species Occurring within Nye County and having the Potential to Occur at TTR (continued)

Common Name	Scientific Name	Federal Status	State of Nevada Status
BIRDS (continued)			
Vesper Sparrow	<i>Poocetes gramineus</i>	---	State Protected
Yuma Clapper Rail	<i>Rallus longirostris yumanensis</i>	Endangered	State Protected
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	---	State Protected
Crissal Thrasher	<i>Toxostoma crissale</i>	---	State Protected
Orange-crowned Warbler	<i>Vermivora celata</i>	---	State Protected
Lucy's Warbler	<i>Vermivora luciae</i>	---	State Protected
Grey viero	<i>Vireo vicinior</i>	---	State Protected

Source: TTR 2006
SOC - Species of Concern

4.4.7.5 *Biological Monitoring and Abatement*

Terrestrial surveillance is conducted at TTR to detect the possible migration of contaminants to off-site locations. Terrestrial surveillance began at TTR in 1992. In addition to routine sampling, a large-scale baseline sampling was performed in 1994 (TTR 2006).

Routine terrestrial surveillance is conducted at onsite, perimeter, and off-site locations that remain essentially the same from year to year. Soil is the only terrestrial medium sampled at TTR since there are no bodies of water (other than the playa lakes) and vegetation is scarce.

Samples are generally collected from fixed locations to effectively make statistical comparisons with results from previous years. The results of the statistical analyses allow for prioritization of sample locations for possible follow-up action. To date, there have been no terrestrial sample results that have indicated a significant level of concern that would trigger actions at locations that are not already being addressed by environmental restoration projects (TTR 2006).

4.4.8 **Cultural and Archaeological Resources**

TTR is within an area considered by descendants of the tribes who called the area home as primarily occupied by the Shoshone cultural group. The Cactus Flat Valley and Gold Flat zones that surround TTR possesses a relative paucity of food and water sources which would have attracted concentrated ceremonial, habitation, and hunting uses (TTR 2006).

In 2004, DOE/NNSA/SSO initiated a consultation with the SHPO on 212 buildings at TTR. The SHPO could not concur with the DOE determination of eligibility for the 212 buildings because of deficiencies in the submitted report. Consultation is ongoing.

A consultation with the Nevada SHPO for rebuilding the TTR power system was initiated in 2004. A cultural resource inventory was completed following an intensive archeological and historic inventory of the proposed project area. No historic properties were found within the proposed project area. As a result, in January 2005, the SHPO concurred with DOE/NNSA/SSO determination that no historic properties would be affected by the proposed project (TTR 2006).

In August 2007, NAFB released the *Integrated Cultural Resources Management Plan (ICRMP)* to research and address Section 110 of the *National Historic Preservation Act*. TTR was investigated as part of the ICRMP. At the time of the release of the ICRMP, 7,973 acres at TTR had been surveyed and 406 sites inventoried. In addition, a historic building inventory at TTR was expected to begin work in 2007 (NAFB 2006).

4.4.9 Socioeconomic Resources

Socioeconomic characteristics addressed at TTR include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current TTR employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

TTR is located in Nye County, Nevada. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Nye and Esmeralda Counties. Figure 4.4.9-1 presents a map of the counties composing the TTR ROI.

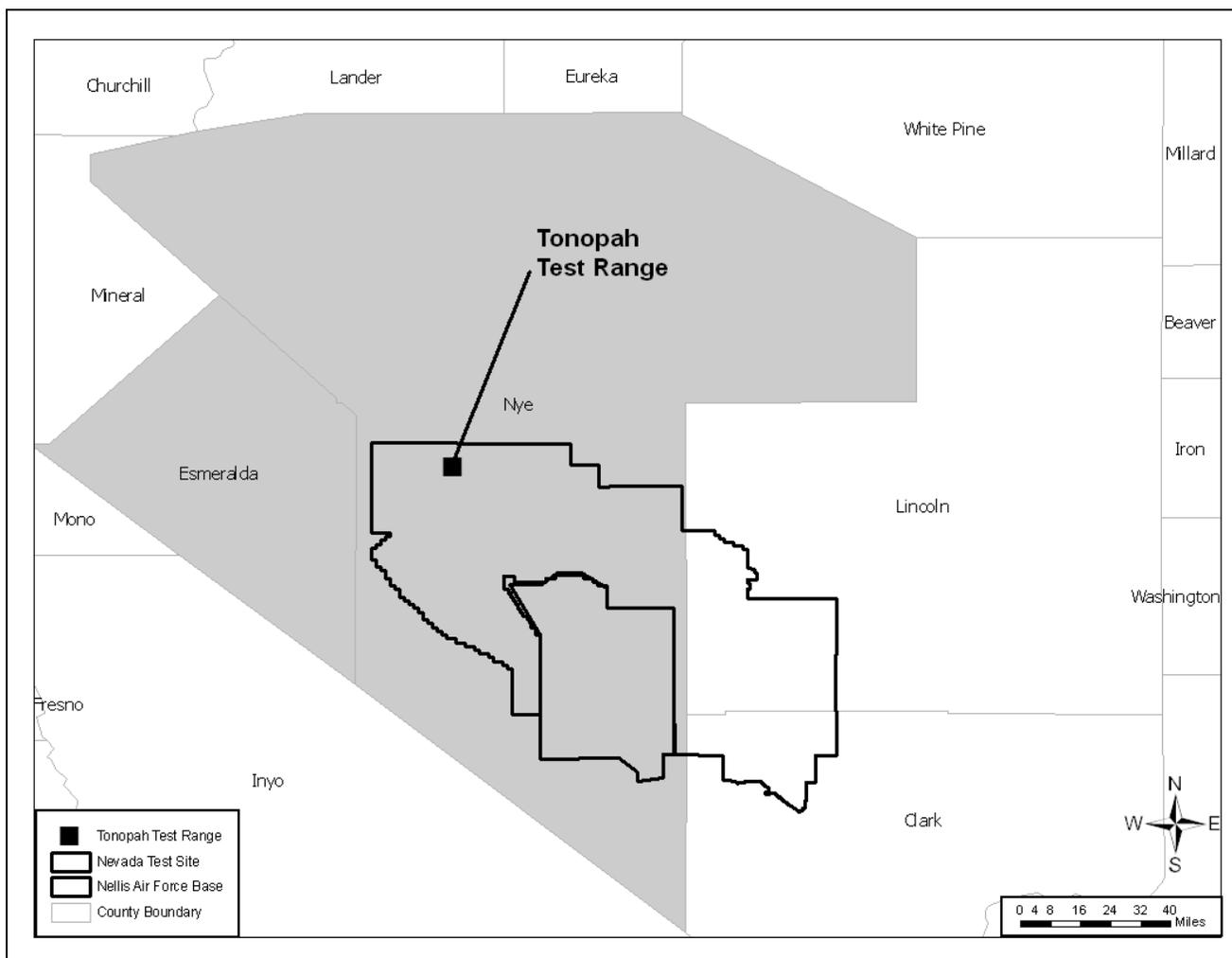


Figure 4.4.9-1 — Region of Influence for TTR

4.4.9.1 *Employment and Income*

Labor force statistics are summarized in Table 4.4.9-1. The civilian labor force of the ROI grew by approximately 16 percent from 14,573 in 2000 to 16,857 in 2005. The overall ROI employment experienced a growth rate of nearly 17 percent with 13,571 in 2000 to 15,912 in 2005 as presented in Table 4.4.9-1 (BLS 2007).

The ROI unemployment rate was 6.9 percent in 2000 and 5.6 percent in 2005. In 2005, unemployment rates within the ROI were 4.8 in Esmeralda County and 5.6 in Nye County. The unemployment rate in Nevada in 2005 was 5.3 percent (BLS 2007).

Table 4.4.9-1 — Labor Force Statistics for ROI and Nevada

	ROI		Nevada	
	2000	2005	2000	2005
Civilian Labor Force	14,573	16,857	852,293	915,489
Employment	13,571	15,912	810,024	867,317
Unemployment	1,002	945	42,269	48,172
Unemployment Rate	6.9	5.6	5.0	5.3

Source: BLS 2007.

Income information for the TTR ROI is provided in Table 4.4.9-2. Nye County is at the high end of the ROI with a median household income in 2004 of \$41,025 and at the low end of per capita income with a per capita income of \$33,049. Esmeralda County had a median household income of \$37,283 and a per capita income of \$34,534 (BEA 2007).

Table 4.4.9-2 — Income Information for the TTR ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Nye	33,049	41,025
Esmeralda	34,534	37,283
Nevada	34,021	49,894

Source: BEA 2007.

4.4.9.2 *Population and Housing*

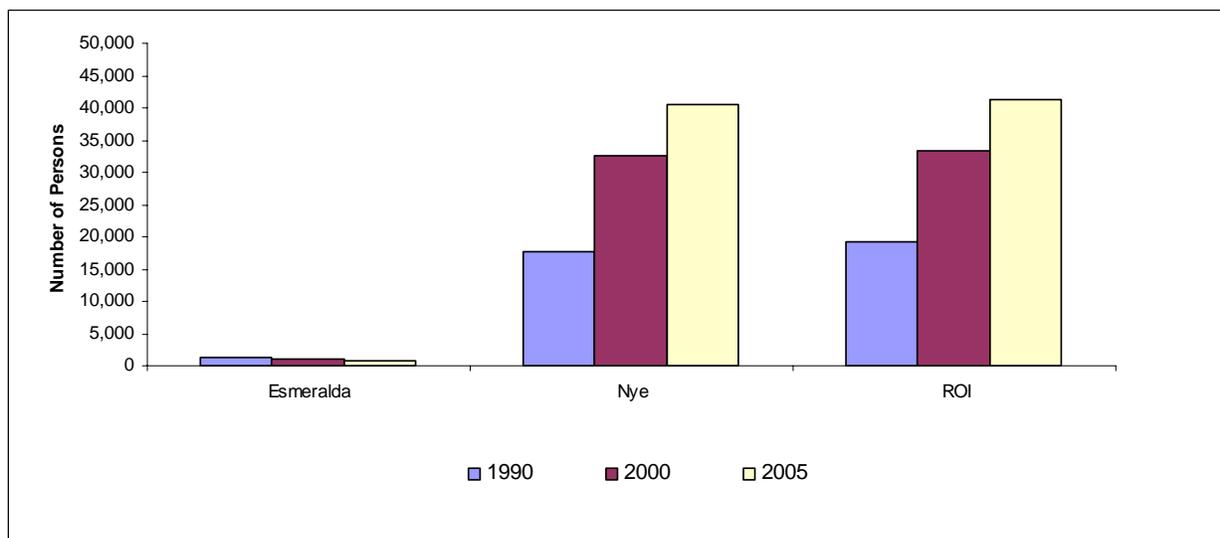
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-3 presents historic and projected population in the ROI and the state.

Table 4.4.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Esmeralda	1,344	971	805	1,076	1,169
Nye	17,781	32,485	40,395	44,985	51,283
ROI	19,125	33,456	41,200	46,061	52,452
Nevada	1,515,069	1,819,046	1,925,985	2,690,078	2,910,959

Source: USCB 2007.

The ROI population increased by 75 percent between 1990 and 2000. Esmeralda County had a 17 percent decrease in population and Nye County had a 24 percent population growth between 2000 and 2005 (USCB 2007). Nye County had 40,395 people while Esmeralda County had a population of 805 in 2005 (USCB 2007). Figure 4.4.9-2 presents the trends in population within the TTR ROI.



Source: USCB 2007.

Figure 4.4.9-2 — Trends in Population for TTR ROI, 1990-2005

Table 4.4.9-3 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 16,767 with 13,764 occupied (82 percent). There were 10,472 owner-occupied housing units and 3,292 rental units. The median value of owner-occupied units in Nye County was the greatest of the counties in the TTR ROI (\$122,100). The vacancy rate in Esmeralda County was 45.4 percent and 16.5 in Nye County (USCB 2007).

Table 4.4.9-4 — Housing in the TTR ROI

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Unites (dollars)
Esmeralda	833	455	305	150	378	45.4	75,600
Nye	15,934	13,309	10,167	3,142	2,625	16.5	122,100
ROI	16,767	13,764	10,472	3,292	3,003	17.9	120,745

Source: USCB 2007.

4.4.9.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. Educational services are provided for approximately 6,211 students by an estimated 374 teachers in the ROI (IES 2006c). The student-to-teacher ratio in the Nye County School District was 17:1 during the 2005 to 2006 school year, while the

Esmeralda County School District had a student-to-teacher ratio of 11:1. The student-to-teacher ratio for the ROI was 17:1 (IES 2006c).

The counties within the ROI employ approximately 18,700 firefighters and law enforcement officers. There is one hospital in the ROI with 44 beds (ESRI 2007).

4.4.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of TTR. Figure 4.4.10-1 shows counties potentially at risk from the current missions performed at TTR. Two counties are included in the potentially affected area. These counties include Esmeralda and Nye Counties. Table 4.4.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

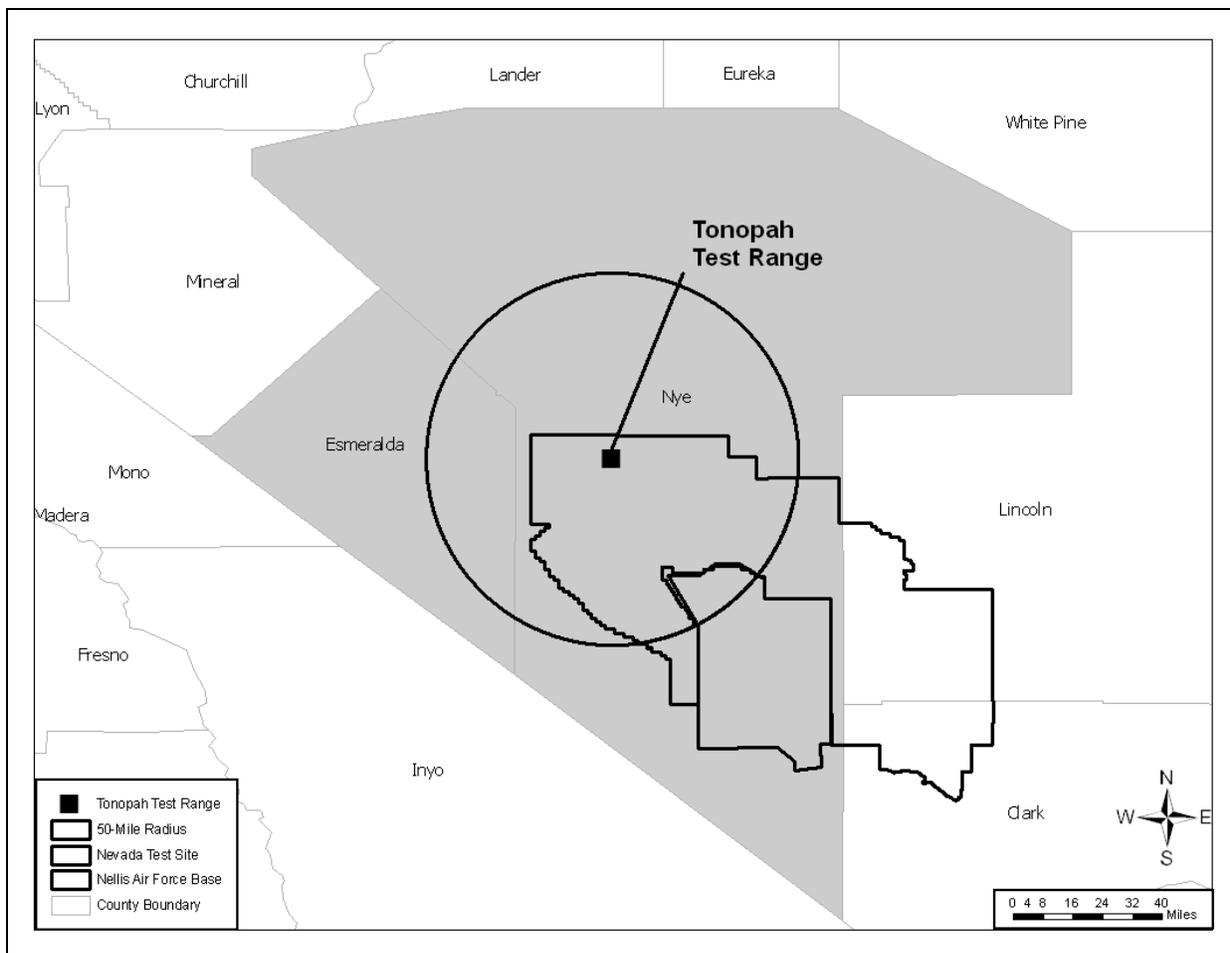


Figure 4.4.10-1 — Potentially Affected Counties Surrounding TTR

Table 4.4.10-1 — Demographic Profile of the Potentially Affected Area Surrounding TTR, 2000

Population Group	Population	Percent
Total Minority	5,164	15.4
Hispanic alone	1,621	4.8
Black or African American	384	1.1
American Indian and Alaska Native	686	2.1
Asian	253	0.8
Native Hawaiian and Other Pacific Islander	107	0.3
Some other race	1,043	3.1
Two or more races	1,070	3.2
White alone	28,292	84.6
Total Population	33,456	100

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 15.4 percent of the total population. Hispanic residents are the largest group within the minority population. As a percentage of the total resident population in 2000, Nevada had a minority population of 34.8 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts with minority populations exceeding 50 percent were considered minority census tracts. Based on 2000 census data, Figure 4.4.10-2 shows minority census tracts within the 50-mile radius where more than 50 percent of the census tract population is minority.

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.4.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tract population is living below the Federal poverty threshold.

According to 2000 census data, approximately 3,600 individuals residing within census tracts in the 50-mile radius of TTR were identified as living below the Federal poverty threshold, which represents approximately 11 percent of the census tract population within the 50-mile radius. There were no census tracts within the 50-mile radius where more than 50 percent of the census tract population was identified as living below the Federal poverty threshold. In 2000, 10.5 percent of individuals for whom poverty status is determined were below the poverty level in Nevada and 12.4 percent in the U.S. (USCB 2007).

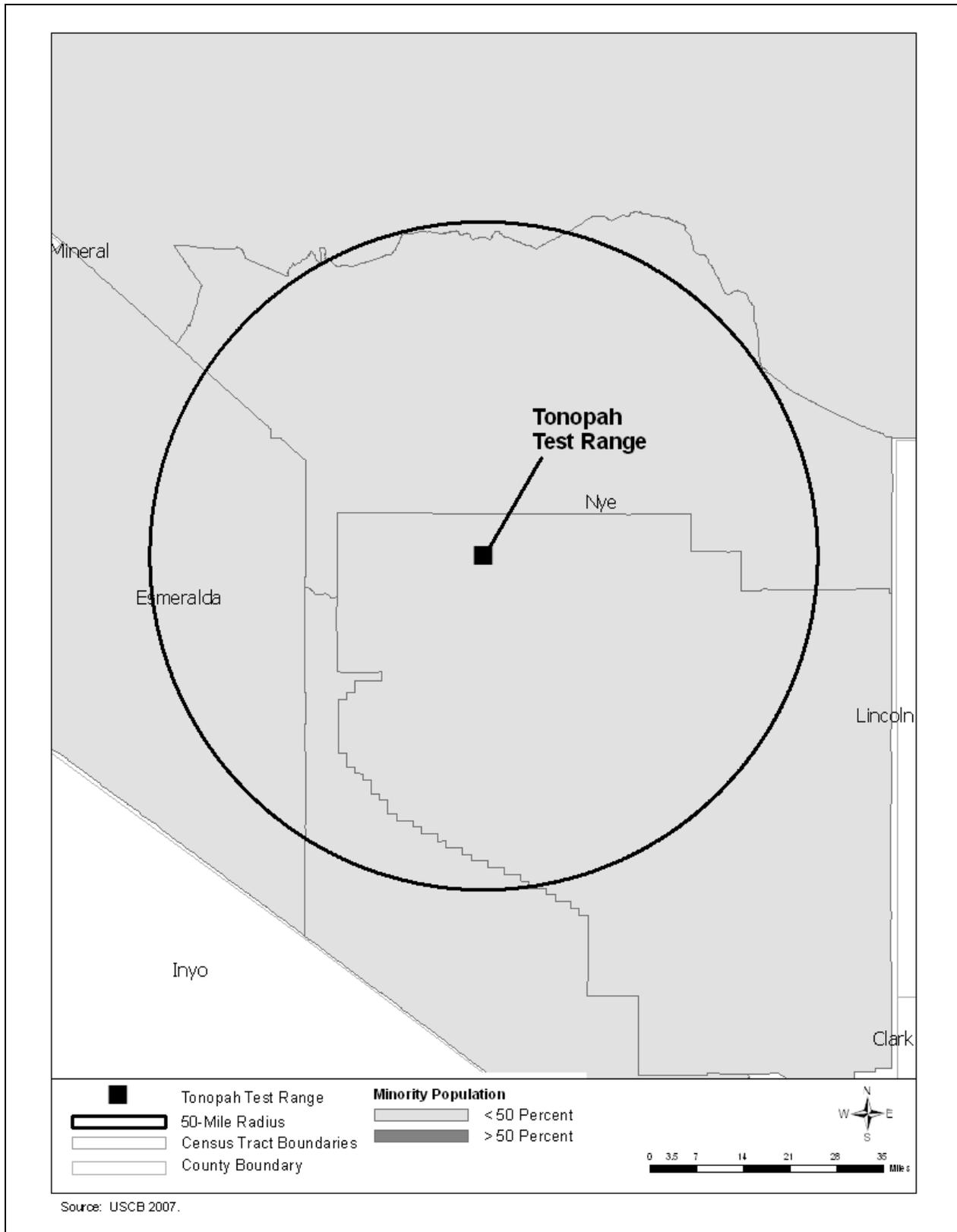
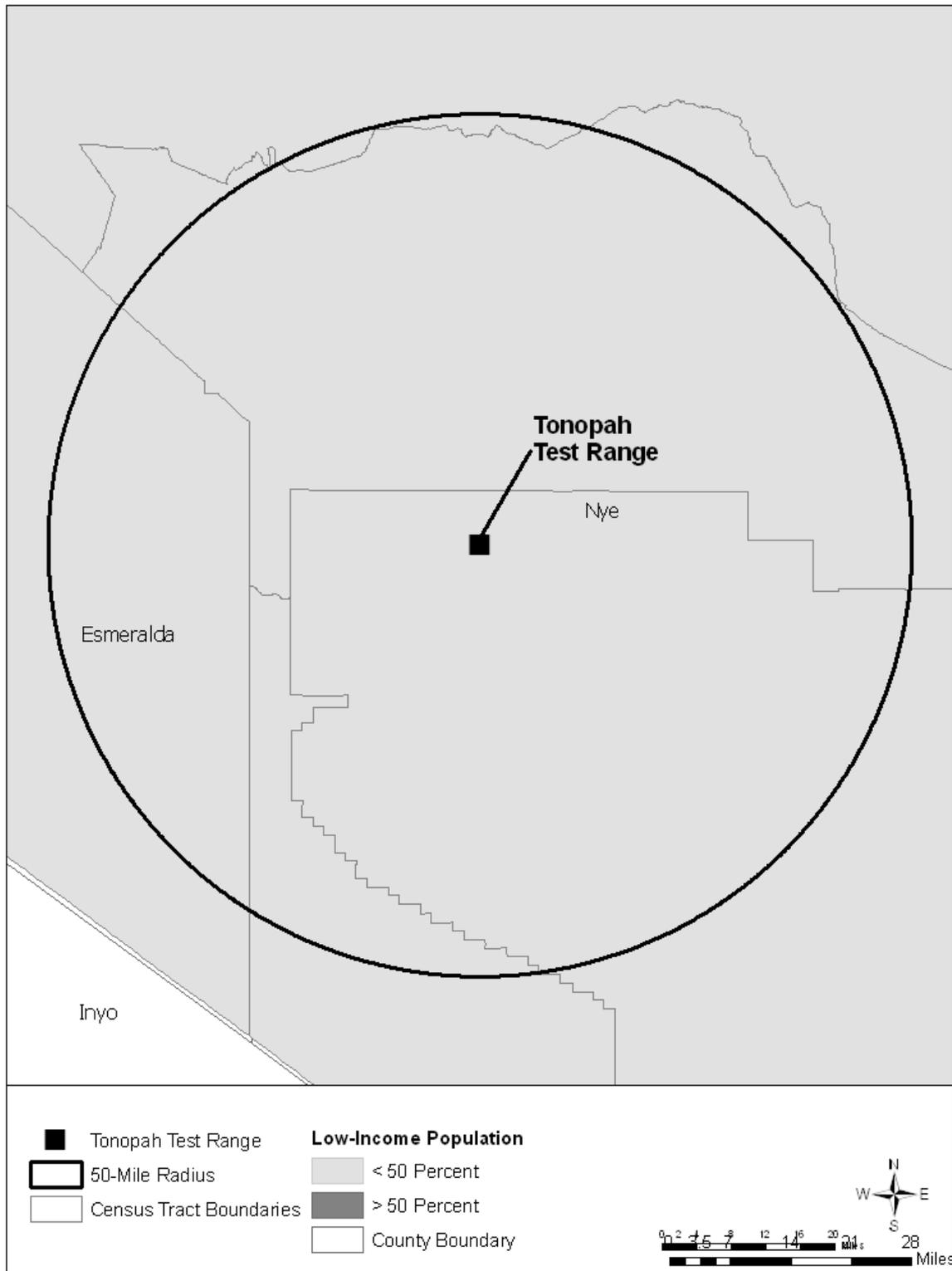


Figure 4.4.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of TTR



Source: USCB 2007.

Figure 4.4.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of TTR

4.4.11 Health and Safety

The potential for activities at the TTR to impact the health and safety of the general public is minimized by a combination of the remote location of the TTR, the sparse population surrounding it, and a comprehensive program of administrative and design controls. Visitors to the TTR are subject to essentially the same safety and health requirements as the workers. Safety briefings are provided as appropriate, personal protective equipment is provided when necessary, and radiation dosimeters are issued to long-term visitors. Secondary access control is provided, when necessary, for safety and or security reasons. Operations with higher-than-normal hazards are fenced or barricaded. The health and safety of TTR workers is protected by adherence to the requirements of federal and state law, DOE orders, and plans and procedures of each organization performing work on the range. A program of self-assessment of compliance with these requirements is conducted by the Sandia National Laboratories, support contractors, and the DOE. Workers are further protected from specific hazards associated with their jobs by training, monitoring the workplace environment, using personal protective equipment, and using administrative controls to limit their exposures to chemical or radioactive materials (TTR 2006).

All DOE activities on the TTR are in compliance with all environmental and other requirements established by federal, state, and local agencies. The main environmental compliance activities included the operation of a less than 90-day storage area for hazardous waste, minimal cleanup activities associated with the ER Program, and compliance sampling for the public water distribution system as required by the SDWA (TTR 2006).

All work at the TTR is performed in accordance with the safety and health requirements of the OSHA as codified in Title 29 CFR Parts 1910 and 1926.

4.4.11.1 Radiological

Radiological air emissions are regulated by NESHAP under the CAA. Operations at TTR do not involve activities that release radioactive emissions from either point sources or diffuse sources such as outdoor testing. The only radionuclide sources at TTR are the three Clean Slate Sites, which are potential sources of diffused radionuclide emissions as a result of the re-suspension of contaminated soils. These sites are currently being addressed by DOE/NNSA/NSO under the ER Project. The calculated dose for the MEI was 0.024 millirem per year, which is approximately 400 times less than the 10 millirem per year standard set by the EPA. Based on this value, an annual dose assessment is not required to be calculated for the TTR site. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension (TTR 2006).

The 0.024 millirem dose rate and the 1,000 picocuries per gram are separate numbers with no correlation to how each was developed. The 0.024 millirem dose rate is a NESHAPs compliance calculation (e.g., 10 millirem per year limit). The calculation is based on a MEI located at the TTR Airport (the highest calculated dose for a member of the public). This calculation only accounts for radionuclide air emissions. The 1,000 picocuries per gram level equates to a less than 25 millirem per year dose to the MEI for the specific land use scenario. This calculation includes inhalation, ingestion, and external exposure pathways.

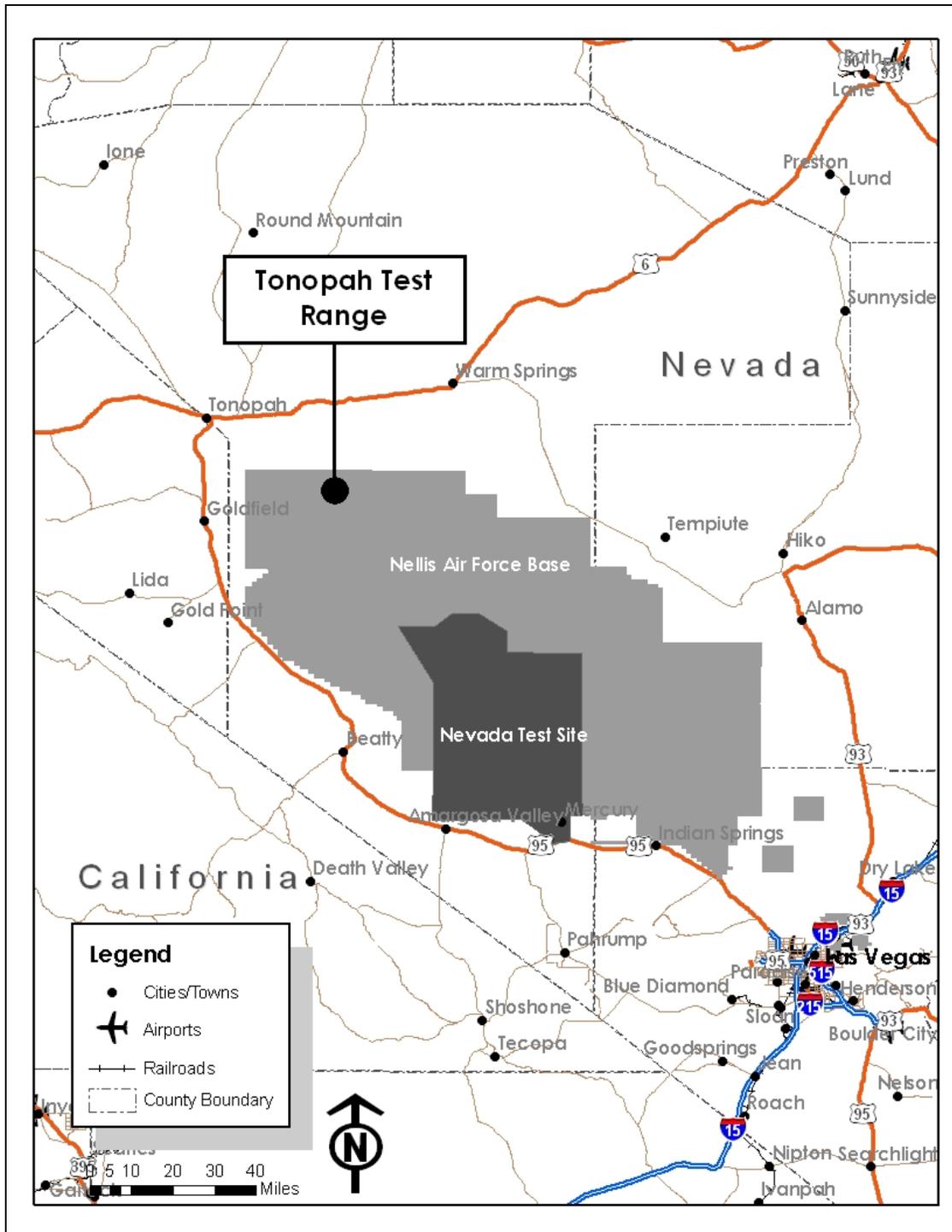
4.4.12 Transportation

The following sections discuss baseline transportation activities at the TTR with respect to onsite traffic, off-site traffic, transportation of materials and waste, and other transportation. Figure 4.4.12-1 displays roads in the vicinity of TTR.

The TTR onsite transportation consists of 118 miles of primary paved roads, 23 miles of secondary paved roads, 113 miles of primary compacted dirt roads and 39 miles of secondary dirt roads. The two primary traveled paved roads on the TTR traverse north-south and east-west. These roads support the majority of the daily traffic, as well as traffic during operations. The dirt roads are used for secondary daily travel, but are primarily used during testing activities. A total 98 miles of roads on the TTR are used on a regular basis (DOE 1996b).

The roadway system on the TTR is jointly maintained by the DOE and the USAF. No personally owned vehicles are permitted on the site, however, personally owned vehicle passes will occasionally be issued to resident personnel. Workers either drive government-supplied vehicles from the main entry of the TTR or ride government-supplied bus transportation to the work site. The majority of the on-site traffic is attributed to security support and facility operations (DOE 1996b).

The primary highway access to the main entry gate of the TTR is via U.S. Highway 6 to north-south alternate Road 504. U.S. Highway 6 links U.S. Highway 95 and U.S. Highway 93 and is an all-weather, two-lane paved roadway. In 1993 the annual average daily traffic on U.S. Highway 6 was 500 vehicles (DOE 1996b).



4.4.13 Waste Management

All waste generated by the SNL activities at TTR is managed by Westinghouse Government Services under the Waste Management Program (TTR 2006). Waste minimization and recycling efforts are integrated into Waste Management Program activities. Waste generated at TTR in 2005 included hazardous waste regulated by the RCRA and non-hazardous industrial and sanitary waste. All hazardous waste was shipped to permitted treatment, storage, and disposal facilities. Hazardous material and petroleum products have been used and stored at several of the facilities at TTR, including acids/bases, adhesives/sealants, cleaning chemicals, compressed gases, corrosive, explosives, fuels, oxidizers, paint, PCBs, pesticides/herbicides, petroleum, oils, and lubricants (POLs), and solvents. SNL maintains a database of hazardous material stored and used in Area 3 facilities (TTR 2006).

Table 4.4.13-1 shows a detailed breakdown of RCRA waste categories and quantities. Table 4.4.13-2 lists regulated non-RCRA waste categories and quantities. Table 4.4.13-3 lists waste categories transported off-site for recycling or alternative fuel use.

Table 4.4.13- 1 — TTR RCRA Regulated Hazardous Waste Shipped Off-site, 2005

Waste Type	Waste Codes	Amount Generated (lbs)
Toxic Solid, Organic, Not Otherwise Specified	D035, F002, F003, F005	25
Lithium Battery	D001, D003	25
Aerosols	D001	120
Water Reactive Solid, Self Heating not otherwise specified	D001, D003, D008	235
Paint Related Material	D001	90
Flammable Liquids	D001	550
Flammable Liquids, not otherwise specified	D001, U220	225
Petroleum Distillates	D001, D008, D018, F005	190
Batteries, Wet Filled with Alkali	D002, D006	40
Hazardous Waste Solid, not otherwise specified	D008	70
Hazardous Waste Solid, not otherwise specified	D009, U151	70
Mercury Contained in Manufactured Articles, hazardous Waste Solid, not otherwise specified	D009	40
Diesel Fuel	D001	1,720
Solid Hazardous Waste, not otherwise specified	D035, F005	235
Corrosive Liquid Waste, not otherwise specified	D002	25
Solid Hazardous Waste, not otherwise specified	D006, D007	150
Solid Hazardous Waste, not otherwise specified	D008, D009	55
Liquid Hazardous Waste, not otherwise specified	D007, D011	280
Liquid Hazardous Waste, not otherwise specified	D006, D007, D011	455
	Total	4,395

Source: TTR 2006.

Table 4.4.13-2 — Non-RCRA Regulated Hazardous or Toxic Waste Shipped Off-site, 2005

Waste Type	Waste Codes	Shipped	Amount Generated (lbs)
Non-Regulated Solid Waste	No Code Required		4,265
Non-Regulated Liquid Waste	No Code Required		100
Regulated Medical Waste	No Code Required		152
Polychlorinated Biphenyl's (PCB) Ballasts	TSCA		18
		Total	4,535
D&D Asbestos Waste	TSCA	10 yd ³	10 yd ³
Apex Solid Waste Landfill (Tires/Metal)	NCR	63 yd ³	63 yd ³
Environmental Restoration			
Hydrocarbon impacted soil and debris		0	0
Investigation-Derived Waste		300	300
Low-level Waste (soil, debris, and PPE)		0	0
Inert Unexploded Ordnance		0	283,500
		Total	283,800

Source: TTR 2006.

Table 4.4.13-3 — Recycled Regulated Hazardous or Toxic Waste Shipped Off-site, 2005

Recycled Material or Energy Recovered Material	Amount Generated (lbs)
Batteries, Wet, Filled with Acid	1,035
Brass	11,290
Batteries Dry Containing Potassium Hydroxide Solid	15
Fluorescent Lights	490
Circuit Boards for Recycle	45
Total	12,875

Source: TTR 2006.

TTR sanitary waste from DOE and USAF operations are disposed of in a Class II solid waste landfill. The TTR landfill is located just east of the USAF industrial area. The materials disposed of are characterized as rubbish, construction debris, and sanitary waste from food service areas. The sanitary landfill currently in operation consists of one active cell.

The construction of an expansion to the existing solid waste storage facility has been proposed and an environmental assessment was completed by the USAF. A Finding of No Significant Impact was signed on March 2007 (USAF 2007). The expansion would handle only Class II solid waste, which excludes the storage of hazardous waste, septic waste, explosive materials or chemical wastes including herbicides and pesticides (USAF 2007). Table 4.4.13-4 shows waste capacities at TTR in 2005. There were no shipments of radioactive waste in 2005.

Table 4.4.13- 4 — Waste Capacities at TTR, 2005

Waste Type	Weight (lbs)
RCRA Hazardous Waste	4,395
Non-RCRA-regulated	4,535
Recycled Waste	12,875
Radioactive Waste	0

Source: TTR 2006.

Only minor quantities of radioactive material are currently in use at the TTR. Most of the radioactive material is intended for specific purposes. A 100 curies of ^{60}Co source is used for industrial radiography. Several small “check sources” of alpha and beta radioactivity are used for the daily standardization or portable and stationary radiation detection system. The cobalt radiography source is maintained in Building 09-09, and the check sources are located in a small safe in Building 03-81T. Access to these sources is limited to the TTR staff with authority to use the material. Based on the program use of the above material, the potential risk that any of cobalt radiography sources contaminating other work areas is low. Based on discussion with SNL staff, there are no other known areas inside buildings where radioactive material has been used or stored (URS 2001).

The other radioactive materials presented at the TTR are less well controlled and are exposed to the elements (wind and storm water). The principal radionuclides involved are ^{238}U in the form of DU metal and Pu-239 and Pu-240 in the form of metal and oxide. DOE uses DU metal as an isotope surrogate in its weapons delivery system testing program. DOE has documented the number of instances where DU has been used and the location of this material. Plutonium isotopes, on the other hand, were used in 1963 (see Section 4.4.6.2) in a series of nuclear weapons safety shot tests (URS 2001).

4.5 PANTEX PLANT

The Pantex Plant is located approximately 17 miles northeast of Amarillo, Texas, on approximately 15,977 acres (Figure 4.5-1). The current missions at Pantex site include dismantling retired weapons; fabricating high-explosives (HE) components; assembling high explosive, nuclear, and non-nuclear components into nuclear weapons; repairing and modifying weapons; and evaluating and performing non-nuclear testing of weapons. Pantex maintains Category I/II quantities of SNM for the weapons program and material no longer needed by the weapons program. Weapons activities involve the handling (but not processing) of uranium, plutonium, and tritium components, as well as a variety of non-radioactive hazardous or toxic chemicals.

4.5.1 Land Use

4.5.1.1 Onsite Land Uses

Pantex is a 15,977-acre facility approximately 17 miles northeast of Amarillo, Texas, in Carson County (see Figure 4.5-1). DOE owns 10,177 acres, including 9,100 acres in the main plant area and 1,077 acres at Pantex Lake, located approximately 2.5 miles northeast of the main plant area. Another 5,800 acres of land south of the main Plant area are leased from Texas Tech University (TTU) for a safety and security buffer zone. Currently there are no government industrial operations conducted at the Pantex Lake (Pantex 2006). Figure 4.5.1-1 displays generalized land use at Pantex.

Pantex is composed of several functional areas, referred to as numbered zones (Figure 4.5.1-2). These include a weapons assembly/disassembly area, a weapons staging area, an area for experimental explosive development, a drinking water treatment plant, a sanitary wastewater treatment facility, and vehicle maintenance and administrative areas (Pantex 2006). Other functional areas include a utilities area for steam and compressed air, an explosive test-firing facility, a Burning Ground for thermally processing explosive materials, and landfills. One functional area is currently only used for storage. Overall, there are more than 400 buildings at Pantex, many of which are grouped into large functional zones. The weapons assembly/disassembly area covers approximately 200 acres and contains more than 100 buildings (Pantex 2006).

The explosive test-firing facility (firing sites) includes several test-shot stands and small-quantity, test-firing chambers. The firing site also includes supporting facilities. The Burning Ground is used for processing explosives, explosive components, and explosive-contaminated materials and waste by means of controlled open burning and flashing (Pantex 2006).



Figure 4.5-1 — Location of Pantex

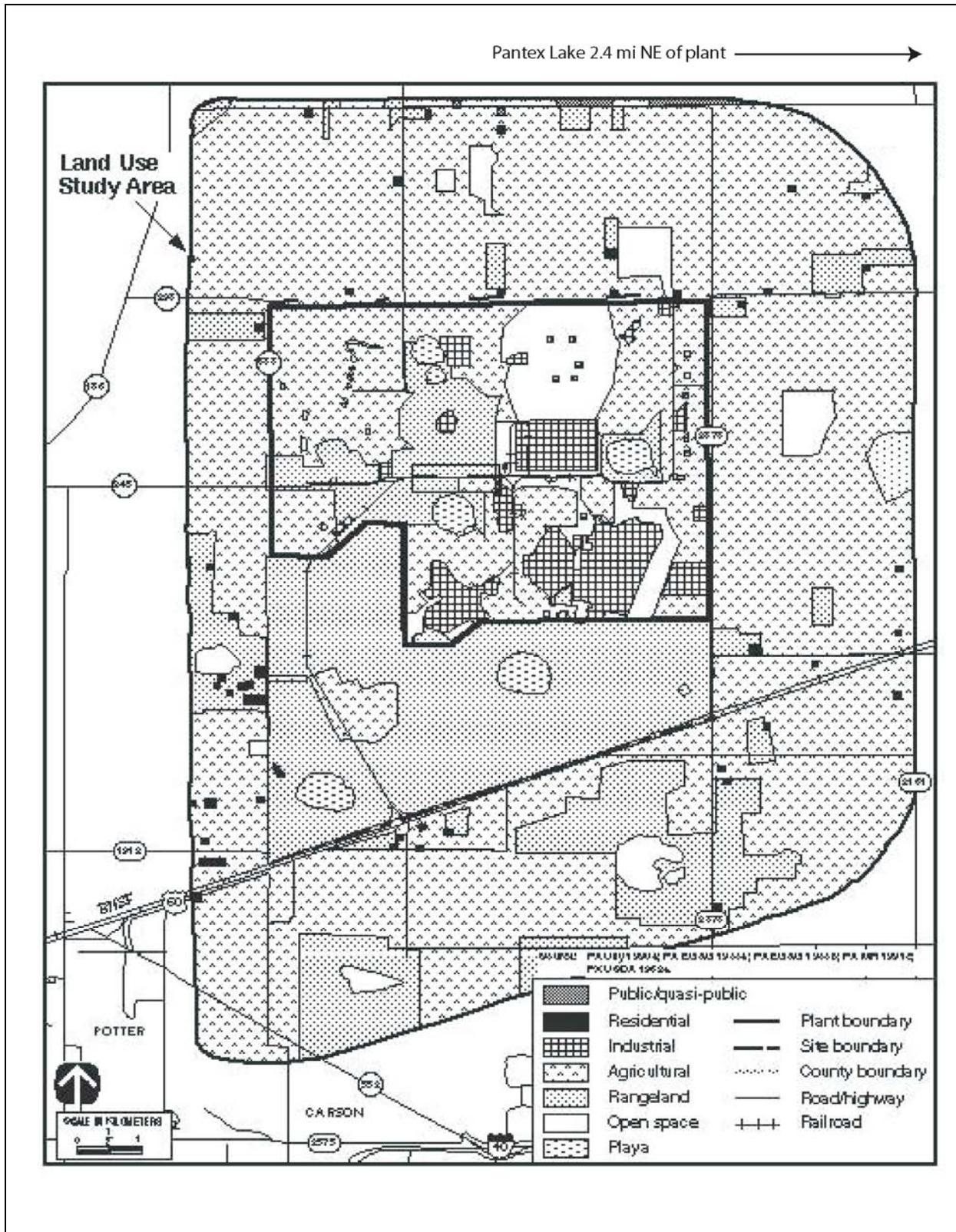
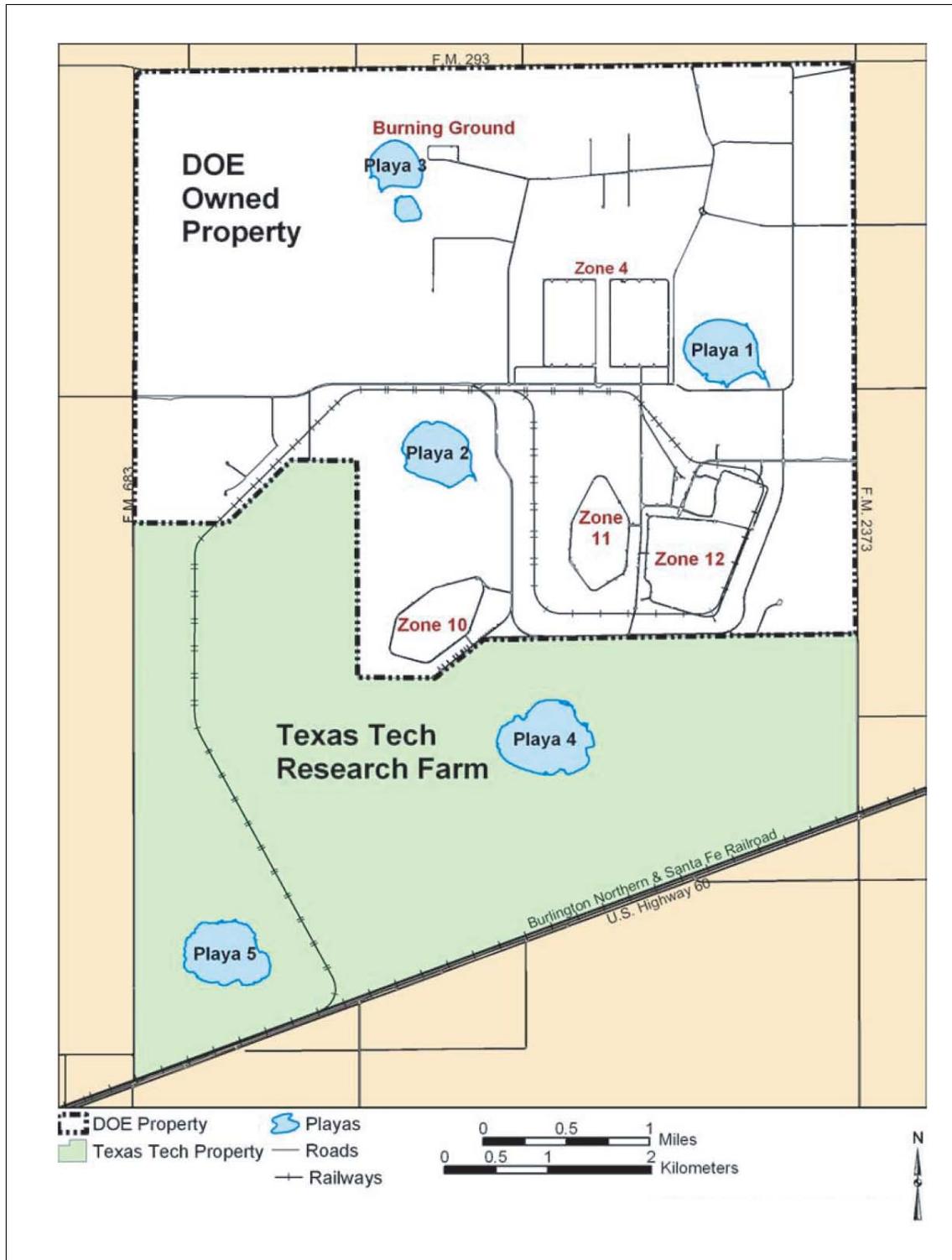


Figure 4.5.1-1 — Generalized Land Use at Pantex and Vicinity



Source: Pantex 2006.

Figure 4.5.1-2 — Principal Features of Pantex

4.5.1.2 *Surrounding Land Use*

The Pantex Plant is surrounded by agricultural land, but several significant industrial facilities are also located nearby (Pantex 2006). In the area near Pantex, residences occur mostly in the small town of Panhandle, 11 miles east of Pantex. Other concentrations of residences are at Highland Park Village, approximately 7 miles southwest and Washburn 6.5 miles south. The closest residences are approximately 100 feet west and north of the plant boundary along Texas Farm-to-Market Road (FM) 683 and 293, and within 0.5 miles east of the Plant boundary along FM 2373.

Most of the surrounding land is prime farmland when irrigated, with the exception of the area northwest of the plant site, which is rangeland. The majority of the surrounding land is cultivated. The packing plant of Tyson Fresh Meats, Inc. is the only industrial facility within 2 miles of the plant.

Four low-altitude Federal airways used by the Amarillo International Airport for aircraft landings and takeoffs cross or come near Pantex. The runway is located approximately 7 miles southwest of the site boundary.

4.5.2 **Visual Resources**

The Pantex Plant is located on the Llano Estacado portion of the Great Plains at an elevation of approximately 3,500 feet. The topography at Pantex is relatively flat and characterized by rolling grassy plains and numerous natural playa basins.

The Pantex Plant is in a treeless plain of a shortgrass prairie ecosystem. The plant consists of over 400 buildings which are surrounded by cropland and rangeland that blend into the offsite viewshed.

The developed areas at Pantex are consistent with a Visual Resource Management Class IV designation, as defined by the BLM (DOI 2001). The remainder of The Pantex Plant is consistent with a Visual Resource Management rating of Class III or IV (see Table 4.5.2-1 for descriptions of the Visual Resource Management Rating System). Plant facilities are visible from U.S. 60 and the local Farm-to-Market roads adjacent to The Pantex Plant’s boundaries. At night, The Pantex Plant lights are visible from U.S. 60 and the local Farm-to-Market roads and I-40.

Table 4.5.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention
Class II	To retain the existing character of the landscape. The level of change to the characteristic landscape should be low
Class III	To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Source: BLM 1980.

4.5.3 Site Infrastructure

An extensive network of existing infrastructure provides services to Pantex activities and facilities as shown in Table 4.5.3–1.

Table 4.5.3–1 — Baseline Characteristics for Pantex

Resource	Current Usage	Site Capacity
Land		
Roads (miles)	47	47
Electrical		
Energy consumption (MWh/yr)	81,850	201,480
Available capacity (MWe)	13.6	47.5
Fuel		
Natural gas (yd ³ /yr)	16,912,000	378,590,000
Oil (gal/yr)	15,830	No Limit
Coal (t/yr)	0	0
Water		
Usage	130,000,000	422,700,00

Source: NNSA 2007

4.5.3.1 *Electricity*

Pantex receives electrical energy from Southwestern Public Service Company. Current usage is 81,850 MWh per year. Two 115-kilovoltampere electrical substations are located onsite with a capacity of 23 megawatts (DOE 1996c). There are several generators, both fixed and portable, that provide standby power in the event of an interruption of normal service to critical systems.

4.5.3.2 *Natural Gas*

The Texas Panhandle is one of the major oil and gas producing regions in the country with considerable reserves. Natural gas is supplied to Pantex by Anthem Energy. The natural gas is delivered through a 10-inch main supply line, which is capable of supplying 10,220 million cubic feet, sufficient capacity for all future plant requirements. Tank 12076 holds a reserve of 630,000 gallons of fuel oil for use, should interruption of the natural gas supply occur.

4.5.3.3 *Water*

Water for Pantex is pumped from the Ogallala aquifer by five production wells located in the northeast portion of the site. A well and two reservoirs were completed in 1994. Pantex uses about 130 million gallons of water per year, which is drawn from the Ogallala Aquifer. Water storage reservoirs are integrated into the water distribution system. The Ogallala formation is capable of yielding adequate water for all current and foreseeable uses by Pantex.

4.5.3.4 *Steam*

Pantex Plant provides steam for operations and facility heating. Building 1613, the plants boilerhouse, contains four boilers and operates on natural gas. Two of the boilers each have the capacity to produce 50,000 pounds of steam per hour and the other two have the capacity to

produce 25,000 pounds of steam per hour each (DOE 1006c). Steam heat is used where open flames, flammable liquids, and flammable gases pose a potential safety risk.

4.5.4 Air Quality and Noise

4.5.4.1 Air Quality

4.5.4.1.1 Meteorology and Climatology

The climate at Pantex is classified as semi-arid and is characterized by hot summers and relatively cold winters, with large variations in daily temperature extremes, low humidity, and irregular periods of rainfall of moderate amounts (Pantex 2006).

The normal rainfall in Amarillo is approximately 19 inches, however, 2005 was a relatively dry rainfall year in the area of Pantex. The official Amarillo Airport National Weather Service (NWS) rain gauge recorded 15.01 inches of precipitation. The potential gross lake surface evaporation in the area is estimated to be about 70 inches or 350 percent of the average annual rainfall (Pantex 2006). Seventy-five percent of the total annual precipitation falls between April and September. The average annual snowfall is 16.9 inches.

Average wind speeds at Amarillo are relatively high. The average annual windspeed is 13.5 miles per hour. Calms occur about 1 percent of the time. The wind blows predominantly from the south from May to September and from the southwest the remainder of the year.

The Pantex Plant is located in an area with a relatively high frequency of tornados; however, tornado occurrences in Amarillo are rare. In 2005, 14 tornados were recorded in the 20 Texas Panhandle counties. At least 10 tornados were sighted in Carson and other contiguous counties including four sightings in Armstrong County that were associated with severe thunderstorms and flash flooding that occurred in the region (Pantex 2006).

4.5.4.1.2 Ambient Air Quality

Pantex Plant operations can result in the release of non-radiological air pollutants that may affect the air quality of the surrounding area. The Pantex Plant is located within the Amarillo-Lubbock Intrastate AQCR. The Amarillo-Lubbock Intrastate AQCR is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and PM₁₀) (40 CFR 81.344). The Texas Commission on Environmental Quality (TCEQ) issued an alteration to "Air Quality Permit No. 21233 on September 12, 2005. This alteration removed the operations performed in Firing Chamber 11-38A from the Permit (Pantex 2006). There were two compliance inspections performed in 2006 by both the State of Texas and the U.S. Environmental Protection Agency (EPA) in regard to air quality. The State identified one noncompliance involving an inadvertent emission event of a cylinder discharge containing fire suppressant FM-200© (Hydrofluorocarbon-227ea) during the testing of a fire alarm system. Corrective actions with engineer controls were implemented for preventing other discharges from reoccurring, and were agreed appropriate by the State. The EPA identified no noncompliance during their inspection.

The primary emission sources of criteria pollutants at Pantex are the steam plant boilers, the explosives-burning operation, and emissions from onsite vehicles. Emission sources of hazardous or toxic air pollutants include the high-explosives synthesis facility, the explosives-burning operation, paint spray booths, miscellaneous laboratories, and other small operations. With the exception of thermal treatment of high explosives at the burning ground, most stationary sources of nonradioactive atmospheric releases are fume hoods and building exhaust systems, some of which have HEPA filters for control of particulate emissions.

At the present time there is no ambient air monitoring performed for hazardous air pollutants or non-radiological substances at Pantex.

Radiological Air Emissions

Atmospheric emissions of radionuclides from DOE facilities are limited under the EPA regulation NESHAP,” 40 CFR Part 61, Subpart H. The EPA annual effective dose equivalent limit of 10 millirem per year to members of the public for the atmospheric pathway is also incorporated in DOE Order 5400.5, “Radiation Protection of the Public and the Environment.”

In the Pantex region, airborne radionuclides originate from natural (i.e., terrestrial and cosmic) sources, worldwide fallout, and Pantex operations. Radiological ambient air monitoring was conducted at 27 locations in 2005.

In normal operating situations, little potential exists for exposure of Pantex personnel, the public, or the environment from release of radioactive materials. Most of the small numbers of radionuclide releases during normal operations are tritium releases. Very small amounts of tritium escape as a gas or vapor during normal operations, and some tritium residual is present onsite as a result of an accidental release in 1989 (Pantex 2006). The accidental release of tritium was conservatively estimated as 40,000 curies (DOE 1996d). The area of accidental release occurred in Zone 12 (Figure 4.5.1-2) where nuclear components have been handled (Pantex 2006).

Table 4.5.4-2 displays the average radiological atmospheric emissions from Pantex from 1995 – 2006. The maximum radiation levels measured at any station were less than three percent of the allowable standard (Pantex 2006).

Table 4.5.4-2 — Average Pantex Radiological Atmospheric Emissions in Curies

Tritium (curies)	Total Uranium^a (curies)	Total Plutonium	Total Other Actinides (curies)	Other^b
6.88 x 10 ⁻¹	4.73 x 10 ⁻⁵	None	2.04 x 10 ⁻⁶	None

a Total Uranium (grams) = 1.94 x 10⁻³

b This category includes the following: ⁸⁵Kr, Total Radioiodine, Total Radiostrontium, Noble Gases (T_{1/2} < 40 day), Short-lived Fission and Activation Products (T_{1/2} < 3 hr), and Fission and Activation Products (T_{1/2} > 3 hr).

Source: Pantex 2006.

As in previous years, relatively high values of tritium were recorded during 2005 at a monitoring location near the site of the aforementioned accidental release. These measurements occurred during periods of rapid changes in barometric pressure and were likely the result of continued off-gassing from soils during these pressure fluctuations. Despite the high measurements of

tritium in 2005, there continues to be a downward trend in tritium measurements since the 1989 release in this area (Pantex 2006). The air monitoring program at Pantex continues to provide information that current plant operations do not have a detrimental effect on the quality of the environment at or near Pantex (Pantex 2006).

4.5.4.2 *Noise*

The major noise sources at Pantex include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, construction and materials-handling equipment, vehicles), as well as small arms firing, alarms, and explosives detonation. Most Pantex Plant industrial facilities are far enough from the site boundary that noise levels from these sources at the boundary are barely distinguishable from background noise. However, some noise from explosives detonation can be heard at residences north of the site, and small arms weapons firing can be heard at residences to the west (DOE 1996d).

The acoustic environment along Pantex boundary and at nearby residences away from traffic noise is typical of a rural location. The day-night average sound levels are in the range of 35 to 50 dBA. Noise survey results in areas adjacent to Pantex indicates that ambient sound levels are generally low, with natural sounds and distant traffic being the primary sources. Traffic is the primary source of noise at the site boundary and at residences near roads.

Traffic noise is expected to dominate sound levels along major roads in the area, such as U.S. 60. The residents most likely to be affected by noise from plant traffic along Pantex access routes are those living along FM 2373 and FM 683. Measurements of equivalent sound levels for traffic noise and other sources along the roads bounding Pantex are 53 to 62 dBA for FM 2373 at about 400 meters (1,300 feet) from the road; 51 to 58 dBA for FM 293 at about 230 feet; 44 to 65 dBA for FM 683 at about 130 feet; and 51 dBA for U.S. 60 at about 740 feet. These levels are based on a limited number of 30-minute samples taken during peak and off-peak traffic periods, mostly at locations within the site boundary. The levels represent the range of daytime traffic noise levels at residences near the site. Other sources of noise include aircraft, wind, insect activity, and agricultural activity (DOE 1996d).

4.5.5 **Water Resources**

4.5.5.1 *Surface Water*

The principal surface water feature on the Southern High Plains is the Canadian River, which flows southwest to northeast, approximately 17 miles north of Pantex. Plant surface waters do not drain into this system, but for the most part discharge into onsite playas. Storm water from agricultural areas at the periphery of Pantex drains into offsite playas. From the various playas, water either evaporates or infiltrates the soil. There are two water-bearing units below Pantex, the perched aquifer and the Ogallala Aquifer. The perched aquifer is located approximately 200 to 300 feet below the ground surface. The Dockum Group Aquifer is the lower boundary of the Ogallala Aquifer.

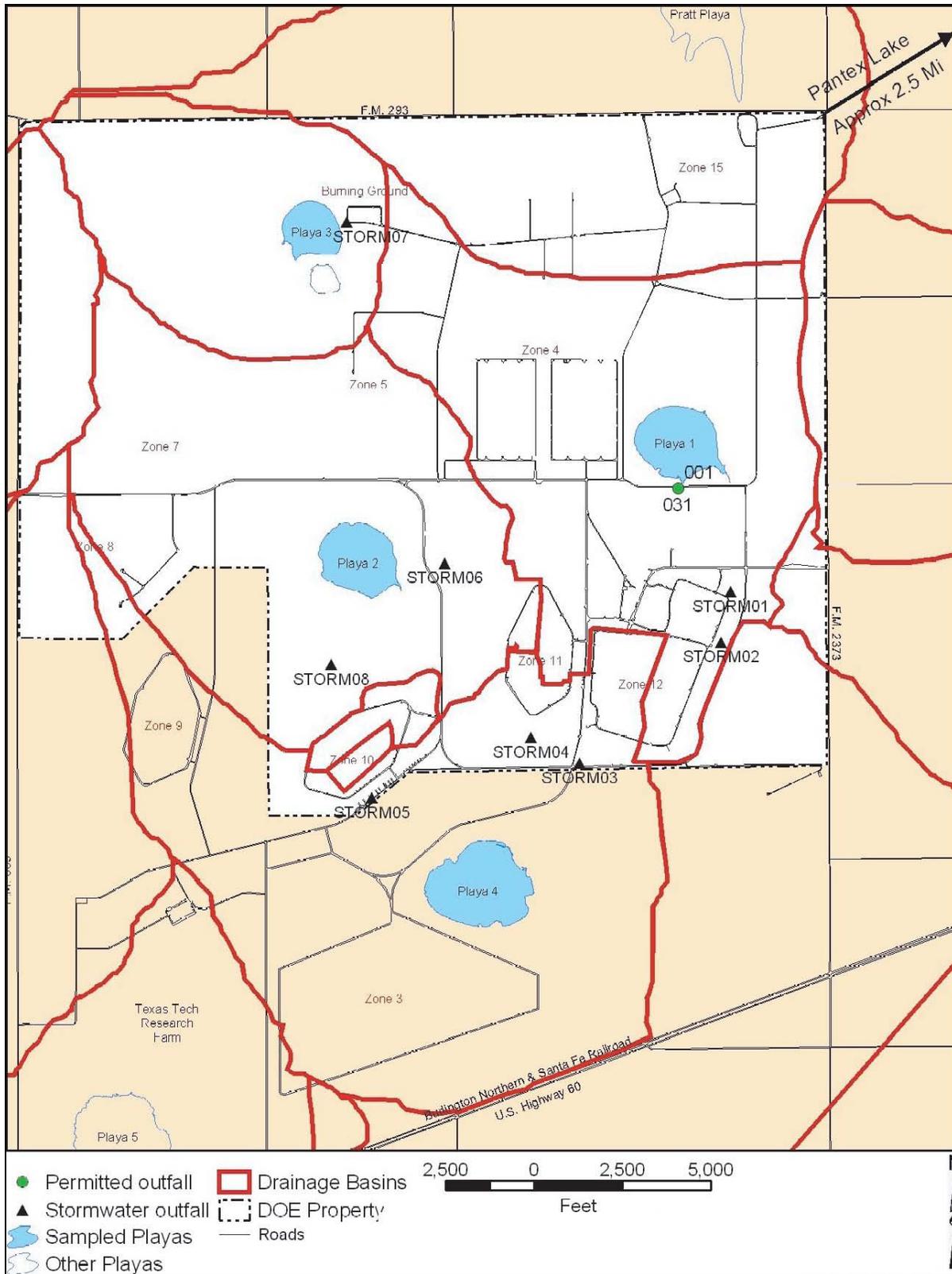
4.5.5.1.1 Stormwater

All surface water at Pantex drains to isolated playa lakes. Playas are shallow, ephemeral lakes that have clay-lined basins that fill periodically with runoff. There are six playas found on DOE-owned and -leased property (Pantex 2006). Most of the surface drainage on the DOE-owned and -leased lands flows via man-made ditches, natural drainage channels, or by sheet-flow to the onsite playa basins. Figure 4.5.5-1 shows the locations of the playas at the facility site with their respective drainage basins (watersheds).

Stormwater runoff from impervious surfaces at Pantex flows overland and through unlined ditches. Runoff accumulates primarily in Playas 1, 2, 3, and 4, on the northeast, west, northwest, and southern sides of Pantex, respectively (Figure 4.5.5-1). Stormwater runoff from surrounding pastures and agricultural operations flows to offsite playa basins from the outer perimeter of the main Plant site. Stormwater that moves offsite flows into Pantex Lake, to the northeast of the Plant, or Playa 5 to the southwest of the Plant (Pantex 2006). Although some of the surface water from the ditches and playas is associated with perched aquifer recharge, most is lost to evapotranspiration (Pantex 2006). The playa lakes are extremely important hydrologic features at Pantex that provide prime habitat for wildlife, especially waterfowl that winter in the southern High Plains. Playas are also believed to be an important source of recharge for the Ogallala Aquifer (Pantex 2006).

4.5.5.1.2 Surface Water Quality

Playa 1 received effluent from the Wastewater Treatment Facility (WWTF) until April 2005; now WWTF and Pump and Treat water are used to irrigate crops on approximately 300 acres by sub-surface drip irrigation system. Playa 1 receives effluent from the WWTF infrequently when farmland is already saturated due to heavy seasonal precipitation. Playas 1, 2, and 4 receive storm water from Pantex Plant's industrial areas; Playa 3 receives storm water from the Burning Ground. All playas receive storm water runoff from agricultural areas. Table 4.5.5-1 displays the annual stormwater monitoring results for metals in 2005.



Source: Pantex 2006.

Figure 4.5.5-1 — Drainage Basins, Playas, and Outfalls at Pantex Plant

Table 4.5.5-1 — Annual Stormwater Results (metals), 2005 (mg/l)

Metal	Outfall STORM01	Outfall STORM02	Outfall STORM03	Outfall STORM04	Outfall STORM05	Outfall STORM06	Outfall STORM07	Outfall STORM08	IWQP
Arsenic	0.003	0.004	0.003	0.004	ND	0.001	NS	0.004	0.3
Barium	0.155	0.132	0.165	0.108	0.076	0.076	NS	0.137	4.0
Cadmium	0.0005	0.00021	0.0003	0.0002	0.0005	0.0005	NS	0.0002	0.2
Chromium	0.009	0.013	0.010	0.007	0.003	0.003	NS	0.007	5.0
Copper	0.012	0.007	0.007	0.007	0.005	0.005	NS	0.006	2.0
Lead	0.007	0.004	0.005	0.005	0.001	0.003	NS	0.003	1.5
Manganese	0.11	0.075	0.102	0.093	0.014	0.068	NS	0.059	3.0
Mercury	ND	ND	ND	ND	ND	ND	NS	ND	0.01
Nickel	0.007	0.005	0.008	0.005	ND	ND	NS	ND	3.0
Selenium	0.002	0.004	0.001	0.001	ND	ND	NS	0.002	0.2
Silver	ND	0.002	ND	0.002	ND	ND	NS	ND	0.2
Zinc	0.103	0.1	0.063	0.080	0.01	0.029	NS	0.018	6.0

NS=no sample; ND=no detection; IWQP=Inland Water Quality Parameter limits, 30 Texas Administrative Code 319.22
Source: Pantex 2006.

Permit-driven and environmental surveillance sampling were conducted at the playas for both radiological and non-radiological materials including metals, volatile organic compounds, semi-volatile organic compounds, and explosives. Radiological sampling included gross alpha/beta, tritium, and limited isotopic radiological analyses (Pantex 2006).

In 2005, sampling was conducted at seven of eight storm water outfalls and at 4 of 6 playa lakes. Storm water monitoring required by the Texas Pollutant Discharge Elimination System (TPDES) Multi-Sector General Permit (MSGP) in 2005 consisted of visual and annual metals monitoring. Visual samples taken and examined appeared to be of good quality, and none showed any abnormalities based on criteria specified in the Multi-Sector General Permit Plan (MSGPP) (Pantex 2006). Annual metals monitored consisted of the twelve metals listed in 30 Texas Administrative Code 319.22 (Inland Water Quality Parameters [IWQPs]). Storm water monitoring results indicated that there were no locations that exceeded IWQP limits (Pantex 2006).

Sampling results from 2005 monitoring were consistent with historical data. Sampling continues to indicate that storm water discharges at Pantex are of good quality and that the operations at Pantex are not degrading storm water quality (Pantex 2006). During 2005, there was an unauthorized discharge of approximately 54,000 gallons of treated, non-chlorinated wastewater due to a mechanical failure of the wastewater treatment system (Pantex 2006). This incident was reported to the TCEQ. No long-term environmental or human health impacts were associated with this event (Pantex 2006). The surface water monitoring program at Pantex continues to provide information that supports the premise that current operations are not having detrimental impact to the quality of the surface waters at Pantex (Pantex 2006).

4.5.5.1.3 Surface Water Rights

The Pantex Plant does not use any surface water; therefore, it exerts no surface water rights.

4.5.5.2 Groundwater

There are two water-bearing units below Pantex, the perched aquifer, and the Ogallala Aquifer. The perched aquifer is located at approximately 200 to 300 feet below ground surface. Perched aquifers are common to regions with playas, such as the Texas Panhandle (Pantex 2006). A relatively low permeability zone referred to as the 'fine-grain zone' (FGZ) that consists of fine-grained sand, silt and clay separates the perched aquifer from the deeper Ogallala Aquifer (Pantex 2006). The Ogallala Aquifer is located below the FGZ, approximately 400 feet below ground surface.

The perched aquifer is a generic term that denotes a shallow reservoir of local extent, which typically does not provide potable water or potable water in sufficient quantities for general use. The perched aquifer ranges in saturated thickness from less than a foot to more than 75 feet. At Pantex, the perched aquifer is associated with natural recharge from Playas 1, 2, and 4, treated wastewater discharge to Playa 1, and historical releases to the ditches draining Zones 11 and 12. Historical operations at Pantex resulted in contamination of this perched aquifer, and the contaminant plume has migrated past the plant boundaries and beneath adjacent landowners' property to the southeast.

The Ogallala Aquifer is the principal aquifer and major source of water in the vicinity of Pantex and the surrounding 8-county region, extending west across the New Mexico-Texas border. The Ogallala Aquifer can yield between 700 and 1,200 gallons per minute of high quality waters to the wells in the area. Depths to the Ogallala Aquifer generally run parallel to the regional land surface, which dips gently from northwest to southeast and varies at Pantex from about 344 feet at the southern boundary to 496 feet at the northern boundary. This south-to-north groundwater flow contrasts with the regional northwest-to-southeast trend of the remaining portion of the Southern High Plains. The current data reflect a decline in the Ogallala water table elevation of up to 30 feet beneath portions of Pantex. The drop in the water table for the Ogallala Aquifer is due to historical groundwater withdrawals and long-term pumping, which have exceeded the natural recharge rate to the Ogallala (Pantex 2006). These overdrafts have removed large volumes of groundwater from recoverable storage, and have caused substantial water-level declines. The withdrawal rate of the aquifer is greater than 10 times the estimated annual recharge rate. Pantex's water use from the Ogallala Aquifer in 2005 was 140.6 million gallons (Pantex 2006).

4.5.5.2.1 Groundwater Quality

The plume management wells and monitoring network in the perched groundwater at Pantex is composed of 75 wells. Fifty-six perched groundwater wells are on-site, and 19 are off-site. Of the 75 wells, 16 perched groundwater wells are dry or do not have enough water to sample, and are monitored regularly for the presence of ground water. The Ogallala Aquifer surveillance and monitoring network is composed of 28 wells. Nineteen wells and 1 dry well are located on-site and 8 are off-site.

Forty-eight wells are used for investigative purposes and 5 are injection wells permitted under the Pantex RCRA permit for groundwater investigation and remediation. One monitor well and 2 investigation wells were plugged and abandoned in 2001. Ten investigation wells (9 perched and 1 Ogallala) have been dropped from the sampling plan and not used for monitoring purposes at this time in agreement with the TCEQ. (Pantex 2002)

Under the RCRA Hazardous Waste Compliance Plan, Pantex is permitted to inject treated wastewater into the Ogallala Aquifer (Permit NO. 5X2600215). The DOE/NNSA is considering implementing corrective measures to address perched groundwater impacts attributable to operations at Pantex. Among the actions being considered, discontinuation of treated groundwater back into the perched zone of the Ogallala Aquifer is a component of five of the six corrective measures. The DOE/NNSA released an EA considering the potential impacts of the proposed corrective measures in February 2007 (Pantex 2006).

The Risk Reduction Rule Guidance for Pantex is a guide used to identify the quantifiable detection limit for sampled constituents. The detection limit is defined as the Practical Quantitation Limit (PQL, lowest level that can be accurately and reproducibly quantified) for non-naturally occurring compounds. Groundwater investigation wells were sampled quarterly, semiannually, or annually, depending on the analyte for which the sampling was performed. Pantex groundwater wells are also monitored quarterly, semiannually or annually, depending upon the analyte being sampled. Pantex production wells are monitored on an annual basis.

The control well location near Bushland, Texas, was sampled quarterly in 2001. Sampling at the Bushland location allows Pantex technicians to obtain comparative data for the Ogallala from a location where the aquifer is perpendicular to the groundwater flow, or cross-gradient. It is unaffected by Pantex operations.

In 2005, 136 samples were collected from the Ogallala Aquifer and 188 samples from the perched aquifers (Pantex 2006). The following discussion regarding perched aquifer and Ogallala Aquifer sampling results is based upon the *2005 Annual Site Environmental Report* (ASER) (Pantex 2006).

Perched Aquifer System

Of the 15 high explosives that were analyzed for in the perched aquifer, 11 were detected at or above the method detection limit (MDL), 6 were detected at or above their respective laboratory PQLs at least once during 2005. These detections are indicative of impacts from historic Plant operations (Pantex 2006).

Of the 24 metals (including hexavalent chromium) analyzed for in the perched aquifer, 18 were detected at or above the MDL, and 3 were detected at or above their respective laboratory PQLs at least once during 2005. Metals, with the exception of hexavalent chromium (Cr+6), are naturally occurring in the sediments and soils at Pantex. Metal concentrations detected in perched groundwater at the Plant, can be attributed to heavy sediment loads that often occur in perched groundwater samples and to historic Plant operations (Pantex 2006).

Perchlorate was detected in 15 out of 163 perched groundwater samples at levels comparable to historical results and at expected values for 2005 (Pantex 2006). Sixty-two VOCs were analyzed for in the perched aquifer during 2005. Of these, 9 were detected at or above the MDL, and 5 were detected at levels at or above their respective laboratory PQLs. These detections are indicative of impacts from historic Plant operations. All of the VOCs have been previously identified as contaminants of potential concern in the perched aquifer through the RCRA Facility Investigation process (Pantex 2006).

Sixty-six semi-volatile organic compounds (SVOC) were analyzed for in the perched aquifer during 2005. Three compounds were detected at or above the MDL, but all were below the PQL. Bis (2-ethyl-hexyl) phthalate is a common laboratory contaminant. The other two compounds, Benzo-a-pyrene and Benzo-g,h,iperylene, are common combustion by-products from gasoline engines (e.g., sampling vehicles) and cross-contamination is suspected during sample collection in the field. None of the three compounds were confirmed in subsequent sampling (Pantex 2006).

Ogallala Aquifer

Of the 25 metals analyzed for in the Ogallala Aquifer, 10 were detected at or above their respective laboratory PQLs at least once during 2005. Metals, with the exception of Cr+6, are naturally occurring in the soils and sediments at Pantex. The metals concentrations that have been detected in Ogallala groundwater at the Plant are either attributable to heavy sediment loads that often occur in the groundwater samples or due to natural background variations (Pantex 2006).

There has never been a confirmed detection of perchlorate in the Ogallala Aquifer, and there were no VOCs, SVOCs, or HE compounds detected at or above the PQL in Ogallala Aquifer samples during 2005. Tables 4.5.5-2 and 4.5.5-3 show analytical results from monitoring efforts in the perched and Ogallala aquifers (Pantex 2006).

4.5.6 Geology and Soils

Pantex Plant is located in the Southern High Plains. The topography is relatively flat and marked by thousands of playa lakes. Pantex is located on the Amarillo Uplift, which, along with the Oldham-Harmon Trend, comprise a west-northwest trending uplifted area that separates the Anadarko Basin to the northeast and the Palo Duro Basin to the southwest. Pantex is located at the southeastern edge of the Whittenburg Trough that separates the Amarillo Uplift from Bush and Bravo Domes to the west (DOE 1996).

4.5.6.1 Geology

The primary surface deposits at Pantex are the Pullman and Randall soil series. These formations grade downward to the Blackwater Draw Formation, which consists of approximately 50 feet of interbedded silty clays and very fine sands with caliche (Pantex 2006).

Table 4.5.5-2 — Groundwater Monitoring Results From the Perched Aquifer System

<i>Perched Compliance Plan Wells</i>					
Analyte Type Code	CAS Number	Constituent	Min (mg/L)	Max (mg/L)	RRS 2 Residential (mg/L)
	99-65-0	1,3-Dinitrobenzene	0.001	0.003	0.0037
	121-14-2	2, 4-Dinitrotoluene	0.001	0.005	0.001
	606-20-2	2, 6 -Dinitrotoluene	0.0002	0.004	0.001
	35572-78-2	2-amino-4, 6-dinitrotoluene	0.0003	0.023	0.006
	1946-51-0	4-amino-2, 6-dinitrotoluene	0.0002	0.017	0.006
	2691-41-0	HMX	0.0004	0.187	1.800
	121-82-4	RDX	0.0003	1.910	0.0077
	118-96-7	TNT	0.0002	0.017	0.018
	99-35-4	1,3,5-Trinitrobenzene	0.0002	0.0005	1.1
	78-11-5	PETN	0.0007	0.020	0.008
Metals	7429-90-5	Aluminum	0.0.015	0.977	37.000
	7440-38-2	Arsenic	0.003	0.010	0.012
	7440-42-8	Boron	0.043	1.680	3.300
	7440-39-3	Barium	0.088	0.747	2.000
	7440-48-4	Cobalt	0.001	0.009	2.200
	7440-47-3	Chromium, Total	0.001	2.38	0.100
	18540-29-9	Chromium, Hexavalent	0.0005	2.756	0.100
	7440-50-8	Copper	0.002	0.014	1.300
	7439-89-6	Iron	0.016	7.600	N/A
	7439-95-4	Magnesium	4.380	57.300	N/A
	7439-96-5	Manganese	0.001	0.230	1.700
	7439-98-7	Molybdenum	0.002	0.060	0.180
	7440-02-0	Nickel	0.001	0.278	0.730
	7782-49-2	Selenium	0.003	0.007	0.050
	7440-24-6	Strontium	0.404	1.830	22.000
	7440-62-2	Vanadium	0.001	0.030	0.260
	7440-66-6	Zinc	0.001	0.150	11.000
Misc	T-005	Alkalinity, Total	94.00	308.00	N/A
	16887-00-6	Chloride	10.10	60.80	N/A
	57-12-5	Cyanide	0.002	0.010	0.200
	16984-48-8	Fluoride	0.130	2.120	N/A
	11/2/2009	Hardness	24.00	324.00	N/A
VOCs	67-64-1	Acetone	0.002	0.002	3.7

**Table 4.5.5-2 — Groundwater Monitoring Results From the Perched Aquifer System
(continued)**

<i>Perched Compliance Plan Wells</i>					
Analyte Type Code	CAS Number	Constituent	Min (mg/L)	Max (mg/L)	RRS 2 Residential (mg/L)
	107-06-2	1,2-Dichloroethane	0.0003	0.006	0.005
	156-59-2	Cis-1, 2-Dichloroethene	ND	ND	0.07
	75-69-4	Trichlorofluoromethane	ND	ND	1.1
	76-13-1	Freon-113 (1,1,2-Trichloro-1, 2,2-Trifluoroethane)	0.003	0.006	1100
	127-18-4	Tetrachloroethylene (PCE)	ND	ND	0.005
	79-01-6	Trichloroethene	0.0003	0.004	0.005
	67-66-3	Chloroform	ND	ND	0.37

Table 4.5.5-3 — Groundwater Monitoring Results From the Ogallala Aquifer System

<i>Ogallala Compliance Plan Wells</i>					
Metals	7440-22-4	Silver	0.001	0.003	0.180
	7429-90-5	Aluminum	0.020	0.905	37.000
	7440-38-2	Arsenic	0.003	0.010	0.012
	7440-42-8	Boron	0.074	0.254	3.300
	7440-39-3	Barium	0.064	0.203	2.000
	7440-47-3	Chromium, Total	0.001	0.026	0.100
	18540-29-9	Chromium, Hexavalent	0.001	0.018	0.100
	7440-50-8	Copper	ND	ND	1.300
	7439-89-6	Iron	0.013	1.020	N/A
	7439-95-4	Magnesium	16.00	33.60	N/A
	7439-96-5	Manganese	0.001	0.046	1.700
	7439-98-7	Molybdenum	0.001	0.032	0.180
	7440-02-0	Nickel	0.001	0.327	0.730
	7782-49-2	Selenium	0.003	0.011	0.050
	7440-24-6	Strontium	0.553	1.160	22.000
	7440-28-0	Thallium	0.0001	0.0004	0.034
	7440-62-2	Vanadium	0.006	0.026	0.260
	7440-66-6	Zinc	0.002	0.031	11.000
Misc	T-005	Alkalinity, Total	130.00	372.00	N/A
	16887-00-6	Chloride	4.01	41.8	N/A
	16984-48-8	Fluoride	0.32	59	N/A
	11/2/2009	Hardness	116	508	N/A

The Ogallala Formation underlies the Blackwater Draw Formation. The Ogallala Formation consists of interbedded sands, silts, clays, and gravels. The base of the Ogallala Formation is an irregular surface that represents pre-Ogallala topography, as a result, the vertical distance to the base of the Ogallala Formation at Pantex varies from 300 feet at the southwest corner to 720 feet at the northeast corner (Pantex 2006).

Sedimentary rock of the Dockum Group underlies the Ogallala Formation. The Dockum group consists of shale, clayey siltstone, and sandstone. The deep geology (4,000 feet) below Pantex has a major influence on the natural radiation environment because radon is released from the granitic rocks there (Pantex 2006).

4.5.6.2 *Soils*

Surface soils at Pantex consist mainly of Randall clay and Pullman clay loam, with areas of Estacado, Lofton, and Pep clay loams in the playa bottoms. The Pullman clay loam series dominates in uplands, and Randall clay dominates in the playa bottoms. The Estacado, Lofton, and Pep clay loams are found in sloping areas surrounding playa bottoms (Pantex 2006).

Onsite soil monitoring results for 2005 were, with few exceptions, within the concentration ranges observed for uncontaminated local soil and was comparable to both historical results and those for control locations (Pantex 2006).

Exceptions included elevated Uranium -234 and -238 in soil samples at Playa 1 and one elevated level of Uranium-238 at the firing range. Elevated levels of uranium in Playa 1 are believed to be directly related to naturally occurring uranium concentrations in Ogallala water discharged to Playa 1 (Pantex 2006).

4.5.6.3 *Seismology*

The closest Tertiary or Quaternary volcanism in the region surrounding the Pantex plant is in New Mexico, over 100 miles from the site. No tectonic faulting younger than Late Permian is recognized at or near Pantex. Three major subsurface faults and one minor surficial fault exist in the area as follows: (1) 155 miles long, about 25 miles north of site; (2) 43 miles long, about 5 miles south of site; (3) 40 miles long, about 7 miles north of site; and (4) the surficial fault is 4 miles long, about 20 miles northwest of site.

Seismic events have occurred infrequently in the region, and their magnitudes have been low. The stress conditions at the site are such that the possibility of high-order seismic events is extremely unlikely. The anticipated seismic activity is well below the levels causing significant damage to structures at Pantex (Pantex 2006).

Approximately 25 earthquakes have been recorded in the Texas Panhandle. The largest earthquakes were the March 27, 1917, Panhandle event, about 15 miles east of the site, and the July 30, 1925, event northeast of Amarillo, about 15 miles northeast of Pantex. Both earthquakes had a Richter magnitude of 5.0 and a Modified Mercalli Scale of VI, with observed effects including pictures falling off walls, furniture moving or overturning, and cracks in weak

masonry. Most shocks in the Texas Panhandle are located along the Amarillo Uplift, although uncertainties in the calculated epicenters preclude identifying specific active faults.

Slope stability is not an issue at Pantex because all structures are built on the essentially flat surfaces rather than on the gentle slopes of the playa basins. In general, the surficial soil extends to depths of no more than 10 feet. The underlying Blackwater Draw Formation is the material on which larger structures are founded.

Liquefaction is not considered to be an issue at Pantex because the near-surface materials are not saturated. Salt dissolution is an active and ongoing process in the Southern High Plains, but is extremely unlikely to affect the site. Most active salt dissolution is concentrated near the eastern caprock (an overlying rock layer usually hard to penetrate) escarpment and to a lesser degree near the northern margin in the Canadian River Valley. It is important to note that salt dissolution is a geologically active process; however, it is a very slow process relative to human activities (DOE 1996d).

4.5.7 Biological Resources

4.5.7.1 Terrestrial Resources

Pantex is located on the Llano Estacado (staked plains) portion of the Southern Great Plains of Texas on tableland at an elevation of approximately 3,500 feet. The topography at Pantex is relatively flat, characterized by rolling, treeless, grassy plains, and numerous natural playa basins. The term “playa” is used to describe shallow ephemeral (temporary) lakes with clay-lined basins that periodically fill with runoff; most are less than 0.6 mile in diameter. Playa lakes are important hydrologic features acting as sources of recharge to surficial groundwater and providing prime habitat for wildlife. Many wildlife species in the region are dependent on playas for their existence.

The region is a semi-arid farming and ranching area. Shortgrass prairie grasslands were the native vegetation until the prairie was converted to agricultural use for crops, grazing, or protective vegetative cover under the Conservation Reserve Program. Shortgrass prairie is dominated by two warm-season drought-resistant grass species: blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Other typical less abundant grass species include sideoats grama (*Bouteloua curtipendula*), western wheatgrass (*Agropyron smithii*), vine mesquite (*Panicum obtusum*) and silver bluestem (*Bothriochloa laguiriodes*) (DOE 1996c).

Since 1955, DOE-owned lands not required for facility operations are managed for agricultural operations under a Service Agreement with TTU. The previously cultivated southeastern portion of Pantex is dominated by silver bluestem (*Bothriochloa laguiriodes*) and rare individuals of yankee weed (*Eupatorium compositifolium*). The west central region of Pantex contains predominantly kochia (*Kochia scoparia*) and pigweed (*Amaranthus* spp.) with lesser extents of buffalo grass, planted Siberian elm, and cottonwood (*Populus deltoides*) (DOE 1996c). From 1996 to 2002, native prairie grasses have been seeded in formerly cultivated areas around the playas and in several disturbed areas. The vegetated buffer zone around the playas provide wildlife habitat and filter storm water runoff that drain to the playas.

Herbivorous mammals such as rabbits, deer, and rodents reach high densities in vegetated buffers surrounding playas. Mammalian and avian predators of herbivores also thrive in playa habitats. Waterfowl and shorebirds associated with playas rely heavily on aquatic and mud flat invertebrate populations in the shallow and receding waters.

At least 13 species of mammals were recorded at Pantex in 2005 during routine activities such as bird surveys, nuisance animal actions, and incidental observations. Species observed included the black-tailed jackrabbit (*Lepus californicus*), black-tailed prairie dog (*Cynomys ludovicianus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), cottontail (*Sylvilagus spp.*), coyote (*Canis latrans*), hispid cottonrat (*Sigmodon hispidus*), mule deer (*Odocoileus hemionus*), pocket gopher (*Geomys or Cratogeomys*), prairie vole (*Microtus ochrogaster*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), and woodrat (*Neotoma spp.*) (Pantex 2006). Additional mammalian species observed previously include the American badger (*Taxidea taxus*), deer mouse (*Peromyscus maniculatus*), northern grasshopper mouse (*Onychomys leugaster*), plains harvest mouse (*Reithrodontomys montanus*), silky pocketmouse (*Perognathus flavus*), and the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) (Pantex 2006).

Prairie dog colonies are annually monitored and managed to prevent encroachment on areas of operational concern (Pantex 2006). Through 2006, prairie dog colonies occupied approximately 470 acres at Pantex and Pantex Lake (Pantex 2006). An active comprehensive management plan removes prairie dogs from areas of operational concern. To minimize the spread of prairie dogs, shrubs of four-winged saltbush and aromatic sumac were planted in 2002 as a visual barrier (Pantex 2002).

Counts of burrowing owls (*Athene cunicularia*) are monitored during prairie dog population surveys and in 2003 estimated 177 owls, with 137 at Pantex and 40 at Pantex Lake (Pantex 2004). The relatively recent increase in availability of food and shrub cover has also resulted in an increasing deer population.

The uplands of Pantex support a variety of invertebrates, reptiles, and amphibians. The insect class is well represented with grasshoppers, beetles, true bugs, flies, bees, wasps, ants, moths, butterflies, and dragonflies. The most frequently occurring species of reptiles and amphibians include the Great Plains toad (*Bufo cognatus*), Woodhouses toad (*Bufo woodhousei*), Plains spadefoot toad (*Scaphiopus bombifrons*), Great Plains skink (*Eumeces obsoletus*), Western coachwhip snake (*Masticophis flagellum testaceus*), bullsnake (*Pituophis melanoleucus sayi*), checkered garter snake (*Thamnophis marcianus marcianus*), and prairie rattlesnake (*Crotalus viridis viridis*) (Pantex 2006).

Migratory birds are an important part of Pantex Plant's natural resources. Bird migrations vary from year to year, especially as conditions change. Some of the more common species of birds that have been observed at Pantex include the Western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), mourning dove (*Zenaida macroura*), Bewicks wren (*Thryomanes bewickii*), mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), common nighthawk (*Chordeiles minor*), greater roadrunner (*Geococcyx californianus*), killdeer (*Charadrius ociferous*), Swainsons hawk (*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (Pantex 2006).

4.5.7.2 Wetlands and Floodplains

4.5.7.2.1 Wetlands

There are six playas on DOE-owned or leased land at Pantex: Playas 1, 2, and 3 are on the main Pantex Site; Playas 4 and 5 are on land leased from TTU; and Pantex Lake is on a separate parcel of DOE-owned property, approximately 2.5 miles northeast of the main portion of Pantex. The playa lakes are extremely important hydrologic features at Pantex that provide prime habitat for wildlife, especially waterfowl that winter in the southern High Plains. Playas are also believed to be an important source of recharge for the perched aquifer (DOE, 1996, Pantex 2006). Playas 1, 2, and 4 receive stormwater from Pantex's industrial areas; Playa 3 receives stormwater from the Burning Ground. All playas receive runoff from agricultural areas. Prior to 2005, Playa 1 received continuous discharge from the WWTF and was a perennial waterbody with a stable water level.

The vegetation communities of playas are dependent upon the surrounding land use, the depth of the playa basin including modifications for irrigation, and the water regime. Concentric zones of vegetation are generally present in unmodified playas with fluctuating water levels. Wetter playas contain open water zones and narrow- or broad-leaved emergent vegetation that produce seeds for waterfowl. Drier playas contain more grassland vegetation (Pantex 2006).

Playa 1

This playa once received continuous discharge from the WWTF and was a perennial waterbody. Now, it receives only intermittent flow from stormwater. As a perennial waterbody, it supported 19 obligate aquatic plant species, the highest number of any playa at Pantex. Like most wet playas, the dominant plants are emergent and submergent species. A narrow leaved perennial emergent zone consisting of cattail (*Typha angustifolia*), spikerush (*Eleocharis macrostachya*), and bulrush (*Scirpus* spp.) was present at Playa 1. Open water habitat contained pondweed (*Potamogeton nodosus*). The broad leaved emergent zone contained seed-producing plants such as arrowhead (*Sagittaria montevidensis*), and smartweed (*Polygonum* spp.). The facultative aquatic or semi-aquatic species found at Playa 1 include slim aster (*Aster subulatus*), and western black willow (*Salix goodingii*). The uplands surrounding Playa 1 are typical High Plains grassland composed of buffalo grass, blue grama, and prickly pear.

Playa 2

The basin of this playa is dominated by several species of smartweed. Other significant species within the basin include mallow (*Malvella leprosa*), ragweed (*Ambrosia grayii*), and sunflower (*Helianthus annuus*). One small association of cattails was also noted within the playa. The edge of the playa basin contains tumbleweed (*Salsola* spp.) and frog fruit (*Phyla* spp.), while, slightly above the basin, the major plant species are wheatgrass and snow-on-the-mountain (*Euphorbia marginata*). The plant composition of the uplands surrounding Playa 2 is very similar to that of Playa 1.

Playa 3

This playa, adjacent to the Burning Ground, has a basin floral composition of primarily spikerush with little vervain (*Verbena bracteata*) and hairy water clover (*Marsilea vestita*). The edge of the basin is dominated by spikerush, woollyleaf bursage (*Ambrosia grayi*) and cocklebur (*Xanthium strumarium*), and the uplands surrounding Playa 3 have a species composition similar to Playas 1 and 2.

Playa 4

The low areas of this playa contain abundant spikerush and ragweed, with some hairy water clover and buffalo grass. One of the lowest areas in the basin supports cattails and several species of smartweed. Extensive stands of wheatgrass are present on the slopes leading from the basin to the uplands. The shortgrass prairie immediately adjacent to Playa 4 has a composition similar to other areas at Pantex, but with a greater coverage of buffalo grass.

Playa 5

When mostly dry, this playa exhibits large areas of bare clay. The plant species found within the playa include suckleya (*S. suckleyana*), goose foot (*Chenopodium glaucum*), and cocklebur. In a small wet area of the playa, cattails and great bulrush were found to be locally prevalent, and their coverage expands when the playa contains more water from seasonal rains. The lower slopes, which transition into the surrounding grassland contain buffalo grass and wheatgrass. The High Plains grassland surrounding Playa 5 is similar in composition to the remainder of the site, except that three-awn has a more significant presence (DOE 1996c).

Pantex Lake

Major plants within the basin of Pantex Lake are spikerush, wheatgrass, and cocklebur. The area at the edge of the basin is dominated by wheatgrass, but there is a transition into High Plains grassland dominated by buffalo grass and, to a lesser degree, three-awn and blue grama. In the past, Pantex Lake received discharge from site activities, but currently does not.

4.5.7.2.2 Floodplains

Floodplains at Pantex were delineated by the U.S. Army Corps of Engineers (USACE) in accordance with Executive Order 11988 (E.O. 11988). This assessment also addressed DOE's environmental review requirement under *Compliance with Floodplain/Wetlands Environmental Review Requirements* (10 CFR 1022). The USACE delineated floodplain boundaries for Playas 1 through 4, Pantex Lake, and Pratt Lake, located north of the site, using criteria for 100-year, 500-year, and Standard Project Flood boundaries.

Except for Playa 3, floodplains at Pantex are within the drainage boundary for each playa. The 500-year and Standard Project Flood runoff into Playa 3 will overflow out of the drainage basin creating shallow (less than 1 foot) flooding of the drainage basins for Playas 1 and 2 (DOE 1996d).

4.5.7.3 *Aquatic Resources*

There are no federally designated Wild and Scenic Rivers onsite. No streams or rivers flow through Pantex. Major surface water in the vicinity includes the Canadian River, 17 miles to the north, Sweetwater Creek and the Salt Fork of the Red River, respectively 50 miles and 20 miles to the east, and the Prairie Dog Fork of the Red River, 35 miles to the south. The Canadian River flows into Lake Meredith about 25 miles north of the plant. The only naturally occurring waterbodies onsite are the playas and very small, unnamed, intermittent channels and ditches that may feed stormwater into the playas. Wastewater treatment lagoons, past concrete ponds and an earthen stock tank near Pantex Lake provide open-water habitat.

Aquatic resources at Pantex are not extensive. Since Playas 1 through 4 and Pantex Lake are considered wetlands, they are detailed in Section 4.5.7.2. The playas are frequently dry because of the high, naturally occurring evaporation rate combined with a rate of infiltration that normally exceeds the rate of inflow. Playas in the area of Pantex may be as large as 4,000 feet in diameter and more than 30 feet deep. Most of the playas are floored with a clay accumulation at the bottom that when dry offer littoral habitat of mud flats that provide foraging habitat for shorebirds. There are no surface waterways that flow throughout the year. Channels and ditches contain flows only after storm events. Although isolated from navigable waters, playas are considered as waters of the U.S. and are designated as jurisdictional wetlands, but are not subject to Section 404 of the *Clean Water Act*.

The aquatic regions of Playa 1 support over 6 genera of plants. The dominant vegetation is narrow-leaved emergent plants such as cattail, or great bulrush (*Scirpus validus*), and 3 species of seed-producing broad-leaved emergent, smartweed (*Polygonum* spp.). During surveys in 1992, 26 families of macroinvertebrates were collected from Pantex playas. Insects identified included mayflies (1 family), dragonflies and damselflies (3 families), beetles (6 families), true bugs (6 families), and flies (3 families). There were also 4 families of crustaceans, two families of mollusks, leeches, and water mites. Vertebrate species recorded at Playa 1 include the Plains leopard frog (*Rana blairi*), the Woodhouses toad, and the upland chorus frog (*Pseudoacris triseriata feriarum*). The concrete ponds, representing another aquatic habitat at Pantex, are inhabited by 6 different species of amphibians, including the barred tiger salamander (*Ambystoma tigrinum mavoritum*), the upland chorus frog, and the Great Plains toad. In May 1996, Pantex personnel resampled the earthen stock tank near Pantex Lake. Specimens of fathead minnows (*Pimephales promelus*) and 1 black bullhead (*Ictalurus melas*) were collected (Pantex 2006). Birds are the most conspicuous animal associated with the playas in terms of numbers, diversity, and biomass. Situated along the central flyway migratory route, the playas provide valuable habitat for migration, wintering, and nesting. The most common wintering ducks are mallards, northern pintails, green-winged teals, and American wigeons. Species known to breed in playas include the mallard, northern pintail, blue winged teal, cinnamon teal, northern bobwhite, western meadowlark, yellow-headed blackbird, red-winged blackbird, and ring-necked pheasant (Pantex 2006).

Fishes do not inhabit most playas however those modified for irrigation may contain black bullheads (*Ictalurus melas*).

4.5.7.4 Threatened and Endangered Species

The Pantex Plant provides habitat for several species protected by Federal and state endangered species. The current status of threatened and endangered (T&E) species known to appear on, or in the vicinity of Pantex is shown in Table 4.5.7-1.

Five special status species have been observed at Pantex. The ferruginous hawk (*Buteo regalis*) is a common winter resident that feeds on prairie dogs and cottontail rabbits. The area west of Zone 4 West is a potential feeding location because of its prairie dog towns. Also associated with the prairie dog towns is the western burrowing owl (*Athene cunicularia hypugaea*). Up to 10 pairs of western burrowing owls have been identified as nesting in the area just west of Zone 4 West. The Texas horned lizard (*Phrynosoma cornutum*) is a Pantex resident and has state-threatened status (DOE 2006, Pantex 2006).

Other rare or protected species listed in Table 4.5.7-1 are known to exist in Carson County, but have not been observed at Pantex.

Table 4.5.7-1 — Rare or Federal and State Listed Species Potentially Occurring at Pantex

Species ^a	Federal Classification	State Classification	Presence Documented at Pantex Plant in 2005
Birds			
Arctic peregrine falcon <i>Falco peregrinus tundrius</i>	Concern	Threatened	
Baird's sparrow <i>Ammodramus bairdii</i>	Concern	Not Listed	
Ferruginous hawk <i>Buteo regalis</i>	Concern	Not Listed	X
Lesser prairie chicken <i>Tympanuchus pallidicinctus</i>	Candidate (Threatened)	Not Listed	
Mountain plover <i>Charadrius montanus</i>	Concern	Not Listed	
Peregrine Falcon <i>Falco peregrinus</i>	Concern	Endangered. Threatened	
Snowy plover <i>Charadrius alexandrinus</i>	Concern	Not Listed	
Western burrowing owl <i>Athene cunicularia hypugaea</i>	Concern	Endangered	X
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i>	Concern	Not Listed	
Whooping crane <i>Grus americana</i>	Endangered	Endangered	
Mammals			
Big free-tailed bat <i>Nyctinomops macrotis</i>	Concern	Not Listed	
Black Bear <i>Ursus americanus</i>	Threatened by Similarity of Appearance; Concern	Threatened	
Black-footed ferret <i>Mustela nigripes</i>	Endangered	Endangered	

Table 4.5.7-1 — Rare or Federal and State Listed Species Potentially Occurring at Pantex (continued)

Species ^a	Federal Classification	State Classification	Presence Documented at Pantex Plant in 2005
Black-tailed prairie dog <i>Cynomys ludovicianus</i>	Concern	Not Listed	X
Cave myotis <i>Myotis velifer</i>	Concern	Not Listed	
Gray Wolf <i>Canis lupus</i>	Endangered	Endangered	
Pale Townsend's big-eared bat <i>Corynorhinus townsendii pallescens</i>	Concern	Not Listed	
Plains spotted skunk <i>Spilogale putorius interrupta</i>	Concern	Not Listed	
Swift fox <i>Vulpes velox</i>	Concern	Not Listed	
Plants			
Mexican mud-plantain <i>Heteranthera mexicana</i>	Concern	Not Listed	
Reptiles			
Texas horned lizard <i>Phrynosoma cornutum</i>	Concern	Threatened	X

a = Species that may be of concern to the US Fish and Wildlife Service but do not receive Endangered Species Act recognition, are included for completeness.

Source: TPWD 2006.

4.5.7.5 *Biological Monitoring and Abatement Programs*

The Pantex Plant has developed management activities designed for biodiversity. In addition, flora and fauna surveillance is conducted to assess potential short and long-term effects of Pantex Plant operations on the environment. Radionuclide and fluoride analyses were performed on both native and vegetation crops and animals were sampled to determine whether Pantex Plant activities have an impact on them (Pantex 2006).

Concentrations of inorganic fluoride were not detected at significant levels in vegetation near the Burning Ground or at offsite locations. Radionuclide concentrations in fauna samples, as well as vegetation samples, which included both native vegetation and crops from onsite and offsite locations, were compared to values observed in samples from control locations. These comparisons indicated no detrimental impacts from Pantex Plant operations in 2005 (Pantex 2006).

To manage for biodiversity, Pantex developed a plan for the revegetation of some formerly cultivated areas and implemented it in 1996. Areas of formerly cultivated land were planted with native grasses. Native grasses were seeded on several disturbed areas, such as abandoned parking areas, well construction sites, landfill covers, and roadsides in an effort to minimize soil erosion (Pantex 2006).

4.5.8 Cultural and Archaeological Resources

Cultural resources identified at Pantex Plant include archeological sites from prehistoric Native American use of Pantex Plant land, standing structures that were once part of the World War II-era, and buildings, structures, and equipment associated with the Plant's Cold War operations. 69 archeological sites have been identified at Pantex which consists of 57 prehistoric sites represented by scatters of stone artifacts, and 12 Euro-American farmstead sites represented by foundation remains and small artifact scatters (Pantex 2006).

In consultation with the SHPO, the Pantex Site Office (PSO) determined that the 12 Euro-American historic sites are not eligible for inclusion in the NRHP.

4.5.8.1 *Archeological Resources*

Systematic archaeological inventories at Pantex have included approximately half of the facility acreage with the other half of the site consisting mainly of industrial areas, playa wetlands, or uplands between playas with very low probability of site occurrence (DOE and TTU areas combined). Through these inventories, 57 prehistoric sites have been identified (DOE 1996d). Archaeological test excavations conducted at 23 of these sites suggest that a majority of the sites were occupied during the Late Archaic and Late Prehistoric periods (1000 B.C.-A.D. 1541). These sites are generally associated with local playas, located within 0.25 mile of the playa margin or along distinct drainages into the playa. However, some sites are located in the upper areas between playas. Sites consist mainly of lithic scatters with varying amounts of fire-cracked rock.

The surficial geology of the Pantex region consists of silts, clays, and sands of the Blackwater Draw Formation. In other areas of the High Plains, this formation contains Late Pleistocene vertebrate remains, including bison, camel, horse, mammoth, and mastodon, with occasional and significant evidence of their use by early North American human populations. Evidence of woolly mammoths has been found north of Pantex near the Canadian River (DOE 1996b). However, no Archaeological resources have been found on Pantex.

The PSO and the SHPO concluded that two of the 57 prehistoric sites are potentially eligible for the National Register, but that additional field work would be required to make a final eligibility determination (Pantex 2006). The PSO will continue to protect the two potentially eligible sites and monitor them on a regular basis, as though they are eligible. In addition, 22 prehistoric sites are protected within playa management units surrounding the four DOE-owned playas (Pantex 2006).

In addition, DOE has decided to protect 22 of the 55 ineligible sites because they are a unique grouping of Southern High Plains sites. The uniqueness is based on the sites' location near contiguous playas and the sites' research potential to illuminate prehistoric human use of the region's playas. This is the largest such grouping of sites currently under Federal protection.

4.5.8.2 *Historic Resources*

Historic resources located at Pantex include archaeological sites dating to pre-1942, World War II-era resources, and Cold War-era resources. Twelve pre-1942 Euro-American historic sites have been identified at Pantex. These sites include foundations of demolished buildings such as homes and agricultural support structures (e.g., barns, windmills), and surface scatters of metal, ceramic, and glass artifacts.

The World War II-era historical resources of Pantex consist of 121 standing buildings and structures, all of which have been surveyed and recorded. In consultation with the SHPO, the PSO has determined that these properties are not eligible for inclusion in the NRHP (Pantex 2006). However, 69 buildings that were constructed during World War II and used during the Cold War are eligible for inclusion in the NRHP under the Cold War context (Pantex 2006).

From 1951-1991, Pantex had a Cold War mission centered around nuclear weapons, including fabrication of high explosives, assembly and disassembly, and repair and modification (DOE 1996d). A literature search was conducted that identified approximately 650 buildings and structures and a large inventory of related equipment and documents from this era.

A draft Pantex Plant Cold War context statement was completed in 1999, to assist in the evaluation of these resources for eligibility in the NRHP. In addition, a draft cultural resources management plan was completed in 2000 to describe the management of all Pantex Plant resources determined eligible for the NRHP. In 2003, the Cold War context statement was finalized and the draft cultural resources management plan was revised. Both documents were presented to the SHPO and the Advisory Council in early 2004 and the final was completed in October 2004. The cultural resources management program at Pantex is now focused on implementing the new program and completing the range of preservation of activities described in the management plan (Pantex 2006).

4.5.8.3 *Native American Resources*

To date, no known Native American traditional cultural properties, sacred sites, or mortuary remains have been identified at Pantex, and based on completed inventories, none are anticipated. A recently completed search of treaty records has indicated that no federally recognized Native American tribes have recognized title or treaty rights to Pantex land area; however, the U.S. Indian Claims Commission has found that the Kiowa, Comanche, and Apache Tribes of Oklahoma have legally recognized traditional interests in the Texas Panhandle (DOE 1996d).

4.5.9 **Socioeconomic Resources**

Socioeconomic characteristics addressed at Pantex include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current Pantex employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

Pantex is located in Carson County, Texas. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Potter, Carson, Randall, and Armstrong Counties. Figure 4.5.9-1 presents a map of the counties composing the Pantex ROI.

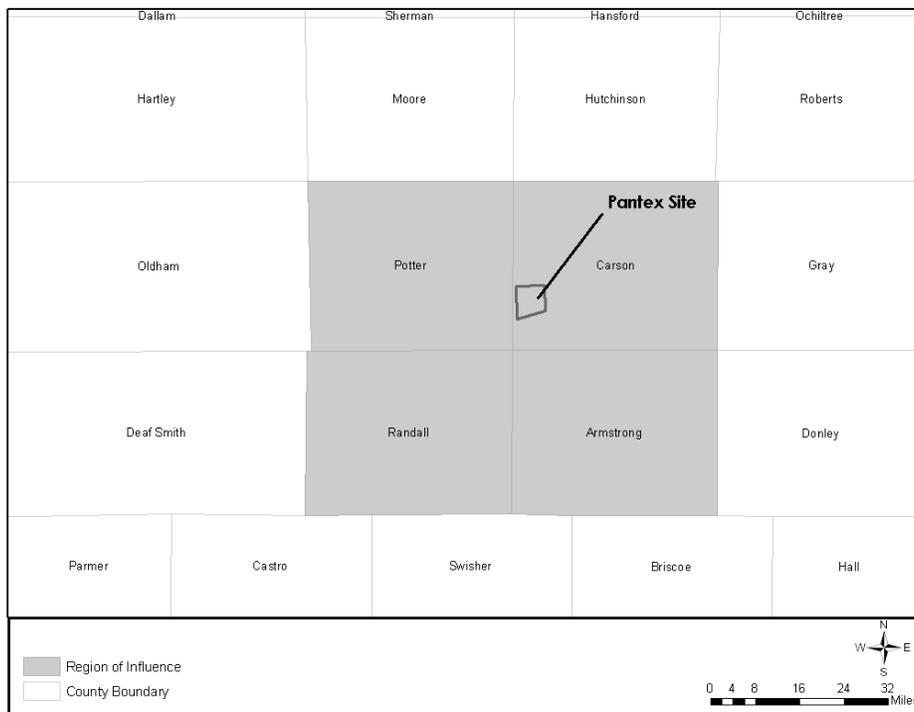


Figure 4.5.9-1 — Region of Influence for Pantex

4.5.9.1 *Employment and Income*

Labor force statistics are summarized in Table 4.5.9-1. The available labor force (i.e., those greater than 16 years old and able to work) of the ROI grew by approximately 9 percent from 117,511 in 2000 to 128,348 in 2005. The overall ROI employment experienced a growth rate of nearly 9 percent with 112,986 in 2000 to 123,280 in 2005 (BLS 2007).

The ROI unemployment rate was 3.9 percent in 2000 and 3.9 percent in 2005. In 2005, Potter County had the highest unemployment rate within the ROI, 4.6 percent. Randall County had the lowest unemployment rate within the ROI, 3.4 percent (BLS 2007).

Table 4.5.9-1 — Labor Force Statistics for ROI and Texas

	ROI		Texas	
	2000	2005	2000	2005
Civilian Labor Force	117,511	128,348	10,347,847	11,282,845
Employment	112,986	123,280	9,896,002	10,677,171
Unemployment	4,525	5,068	451,845	605,674
Unemployment Rate	3.9	3.9	4.4	5.4

Source: BLS 2007.

Income information for the Pantex ROI is provided in Table 4.5.9-2. Potter County is at the low end of the ROI with a median household income in 2004 of \$30,294 and a per capita income of \$25,048. Randall County had a median household income of \$47,377 and a per capita income of \$29,164 (BEA 2007).

Table 4.5.9-2 — Income Information for the Pantex ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Armstrong	28,743	40,857
Carson	25,796	38,724
Potter	25,048	30,294
Randall	29,164	47,377
Texas	30,664	41,645

Source: BEA 2007.

4.5.9.2 *Population and Housing*

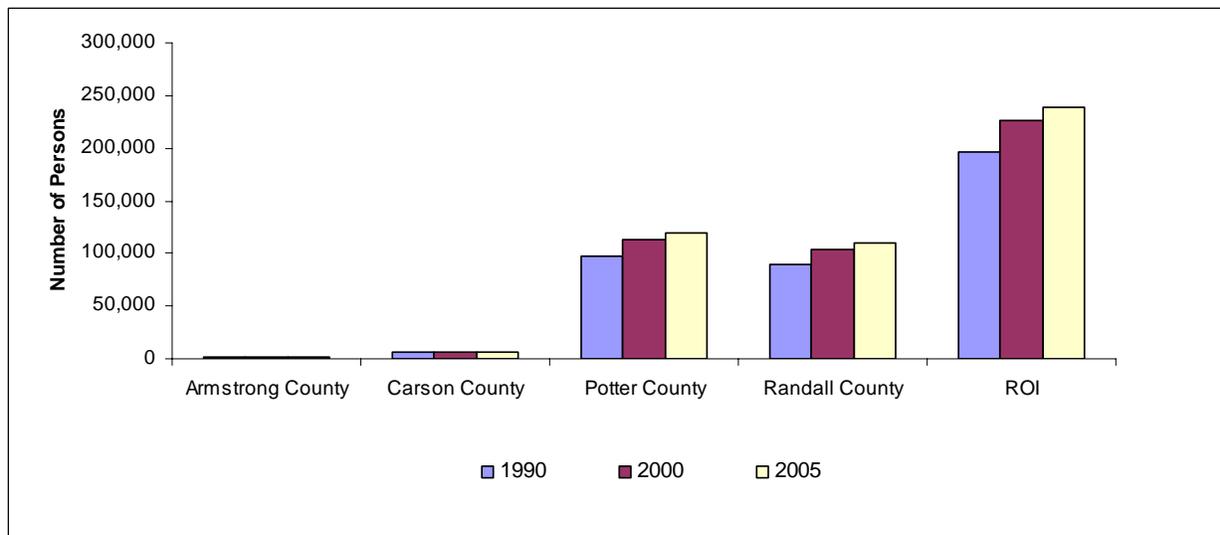
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-3 presents historic and projected population in the ROI and the state.

Table 4.5.9-3 — Historic and Projected Population

	1990	2000	2005	2010	2020
Armstrong County	2,021	2,148	2,176	2,236	2,355
Carson County	6,576	6,516	6,577	6,702	6,925
Potter County	97,874	113,546	120,033	125,209	135,313
Randall County	89,673	104,312	110,021	108,230	110,090
ROI	196,144	226,522	238,807	242,377	254,683
Texas	16,986,510	20,851,820	22,928,508	22,802,947	24,330,685

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 15 percent from 196,144 in 1990 to 226,522 in 2000. From 2000 to 2005, the population of the ROI increased 5 percent to 238,807 in 2005. Potter County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 5.7 percent (USCB 2007a). Figure 4.1.9-2 presents the trends in population within the Pantex ROI.



Source: USCB 2007.

Note – Number of persons for Armstrong and Carson Counties are also presented in Table 4.5.9-3.

Figure 4.5.9-2 —Trends in Population for the Pantex ROI, 1990-2005

Table 4.5.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 91,594 with 85,272 occupied (93 percent). There were 56,173 owner-occupied housing units and 29,099 rental units. The median value of owner-occupied units in Randall County was the greatest of the counties in the Pantex ROI (\$93,500). The median value of owner-occupied units was \$54,400 in Potter County. The vacancy rate was the lowest in Randall County (4.7 percent) and the highest in Armstrong County (12.8 percent) (USCB 2007).

Table 4.5.9-4 — Housing in the Pantex ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Armstrong County	920	802	633	169	118	12.8	60,500
Carson County	2,815	2,470	2,067	403	345	12.3	52,400
Potter County	44,598	40,760	24,484	16,276	3,838	8.6	54,400
Randall County	43,261	41,240	28,989	12,251	2,021	4.7	93,500
ROI	91,594	85,272	56,173	29,099	6,322	6.9	74,573

Source: USCB 2007.

4.5.9.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 11 school districts with 87 schools serving the Pantex ROI. Educational services are provided for approximately 43,054 students by an estimated 3,031 teachers for the 2005 to 2006 school year (IES 2006d). The student-to-teacher ratio in these school districts ranges from a high of 16:1 in the Canyon School District in Randall County to a low of 9:1 in the Claude and Groom School Districts, in Armstrong and Carson Counties, respectively. The student-to-teacher ratio in the ROI was 14:1 (IES 2006d).

The counties within the ROI employ approximately 2,900 firefighters and law enforcement officers. There are 5 hospitals that serve residents of the ROI and are all located in Potter County. These hospitals have a total bed capacity of 1,133 (ESRI 2007).

4.5.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of Pantex. Figure 4.5.10-1 shows counties potentially at risk from the current missions performed at Pantex. There are 14 counties included in the potentially affected area. Table 4.5.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

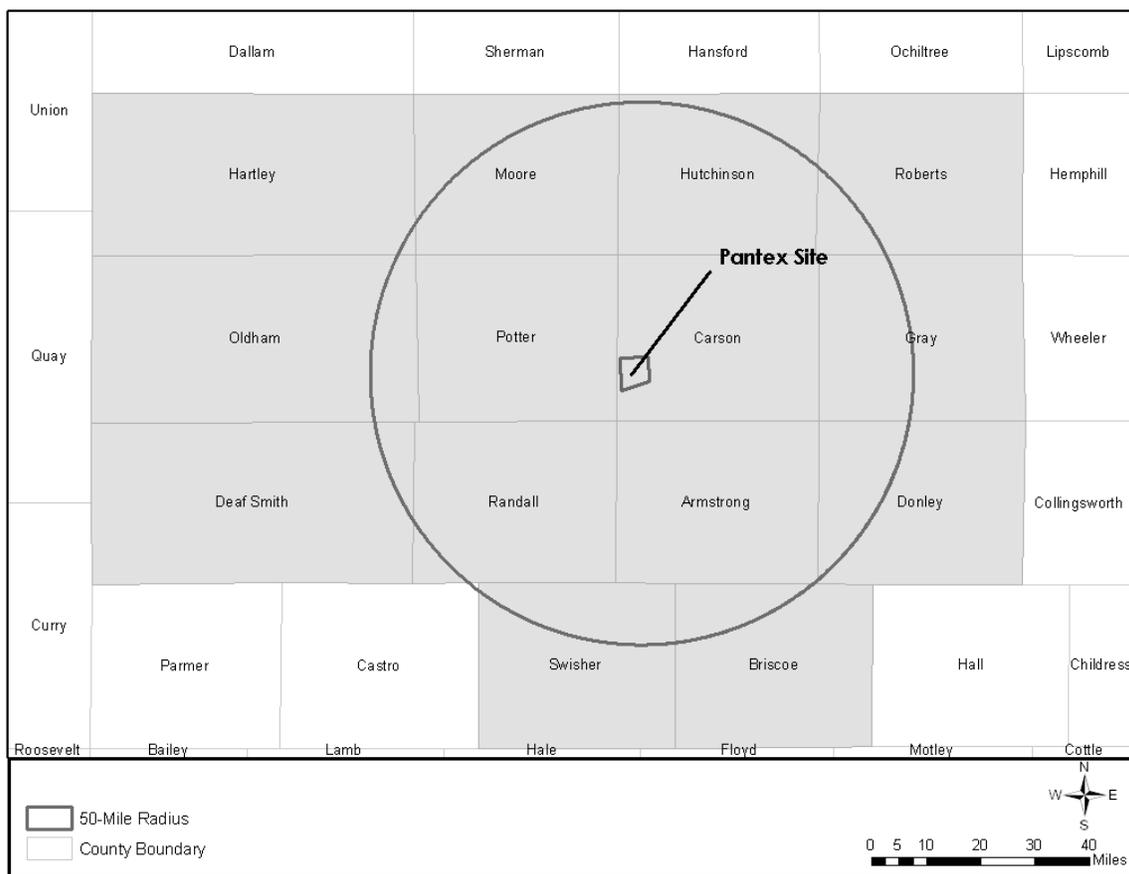


Figure 4.5.10-1 — Potentially Affected Counties Surrounding Pantex

Table 4.5.10-1 — Demographic Profile of the Potentially Affected Area Surrounding Pantex, 2000

Population Group	Population	Percent
Total Minority	100,657	30.1
Hispanic alone	30,644	9.2
Black or African American	16,416	4.9
American Indian and Alaska Native	2,708	0.8
Asian	4,347	1.3
Native Hawaiian and Other Pacific Islander	120	0.04
Native Hawaiian	44	0.01
Some other race	39,218	11.7
Two or more races	7,160	2.1
White alone	233,753	69.9
Total Population	334,410	100

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 30.1 percent of the total population. Residents designated as some other race are the largest group within the minority population. As a percentage of the total resident population in 2000, Texas had a minority population of 47.6 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.5.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 44,312 individuals residing within census tracts in the 50-mile radius of Pantex were identified as living below the Federal poverty threshold, which represents approximately 14 percent of the census tracts population within the 50-mile radius. There were no census tracts within the 50-mile radius where more than 50 percent of the population was identified as living below the Federal poverty threshold. In 2000, 15.4 percent of individuals for whom poverty status is determined were below the poverty level in Texas and 12.4 percent in the U.S. (USCB 2007).

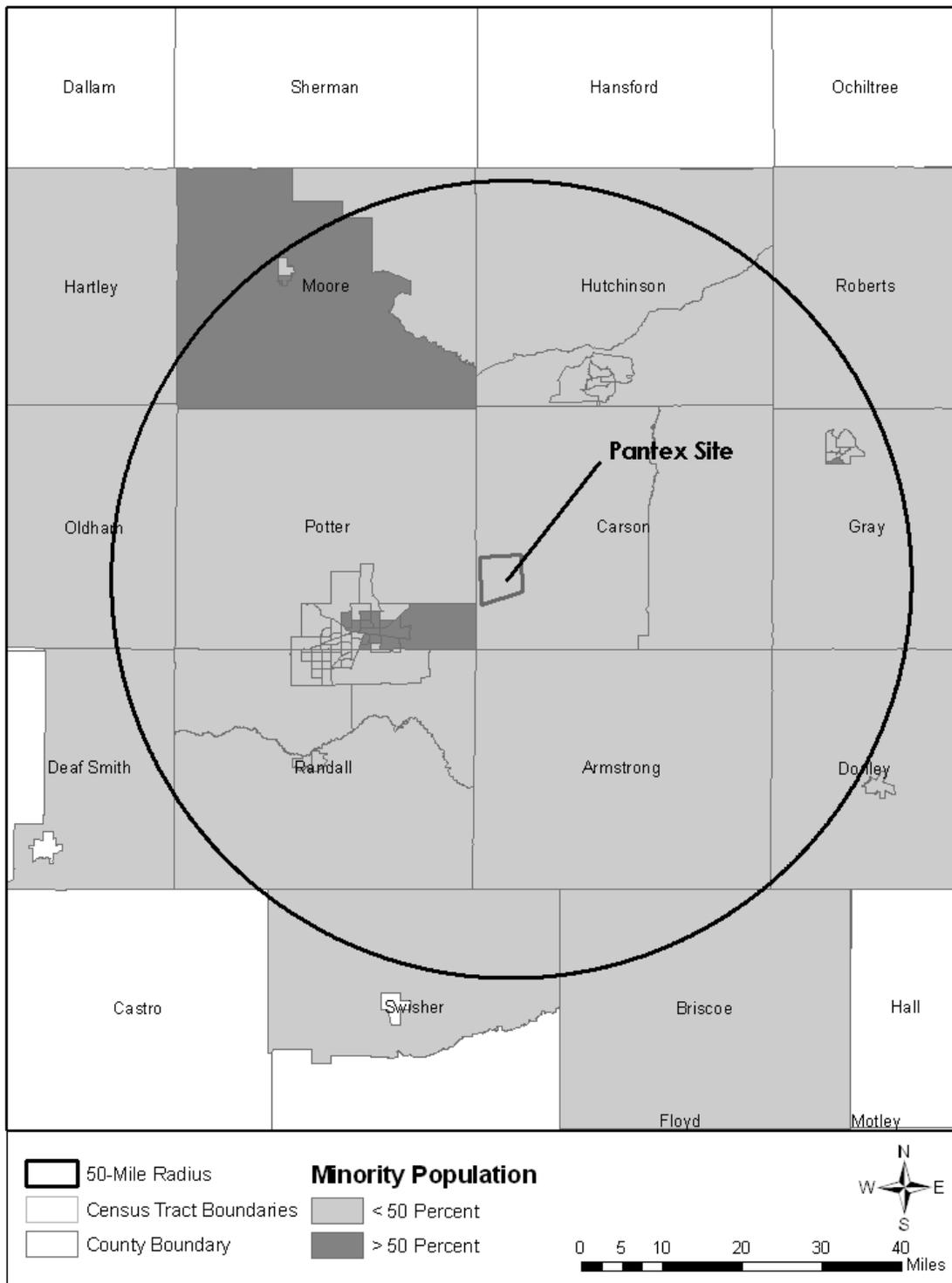


Figure 4.5.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of Pantex

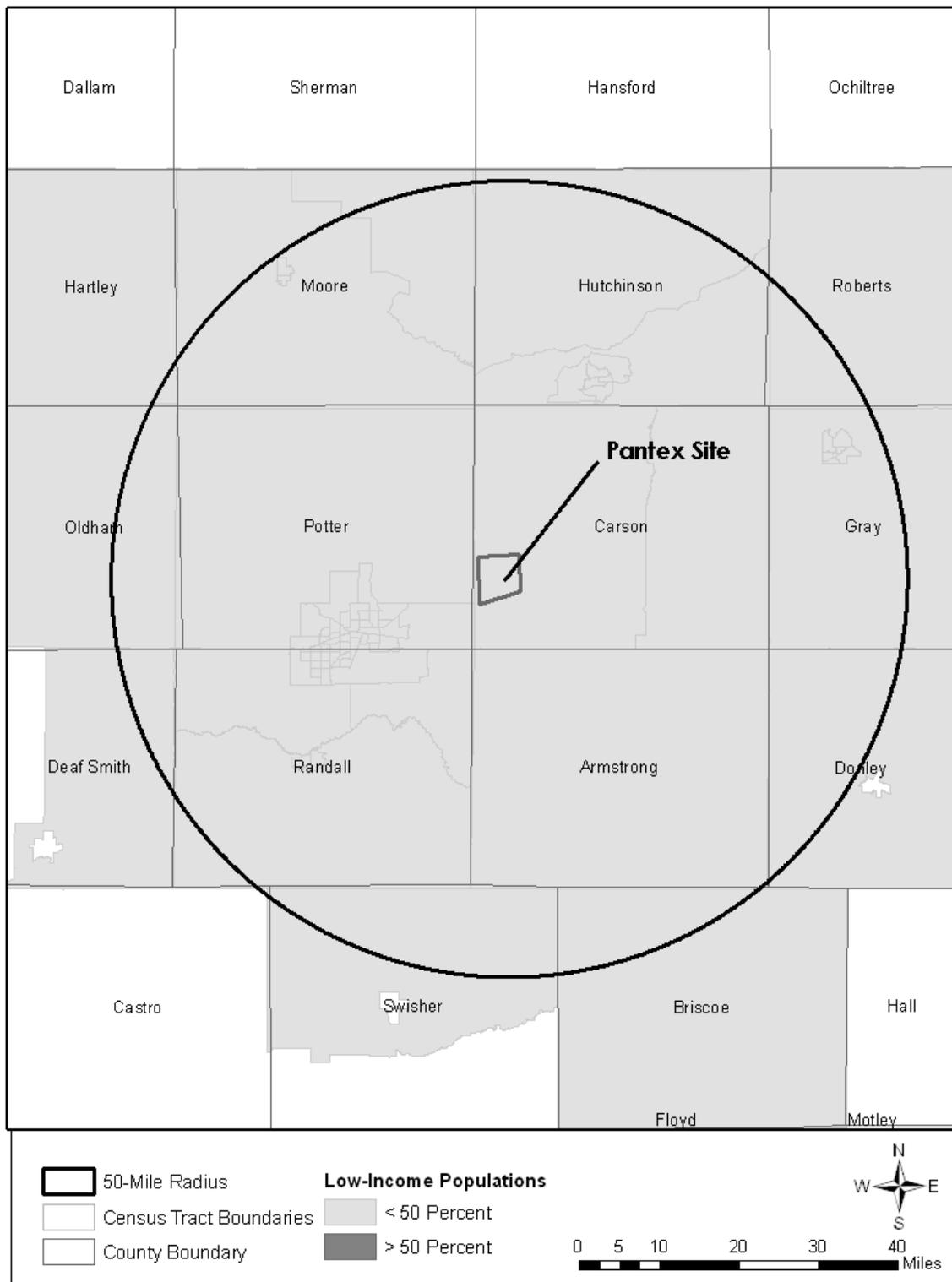


Figure 4.5.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of Pantex

4.5.11 Health and Safety

Most nuclear weapon parts that include radioactive materials are sealed, therefore, minimizing the likelihood of contamination of the weapons themselves, the workers, the public, and the environment. Some activities at Pantex however, do involve the release or the potential release of small amounts of radionuclides (Pantex 2006).

4.5.11.1 Public Health

4.5.11.1.1 Radiological

Releases of radionuclides to the environment from Pantex operations provide a source of radiation exposure to individuals in the vicinity of Pantex. During 2005, Pantex Plant's environmental radiological monitoring program was conducted according to DOE Orders 450.1, "Environmental Protection Program," and 5400.5, "Radiation Protection of the Public and the Environment." The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public. The program monitored for the principal radionuclides associated with plant operations: tritium, thorium-232, uranium-234, uranium-238, and plutonium-239 in air, groundwater, drinking water, surface water, soil, flora, and fauna samples. The radionuclides thorium-232, uranium-234, uranium-238, and plutonium-239 emit primarily alpha particles. Tritium emits beta particles. Gamma radiation emissions from these radionuclides were also monitored and evaluated.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to DCGs listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Current Pantex policy does not allow the discharge of radioactive material into liquid effluent, thus eliminating any future potential impact to groundwater from that source. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the MEI member of the general public. This individual is a person who resides near Pantex Plant, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Plant operations. Calculations are performed using the EPA's CAP88-PC model (EPA 1992).

The dose received by the MEI and the collective population dose are tabulated in Table 4.5.11-1. Because there were no releases from Pantex Plant to the water pathway or any other pathway, the indicated dose represents that for the *air* pathway as well as *all* pathways. Based on the 2005 operational data, Pantex caused a dose to the MEI of 4.28×10^{-9} millirem per year. This dose is 4.28×10^{-9} percent of the DOE public dose limit for all pathways. This dose is significantly below the U.S. EPA maximum permissible exposure limit to the public (and the DOE “air pathway” limit) of 10 millirem per year. The monitoring and analysis results demonstrate that no adverse effects occurred from Plant operations in 2005.

Based upon the same CAP88-PC modeling results, the collective population dose received by those living within 50 miles of Pantex Plant would have been 3.07×10^{-8} person-rem per year in 2005. For comparison purposes, the estimated background radiation dose to the population within 50-miles of Pantex was calculated to be 29,600 person-rem (Pantex 2006).

**Table 4.5.11–1 — Radiation Doses to the Public from Normal Pantex Operations in 2004
 (Total Effective Dose Equivalent)**

Members Of the Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual
Offsite MEI (millirem)	10	4.28×10^{-9}	4	0	100	4.28×10^{-9}
Population within 50 miles ^b (person-rem)	None	3.07×10^{-8}	None	0	None	3.07×10^{-8}

^a The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10-millirem per year limit from airborne emissions is required by the *Clean Air Act* (40 CFR 61) and the 4-millirem per year limit is required by the *Safe Drinking Water Act* (40 CFR 141). For this EIS, the 4- millirem per year value is conservatively assumed to be the limit for the sum of doses from all liquid pathways. The total dose of 100 millirem per year is the limit from all pathways combined. If the potential collective dose to the offsite population exceeds the 100 person-rem value, the contractor operating the facility would be required to notify DOE.

^b 50-mile population is approximately 334,000 based on 2000 census data.

Source: Pantex 2006.

Pantex workers receive the same dose as the general public from background radiation, but they also may receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker and the cumulative dose to all workers at Pantex from operations in 2005 are presented in Table 4.5.11.–2. These doses fall within the radiological regulatory limits of 10 CFR 835. Using a risk estimator of 6×10^{-4} LCFs per rem among workers (see Appendix C), the number of projected fatal cancers among Pantex workers from normal operations in 2005 is 0.03.

**Table 4.5.11–2 — Radiation Doses to Workers From Normal Pantex Operations in 2005
 (Total Effective Dose Equivalent)**

Occupational Personnel	Standard	Actual
Average radiation worker dose (millirem)	5,000 ^a	132
Collective radiation worker dose ^b (person-rem)	None	44.2

^a DOE’s goal is to maintain radiological exposure as low as is reasonably achievable. Therefore, DOE has recommended an administrative control level of 500 millirem per year (DOE 1999e); the site must make reasonable attempts to maintain individual worker doses below this level.

^b There were 334 workers with measurable doses in 2001.

Source: Pantex 2006.

4.5.11.1.2 Non-radiological

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (e.g., soil through direct contact or via the food pathway).

Workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. Pantex workers are also protected by adherence to OSHA and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals.

Appropriate monitoring, which reflects the frequency and amounts of chemicals used in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm.

Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at Pantex via inhalation of air containing hazardous chemicals released to the atmosphere by Pantex operations. Risks to public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

Non-radiological ambient air monitoring was conducted at a single location designated in Texas Natural Resources Conservation Commission (TNRCC) Hazardous Waste Permit HW-50284. The maximum measurement of hydrogen fluoride at this air monitoring site was 3.9 percent of the TNRCC Effects Screening Level (ESL) for hydrogen fluoride. The maximum measurement for any VOC was 87.5 percent of its ESL. This VOC (hexachlorobutadiene) was measured on a day when thermal treatment (burning) was not being conducted at the Burning Ground. The maximum concentration of respirable particulate matter measured at the site designated in HW-50284 was 78.9 percent of the NAAQS, 24-hour average concentration (150 micrograms per cubic meter).

4.5.12 Transportation

Pantex is in the northern Texas panhandle approximately 17 miles northeast of Amarillo, Texas. I-40 provides the main east-west route in the region. I-27 connects Amarillo with locations to the south as far as Lubbock, which is 124 miles away. Highway 87 provides access to and from the north. Truck shipments to Pantex from the east would arrive on I-40, exiting at FM 2373 (Figure 4.5.12-1). The shipping gate is off FM 2373.

Access to the site is provided by the Texas Farm-to-Market roads bounding the site on the north, east, and west and by U.S. 60, one mile to the south. I-40 and I-27 provide access to the interstate highway system. Additionally, 47 miles of roads exist within Pantex boundaries.

Roads within Pantex are classified as primary, secondary, and tertiary roadways. Primary roads are the main distribution arteries for all onsite and offsite traffic. Secondary roads are collector roadways that supplement the primary roads. Primary and secondary roads are paved, two-lane roadways. Tertiary roads are generally single-lane roads, but some heavily traveled tertiary roads are two lanes (M&H 1996).

4.5.12.1 *Aircraft and Railroad Operations*

The Amarillo International Airport is located approximately 7.5 miles southwest of Pantex Plant. The airport is primarily used for commercial aviation and is equipped for international commerce. Pantex Plant leases a small facility at the airport for its own transportation use. The management and operations (M&O) contractor provides the necessary ground transportation.

A major rail center for the Burlington Northern Santa Fe Railroad, formerly known as the Atchison, Topeka, and Santa Fe Railroad, is located in Amarillo, Texas. The railroad passes along the southernmost portion of the TTU property at Pantex Plant Site. A railroad spur which extended through the TTU property into Pantex Plant from the southwest was removed in 2006. (DOE 1996b).

4.5.12.2 *Transportation Accidents*

Motor vehicle accidents in Carson County and nearby counties are reported in Table 4.5.12-1. In 2001, there were 31 motor vehicle accidents in Armstrong, Carson, Potter, and Randall Counties resulting in 37 fatalities.

Table 4.5.12-1 — Texas Traffic Accidents in Nearby Counties, 2001

County	Total Vehicle Accidents	Interstate Accidents	Fatalities
Armstrong	1	1	1
Carson	4	1	7
Potter	16	2	18
Randall	10	1	11

Source: TXDPS 2001.

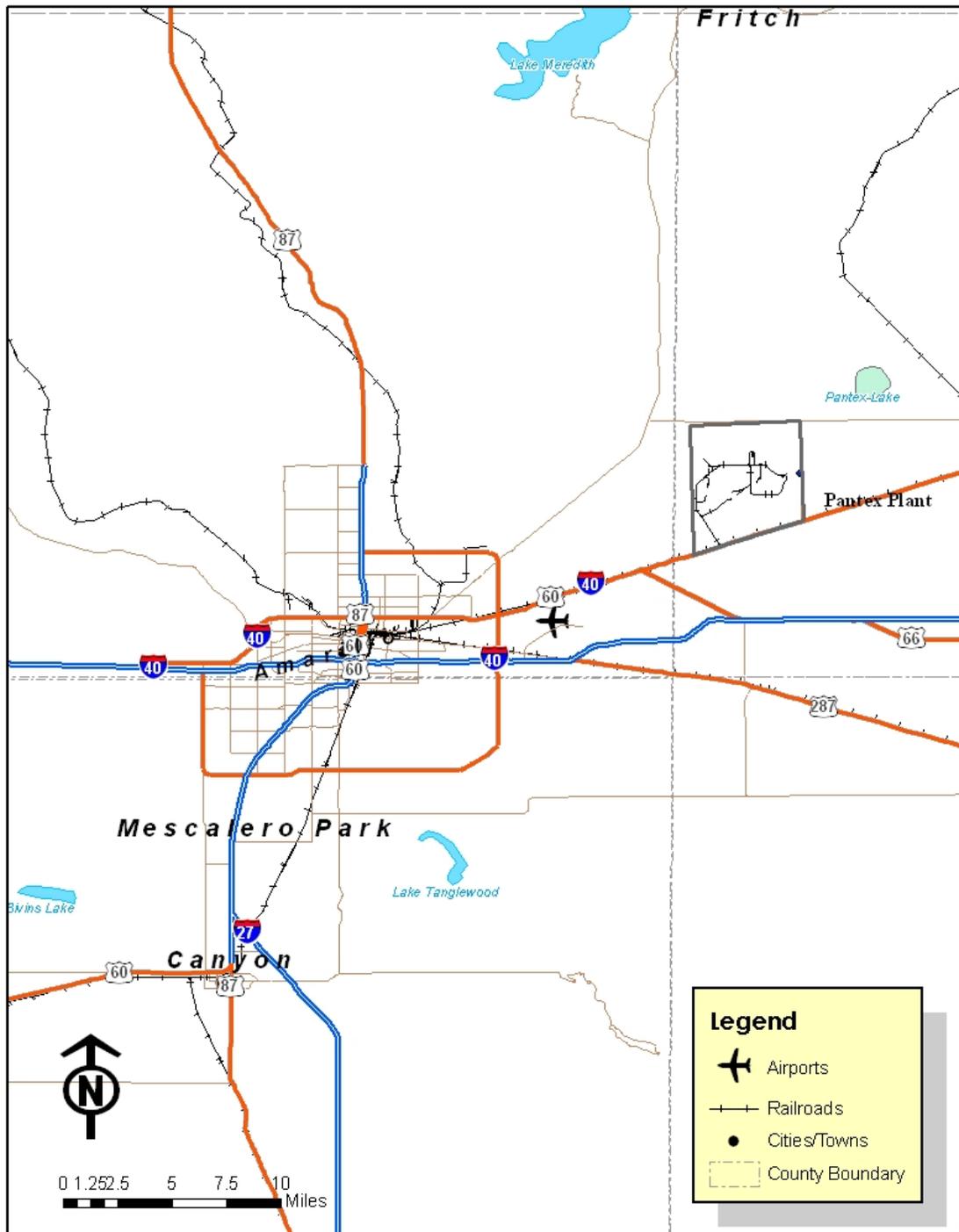


Figure 4.5.12-1 — Roads in the Vicinity of Pantex

4.5.13 Waste Management

The types of wastes generated at Pantex Plant include hazardous wastes, regulated under RCRA, universal waste, non-hazardous wastes, wastes regulated under TSCA, LLW, MLLW, and sanitary waste.

4.5.13.1 *Low-Level Waste*

Compactable solid LLW is processed at the LLW compactor and stored along with non-compactable materials for shipment to NTS, where most Pantex LLW is disposed of, or to a commercial disposal facility. Radioactively contaminated classified weapons components are sent to the classified LLW repository at NTS. Soil contaminated with depleted uranium has been disposed of at a commercial facility, and the possibility for disposal of other LLW at commercial facilities is being pursued where technically and economically advisable (DOE 1996d).

4.5.13.2 *Mixed Low-Level Waste*

Most Pantex mixed waste consists of paper products contaminated with solvents and low-level radionuclides, and inorganic debris (including metals) contaminated with low levels of radionuclides. Mixed waste is disposed of offsite. Pantex treats mixed LLW onsite in two facilities: Building 16-18 and the Burning Ground.

Building 16-18 is permitted for the treatment and processing of mixed LLW and hazardous waste in containers. The Burning Ground is permitted to treat explosives and explosive-contaminated waste by open burning. In some cases, a large volume reduction is attained by this treatment, and some wastes are rendered nonhazardous due to elimination of the reactivity hazard.

DOE decided to construct a Hazardous Waste Treatment and Processing Facility (HWTPF, Building 16-18) in its ROD for the *Final Environmental Impact Statement for the Continued Operation of Pantex and Associated Storage of Nuclear Weapon Components* (62 FR 3880; January 27, 1997). DOE completed construction and initiated operations of the HWTPF in FY2000 (DOE 2001a). Building 16-18 is assuming more of the treatment and processing as Building 11-9S is scheduled for closure. Operations currently consist of segregating and downgrading production line generated waste, destruction of classified and sensitive matter, evaporation of tritiated water, waste compaction, and segregation of scintillation vials into solid and liquid waste streams. There is also the capability to solidify liquids and to rinse drums for reuse, should the need arise.

4.5.13.3 *Hazardous Waste*

During 2005, Pantex generated 711 cubic yards of hazardous waste. Typical hazardous wastes generated at Pantex Plant included explosives-contaminated solids, spent organic solvents, and solids contaminated with spent organic solvents, metals, and/or explosives. Before onsite processing and/or shipment to commercial facilities, hazardous wastes were managed in satellite accumulation areas, less than 90-day waste accumulation sites, or RCRA permitted authorized waste management units. Some hazardous wastes, such as explosives, were processed onsite

before the process residue was shipped offsite for final treatment and disposal. During the year, environmental restoration projects and deactivation and decommissioning of excess facilities contributed 1.9 percent of the total hazardous waste generated. Hazardous wastes and residues from hazardous waste processing are shipped to commercial facilities authorized for final treatment and disposal or, as applicable, recycling (Pantex 2006).

4.5.13.4 *Other Wastes*

During 2005, Pantex generated 6,374 cubic yards of non-hazardous waste. Non-hazardous wastes generated at Pantex were characterized as either Class 1 non-hazardous industrial solid or Class 2 non-hazardous industrial solid wastes, as defined by Title 30 of the Texas Administrative Code. Class 1 non-hazardous wastes generated at Pantex were managed in a similar manner as hazardous waste, including shipment to offsite treatment and/or disposal facilities. Some Class 2 non-hazardous wastes (inert and insoluble materials such as bricks, concrete, glass, dirt, and certain plastics and rubber items that are not readily degradable) were disposed of in an onsite Class 2 non-hazardous waste landfill. Other Class 2 nonhazardous wastes, generally liquids, were shipped to commercial facilities for treatment and disposal (Pantex 2006).

The Pantex Plant environmental restoration projects, deactivation and decommissioning of excess facilities and construction projects contributed 82.4 percent of the total non-hazardous waste generated, during 2005. In addition, during the year, Pantex generated 945 cubic yards of sanitary wastes (cafeteria waste and general office trash). Sanitary wastes were also characterized as Class 2 non-hazardous wastes and disposed of at authorized offsite landfills (Pantex 2006).

During 2005, Pantex generated 2,036 cubic yards of wastes regulated by the TSCA. These wastes include asbestos, asbestos-containing material, and materials containing or contaminated by PCBs. During the year, environmental restoration projects and deactivation and decommissioning of excess facilities contributed 99.5 percent of the total TSCA waste generated. All TSCA wastes were shipped offsite for final treatment and disposal (Pantex 2006).

During 2005, Pantex generated 31 cubic yards of waste that were managed as universal wastes. Universal wastes are defined as hazardous wastes that are subject to alternative management standards in lieu of regulation, except as provided in applicable sections of the Texas Administrative Code. Universal wastes include batteries, pesticides, paint and paint-related waste, and fluorescent lamps. During the year, deactivation and decommissioning of excess facilities and construction projects contributed 12.2 percent of the total universal waste generated. These wastes are shipped offsite for final treatment, disposal, or, as applicable, recycling (Pantex 2006).

Pantex generated 97 cubic yards of low-level radioactive waste, during 2005. The majority of the low-level radioactive wastes were generated by weapons-related activities. During the year, deactivation and decommissioning of excess facilities and construction projects activities contributed 0.3 percent of the total low-level radioactive waste generated (Pantex 2006).

Assembly and disassembly of weapons also results in some wastes that include both radioactive and hazardous constituents, which are referred to as “mixed waste.” The hazardous portion of the mixed waste is regulated by the TCEQ pursuant to RCRA regulations. The radioactive portion is regulated under the *Atomic Energy Act* (Pantex 2006).

During 2005, Pantex generated 1.8 cubic yards of mixed waste. Most mixed wastes generated at Pantex consist of paper products contaminated with solvents and low-levels of radionuclides, and inorganic debris (including scrap metals) contaminated with low-levels of radionuclides. During the year, deactivation and decommissioning of excess facilities contributed 5.4 percent of the total mixed waste generated (Pantex 2006).

4.5.13.5 Waste Management Volumes

Wastes generated from the operation, maintenance, and environmental cleanup of Pantex in calendar year 2005 are summarized in Table 4.5.13-1. Overall, the amount of waste generated in 2005 increased 12.6 percent from 2004. This is due primarily to an increase in the generation of TSCA wastes from deactivation and decommissioning of excess facilities and construction projects.

Table 4.5.13-1 — Waste Volumes Generated at Pantex (yd³)

Waste Type	1993	2003	2004	2005	Percent Change from 1993	Percent Change from 2004
Non-hazardous Waste	14,237	14,208.3	6,050	6,374.5	(55.2)	5.4
Sanitary Waste	800.5	988.8	1,061	944.9	18.04	(10.9)
Hazardous Waste	483.8	8,798.9	337.6	711	37.06	110.6
Low-Level Waste	375.4	75.8	95.6	96.8	(74.2)	1.2
Mixed Waste	49	0.8	3.3	1.8	(96.3)	(44.6)
TSCA Waste	147.7	542.9	1,481.8	2,036.1	1,278.8	37.4
Universal Waste ^a	-	31.9	24	30.7	-	27.7
Total	18,086.4	26,650.4	11,057.3	12,200.8	(36.6)	12.6

^a In 2001, Pantex began managing some hazardous Waste under the Universal Waste Rules.
Source: Pantex 2006.

4.5.13.6 Waste Management Facilities

Wastes are collected from various generator sites in Zone 12 South at Pantex Plant and staged at Building 1242 for sorting and segregating before they are transferred to various waste management facilities. Other generator sites throughout Pantex Plant move waste directly to the 117N storage pad or Building 119N (DOE 1996c). Given below is a brief summary of the current and proposed management facilities for Pantex Plant waste.

Four facilities (117N Pad, 117A, 117B, and 119N) are used for storing waste in Zone 11. The 117N Pad is an above-grade permitted storage pad with two sheds. This facility is used to store LLMW, hazardous waste, LLW, and other wastes and materials. Units 117A and B are permitted storage pads adjacent to the 117N Pad and are used for storage of wastes on a single, above-grade concrete pad. Building 119 is used for the storage of hazardous waste, LLMW, LLW, and other wastes and materials. The north portion of this building is also used to repackage and stage waste for shipment (DOE 1966c).

In Zone 4, 4 HW magazines, 1 LLW magazine, 13 hazardous waste Conex boxes, and 20 LLW Conex boxes are available for storage of wastes. The four hazardous waste magazines are used for storage of liquid and solid MLLW and hazardous waste. Containers of LLW are periodically moved from storage areas and transported to NTS for disposal. The Conex boxes are large steel containers with a capacity of about 94 cubic yards. The 13 hazardous waste Conex boxes have a permitted storage capacity of 4,467 drums and a total operating capacity of 946 containers. Twenty Conex boxes are used for storage of LLW until it is shipped offsite (DOE 1996c).

4.6 SANDIA NATIONAL LABORATORIES/NEW MEXICO

Sandia National Laboratories/New Mexico (SNL/NM) was established as a nuclear weapons design laboratory in 1949. Its facilities are located in Albuquerque, NM; Amarillo, TX; Carlsbad, NM; Las Vegas, NV; Livermore, CA; and Tonopah, NV. The facilities discussed in this section refers only to the main Albuquerque site, which is located on approximately 2,935 acres of DOE property on Kirtland Air Force Base (KAFB) (Figure 4.6-1). An additional 15,000 acres are provided to DOE/NNSA through various agreements, land use permits, and leases from the USAF, the USFS, and the BLM to conduct operations.

The principal NNSA missions at SNL/NM are to conduct system engineering of nuclear weapons; design and develop non-nuclear components; conduct field and laboratory non-nuclear testing; conduct research and development in support of the nuclear weapon non-nuclear design; manufacture a limited number of non-nuclear weapon components; provide safety and reliability assessments of the stockpile; and manufacture neutron generators for the stockpile.

4.6.1 Land Use

4.6.1.1 *Onsite Land Uses*

SNL/NM is located approximately 7 miles southeast of downtown Albuquerque, NM (Figure 4.6-1). There are no prime farmlands on SNL/NM (DOE 1999).

There are five SNL/NM technical areas (TA) which cover approximately 2,560 acres of land within the boundary of KAFB. TAs-I, -II, and -IV encompass approximately 645 acres. TA-III encompasses approximately 1,890 acres, and TA-V encompasses approximately 25 acres (DOE 2003).

The USAF and DOE are the principal land users within KAFB, occupying over 90 percent of the land. DOE owns only a small portion of the land it needs and is required to conduct many of its activities under permit on land owned or withdrawn by the USAF. SNL/NM facilities and operations make up a majority of DOE's land use requirements on KAFB. Other DOE-funded activities make up the remainder (DOE 1996b, DOE 2006a).

The military living quarters on KAFB is the most heavily developed area on the base and is located adjacent to TA-I. KAFB continues to share lands and infrastructure with several entities, including DOE and SNL/NM. KAFB comprises approximately 51,560 acres of land and includes lands owned by the DOE, DoD, and portions of the Cibola National Forest withdrawn for use by the USAF and DOE (SNL/NM 2004). Most of the land is under the control of the USAF which includes land donated to KAFB by the City of Albuquerque (DOE 1996b, DOE 2006a).

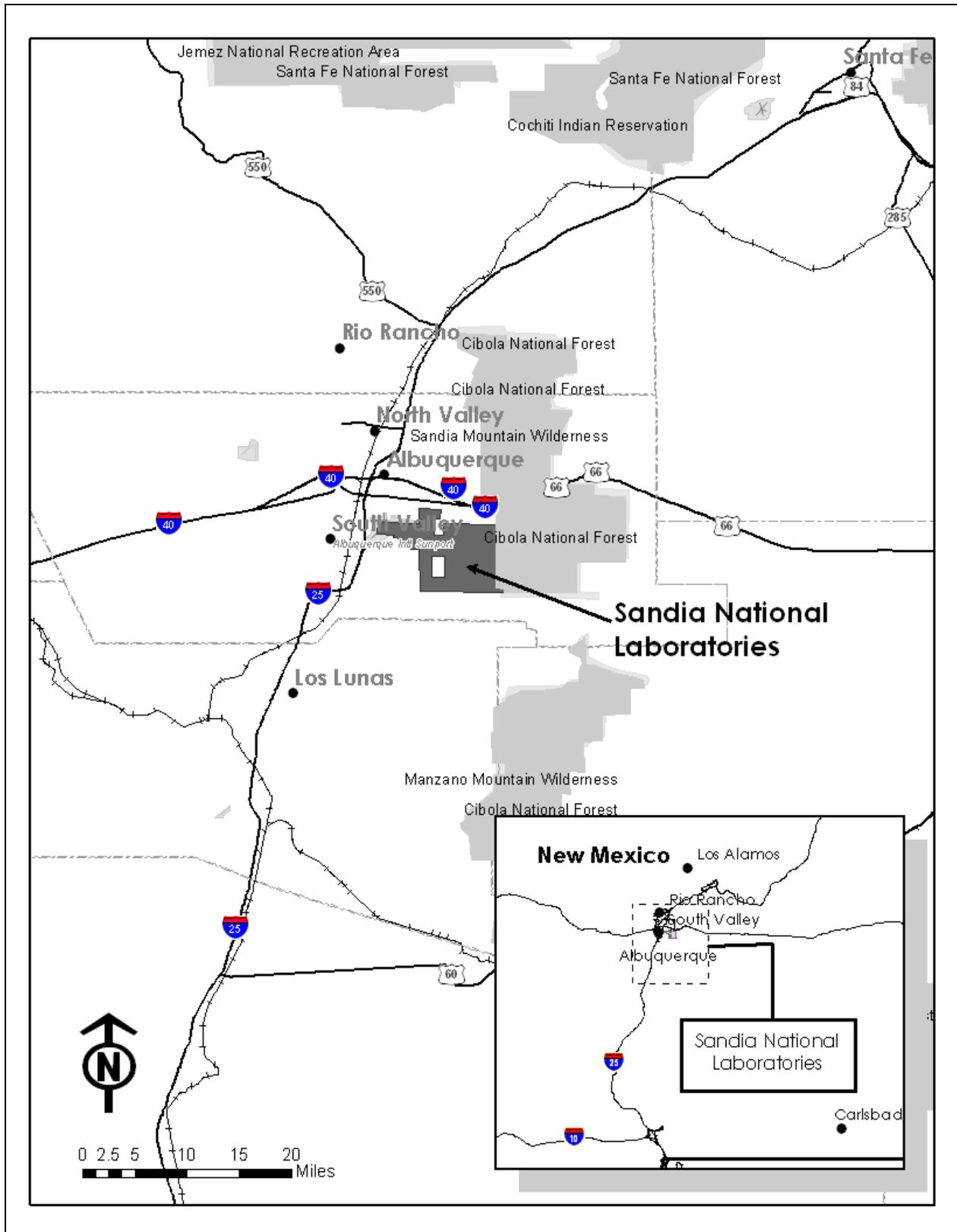


Figure 4.6-1 — Location of SNL/NM

4.6.1.2 *Surrounding Land Uses*

Except for vacant land on both sides of Tijeras Canyon east of TA I and some unmanned utility facilities, the land north of SNL/NM is part of the urbanized city of Albuquerque. The urban land use consists of a mixture of residential, commercial, industrial, institutional, and various supporting public uses. The closest residence to the KAFB boundary is approximately 20 feet to the north. Commercial uses are primarily concentrated north of the site along Central Avenue and Gibson Boulevard. SNL/NM does not contain any public recreation facilities (DOE 1996b).

4.6.2 **Visual Resources**

The surrounding visual characteristics of SNL/NM consist of mostly flat, gently sloping grassland to the west and mountainous terrain to the east. Key landforms that dominate views in the general area include the Four Hills formation, the Manzanita Mountains, and the Manzano Mountains further south. From areas of Albuquerque nearest KAFB, views to the east and southeast are limited by the Four Hills formation and surrounding foothills of the Manzano Area. Views to the south partially consist of KAFB facilities, the Albuquerque International Sunport, and open rangeland. In general, the terrain features associated with the western portion of KAFB are not particularly distinctive. The eastern half, however, exhibits greater visual variety due to its mountain and canyon topography. Most SNL/NM facilities are well within the KAFB boundary and away from public view. Because of their location and the surrounding terrain characteristics, most facilities are not visible from roads and areas with public access (SNL/NM 2006).

Development on KAFB is the most apparent alteration affecting visual quality. Development is most apparent within the TAs. TA-I, TA-II, and TA-V are the most densely developed. TA-III and TA-IV contain more open space; however, development in these areas is still apparent. In the 1999 SNL/NM SWEIS, SNL/NM initiated Campus Design Guidelines which contain a set of principles and guidelines that provide a framework for the physical development and redevelopment of SNL/NM sites (SNL/NM 2006).

4.6.3 **Site Infrastructure**

Site infrastructure available at SNL/NM is used to support the current missions at SNL/NM. To support these missions an infrastructure exists as shown in Table 4.6.3-1.

4.6.3.1 *Electricity*

Since the release of the *1999 SNL/NM SWEIS* (DOE 1999c) electricity usage has increased from 198, MWh to 207,672 MWh. This usage is approximately 28 percent of system capacity (DOE 2006a).

4.6.3.2 *Water*

Water consumption projection for 2008, which include new facilities, shows water use increasing to 555.3 million gallons per year. This is an 11 percent increase over the water consumption

under the 1999 SNL/NM SWEIS. The combined SNL/NM projected water use total plus other KAFB water total (for baseline year 1996) of 1.3 billion gallons per year is still below, or 65 percent of the 1999 SNL/NM SWEIS KAFB water infrastructure capacity of 2 billion gallons per year (DOE 2006a).

Table 4.6.3-1 — Baseline Characteristics for SNL/NM and KAFB Site

Characteristics	Current Value
Land	
Area (acres)	2,935
Roads (miles)	65
Railroads (miles)	4
Electrical	
Available capacity (MWh)	735,840
Energy consumption (MWh)	207,672
Natural Gas	
Available Capacity (million yd ³)	8.5
Consumption (yd ³)	55,555
Water	
Treated Water Usage (MGD)	1.44
Sanitary Sewer System	
System Capacity (MGD)	2.33
Average Daily Flow (MGD)	1

Sources: DOE 1999a SNL/NM 2004, DOE 2000a, DOE 2003a, DOE 2006a
EOA = Expanded Operations Alternative
ft³ = cubic feet
gal = gallon
KAFB = Kirtland Air Force Base
M = million
MWh = megawatt-hours
SNL/NM = Sandia National Laboratories/New Mexico

4.6.3.3 *Natural Gas*

Natural gas usage has increased over the level used in the 1999 SNL/NM SWEIS analysis. The available capacity is 8.5 million cubic yards while consumption is 55,555 cubic yards. This represents 6.5 percent of natural gas capacity.

4.6.4 **Air Quality and Noise**

4.6.4.1 *Air Quality*

4.6.4.1.1 **Meteorology and Climatology**

Large diurnal temperature ranges, summer monsoons, and frequent drying winds are characteristic of the regional climate in the Albuquerque Basin and Sandia and Manzano Mountains. Temperatures are typical of mid-latitude dry continental climates with summer high temperatures in the basin in the 90s°F and inter high temperatures around 50°F. Daily low temperatures range from around 60s°F in the summer to the low 20s°F in the winter. The dry continental climate also produces low average humidities in the late spring and summer prior to the onset of the monsoon season. Daytime relative humidities can be between 10 and 20 percent in the spring and early summer, with an average humidity near 30 percent. Average winter relative humidities are approximately 50 percent (SNL/NM 2006).

Precipitation varies across the region with many locations in the higher elevations of the mountains receiving twice the annual rainfall of locations in the Albuquerque Basin. Most precipitation falls between July and October, and mainly in the form of brief heavy rain showers. Average annual precipitation based on 10 years of data collected between 1995 and 2004 is around 8.5 inches at SNL/NM with 10.9 inches in the lower foothills. Annual precipitation recorded at the NWS cooperative stations in mountain elevations varies between 10 and 23 inches. The winter season in the Albuquerque Basin and around SNL/NM is generally dry with an average of less than 1.5 inches of precipitation falling between December and February (SNL/NM 2006).

While the regional climate is described by the atmospheric state variables of temperature and humidity, site-specific meteorology at SNL/NM is influenced by the proximity to topographic features such as mountains, canyons, and arroyos. These features influence local wind patterns across the site; canyons and arroyos tend to channel or funnel wind, whereas mountains create an upslope-downslope diurnal pattern to wind flows. Winds tend to blow toward the mountains or up the Rio Grande Valley during the day and nocturnal winds tend to blow down the mountain towards the Rio Grande Valley. These topographically induced wind flows can be enhanced or negated by weather systems that move across the southwest part of the U.S. The strongest winds occur in the spring when monthly wind speeds average 10.3 miles per hour. Wind gusts can commonly reach 50 miles per hour (SNL/NM 2006).

Average Annual values for wind speed, temperature, and precipitation are shown in Table 4.6.4-1.

Table 4.6.4-1 — Average Annual Wind Speed, Temperature, and Precipitation Minimum and Maximum Values for SNL/NM

Parameter (Average Annual)	Minimum	Maximum
Wind Speed (m/sec)	11	12
Temperature (°F)	57	58
Precipitation (in)	11	12

Source: SNL/NM 2006

4.6.4.1.2 Ambient Air Quality

Bernalillo County has been designated as a maintenance area under the CAA for carbon monoxide emissions and is in attainment for other federally regulated pollutants. The New Mexico Administrative Code (NMAC), Title 20, Part 11.04, (20 NMAC 11.04), entitled General Conformity, implements Section 176(c) of the CAA, as amended (42 U.S.C 7401 et seq.), and regulations under 40 CFR 51, Subpart W, with respect to conformity of general Federal action in Bernalillo County. 20 NMAC Part 11.04.11.1.2, paragraph B, establishes the emission threshold of 100 tons per year of carbon monoxide at SNL/NM that would trigger the requirement to conduct a conformity analysis (DOE 2006a).

Depending on emission levels, modification to existing sources or construction of new sources emitting carbon monoxide may require a general or transportation conformity analysis as well as additional levels of controls to comply with the NAAQS. In addition, modification to existing sources or construction of new sources emitting the other criteria pollutants (sulfur dioxide,

nitrogen dioxide, ozone, PM₁₀, and lead) for which a pre-construction permit must be obtained are required to comply with the NAAQS (DOE 2003).

NESHAP compliance support is provided to all SNL/NM source owners subject to radionuclide air emissions regulations. The EPA regulates radionuclide air emissions in accordance with 40 CFR 61, Subpart H. Dose is calculated using the CAP-88 computer code. NESHAP regulations stipulate that direct stack or diffuse monitoring is only required if a facility has the potential to produce an effective dose equivalent to the MEI of greater than 0.1 millirem per. Currently there are no facilities with this potential, and therefore, no stack monitoring is required at SNL/NM. However, while not required by regulation, stack monitoring and calculations based on measured parameters are performed as a best management practice at several facilities. All emissions based on measurements (i.e., continuous monitoring, periodic monitoring, and calculations based on measured parameters) are used to calculate the doses (DOE 2003).

Non-radiological Air Emissions

There were no exceedences of the criteria pollutant standards in 2005 (Table 4.6.4-2). The highest daily PM₁₀ loading on the site was 70.6 micrograms per cubic yard. The annual PM concentrations for 2005 are similar to or slightly higher than the results for 2004. Dry conditions in the area contributed to an increase in monthly averages during the later part of 2005 as compared to reported values in 2004 (SNL/NM 2006).

Table 4.6.4-2 — Criteria Pollutant Results as Compared to Regulatory Standards, 2005

Criteria Pollutant	Averaging Time	Unit	NMAAQs Standard	NAAQS Standard	Maximum or Measured Concentrations
Carbon Monoxide	1 hour	ppm	13.1 8.7	35 9	2.73 1.65
	8 hours	ppm			
Nitrogen Dioxide	24 hours	ppm	0.10 0.05	-0.053	0.041 0.013
	Annual	ppm			
Sulfur Dioxide§	3 hours	ppm	-	0.50 0.14	0.054
	24 hours	ppm	0.10 0.02	0.03	0.005 <0.001
	Annual	ppm			
Ozone	1 hour	ppm	0.12	0.12 0.08	0.092
	8 hour	ppm			0.078 ^a
PM ₁₀	24 hours	µg/m ³	--	150	54 ^b
	Annual	µg/m ³		Revoked ^c	12.1
PM _{2.5}	24 hours	µg/m ³	--	35	19.8 ^d
	Annual	µg/m ³		15.0	8.5
Lead	30 days	µg/m ³	-	-	0.0040 0.0020
	Any quarter	µg/m ³	1.5	1.5	

Source: SNL/NM 2006.

SWEIS = Site-Wide Environmental Impact Statement

CPMS = Criteria Pollutant Monitoring Station

NMAAQs = New Mexico Ambient Air Quality Standards

NA = not applicable

NAAQS = National Ambient Air Quality Standards

ppm = parts per million

PM₁₀ = Particulate matter 10 microns in diameter

PM_{2.5} = Particulate matter 2.5 microns in diameter

µg/m³ = micrograms per cubic meter

§Standards are defined in ug/m³ and have been converted to ppm.

^aReported as the fourth highest average for the year – per regulatory standards.

^bReported as the 99th percentile value – per regulatory standards

^c Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM₁₀ standard in 2006 (effective December 17, 2006).

^dReported as the 98th percentile value – per regulatory standards

Concentrations of PM_{2.5} were highest in the summer months being most likely the result of wildland fire smoke transported from areas outside of SNL/NM. Detected concentrations of VOCs were multiple orders of magnitude below the Threshold Limit Values (TLV). The TLV defines the reasonable level to which a worker can be exposed without adverse health effects. Table 4.6.4-2 compares the criteria pollutant concentrations measured for the 2004 CPMS with those reported in the 2005 SNL/NM ASER (SNL/NM 2006).

Table 4.6.4-3 — Summary of Radionuclide Releases from the 15 NESHAP Sources in 2004

TA	Facility Name	Monitoring Method	Used in Dose Calculation	Radionuclide	Reported Release (Ci/yr)
I	Sandia Tomography and Radionuclide Transport (START) Laboratory	Calculation	No	⁶⁰ Co ¹⁵ Cs	2.5E-08 5.0E-09
I	Radiation Laboratory	Calculation	No	³ H ¹³ N ⁴¹ Ar	1.0E-05 1.0E-06 1.0E-00
I	Calibration Laboratory	Calculation	No	³ H	6.9E-05
I	Neutron Generator (NGF)	Continuous	Yes	⁵ H	0.11
	TANDEM Accelerator	Calculation	No	⁵ H	1.0E-05
	Metal Tritide Shelf-Life Laboratory	Calculation	No	⁵ H	5.0E-09
I	Cleaning and Contamination Control Laboratory (CCCL)	Calculation	No	¹⁴ C	2.7E-04
II	Explosive Components Facility (ECF)	Calculation	No	³ H	8.4E-04
II	Mixed Waste Landfill (MWL)	Periodic	Yes	³ H	0.09
III	Radioactive & Mixed Waste Management Facility (RMWMF)	Continuous	Yes	⁵ H ²⁴¹ Am ⁹⁰ Sr ¹⁵ Cs	
IV	HERMES III	Periodic	No	¹³ N ¹⁵ O	1.3E-03 1.3E-04
IV	Z-Facility (Accelerator)	Calculation	No	³ H ²³⁸ U ²³⁴ U ²³⁵ U	1.6E-07 2.0E-07 9.2E-09 2.1E-07
V	Hot Cell Facility (HCF)	Periodic	Yes	N/A	N/A
V	Annular Core Research Reactor	Periodic	Yes	⁴¹ Ar	4.5
V	Sandia Pulsed Reactor (SPR)	Periodic	Yes	N/A	N/A

Note: Monitoring Method: Periodic = Based on periodic measurements; Calculation = Calculated from known parameters; Continuous = Based on continuous air monitoring results

HERMES III = High Energy Radiation Megavolt Electron Source III

Ci/yr = curies per year

TA = Technical Area

N/A = not available

Source: SNL/NM, 2006

Radiological Air Emissions

SNL/NM currently has 15 potential NESHAP facilities that may be defined as either point or diffuse emissions sources. Table 4.6.4-3 lists the radionuclides and the total reported emissions (in curies) from each SNL/NM NESHAP source in 2004. Of the 15 sources, 14 were point sources and one was a diffuse source (landfill). Two of the 15 facilities reported no emissions in 2004. The 15 SNL/NM NESHAP facilities are illustrated in Figure 4.6.4-1.

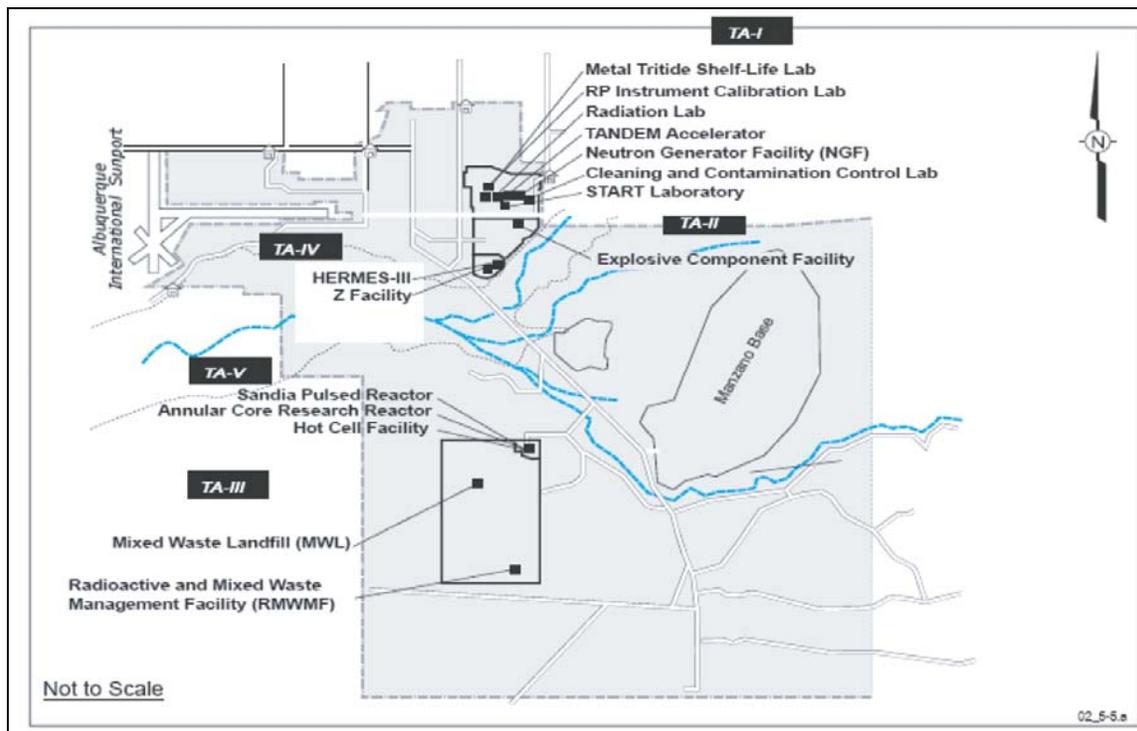


Figure 4.6.4-1 — Locations of the 15 Facilities at SNL/NM that Provided Radionuclide Release Inventories in 2004

4.6.4.2 Noise

Noise levels remain within levels characteristic of a light industrial setting in the range of 50 and 70 dBA. Construction activities would generate noise produced by heavy construction equipment, trucks, and power tools. In addition, traffic and construction noise is expected to increase during construction onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site. These construction noise levels would contribute to the ambient background noise levels for the duration of construction, after which ambient background noise levels would return to pre-construction levels. Table 4.6.4-5 presents peak attenuated noise levels expected from operation of construction equipment including peak noise levels at the source and at distances of 50, 100, 200, and 400 feet.

Table 4.6.4-5 — Peak Attenuated Noise Levels (in decibels [dBA]) Expected from Operation of Construction Equipment

Source	Peak Noise Level	Distance from Source			
		50 ft	100 ft	200 ft	400 ft
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	108	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Bulldozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Forklift	100	95	89	83	77

Source: DOE 2000c.

4.6.5 Water Resources

4.6.5.1 Surface Water

4.6.5.1.1 Surface Water Quality

Surface discharges are releases of water and water-based compounds made to roads, open areas, or impoundments. Past sampling results from 1998 and 1999 have shown a presence of metals such as zinc, magnesium, and iron elevated above the benchmark values (SNL/NM 2001a). No unusual characteristics were observed in 2001, 2002, and 2003 (SNL/NM 2002a, 2003a, 2004b). No monitoring was required in 2000 (SNL/NM 2001b). Monitoring results in 2004 identified elevated levels of total suspended solids (TSS) and magnesium (SNL/NM 2006). Albuquerque's semiarid climate with sparse vegetative cover and high erosion rates naturally produce high TSS levels. SNL/NM has reduced TSS levels in developed areas through best management practices, such as retention and detention ponds, landscaping conducive to infiltration, and lining of storm drain channels for erosion reduction. All monitoring points show elevated levels of magnesium even though they are separated by several miles and collect runoff from several different drainage areas. The presence of zinc, magnesium, and iron is likely due to natural conditions associated with rocks and soils derived from the igneous/metamorphic complex of the Manzanita Mountains.

The 1999 SNL/NM SWEIS identified oil and grease runoff and increased frequency of outdoor testing to be sources of contaminants of concern (DOE 1999a). No levels of water quality constituents exceeded the projections identified in the 1999 SNL/NM SWEIS (DOE 1999a).

Review of surface water quantity was completed according to the methodology outlined in the 1999 SNL/NM SWEIS (DOE 1999a), which determined the SNL/NM contributions to the Rio Grande due to storm water runoff and discharges to the Southside Water Reclamation Plant. Extended drought conditions have resulted in reduced surface water flows. Surface water flows peaked in 2004 due to near normal levels of precipitation (SNL/NM 2006).

4.6.5.1.2 Surface Water Rights and Permits

New Mexico is in the process of obtaining the authority to regulate discharges under NPDES with the goal of obtaining this authority by 2008. Until that time, EPA Region VI is the current permitting authority. New Mexico has enacted 20.6.4 NMAC “Standards for Interstate and Intrastate Surface Waters” to protect the quality of surface waters in the State. Due to the hydrologic conditions at SNL/NM, Sandia Corporation does not specifically monitor for compliance with these standards. SNL/NM does not compare analytical results from NPDES sampling with the stream standards. Some constituents of concern in New Mexico’s Stream Standards that are not on the NPDES analyte list have been added to SNL/NM’s analyte list to confirm compliance (SNL/NM 2006).

4.6.5.2 Groundwater

The groundwater beneath the SNL/NM and adjacent areas is the source of drinking water for SNL/NM, KAFB, adjacent portions of the Albuquerque, and the Pueblo of Isleta. All known groundwater contamination is the result of past activities. No current or planned future activities are expected to adversely impact groundwater quality. Investigations or remediation of these sites is ongoing (SNL/NM 2006). Figure 4.6.5-1 displays a conceptual diagram of the groundwater system underlying SNL/NM.

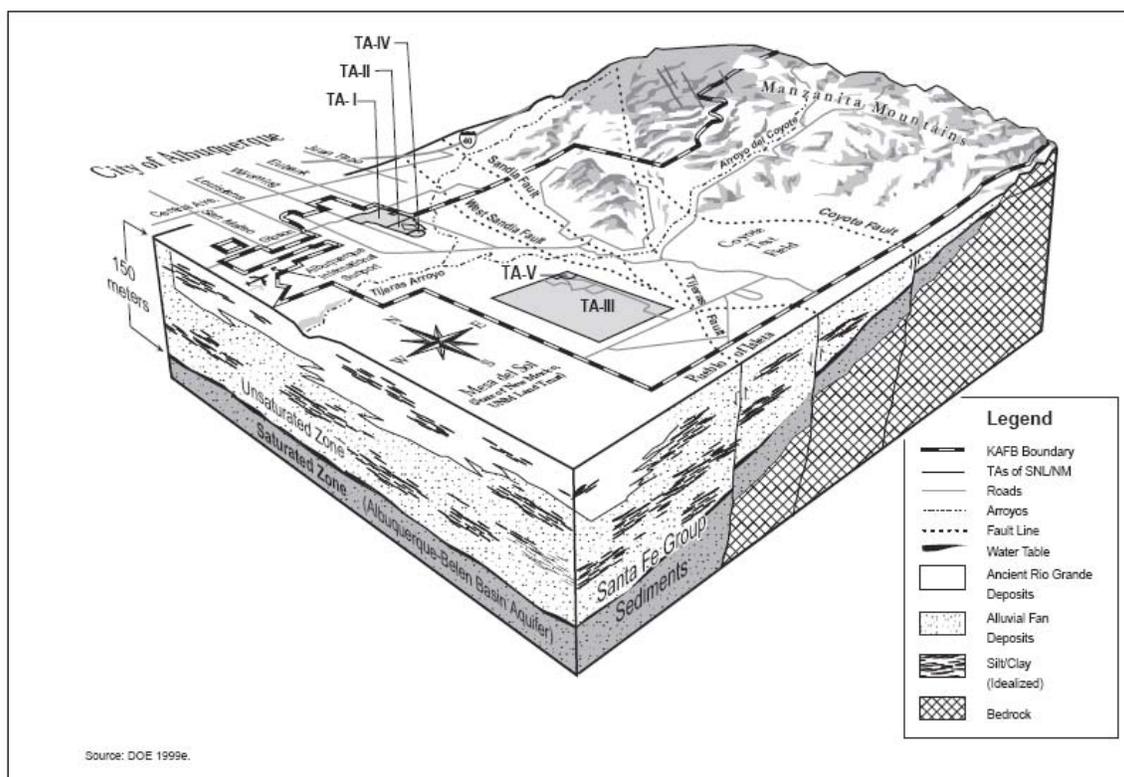


Figure 4.6.5-1 — Conceptual Diagram of the Underlying Groundwater System at SNL/NM

4.6.5.2.1 Groundwater Quality

The EPA regulates drinking water constituents by setting MCLs. The New Mexico Water Quality Control Commission regulates drinking water constituents by establishing maximum allowable concentrations (MACs). During August 2005, annual sampling of groundwater was conducted by the Groundwater Protection Program (GWPP) Groundwater Surveillance Task. Samples were collected from 14 wells. Groundwater surveillance samples for the GWPP were analyzed for the following parameters:

- VOCs,
- dissolved metals (except for mercury),
- selected radionuclides,
- gross alpha & beta activity,
- major ions including nitrate,
- alkalinity/total phenols,
- total halogenated organics (TOX), and
- gamma spectroscopy

No groundwater samples exceeded MCLs for VOCs. Only bromoform and carbon disulfide were detected at quantifiable values about the reporting limits. No groundwater samples exceeded established MCLs for any of the non-metallic inorganic constituent analytes. Of the metals, only manganese and iron exceeded their established MACs for aesthetic purposes at CTF-MW2 (manganese and iron) and Eubank-1 (iron). No groundwater samples were found to exceed the MCLs for radionuclide activity (SNL/NM 2006).

4.6.5.2.2 Groundwater Availability, Use, and Rights

Most of the City of Albuquerque's water supply wells are located on the east side of the Rio Grande. As a result of groundwater withdrawal, the water table has dropped by as much as 141 feet (Thorn et al. 1993).

Potable water to KAFB and SNL/NM facilities is supplied by on-site production from 10 wells. In 2005, KAFB pumped approximately 1.13 billion gallons of groundwater (SNL/NM 2005). Groundwater withdrawals from KAFB and the City of Albuquerque wells at the north end of KAFB have created a trough-like depression in the water table causing flow to be diverted northeast in the direction of the well fields (SNL/NM 2006).

4.6.6 Geology and Soils

The regional geologic setting in which SNL/NM and KAFB are situated has been subjected to relatively recent episodes of basaltic volcanism and ongoing regional rifting (crustal extension). The Rio Grande rift has formed a series of connected down-dropped basins in which vast amounts of sediments have been deposited. The Rio Grande rift extends for about 450 miles from Leadville, Colorado to northern New Mexico (SNL/NM 2006).

4.6.6.1 *Geology*

SNL/NM is in the eastern portion of the 30-mi-wide Albuquerque-Belen Basin, about midway along its north-south trending length of about 100 miles. The Albuquerque Basin is one of several north-south trending sediment-filled basins formed by the Rio Grande rift. On the east, uplifted fault blocks, manifested by the Sandia, Manzanita, and Manzano Mountains bound the basin. The western and northern sides of the Basin are bound by the Lucero Uplift to the west; the Rio Puerco fault belt to the northwest, and the Nacimiento Uplift to the north. There is relatively little topographic relief along the Rio Puerco fault belt on the northwestern side of the basin. Two south-flowing rivers drain the basin: the Rio Puerco to the west and the Rio Grande to the east (SNL/NM 2006).

4.6.6.2 *Soils*

Soils at SNL/NM are derived primarily from eroded bedrock in the Manzanita Mountains that was transported downslope by water. Soil layers formed by these sediments tend to be discontinuous. The chemical composition of these soils reflect the composition of the source bedrock, and soils at SNL/NM frequently have high naturally occurring (background) concentrations of the metals arsenic, beryllium, and manganese (DOE 1999).

As a result of past SNL/NM activities, soil contamination exists or may exist at a number of locations at KAFB, although most sites are less than 1 acre in size. Cleanup of these contaminated sites is regulated under RCRA. SNL/NM investigates and remediates these sites through the ER Project. A large cleanup under the ER Project was the excavation of the Chemical Waste Landfill (CWL). This project began September 30, 1998, and was completed in February 2002. During this time over 52,000 cubic yards of soil and debris were excavated and most were disposed of at the Corrective Action Management Unit (CAMU), adjacent to the CWL, for treatment and/or placement in the containment cell for long-term management. Approximately 70 cubic yards of soil were disposed off site due to radiological activity above CAMU acceptance criteria. Additionally, a minor amount of soil contaminated with PCB compounds was disposed of offsite after the CAMU stopped accepting waste. Backfilling of the CWL to four feet below ground surface was completed in February 2004. Clean-up activities in the site operational boundary area adjacent to the CWL were completed in February 2004 and closure activities continued in 2005. Removal of waste from the CWL, backfilling and capping of the CWL with clean material, and deposition of CWL waste in the CAMU, which has a containment cell design, has resulted in improved soil conditions at SNL/NM since the 1999 SNL/NM SWEIS (DOE 2006a).

Soil contamination also exists at some active SNL/NM outdoor test facilities. In the past decade, environmental controls on testing have reduced the concentrations or extent of additional soil contamination. The ER Project addresses soil contamination resulting from past testing (DOE 1996c). Most of the soil contamination at these active sites is shallow surface contamination stemming from the explosion, destruction, or burning of tested devices containing hazardous material. The primary contaminants at these active sites are depleted uranium and lead (SNL/NM 2005).

SNL/NM actively performs environmental soil monitoring on and near KAFB to confirm the effectiveness of control systems in place at the various TAs. In 2004, soil samples were collected from a total of 51 locations (30 on-site, 15 perimeter, and six off-site locations). A soil sample was not collected at one on-site location (32E) due to human error. Samples are analyzed for common radionuclides and metals, with analytical results compared to naturally occurring concentrations. For 2004, soil monitoring for radiological parameters results identified all soil locations as Priority-4 (consistent with off-site values and no increasing trends (SNL/NM 2005).

Due to the drought, many of the soil samples collected had such low soil moisture content that meaningful tritium in soil moisture measurements were frequently not possible. Tritium is not a significant indicator radionuclide for operations at SNL/NM and the low soil moisture in the area will always make low activity assay difficult. In 2004, it was decided to not sample for tritium in soil (SNL/NM 2005).

4.6.6.3 *Seismology*

Albuquerque is in a region expected to experience moderate earthquakes that could result in damage to buildings, depending on the quality of construction. Since the 1999 SNL/NM SWEIS, three earthquakes have occurred within a 100 mile radius of Albuquerque. The epicenter of the closest earthquake was 52 miles west of Albuquerque, had a Richter scale magnitude of 3.0, and occurred in May 2004. The other two earthquakes were of magnitude 2.4 and 3.5 and occurred 81 and 54 miles south of Albuquerque, respectively. In the Albuquerque area, the largest magnitude earthquake of the century, a recorded magnitude 4.7, occurred on January 4, 1971. SNL/NM buildings did not receive any appreciable damage from this event.

Several major faults are located on KAFB. The Tijeras fault, which has been traced as far north as Madrid, New Mexico, trends southwesterly through Tijeras Canyon and across KAFB. The Tijeras Canyon was formed by preferential erosion along the fault. The system of faults connecting with the Tijeras fault on KAFB is collectively referred to as the Tijeras fault complex (SNL/NM 2006). Figure 4.6.6-1 displays regional faults at SNL/NM.

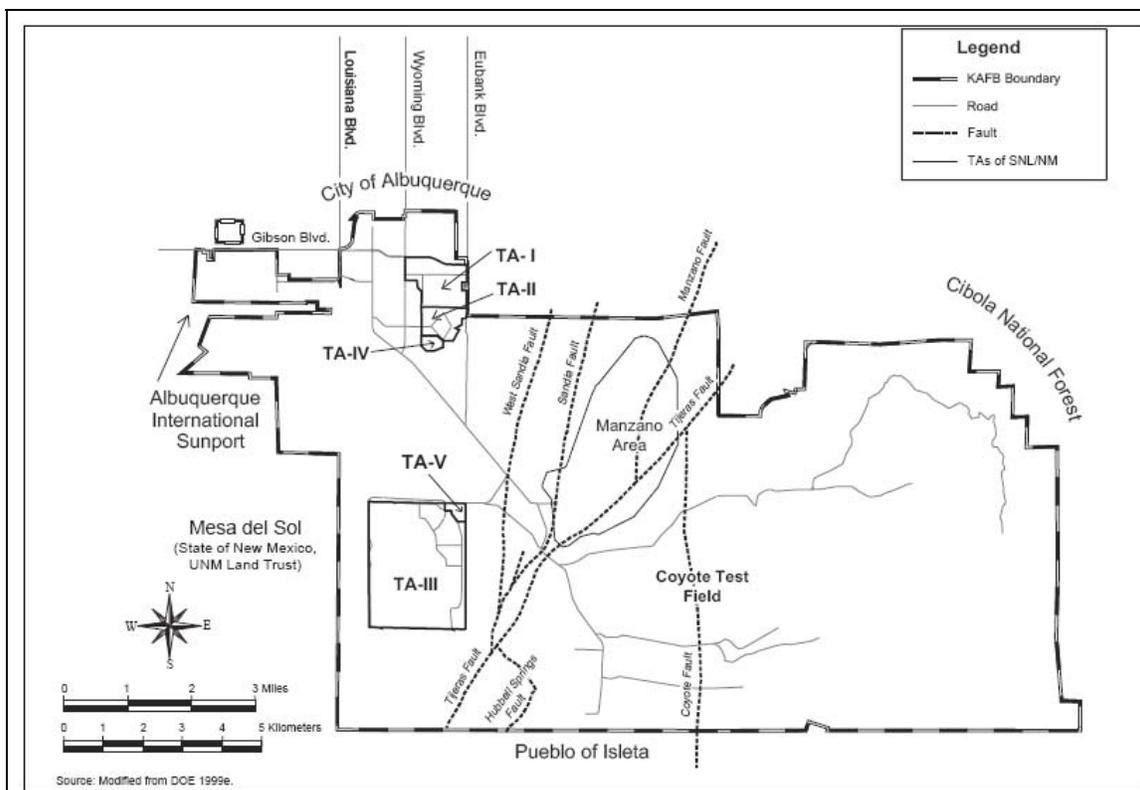


Figure 4.6.6-1 — Regional Faults at KAFB

The Tijeras fault complex marks a distinct geologic boundary between the uplifted blocks on the east and the sediment-filled basin to the west. This geologic boundary also forms a boundary between the two major groundwater regimes at KAFB. The Sandia fault is thought to be the primary boundary between the Sandia Mountains and the Albuquerque Basin. The Sandia fault converges with the Tijeras fault and the Hubbell Springs fault. Both the Sandia fault and Hubbell Springs fault are north-south trending, down-to-the-west, en-echelon normal faults, which are Tertiary in age (Lozinsky and Tedford 1991, Woodward 1982, Kelley and Northrup 1977) (SNL/NM 2006).

4.6.7 Biological Resources

This section describes ecological resources at SNL/NM including terrestrial and aquatic resources, T&E species, and floodplains and wetlands.

4.6.7.1 Terrestrial Resources

There are four major habitat types at the SNL/NM site: grassland, woodland, riparian, and altered. Much of the unaltered habitats receive minimal disturbance from site operations. Figure 4.6.7-1 displays vegetation types at SNL/NM.

Altered habitat at SNL/NM and KAFB includes buildings and the areas surrounding buildings, field testing areas, training areas, a golf course, residential areas, roadways, utilities, runways, and taxiways. The vegetation in this habitat type varies greatly, including bare ground and

manicured landscapes, but the bulk of this habitat is comprised of non-native, weedy species of plants. Increasingly, efforts are underway to reseed altered areas with native plant species to assist the natural revegetation process (SNL/NM 2004).

Each of the major habitat types within the KAFB boundary supports a variety of wildlife species. Bird communities are particularly dynamic; some resident bird species remain on-site throughout the year, and many migratory bird species frequent SNL/NM. Some common wildlife species at SNL/NM include coyote (*Canis latrans*), deer mouse (*Peromyscus leucopus*), rock squirrel (*Spermophilus variegates*), common raven (*Corvus corax*), American robin (*Turdus migratorius*), and the house finch (*Carpodacus mexicanus*) (SNL/NM 2004).

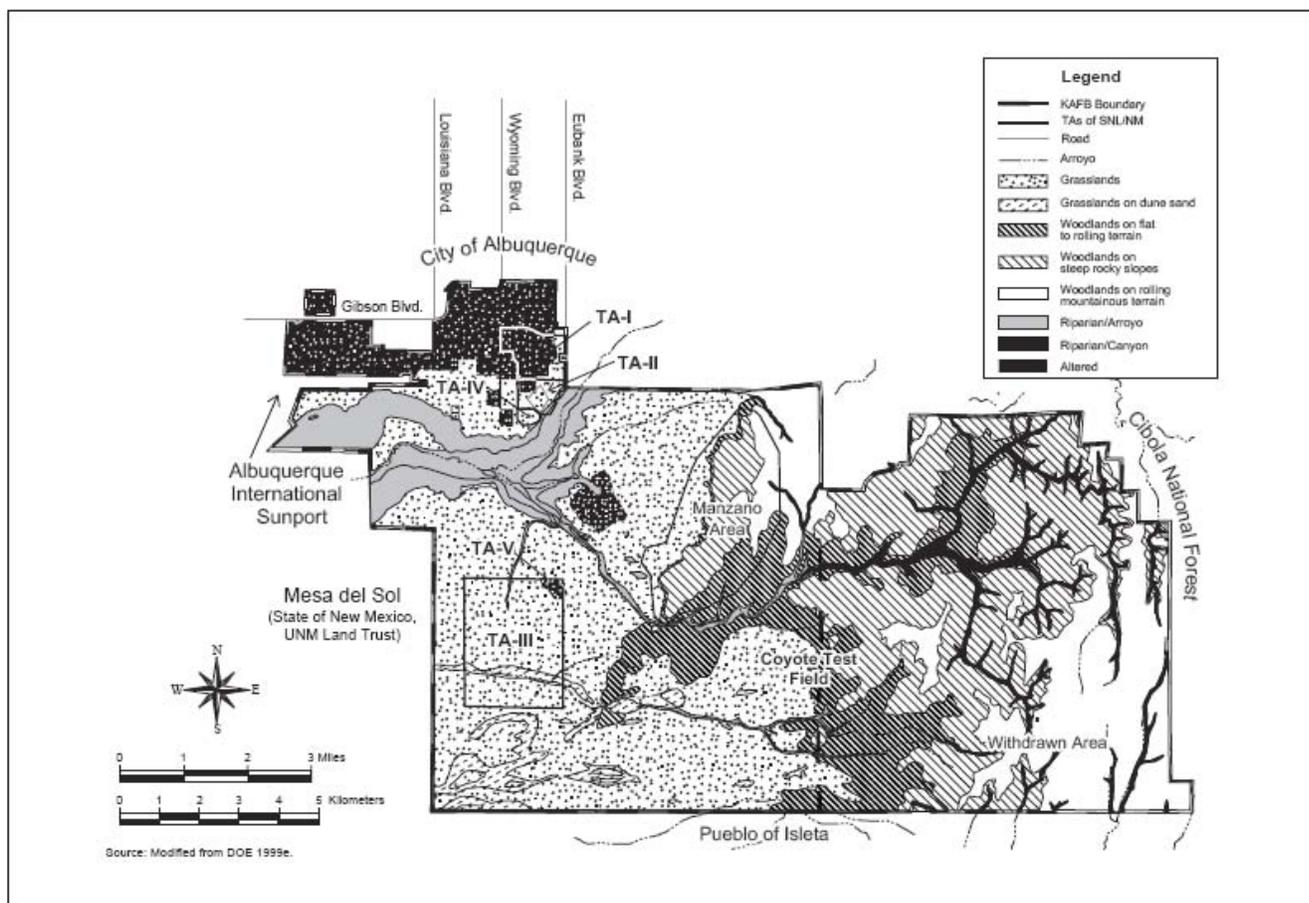


Figure 4.6.7-1 — Vegetation Types at SNL/NM

4.6.7.2 Floodplains and Wetlands

4.6.7.2.1 Wetlands

Six wetlands have been identified that are associated with natural springs and are cumulatively less than one acre (DOE 1999f). Coyote Springs is the largest natural wetland onsite and consists of four separate seep areas. Two of the wetlands, Sol se Mete and Burn Site Springs, are in the canyons of the Withdrawn Area. Species characteristic of these wetlands include wire rush, three-square, Torrey rush, and cattail (USACE 1995). Only the Burn Site Spring is on land used by SNL/NM.

4.6.7.2.2 Floodplains

Floods and runoff occur most commonly during the summer thunderstorm season (July through September) when approximately 50 percent of the average annual rainfall occurs. Snow in the Manzanita Mountains can produce local runoff that rarely reaches the lower portions of the arroyos or the Rio Grande. The 100 and 500-year floodplains are narrow and confined to existing drainage channels and several low-lying streets and vacant areas (DOE 1999).

4.6.7.3 Aquatic Resources

Five small unnamed springs occur around the Four Hills. Three support wetland vegetation and the other 2 are rock seeps and do not support wetland vegetation, but may provide surface water to wildlife (SNL/NM 2004). Natural spring-fed wetlands form a minor component of the riparian habitat on KAFB and are cumulatively less than 1 acre in size. The USFS manages a tank that collects water for wildlife at this spring and Sol se Mete Spring. The USAF administers constructed ponds on KAFB Tijeras Arroyo Golf Course and a constructed lake, Christian Lake, in the southern part of KAFB (DOE 1999).

4.6.7.4 Threatened, Endangered and Sensitive Species

Fifteen threatened, endangered and other species of concern were identified as potentially occurring in Bernalillo County (USFWS 2005). Of the 15, 4 of these species (Table 4.6.7.2-1) have been documented on KAFB (SNL/NM 2006).

Table 4.6.7-1 — Threatened and Endangered Species Potentially Occurring at KAFB

Species	Scientific Name	Federal Status	State Status	Observed at KAFB
Mammals				
Spotted Bat	<i>Euderma maculatum</i>		Threatened	
New Mexican Jumping Mouse	<i>Zapus hudsonius luteus</i>		Threatened	
Fish				
Rio Grande Silvery Minnow	<i>Hybognathus amarus</i>	Endangered	Endangered	
Birds				
Common Black Hawk	<i>Buteogallus anthracinus anthracinus</i>		Threatened	
American Peregrine Falcon	<i>Falco peregrinus anatum</i>		Threatened	Yes
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened		
White-eared Hummingbird	<i>Hylocharis leucotis borealis</i>		Threatened	
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	Endangered	
Whooping Crane	<i>Grus Americana</i>	Endangered	Endangered	
Bell's Vireo	<i>Vireo bellii</i>		Threatened	Yes
Gray Vireo	<i>Vireo vicinior</i>		Threatened	Yes
Baird's Sparrow	<i>Ammodramus bairdii</i>		Threatened	Yes
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>		Threatened	
Yellow-billed Cuckoo	<i>Coccyzus Americanus</i>	Candidate		

Source: SNL/NM 2006.

Of the state-listed threatened and endangered wildlife species, only the gray vireo is known to regularly breed on site. The American peregrine falcon is listed as a species of concern by the USFWS (USFWS 2005). No nesting of this species has been observed, and only a small amount of American peregrine falcon nesting habitat exists on KAFB (SNL/NM 2004).

No plant species currently listed as threatened or endangered are known to occur at KAFB. The Santa Fe milkvetch (*Astragalus feensis*) has been observed at the SNL/NM site and is listed in the New Mexico Rare Plants List (New Mexico Rare Plant Technical Council 2005, SNL/NM 2004).

4.6.7.5 *Biological Monitoring and Abatement Programs*

Ecological monitoring of selected biota, including small mammals, birds, reptiles, amphibians, and vegetation, is conducted annually by SNL/NM. Baseline measurements are collected on potential contaminant loads in species as well species density and composition. In 1997, data were collected at two sites: TA-II and a site at the southeastern end of the perimeter fence separating the Pueblo of Isleta and KAFB. Analysis of samples of seven small mammals from these sites did not show any significant radionuclide or metal contamination (SNL/NM 1997u).

SNL/NM completed an ecological risk assessment validation study (SNL/NM 1999d). This study was conducted for the SNL/NM ER project to provide site-specific data in support of the ecological risk assessment currently being used to evaluate potential risks to natural populations at contaminated sites. The field work for this study included both biomonitoring and quantitative surveys of key populations at potential ecological risk. Biomonitoring consisted of the collection of soil, plant, invertebrate, and small mammal samples from four ER Project sites and the analysis of these samples to determine the concentrations of 18 selected inorganic analytes. No significant effects to small mammal communities were found at any of the sites. A report presenting the results of these studies is currently in preparation. The study objectives recommended by the U.S. Department of Interior (DOI) will be considered in ongoing study objectives (DOE 1999).

4.6.8 *Cultural and Archaeological Resources*

4.6.8.1 *Prehistoric Resources*

Archaeological surveys of 100 percent of the area within the 5 DOE-owned TAs were conducted in the 1990s, thus no new surveys have been conducted since the 1999 SNL/NM SWEIS. In addition, portions of these technical areas had been surveyed for specific projects. There are no known archaeological sites within these five TAs (SNL/NM 2004).

Extensive archaeological surveys have been conducted of the remainder of KAFB since the 1999 SNL/NM SWEIS. The areas surveyed include all USFS-owned lands withdrawn to USAF and DOE, all BLM-owned lands withdrawn to USAF, and all USAF-owned lands. The TAs, the main facility and housing of the base, and some ER Project sites were the only areas excluded. These surveys were much more comprehensive than those conducted before the 1999 SNL/NM SWEIS. Table 4.6.8-1 compares the current knowledge about known archaeological sites with the information presented in the 1999 SNL/NM SWEIS.

The types of archaeological sites identified on KAFB have remained consistent with those known at the time of the 1999 SNL/NM SWEIS. The number and density of sites have increased overall due to the comprehensive nature of the recent surveys. The patterns of geomorphic and topographic distribution of archaeological sites have changed somewhat since the 1999 SNL/NM SWEIS. While prehistoric and historic sites are still clustered in 4 major areas, as shown in the 1999 SNL/NM SWEIS (DOE 1999a), the clusters now have slightly wider boundaries (SNL/NM 2004). The cluster at the headwaters of Arroyo del Coyote is the same. The cluster at the Joint Operating Agreement Area has expanded into the southern portion of the Cask Testing Facility (CTF). The cluster located along Tijeras Arroyo has extended slightly to the west.

Table 4.6.8-1 — Known Prehistoric and Historic Archaeological Sites by Land Owner

Land Owner	Number of Archaeological Sites			
	All Known Sites		NRHP Eligible or Potentially Eligible Sites	
	1999 SNL/NM SWEIS	Current	1999 SNL/NM SWEIS	Current
DOE	0	0	0	0
USAF (includes BLM withdrawn areas)	130	267	86	168
USFS, Withdrawn to DOE	41	48	35	42
USFS, Withdrawn to USAF	110	183	68	142
Leased to DOE by State of New Mexico	3	3	3	3
Leased to DOE by Pueblo of Isleta	0	1	0	1
TOTALS	284	502	192	356

Sources: DOE 1999a, KAFB 2004
BLM = Bureau of Land Management
DOE = Department of Energy
NRHP = National Register of Historic Places
SNL/NM = Sandia National Laboratories/New Mexico
SWEIS = Site-Wide Environmental Impact Statement
USAF = United States Air Force
USFS = United States Forest Service

4.6.8.2 *Historic Resources*

Information on architectural properties was limited at the time of the 1999 SNL/NM SWEIS (DOE 1999a). Based on a consultation completed with the NM SHPO in 2005, 1 building was determined to be eligible for the NRHP (SNL/NM 2006). In TA-I, 52 buildings had been evaluated and none were found to be eligible or potentially eligible for the NRHP. In the diamond-shaped area that was originally identified as TA-II, the entire TA was determined to be eligible as a district, with three buildings individually eligible and 32 buildings contributing to the district eligibility. SNL/NM conducted extensive documentation of the buildings and the buildings were all demolished (SNL/NM 2004).

Architectural inventories of buildings and structures within the five technical areas have been undertaken since the SWEIS, focusing on those buildings that reach the 50-year age criterion. Eighty-one buildings in TA-I have been recorded since the 1999 SNL/NM SWEIS and some of them evaluated; 2 are eligible for the NRHP (one of which has been extensively documented and demolished), 22 are not eligible, 6 are of historical interest, and the remaining buildings have not been evaluated. Within the new TA-II boundaries, only one building has been evaluated and it is

not eligible. Within TA-III, 77 buildings or structures have been evaluated and found not eligible for listing on the NRHP. Eligible properties in TA-III include the Sled Track (the track and six buildings), Centrifuge Complex (two centrifuge facilities and two support structures), Mechanical Shock Facility (one building), Vibration and Acoustics Facility (two buildings), and Water Impact Facility (building, tower, and associated structures). Four buildings in TA-IV have been evaluated for NRHP-listing; 3 are not eligible and 1 is eligible. At TA-V only 1 building has been evaluated and it is not eligible (SNL/NM 2004; DOE 2003).

SNL/NM facilities that are located outside of the technical areas and have been evaluated for NRHP-eligibility include the ACF Complex and the Lurance Canyon Burn Site. Both of these facilities are located within the CTF on USFS-owned land withdrawn to DOE. At the ACF Complex, 16 buildings have been determined not eligible. Three buildings and the aerial cables themselves have been determined eligible. Fifteen buildings at the Burn Site, slated for demolition, were evaluated and determined not eligible (Ullrich 2006). The SNL/NM facilities at Thunder Range have been evaluated and none of them are eligible. Building 9972, the Radar Cross Section Facility, has been evaluated and was determined eligible.

4.6.8.3 *Native American Resources*

A Traditional Cultural Property (TCP) is a place or object that is significantly associated with the cultural practices and beliefs that are rooted in a community's history and are important in maintaining the cultural identity of the community. Consultations with Tribes were conducted during preparation of the SWEIS; no specific TCPs were identified at that time. Since then, some project-specific consultations have occurred; however, there are still no specific TCPs identified for KAFB (KAFB 2006).

4.6.9 **Socioeconomic Resources**

Socioeconomic characteristics addressed at SNL/NM include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current SNL/NM employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

SNL/NM is located in Bernalillo County, New Mexico. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Bernalillo, Sandoval, Torrance, and Valencia Counties. Figure 4.6.9-1 presents a map of the counties composing the SNL/NM ROI.

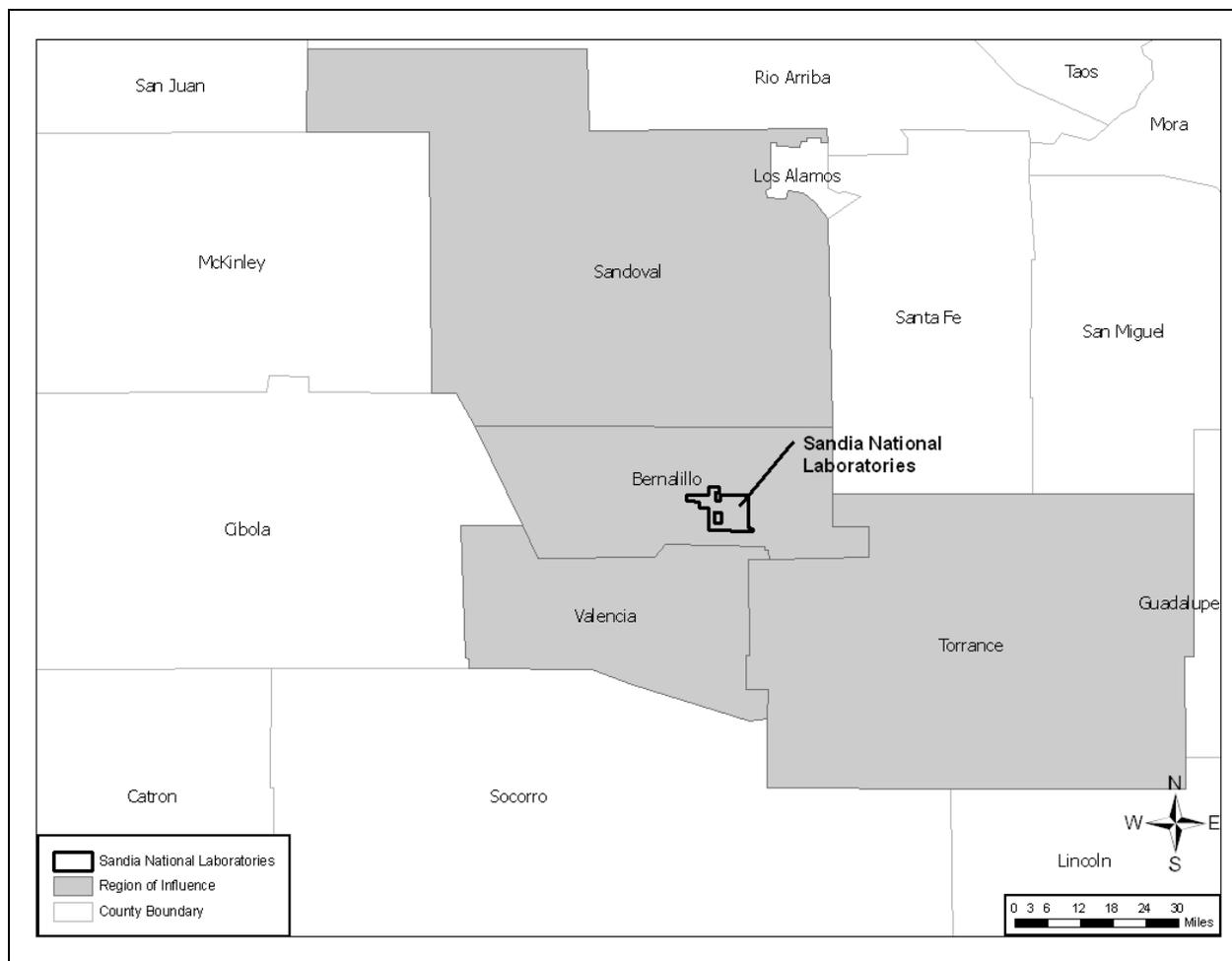


Figure 4.6.9-1 —Region of Influence for SNL/NM

4.6.9.1 *Employment and Income*

Labor force statistics are summarized in Table 4.6.9-1. The civilian labor force of the ROI grew by approximately 6 percent from 370,858 in 2000 to 391,884 in 2005. The overall ROI employment experienced a growth rate of nearly 5 percent with 355,580 in 2000 to 372,371 in 2005 (BLS 2007).

The ROI unemployment rate was 5 percent in 2005 and 4.1 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 4.8 percent in Bernalillo County to a high of 5.5 percent in Valencia County. The unemployment rate in New Mexico in 2005 was 5.3 percent (BLS 2007).

Table 4.6.9-1 — Labor Force Statistics for ROI and New Mexico

	ROI		New Mexico	
	2000	2005	2000	2005
	2000	2005	2000	2005
Civilian Labor Force	370,858	391,884	852,293	915,489
Employment	355,580	372,371	810,024	867,317
Unemployment	15,278	19,513	42,269	48,172
Unemployment Rate (percent)	4.1	5.0	5.0	5.3

Source: BLS 2007.

Income information for the SNL/NM ROI is provided in Table 4.6.9-2. Torrance is at the low end of the ROI with a median household income in 2004 of \$30,347 and a per capita income of \$21,111. Bernalillo had a median household income of \$43,047 and a per capita income of \$31,441 (BEA 2007).

Table 4.6.9-2 — Income Information for the SNL/NM ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Bernalillo	31,441	43,047
Sandoval	26,418	47,745
Torrance	21,111	30,347
Valencia	23,311	36,955
New Mexico	26,679	37,838

Source: BEA 2007.

4.6.9.2 *Population and Housing*

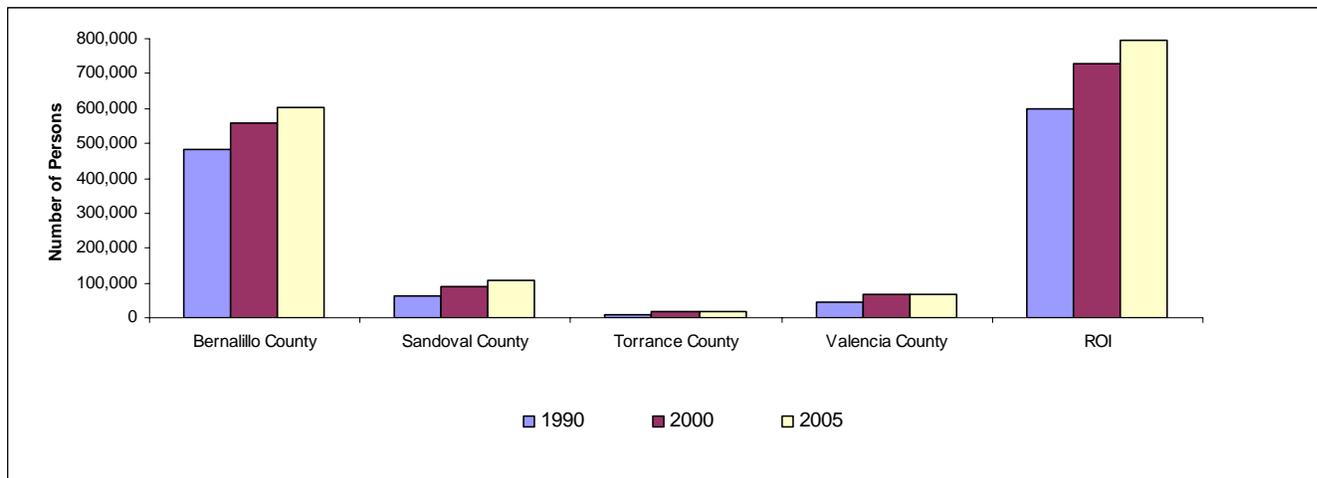
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-3 presents historic and projected population in the ROI and the state.

Table 4.6.9-3 — Historic and Projected Population

County	1990	2000	2005	2010	2020
Bernalillo County	480,577	556,678	603,783	631,839	698,832
Sandoval County	63,319	89,908	107,146	126,294	162,409
Torrance County	10,285	16,911	17,456	21,690	24,979
Valencia County	45,235	66,152	69,132	86,708	108,064
ROI	599,416	729,649	797,517	866,531	994,284
New Mexico	1,515,069	1,819,046	1,925,985	2,112,986	2,383,116

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 22 percent from 599,416 in 1990 to 729,649 in 2000. From 2000 to 2005, the population of the ROI increased 9 percent to 797,517 in 2005. Sandoval County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 19 percent (USCB 2007). Figure 4.1.9-2 presents the trends in population within the SNL/NM ROI.



Source: USCB 2007.

Figure 4.6.9- 2 —Trends in Population for the SNL/NM ROI, 1990-2005

Table 4.6.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 305,840 with 281,052 occupied (92 percent). There were 190,981 owner-occupied housing units and 90,071 rental units. The median value of owner-occupied units in Bernalillo County was the greatest of the counties in the SNL/NM ROI (\$128,300). The vacancy rate was the lowest in Bernalillo County (7.6 percent) and the highest in Torrance County (17 percent) (USCB 2007).

Table 4.6.9-4 — Housing in the SNL/NM ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Bernalillo County	239,074	220,936	140,634	80,302	18,138	7.6	128,300
Sandoval County	34,866	31,411	26,257	5,154	3,455	9.9	115,400
Torrance County	7,257	6,024	5,055	969	1,233	17.0	82,800
Valencia County	24,643	22,681	19,035	3,646	1,962	8.0	108,300
ROI	305,840	281,052	190,981	90,071	24,788	8.1	123,328

Source: USCB 2007.

4.6.9.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 10 school districts with 256 schools serving the SNL/NM ROI. Educational services are provided for approximately 131,095 students by an estimated 8,642 teachers for the 2005 to 2006 school year (IES 2006a). The student-to-teacher ratio in these school districts ranges from a high of 16:1 in the Los Lunas School District in Valencia County to a low of 11:1 in the Jemez Valley School District, in Sandoval County. The student-to-teacher ratio in the ROI was 15:1 (IES 2006a).

The counties within the ROI employ approximately 8,008 firefighters and law enforcement officers. There are 10 hospitals that serve residents of the ROI with the majority located in Bernalillo County. These hospitals have a total bed capacity of 1,456 (ESRI 2007).

4.6.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of SNL/NM. Figure 4.1.10-1 shows counties potentially at risk from the current missions performed at SNL/NM. There are seven counties included in the potentially affected area. Table 4.1.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

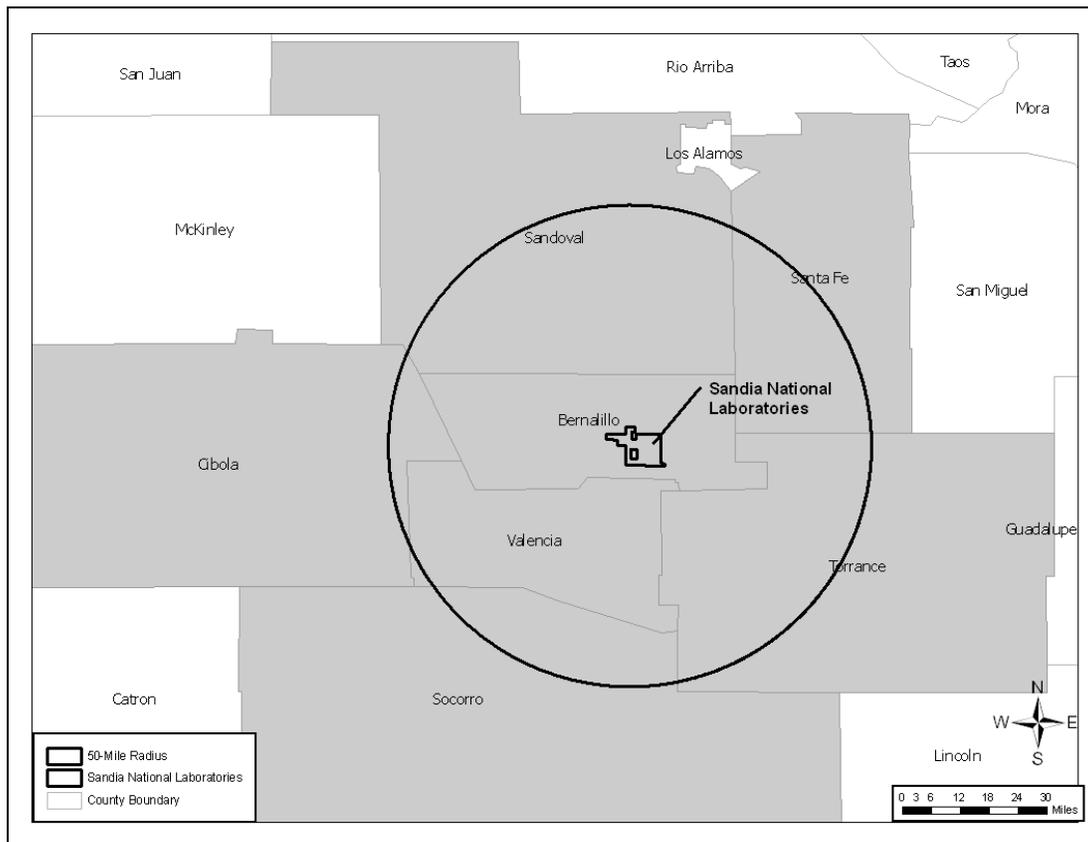


Figure 4.6.10-1 — Potentially Affected Counties Surrounding SNL/NM

Table 4.6.10-1 — Demographic Profile of the Potentially Affected Area Surrounding SNL/NM, 2000

Population Group	Population	Percent
Minority	535,543	59.3
Hispanic alone	274,020	30.4
Black or African American	19,241	2.1
American Indian and Alaska Native	54,438	6.0
Asian	16,221	1.8
Native Hawaiian and Other Pacific Islander	4,759	0.5
Some other race	130,997	14.5
Two or more races	35,867	4.0
White alone	367,071	40.7
Total Population	902,614	100.0

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 59.3 percent of the total population. Hispanic residents are the largest group within the minority population. As a percentage of the total resident population in 2000, New Mexico had a minority population of 55 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.6.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 126,580 individuals residing within census tracts in the 50-mile radius of SNL/NM were identified as living below the Federal poverty threshold, which represents approximately 14 percent of the census tracts population within the 50-mile radius. There was one census tract located in Cibola County with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 18.4 percent of individuals for whom poverty status is determined were below the poverty level in New Mexico and 12.4 percent in the U.S. (USCB 2007).

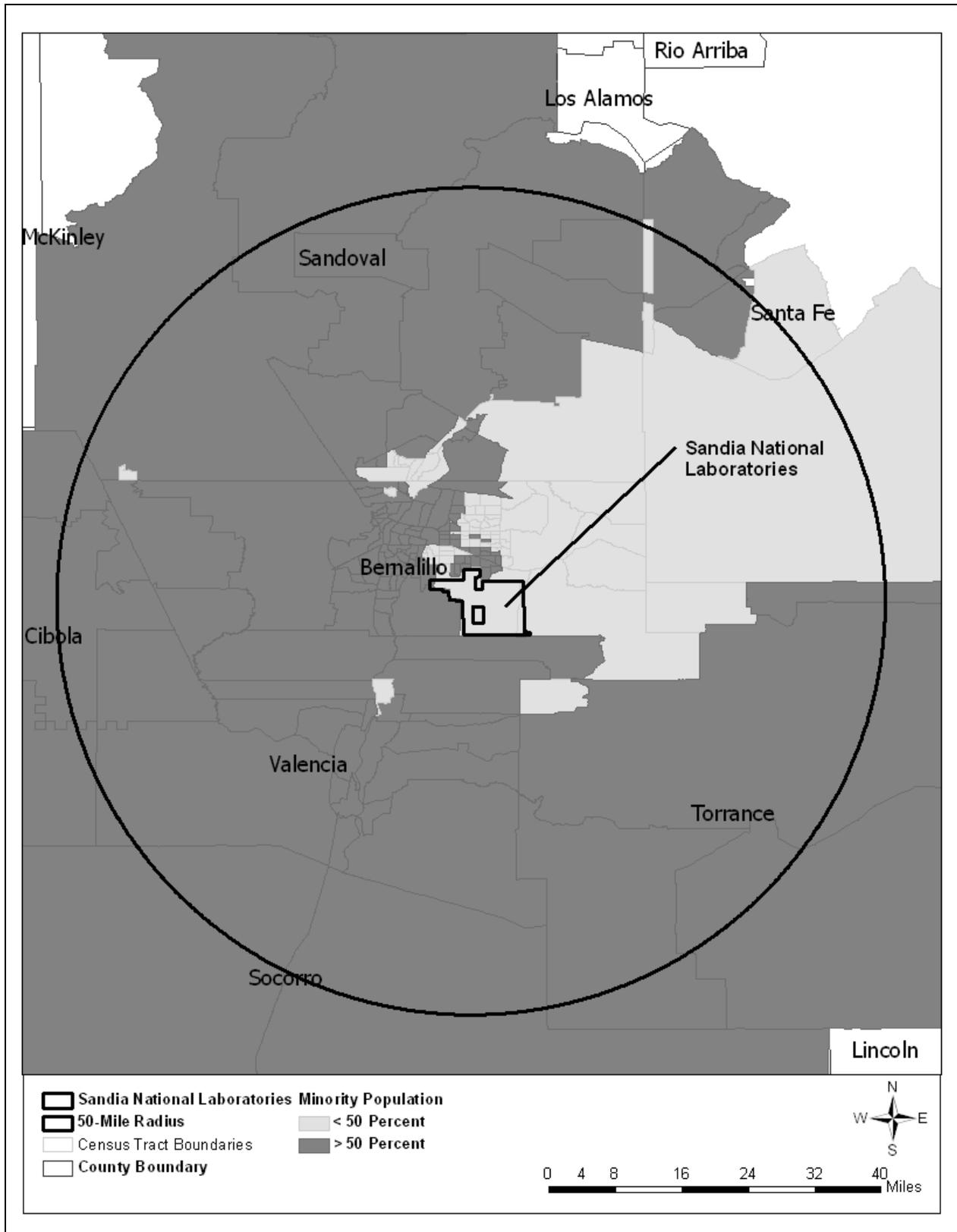


Figure 4.6.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of SNL/NM

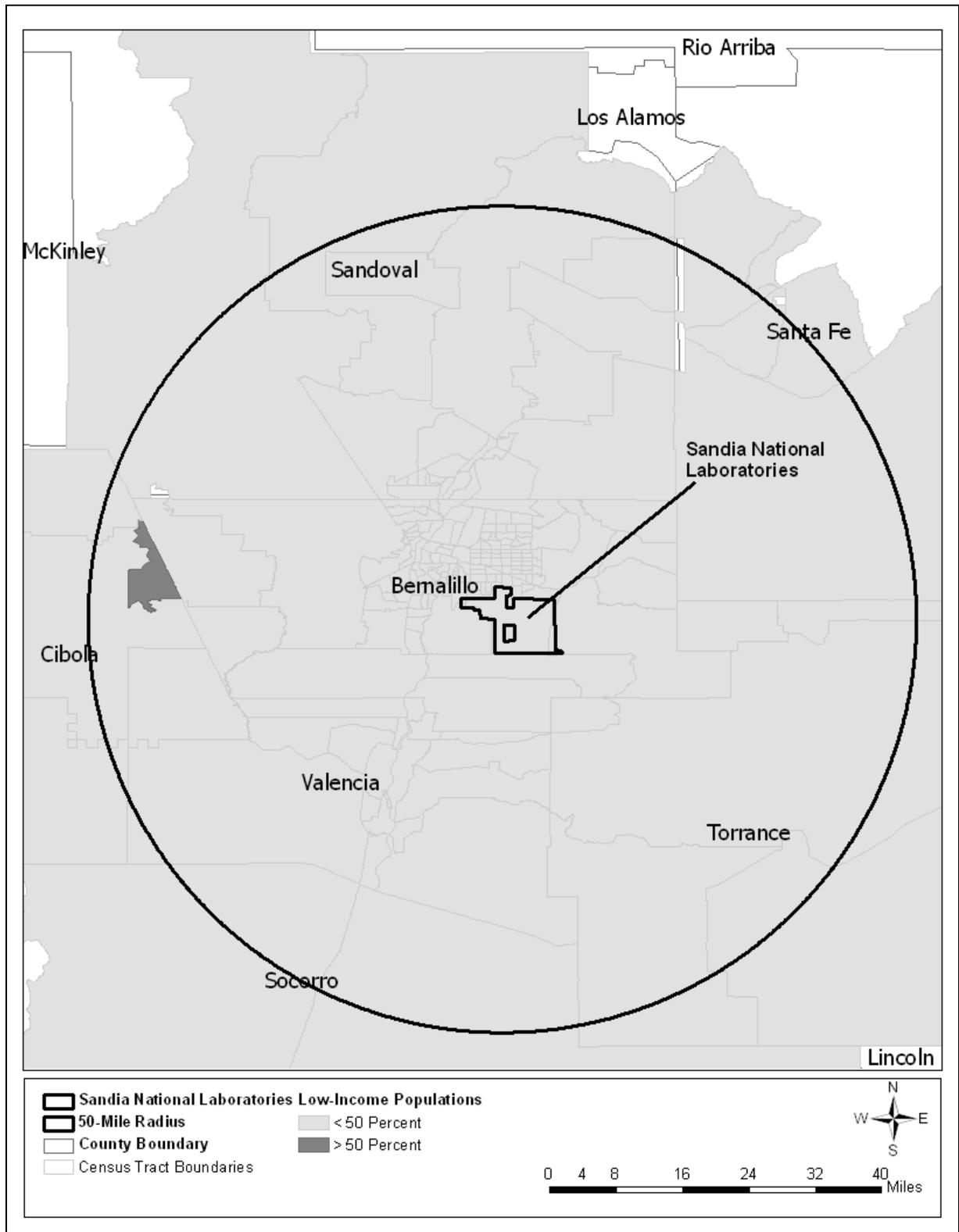


Figure 4.6.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of SNL/NM

4.6.11 Health and Safety

Current activities associated with routine operations at SNL/NM have the potential to affect worker and public health. The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at SNL/NM. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.6.11.1 Public Health

4.6.11.1.1 Radiological

Releases of radionuclides to the environment from SNL/NM operations provide a source of radiation exposure to individuals in the vicinity of SNL/NM. During 2005, SNL/NM's environmental radiological monitoring program was conducted according to DOE Orders 450.1, "Environmental Protection Program,"¹ and 5400.5, "Radiation Protection of the Public and the Environment." The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public.

Radiological and non-radiological hazardous materials released from SNL/NM facilities reach the environment and people through different transport pathways. Of the transport pathways that could potentially impact human health, only the air exposure pathway from air emissions provides a complete exposure pathway. Soils, groundwater, and surface water exposure do not provide complete exposure pathways and are not expected to lead to radiological or non-radiological exposure to public receptors. Section 4.6.4.1 identifies the facilities at SNL/NM that emit radiological emissions, and quantifies the amounts of each radionuclide released.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to derived concentration guides (DCGs) listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual member of the general public. This individual is a person who resides near SNL/NM, and who would receive, based on theoretical assumptions

about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from SNL/NM operations. Calculations are performed using the EPA’s CAP88-PC model (EPA 1992).

The dose received by the MEI and the collective population dose are tabulated in Table 4.6.11-1. Based on the 2005 operational data, SNL/NM emitted a dose to the maximally exposed member of the general public of 0.00082 millirem per year (SNL/NM 2006). This dose is less than 1 percent of the DOE public dose limit for all pathways and less than 1 percent of the EPA maximum permissible exposure limit to the public (and the DOE “air pathway” limit) of 10 millirem per year. The monitoring and analysis results demonstrate that no adverse effects occurred from SNL/NM operations in 2005. SNL/NM met all NESHAP compliance requirements in 2005 (SNL/NM 2006).

The 2005 collected dose for the collective regional population (793,740 estimated to be living within 50-mile radius of SNL/NM) is 1.7×10^{-4} . For perspective, the annual radiation dose from natural background radiation is approximately 360 millirem per year (SNL/NM 2006).

Table 4.6.11–1 — Radiological Dose Reporting, 2005

Pathway	Dose to MEI (mrem)	Percent of DOE 100-mrem/yr Limit	Estimated Population Dose with 50 miles (person-rem)	Population within 50 mile radius of site	Estimated Background Radiation Population Dose (mrem)
Air	8.2×10^{-4}	0.001 percent	1.7×10^{-4}	793,740	-
Water	0	0	0	0	-
Other Pathways	0	0	0	0	-
All	8.2×10^{-4}	0.001 percent	1.7×10^{-4}	793,740	2.9×10^5

Source: SNL/NM 2006.
mrem=millirem
mrem/yr=millirem per year

SNL/NM operations are required to be in compliance with the DOE and OSHA requirements for worker health and safety. DOE Environment, Safety, and Health (ES&H) programs regulate the work environment and seek to minimize the likelihood of work-related exposures, illnesses, and injuries. In addition, SNL/NM’s Occupational Radiation Protection Program complies with 10 CFR 835, *Occupational Radiation Protection*, and DOE-N-441.1, *Radiological Protection for DOE Activities*, which provide requirements for protection of onsite workers and visitors.

Table 4.6.11-2 lists the average, maximum and collective effective dose equivalent to workers for the years 1999 through 2003. Table 4.6.11-3 identifies the nonfatal injury/illness case rates and lost workday case rates for Sandia Corporation employees from 1999 through 2003. The doses and rates for this period have remained relatively constant, indicative of a stable occupational health and safety environment. In 2005, the collective dose to workers was 8.5 person-rem.

Table 4.6.11-2 — Average, Maximally Exposed Individual (MEI) and Collective Radiation-Badged Worker Doses

Parameter	Calendar Year				
	1999	2000	2001	2002	2003
Average dose to workers (mrem/yr)	68	84	50	45	43
Dose to MEI (mrem/yr)	603	720	472	425	417
Collective dose to workers (person-rem/yr)	7.34	7.81	5.30	4.95	10.49

Source: SNL/NM 2006.
 mrem/yr=millirem per year

Table 4.6.11-3 — Comparison of Nonfatal Injury/Illness and Lost Work Day Case Rates

Parameter	Calendar Year				
	1999	2000	2001	2002	2003
Nonfatal Occupational Injury/Illness Rates (per 100 workers/year [per 200,000 hours])	3.5	3.6	4.2	3.3	3.6
Lost Work Day Case Rates (per 100 workers/year [per 200,000 hours])	1.5	1.4	1.3	1.8	1.3

Source: SNL/NM 2006.

4.6.11.1.2 Non-radiological

Non-radiological chemical air pollutants are released from SNL/NM facilities that house chemistry laboratories or chemical operations. Air samples collected near known chemical emission sources are the highest expected chemical air pollutant levels from current SNL/NM operations. Due to dilution and dispersion, lower levels of these air pollutants would occur at locations offsite and further away from the sources. The maximum ambient concentrations of VOCs measured by monitoring stations onsite at SNL/NM are below safety levels established for workers in industrial areas. Although there are no SNL/NM-operated monitoring stations offsite, it is possible to make the assessment that concentrations decrease with distance from the source and, therefore, are also below health-risk levels for impacts to public health

Small amounts of non-radiological chemical contamination, which have been caused by past SNL/NM operations, have been identified in other environmental resources (such as groundwater and soils subsurface). Chemicals existing in the environment have the potential to reach members of the public through these different transport pathways. Environmental sampling programs involving resources such as groundwater, soils, and surface water, are designed to monitor and assess the potential for public exposure to these pollutants through these different media. Evaluations of groundwater, soils, and surface water information indicate that the public is not in contact with these areas of contamination within SNL/NM site boundaries and that the contamination is not being transported offsite (SNL/NM 1999). Non-radiological chemical air emission values were reviewed in the 2006 SNL/NM SA. Because the emissions had not changed significantly from the results presented above, the concentrations of VOCs remain below health-risk levels (SNL/NM 2006).

4.6.12 Transportation

Figure 4.6.12-1 shows major transportation routes in vicinity of SNL/NM. Nearly all of SNL/NM activities are conducted within the boundaries of KAFB. Three principal entrances of KAFB, the Wyoming, Gibson, and Eubank Gates, provide access to SNL/NM. Additional entrances are located at the Truman/Gibson and Carlisle/Gibson intersections. Average weekday traffic volume (two-way) on Wyoming Boulevard south of the Gibson Boulevard intersection is 16,211 vehicles per day. Traffic entering the intersection of G Avenue and 20th Street from the east (traveling from the direction of the Eubank gate) is 20,066 average weekday traffic volume (DOE 2006a).

Traffic in the KAFB vicinity is predominantly associated with USAF operations. In addition to Air Force and SNL/NM activities, other Federal agencies conduct operations at KAFB including the Department of Homeland Security, the Defense Threat Reduction Agency (DTRA), and the USGS. Traffic volumes for SNL/NM-affiliated activities are based on estimates derived from various traffic studies. The average estimated daily SNL/NM-affiliated traffic flow at KAFB's main access points are provided in Table 4.6.12-1.

Table 4.6.12-1 — Daily Gate Traffic Estimates for SNL/NM Activities at KAFB

Study Year	Gibson Gate	Wyoming Gate	Eubank Gate	Total
1982	16,700	17,800	10,000	44,500
1993	21,160	21,700	12,200	55,060
1995	22,523	19,835	14,788	57,146
2004	15,255	16,075	19,636	50,966

Source: SNL/NM 2004.

4.6.12.1 Aircraft Operations

Access to passenger and air freight services for shipments to or from SNL/NM is possible by traversing between SNL/NM and the Albuquerque International Sunport. KAFB and the Sunport share runways, and it is possible to travel between KAFB and SNL/NM without exiting the Air Force base. Commercial air freight services, such as Menlo Worldwide or DHL Worldwide are available at the Sunport. The NNSA Office of Secure Transportation Aviation Operations Branch (AOB), also located at the Sunport, supports DOE programs and operations. All inbound and outbound KAFB shipments via AOB are considered to be DOE air transport shipments.

4.6.12.2 Transportation Accidents

In a lessons learned report documenting motor vehicle accidents (MVAs) during the period of January 1997 to May 2002, 50 MVAs were reported at SNL/NM-controlled facilities (SNL/NM 2002). Online record searches for the five-year period spanning CY1999 through 2003 found 22 MVAs at SNL/NM. The sources used were the Occurrence Reporting and Processing System (ORPS) and the Human Resources (HR) Queries database.

It should be noted that the lessons learned documents includes MVAs at the TTR; however it is believed that the 22 MVAs for the CY1999 to CY2003 period does not provide a complete list of

MVAs at SNL/NM. The ORPS only lists those accidents that meet certain criteria including property damage over a certain dollar amount and environmental impacts due to MVAs. The HR Queries emphasizes injuries to SNL/NM employees, at times not accounting for subcontractor MVAs.

Motor vehicle accidents in Bernalillo County and nearby counties are reported in Table 4.6.12-2. In 2005, there were 28,360 motor vehicle accidents in Bernalillo, Sandoval, Santa Fe, Torrance, and Valencia Counties resulting in 162 fatalities.

Table 4.6.12-2 New Mexico Traffic Accidents in Bernalillo and Nearby Counties, 2005

County	Total Accidents	Fatalities	Injuries
Bernalillo	20,917	78	9,650
Sandoval	1,953	24	1,161
Santa Fe	4,217	33	2,323
Torrance	281	13	172
Valencia	992	14	592
New Mexico	49,023	488	24,001

Source: NMDOT 2006.

4.6.13 Waste Management

The method of screening for waste generation is to compare the types and quantities of waste generated and projected to be generated by SNL/NM operations (excluding ER Project and decommissioning activities) with the waste generation analysis reported as the EOA in the 1999 SNL/NM SWEIS. Projection methodology is explained when the projections are discussed in the following subsections.

4.6.13.1 Low-Level Waste

SNL/NM continues to generate LLW and MLLW in its ongoing operations. TRU and mixed TRU wastes are not generated by current operations and are not expected to be generated by the new facilities that are expected to be operational by 2008. However, these wastes are still actively managed at the Radioactive and Mixed Waste Management Facility (RMWMF) while awaiting shipment to offsite disposal facilities.

The quantities of LLW generated in 1999, 2000, and 2001 exceeded the quantity projected under the EOA in the 1999 SNL/NM SWEIS. The quantities generated in 2002, 2003, and 2004 were well under the SWEIS quantity. The projections for 2005 through 2008 were based on the average amounts generated from 1999 through 2004 and adjusted for the expected activity increases or decreases at SNL/NM facilities, which are presented in Table 2.2-1 and projected the new facilities described in Chapter 2. The quantities projected for 2005 through 2008 are about 96 percent of the SWEIS quantity (TtNUS 2006); therefore, the 1999 SNL/NM SWEIS impacts analysis is considered sufficient for LLW.

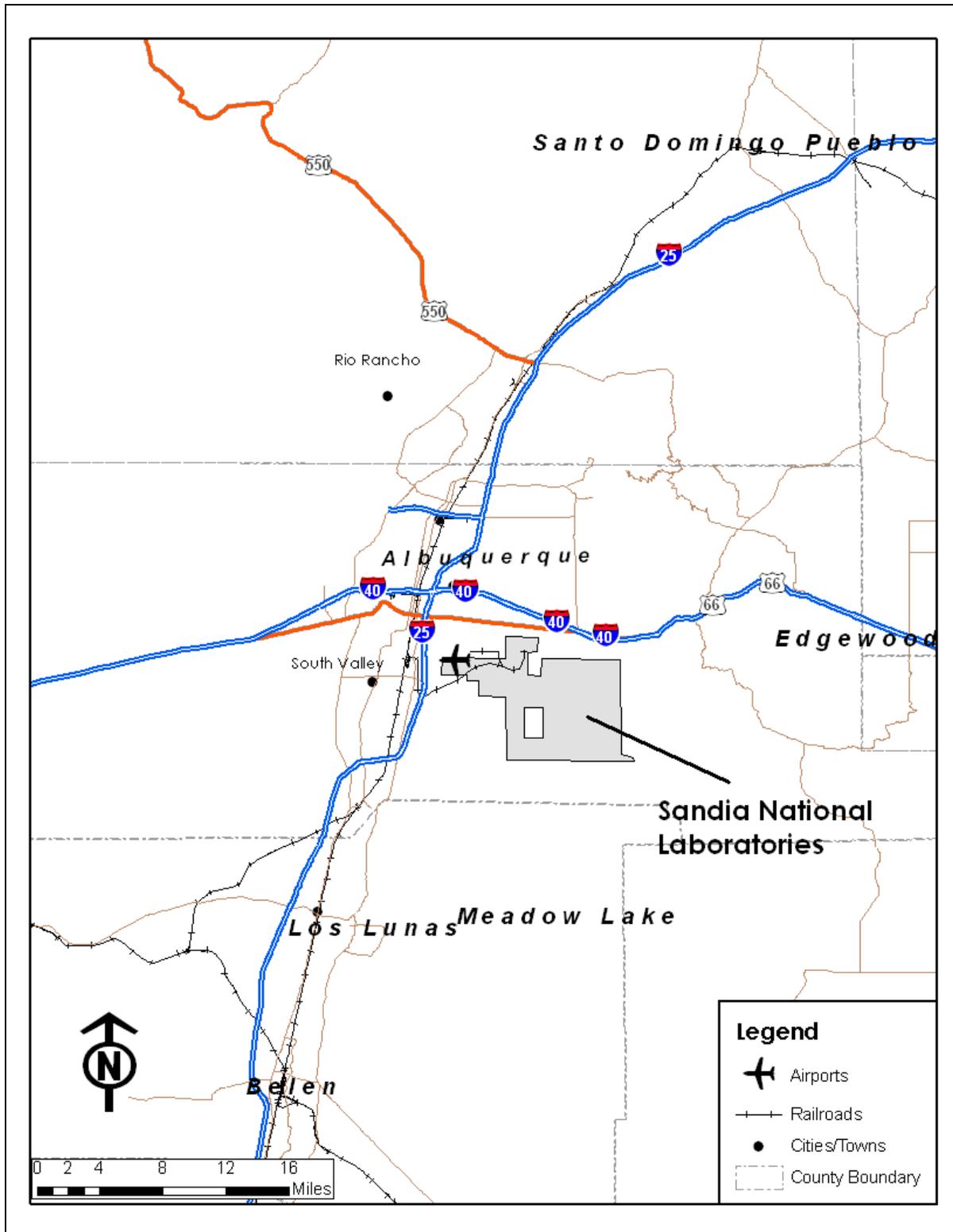


Figure 4.6.12-1 — Major Roads at SNL/NM

4.6.13.2 *Mixed Low-Level Waste*

The annual generation of MLLW from 1999 through 2004 did not exceed the 1999 SNL/NM SWEIS bounding quantity. For 2005 through 2008, the annual generation is projected to be less than that generated in 2004 and would remain steady at about 118 cubic feet (1,838 kilograms, using an average density of 1,586 pounds per cubic yard [DOE 1999a, Appendix H]), which is about 37 percent of the SWEIS quantity (TtNUS 2006). Since the quantities projected for 2005 through 2008 are less than the amount projected in the 1999 SNL/NM SWEIS, the 1999 SNL/NM SWEIS impacts analysis is considered sufficient for LLMW.

4.6.13.3 *Hazardous Waste*

The 1999 SNL/NM SWEIS analysis projected the annual maximum quantity of hazardous waste generated at SNL/NM operating facilities to be 206,163 pounds. As presented in Table 4.6.13-1, SNL/NM has generated less than that amount each year except in 2003. Hazardous waste generation for 2005 through 2008 was projected based on the average generation during the period from 1999 through 2004 and adjusted for increasing and decreasing activity levels at the selected facilities and the new facilities. For 2005-2008, the annual generation is projected to be highest in 2007 and 2008, at 122,687 pounds, which is about 60 percent of the SWEIS EOA quantity (TtNUS 2006). Since the quantities projected for 2005-2008 are less than the amount projected in the 1999 SNL/NM SWEIS, the impacts analysis of the 1999 SNL/NM SWEIS is considered sufficient for hazardous waste.

4.6.13.4 *Nonhazardous Waste*

Nonhazardous chemical waste is generated at SNL/NM through ongoing operations and ER Project activities. This waste stream is composed of non-regulated waste that is processed at the Hazardous Waste Management Facility (HWMF). The 1999 SNL/NM SWEIS stated that 275,824 pounds would be generated by ER Project activities and that the maximum quantity generated by operations would be 203,464 pounds. The 2004 quantity generated by ER Project activities and operations (separate quantities were not available) was 428,298 pounds (SNL/NM 2006). NNSA expects this amount to decrease as the ER Project is completed.

4.6.13.5 *Waste Generation Capacities*

Table 4.6.13-1 presents the waste generation quantities for 2005. It also lists the maximum annual quantity of waste presented in the 1999 SNL/NM SWEIS for the EOA (i.e., bounding quantity) for LLW, MLLW, TRU, mixed TRU, hazardous, municipal solid wastes, and wastewater. The 1999 SNL/NM SWEIS EOA quantities did not account for ER Project wastes and wastes resulting from D&D activities; therefore, ER project waste quantities are not reflected in Table 4.6.13-1.

4.6.13.6 *Waste Generation Facilities*

Waste at SNL/NM is processed at 5 facilities: the Thermal Treatment Facility (TTF), the HWMF, the RMWMF, the Manzano Storage Bunkers (MSB), and the Solid Waste Transfer

Facility (SWTF). Waste generated and shipped by the HWMF in 2005 is shown in Table 4.6.13-1.

Table 4.6.13-1 — Waste Generated and Shipped By the HWMF in 2005

Waste Categories Handled at the HWMF	2005 Waste Shipped
RCRA Waste	pounds
Hazardous Waste	230,032
Hazardous Waste (generated by ER Project)	981,235
Hazardous Waste (recycled)	10,901
Total	1,222,168
TSCA	
Asbestos	380,609
PCB (recycled NR)	10,624
PCB (incin NR)	4,862
PCB (incin RCRA)	2,066
Total	398,161
Biohazardous	
Infectious Waste	1,538
Other	
NR Waste (minus asbestos, PCB, subtitle D, ER, recycled)	698,434
Non-hazardous Solid Waste (RCRA Subtitle D)	24,552
Non-RCRA (generated by ER Project)	81,292
Used Oil	83,373
Other (recycled)	162,279
Total	1,049,930
Total Waste and Recyclables Shipped	2,671,797

Source: SNL/NM 2006.

lb = pounds

4.7 WHITE SANDS MISSILE RANGE

WSMR is a unique tri-service facility for test, evaluation, research, and assessment of military systems and commercial products located in south-central New Mexico (Figure 4.7-1). WSMR offers a broad assortment of testing capabilities and infrastructure, from management of the largest open-air/over-land missile range in the hemisphere to environmental testing chambers and computer modeling laboratories. WSMR is part of the Developmental Test Command (DTC), which reports to the United States Army Test and Evaluation Command (ATEC).

The WSMR possesses extensive capabilities and infrastructure used by the Army, Navy, Air Force, NASA and other government agencies as well as universities, private industry and foreign militaries. No NNSA activities currently take place on the WSMR.

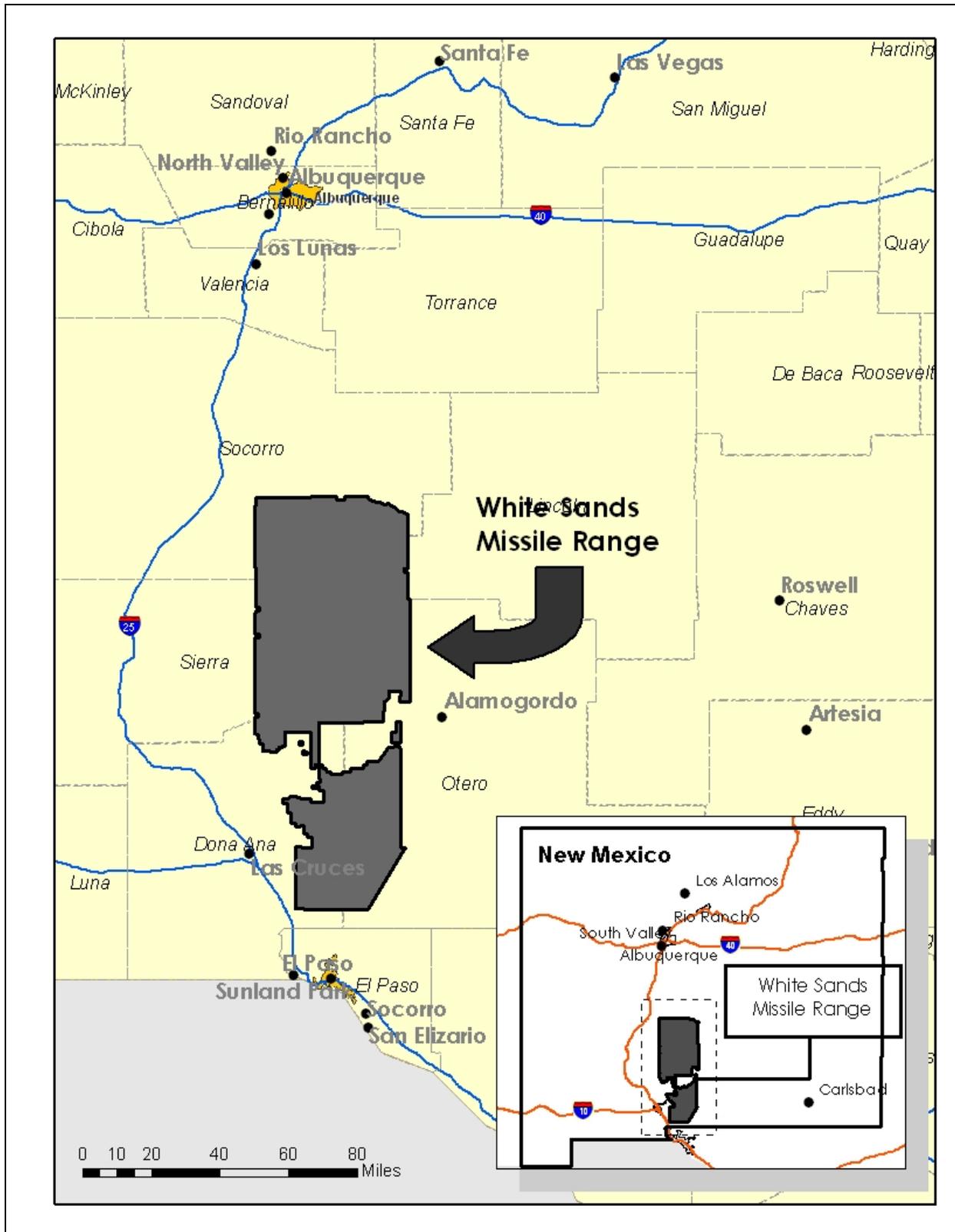
4.7.1 Land Use

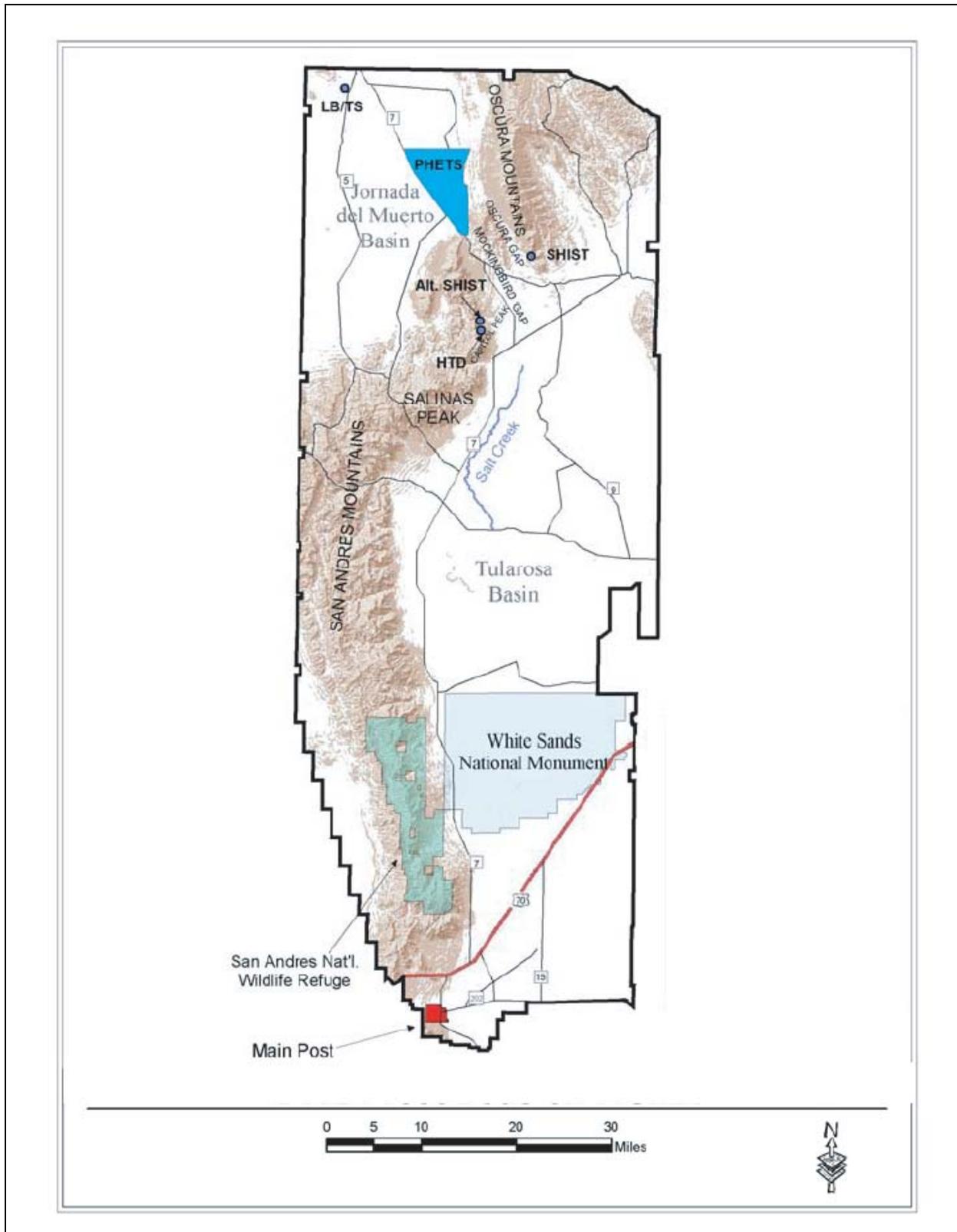
4.7.1.1 *Onsite Land Uses*

WSMR lies within the Mexican Highland section of the Basin and Range Physiographic Province (Hawley 1986). This region is typified by alternating north-south aligned mountain ranges separated by expanses of sediment-filled basins (Peterson 1981, Hawley 1986).

Consistent with the regional basin and range topography, the overall landscape of WSMR consists of two large basins, the Jornada del Muerto and the Tularosa, which are separated mainly by the San Andres Mountains (Figure 4.7.1-1). There are no prime farmlands on WSMR (NRCS 2002).

Defense Threat Reduction Agency (DTRA) test beds lie within the Jornada del Muerto Basin, northern portions of the San Andres Mountains, and an area on the western side of the Oscura mountains. The Permanent High Explosive Test Site (PHETS) lies on a nearly level alluvial plain in the northern Jornada del Muerto Basin. It is located in Socorro County approximately 13 miles south of Stallion Range Center in the northwest corner of WSMR. PHETS is the largest of the DTRA test sites and has an overall area of approximately 22,400 acres; however, most test activities at PHETS take place in three test beds that cover a smaller area of approximately 5,246 acres. PHETS is used for HE events and tests to evaluate the effectiveness of various weapon systems against hardened targets.





Source: DTRA 2007.

Figure 4.7.1-1 — Map of WSMR showing DTRA test beds

The Large Blast Thermal Simulator (LB/TS) is also located in the northern portion of the Jornada del Muerto Basin approximately 2.1 miles southwest of the Stallion Range Center, 12 miles northwest of PHETS, and 2.2 miles south of the nearest WSMR boundary. The site covers approximately 50 acres, with the nearest mountains approximately 17 miles to the east. LB/TS contains a large building complex and parking areas. LB/TS is an enclosed facility used to evaluate the survivability and vulnerability of full-scale military and other equipment subjected to the air blast and thermal conditions of an enemies simulated nuclear explosion.

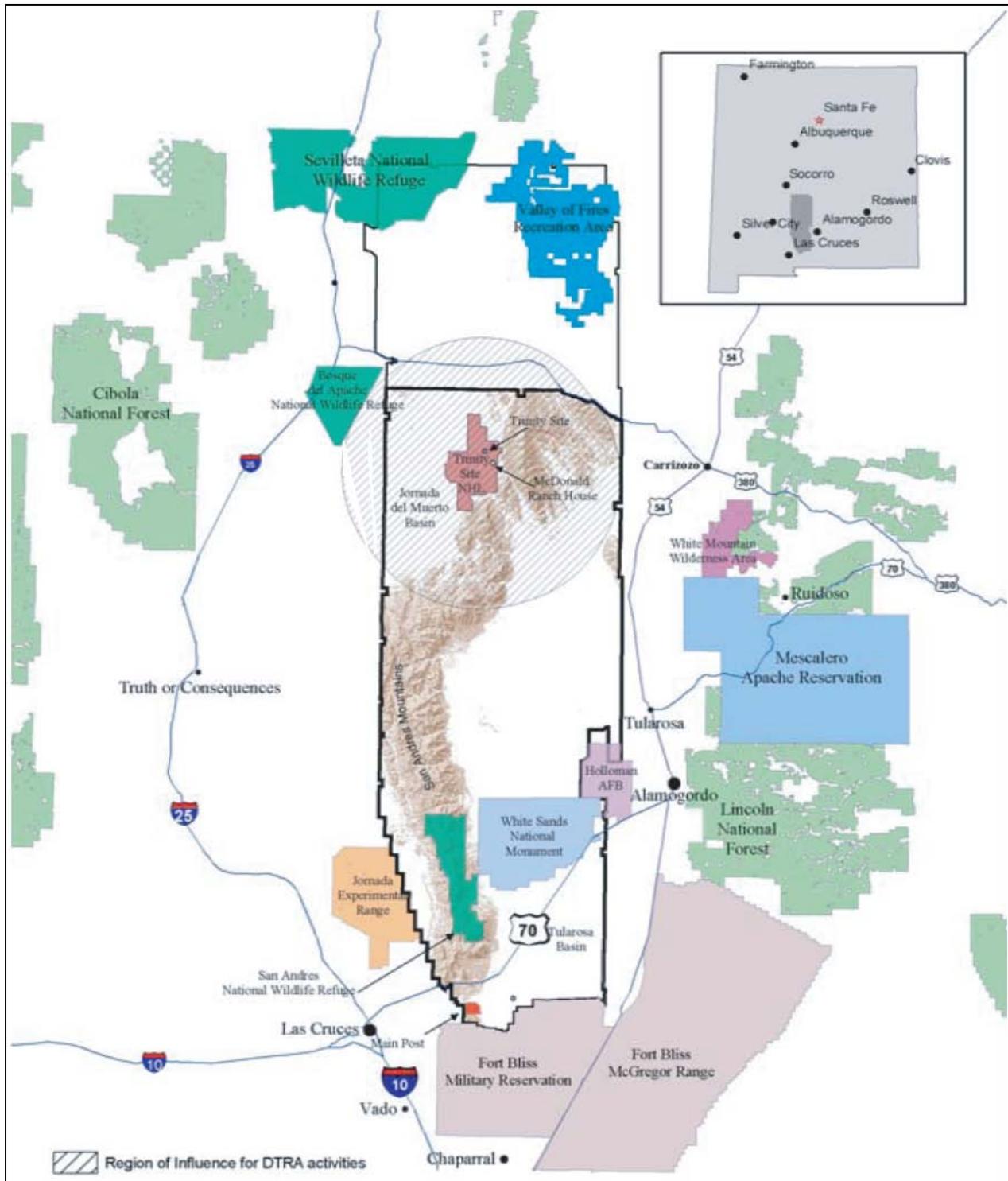
The Seismic Hardrock In Situ Test site (SHIST) site is located in Sierra County approximately 14 miles southeast of PHETS, and covers a 17 acre area. This site has been used in support of bedrock penetration testing. The Oscura Mountains and adjoining Chupadera Mesa cover the northeast corner of WSMR (Figure 4.7.1-1). The Chupadera Mesa extends beyond WSMR boundaries into the Northern Extension. (The Northern Extension is an area outside of WSMR boundaries that can be used for certain non-explosive testing activities under pre-existing agreements with the landowners.) SHIST is used principally for bedrock (e.g., granite, diabase, shale, or limestone) penetration tests using various warhead types.

4.7.1.2 *Surrounding Land Uses*

Figure 4.7.1-2 displays the surrounding land use in the vicinity of the WSMR. Bordering WSMR to the west is the Jornada Experimental Range (JER) and the Jornada Long Term Ecological Research Site operated by the U.S. Department of Agriculture (USDA). Bosque Del Apache National Wildlife Refuge is located near the northwest corner of WSMR and Sevilleta National Wildlife Refuge is located north of Socorro overlapping the North Extension Area.

The bulk of BLM lands adjacent to WSMR come under the jurisdiction of Las Cruces Field Office. Managed by the BLM, Aguirre Springs Recreation Area is located west of the Main Post on the eastern aspect of the Organ Mountains and Dripping Springs Preserve is located at the base of the Organ Mountains east of Las Cruces. Formerly part of the privately owned Cox Ranch, Dripping Springs is now a historical feature of the Organ Mountains Recreation Area. The Preserve abuts Fort Bliss lands on the east side of the Organ Mountains, but is little affected by the activities of WSMR despite its close proximity. Several private ranches and farms are also adjacent to or a short distance from WSMR.

The Valley of Fires Recreation Area, managed by the BLM Roswell Field Office, is located 3 miles from Carrizozo and contains one of the youngest lava fields in the continental U.S. (approximately 10,000 years old); these lava flows extend into the eastern part of the WSMR called the “Malpais”. The Mescalero Apache Reservation encompasses parts of the Sacramento and White Mountains to the east of WSMR.



Source: DTRA 2007.

Figure 4.7.1-2 — Land Use in the Vicinity of WSMR

4.7.2 Visual Resources

Scenic desert landscapes with rugged topography are typical at WSMR. Also, high mountains with sheer rock faces contrast with broad, flat basins to create much visual appeal. Nearby White Sands National Monument is a beautiful expanse of white gypsum sand dunes whose sand supply is derived from Lake Lucero, a largely barren playa lakebed. However, most of the WSMR landscape is not readily viewable by the general public due to access restrictions.

PHETS is part of a larger area that has been used for high explosive tests, bombing, and missile impacts since the creation of WSMR in the 1940s. PHETS is located within the Jornada del Muerto Basin. It is a remote area with a stark and expansive landscape; viewed from the Jornada del Muerto Basin, the Oscura and San Andres Mountains create a scenic backdrop to the east.

PHETS is located within the boundaries of a 49,360 acre portion of WSMR designated as the Trinity Site National Historic Landmark (Trinity NHL). PHETS test beds and infrastructure can be seen from the Trinity NHL monument, which is open to visitors for one day twice a year.

PHETS and the surrounding area have an overall disturbed appearance as a result of extensive historic use. Active disturbance at PHETS is limited to three primary test beds containing nonpermanent single and multiple story test structures, test support equipment, berms, and an established road network. Berms and other light-colored bare soil areas are visually prominent against a background of natural vegetation. An administrative complex is located at the intersection of Range Roads 7 and 20. Located near PHETS are several impact areas including Stallion WIT, 649 WIT, and the Northeast Center Impact Area (NECI). Many test programs launch missiles from the southern portion of WSMR into these northern impact areas. As a result of continuous mechanical ground-clearing activities, the impact areas have a disturbed appearance.

SHIST (Seismic Hard rock In-Situ Source Test) and Alt. SHIST have been used for projectile penetration testing since the early 1990s. Earth-moving activities associated with projectile recovery have noticeably altered the appearance of the land surface. Fresh rock and bare soil areas contrast sharply with vegetated areas. Evidence of historic and on-going DoD activities is visible from access roads to both sites. The immediate area surrounding various test beds has been altered from historic use and contains support roads, target bunkers, and tunnels. The Hard Target Defeat (HTD) test beds are located in Capitol Peak area, a relatively remote mountain setting. The excavation of target tunnels and the resultant large spoil piles have altered the landscape. In addition, construction of a road network, several staging areas for equipment and temporary buildings have altered the appearance of the landscape. The lower part of Capitol Canyon can be partially seen from Range Road 7 about 5 miles distant.

However, other than the access road, there are no routinely utilized facilities from which the project area can be viewed. This site is beyond the visual range of visitors to WSMR. The LB/TS is a 50-acre complex located in a remote basin-floor desert-shrub land setting. The site includes a one-story reinforced-concrete administration and control building, several other large buildings related to facility operation, and a roughly 820 foot long semicircular shock tube surrounded by 8-foot earthen berms. The LB/TS can be glimpsed from Stallion Range Center

and Range Road 7, both about 2.1 miles distant. A 7-foot chain link security fence encloses the large building complex and parking areas.

Although there are no BLM Visual Resource Contrast ratings for WSMR, undeveloped lands within WSMR generally meet the characteristics of Classes II and III, which are described in Table 4.7.2-1.

Table 4.7.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low and must not attract attention.
Class II	To retain the existing character of the landscape, the level of change to the characteristic landscape should be low.
Class III	To partially retain the existing character of the landscape, the level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape, the level of change to the characteristic landscape can be high.

Source: BLM 1980.

4.7.3 Site Infrastructure

Electricity is provided to WSMR from several commercial sources, with El Paso Electric Company supplying 92 percent of the 92,121 MWh consumed during the 1999 fiscal year. The local power grid connects many frequently used sites across WSMR. Approximately 300 portable diesel generators, with an output from 10-700 kVA, are provided by WSMR to supply power at remote sites. The Information Operation Directorate is responsible for communication support to WSMR, including distribution, maintenance, and scheduling. Off-range telephone services are provided by Qwest Communications. Cellular phones and/or radios are required for personnel traveling north of U.S. Highway 70 on WSMR (DTRA 2007).

The PHETS Administrative Park is served for electricity, water, and heating; LB/TS, SHIST, Alt. SHIST, and HTD are not. Water for PHETS is obtained from the Stallion Range Center water system and delivered to a storage tank at the Administrative Park via tank truck. Many of the bunkers and support buildings on the PHETS test beds are hardwired for power. Heating is provided through refillable propane tanks (DTRA 2007).

4.7.4 Air Quality and Noise

4.7.4.1 Air Quality

4.7.4.1.1 Meteorology and Climatology

WSMR climate is typical of the northern Chihuahuan Desert. Summer is hot, and fall, winter, and spring are typically mild. There is a consistent pattern of strong westerly winds in the spring. Skies are usually clear, and most precipitation occurs during thunderstorms in the late summer. However, daily and annual temperature and precipitation vary considerably, and weather patterns can be difficult to predict (Goudie and Wilkinson 1977). Although overall climate can be generalized, WSMR contains many “microclimates” that may vary significantly from one to another even within the same climate zone. Vegetation patterns often reflect these subtle differences in microclimate (Dick-Peddie, 1993). Wind exposure and topographic relief mostly cause these small-scale variations, and slight changes in elevation affect the temperature and precipitation levels in the landscape (WSMR 2000a).

The climate at WSMR is hot summer and mild fall, winter, and spring. WSMR temperatures are generally mild and influenced by elevation (U.S. Army 2002a). The warmest WSMR temperatures are reached in July and average highs range from 92 to 93°F. The lowest temperatures are reached in January and average low temperatures in January range from 21-34°F. Summertime temperatures often exceed 100°F and wintertime nighttime temperatures often drop below freezing (U.S. Army 2002a). Mean annual temperature at the WSMR Main Post (elevation 4,250 feet) was reported as 62°F (Hatfield and Koperski 2000). Higher elevations are typically cooler on average. In general, temperature drops 5°F for every 1,000 foot rise in elevation (Dick-Peddie 1993). Average temperatures recorded at two WSMR surface meteorological stations (the Surface Atmosphere Measuring System) during July 2000 illustrate the effect of elevation on temperature. The average July temperature at an elevation of 4,005 feet was 83°F, with a maximum of 104°F; whereas during the same timeframe the average temperature at Salinas Peak, at an elevation of 8,941 feet, was 64°F, with a maximum of 81°F (U.S. Army 2002a).

Approximately 60 percent of the total annual rainfall occurs during the summer “monsoon” season, and most of the remaining portion during the winter and spring months. Mean annual precipitation in the basins is less than 10 inches, increasing to approximately 16 inches at higher mountain elevations (U.S. Army 2002a). Strong westerly winds frequently occur from late February through early May, and these inhibit movement into the area of precipitation from the Gulf of Mexico. The spring winds sometimes raise large amounts of dust and sand from the soil surface in areas with sparse vegetation, causing occasional severe dust storms. Dust storms occur most frequently in March and April, and more rarely in other months (Eschrich 1992). During the year, the prevailing wind direction varies from north to south to west. From June to October the prevailing winds are usually from the south, but they can vary and be from the north or the west (U.S. Army 2002a).

4.7.4.1.2 Ambient Air Quality

The location and topography of WSMR generally promote conditions that do not concentrate manmade pollutants. The natural setting of the range, however, is conducive to generation of

airborne dust during high winds. The NMED and the U.S. EPA through AQCR regulate air quality of New Mexico. WSMR is situated mostly within AQCR 153, although the northern end (Socorro County) is in AQCR 156. Pollutants that are monitored using the AQCR include carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, respirable particulate matter, and lead. WSMR is located in areas that are considered to be in attainment of NAAQS (WSMR 2001). Equipment covered by this section includes certain listed stationary sources that emit more than 100 tons per year of any regulated pollutant, or other stationary sources that emit more than 250 tons per year.

Non-Radiological Air Emissions

Airborne dust is a persistent problem throughout WSMR, including the DTRA test beds. Strong westerly winds are typical in the spring (March through early May) producing dust storms prior to the onset of the rainy season. Intact soils and vegetation generally promote better air quality; however, if vegetation is removed and soil exposed, wind erosion often leads to substantial amounts of airborne dust. Likewise, the arid to semiarid climate in the region results in less plant cover and thus tends to exacerbate wind erosion and dust generation.

Manmade pollution sources occur throughout WSMR but are mainly concentrated in the Main Post region where activity levels are highest. The main continuous source of manmade air pollution on WSMR is from vehicle emissions, including automobiles, missiles, aircraft, and ground targets. Dust generated from vehicular traffic on dirt and gravel roads is a common problem everywhere on WSMR. Specific to the north part of the range, a concrete batch plant and a propane boiler at PHETS generate airborne particulate matter and hydrocarbon emissions that require permitting under Title V of the Clean Air Act. The concrete batch plant and the propane boiler are included in the WSMR Title V air quality permit (DTRA 2007).

Radiological Air Emissions

High voltage radar equipment is a common source of x-rays on WSMR but proper shielding reduces this hazard to all site personnel. Trinity Site, the location of the first atomic bomb detonation in 1945, is within PHETS and continues to produce low levels of ionizing radiation (approximately 0.5 millirem during a one-hour visit). Non-ionizing radiation refers to lower energy electromagnetic radiation, mostly in microwave and thermal wavelengths. Potential sources of non-ionizing radiation include lasers and radars. Lasers emit high-intensity light and are used for tracking and sighting purposes. Radar units produce microwave (heat) radiation in addition to x-ray (ionizing) radiation. The regulatory limit for hazardous human exposure is expressed by power density (mW/cm²). It can be as low as 1 mW per centimeters squared or as high as 10 mW per centimeters squared, depending on the frequency. Sources of ionizing radiation previously used in program activities include instrumentation fielded for large-scale explosive testing and the testing of chemical agent detectors. Sources of non-ionizing radiation previously used by DTRA activities include laser guidance and tracking systems, radar guidance and tracking systems, site illumination, communication, and electro-optical countermeasures.

Radiation safety issues are the responsibility of the WSMR Environment and Safety Directorate, Radiation Protection Division, which ensures compliance of rules and regulations outlined by the U.S. Nuclear Regulatory Commission and Army Regulation 11-9 (1999). These regulations focus on establishing policies and procedures for the use, licensing, disposal, transportation,

safety design, and inventory control of ionizing and non-ionizing radiation sources. Radiation exposure standards, dosimetry (measurements of radiation doses) and accident reporting instructions are also addressed. For a more detailed description of radiation sources on WSMR refer to the WSMR RW-EIS (DTRA 2007).

4.7.4.2 *Noise*

Major sources of noise at WSMR include missile launches, sonic booms, ordnance explosions, low-altitude military jet traffic, aircraft drone overflights, gunfire, military helicopters, and general vehicle traffic. Typical noise sources for DTRA activities include background noises from vehicles, aircrafts, and other equipment. Intermittent noises from weapons tests include high explosive discharges, bomb impacts, and various munitions delivery systems (DTRA 2007).

Traffic along established roads and other human activity add to background noise levels in accessible areas of WSMR. The average automobile traveling at 30-60 miles per hour produces 60-75 dBA at a distance of 50 feet, which is considered representative of vehicle-generated noise throughout the area (DTRA 2007).

4.7.5 **Water Resources**

Three regional watersheds are located within WSMR boundaries: the Jornada del Muerto, Tularosa Valley, and Jornada Draw basins. All three watersheds are closed basins. (Closed basins have no drainage outlet for surface water flow, and essentially all surface water is lost to evaporation.) The Jornada del Muerto Basin is located in the northwest portion of WSMR, and drains a 1,893 square mile area, almost half of which is located within WSMR. The highest elevation points and headwaters of this basin system include portions of the San Andres Mountains, Mockingbird Mountains, Little Burro Mountains, Oscura Mountains, and Chupadera Mesa (WSMR 2001). The Tularosa Valley watershed (basin) drains most of the WSMR land area (6,604 square miles). More than a third of the Tularosa Valley basin is located within the boundary of WSMR.

The highest topographic relief of this watershed includes portions of the San Andres and Sacramento mountains. Water from the mountain front recharges the basin ground water, which is then lost to evaporation at Lake Lucero, the lowest portion of this closed basin system (WSMR 2001). Only a narrow portion of the Jornada Draw watershed is located within WSMR. It drains 1,268 square miles, and the San Andres Mountains form the highest elevation within this basin (WSMR 2001).

4.7.5.3 *Surface Water*

Surface water resources within WSMR are limited due to low rainfall, high evaporation rates (due to high temperature and low humidity), and high soil infiltration properties. Most streams, lakes, and rainwater catchments are ephemeral (not permanent) and are dependent on runoff from relatively infrequent precipitation events typical of the region. Surface water generally occurs as overland flow from occasional intense thunderstorms during summer, accumulating in natural or manmade depressions. The gently sloping topography and the tendency for water to evaporate quickly and rapidly percolate into underlying sandy alluvium promote relatively low

runoff amounts at PHETS and LB/TS. Test beds in the more mountainous locations (SHIST, Alt. SHIST, and HTD) experience greater surface flow during the more intense precipitation events. Surface water resources within WSMR are limited and water quality ranges from fresh to brine. Surface water quality is variable and is measured as the concentration of dissolved minerals in the water, termed total dissolved solids (TDS).

4.7.5.3.1 Surface Water Quality

Surface water quality in ephemeral water bodies ranges from fresh to brine, and can become more highly concentrated with TDS over time due to evaporation. The northern Jornada del Muerto Basin has poorly defined and integrated surface water drainage, except within bedrock outcrops along the basin margins where water flows toward the basin center (Weir 1965). Surface flow within this watershed is intermittent and depends on precipitation levels. Weir (1965) conducted the most comprehensive evaluation of water sources in the Jornada del Muerto Basin but no perennial springs or surface water sources were reported.

There are many ephemeral lakes (playas) in the Jornada del Muerto Basin, and these provide seasonal water sources for wildlife. The northern Tularosa Valley watershed has a better-integrated and defined drainage pattern than the Jornada del Muerto Basin (WSMR, 2001). The majority of runoff from the San Andres Mountains drains into the Tularosa Basin through approximately 14 large canyons (Kottlowski et al., 1956). Streambeds in the mountains have a rectangular drainage pattern, with major canyons formed perpendicular and tributary canyons formed parallel to the strike of the beds of sedimentary rocks (Kottlowski et al., 1956).

Perennial surface water bodies on WSMR are essentially limited to the Tularosa Basin, and Salt Creek is the only major perennial stream. Salt Creek is located in the northwestern portion of the basin and flows from north to south. It contains saline to brine water for the majority of the year. The source of its water is brackish to saline shallow ground water flowing through the underlying alluvium. The stream flow eventually disappears into the ground or empties into the playas north of Lake Lucero.

Lake Lucero is located in the southwestern portion of the basin, and it contains saline to brine water most of the time. Flow rate depends on precipitation runoff events and can quickly change. Stream flow measured (since 1995) at the USGS gauging station on Salt Creek, located at RR 316, showed a high of 88 cubic feet per second and a low of zero (WSMR 2001). The water in Salt Creek has high concentrations of TDS and is classified as saline, and water quality has been shown to depend on location and flow rate at time of collection (WSMR 2001). There are several perennial ponds associated with Mound Springs and Malpais Spring, with Malpais Spring providing sufficient water to form a wetland. Several earthen water catchments, probably abandoned ranching-era stock tanks, are found at PHETS. Storm water runoff from PHETS drains westward across a broad alluvial plain and into ephemeral playa lakes in the central part of the Jornada del Muerto Basin.

Perennial and ephemeral seeps and springs occur throughout the San Andres and Oscura mountains. Capitol Peak and Alt. SHIST sites are located in the San Andres Mountains, and SHIST site is located approximately 4.7 miles to the northeast in the Oscura Mountains. The

closest major spring to Capitol Peak and Alt. SHIST is Russell Spring, which is located approximately 3.7 miles to the south-southwest in Thrugood Canyon south of Capitol Peak. Wildlife watering units, which are mostly former ranch stock tanks, also periodically hold water. The watering unit at the old Burris Ranch in Burris Valley is located approximately 1.5 miles west of both Capitol Canyon and Alt. SHIST sites. The closest major spring to SHIST site is Kidd and Duffy Spring, located about 3 miles to the north-northeast of the test bed. Unlike for the springs in the Tularosa Basin that are potential habitat for the White Sands pupfish, there are little data available on the water quality of mountain springs (WSMR 2001). All three sites drain toward the Tularosa Basin.

4.7.5.4 *Groundwater*

Groundwater on WSMR can occur in all lithologic units, ranging from Precambrian to Quaternary in age. Large amounts of water are contained in the Tertiary to Quaternary unconsolidated basin-fill and alluvial deposits in the Tularosa and Jornada del Muerto basins; these locally yield large amounts of water to wells and springs (Roybal 1991). However, most of this water contains high concentrations of TDS and is of poor quality (Orr and Myers 1986; Roybal 1991, Weir 1965). Rocks of Permian and Cretaceous ages yield small to moderate amounts of water from joints and fractures in a few localities (Weir 1965).

4.7.5.4.1 *Groundwater Quality*

The chemical quality of groundwater in the northern part of WSMR is mostly poor because of the high concentrations of TDS, particularly sulfate, chloride, and sometimes nitrate (Weir 1965). Small amounts of water of good to fair quality are present in wells and springs at a handful of localities (Weir 1965); and ground water containing less than 1,000 milligrams per liter TDS has been reported at points of recharge high in alluvial fans next to the mountain fronts (WSMR 2001). However, TDS concentrations in most WSMR groundwater exceeds 1,000 milligrams per liter; more than 85 percent of ground water in the Tularosa Basin may contain TDS exceeding 3,000 milligrams per liter (Orr and Myers 1986), and TDS concentrations as high as 177,000 milligrams per liter have been reported (WSMR 2001).

Groundwater monitoring wells were drilled at PHETS in 2000 and 2001 to evaluate possible testing-related cumulative impacts (U.S. Army 2002a). Chemical quality data reported in the literature for water from historic wells (Roybal 1991, Weir 1965) indicated that ground water throughout PHETS is non-potable and brackish (1,000-10,000 milligrams per liter TDS). The Federal government regulates TDS concentrations in drinking water, and the secondary MCL for TDS in drinking water is 500 milligrams per liter (EPA 1986). Chemical quality data from historic wells in the area show that TDS concentrations, e.g. 3,310; 3,520; and 3,700 milligrams per liter (Weir 1965, Roybal 1991) exceeded the Federal drinking water standard. In addition, sulfate concentrations in water from these wells ranged from approximately 2,200 to 2,500 milligrams per liter. These concentrations were far higher than the 250 milligrams per liter allowed by Federal drinking water regulations (EPA 1986). In addition to TDS, high concentrations of sulfate make groundwater in the region non-potable. The high concentration of dissolved solids and sulfate in the groundwater in this region are a result of naturally occurring minerals that exist in the subsurface.

Non-potable water for construction, project activities, or personnel use is trucked in from outside sources, usually from wells at Stallion Range Center. Potable water for DTRA and other actions occurring in the area would come from the desalinization plant at Stallion Range Center. Selected analytical results from year 2001 sampling of the three monitoring wells (U.S. Army 2002b) at PHETS are presented in Table 4.7.5.1-1. Sulfate, nitrate, and TDS content closely match historic well data for the area (Weir 1965, Roybal 1991). The chemical simulant triethyl phosphate (TEP) used in previous collateral damage tests (U.S. Army 2002b) was not detected in any of the samples. In addition, annual sampling and analysis of ground water at this test bed is planned to detect adverse trends in ground water quality (U.S. Army 2002b).

4.7.5.4.2 Groundwater Availability

The major source of recharge to the groundwater system occurs in areas adjacent to the mountain ranges. Runoff resulting from snowmelt or rainfall on relatively impermeable mountainous watersheds infiltrates the relatively permeable alluvial basin-fill deposits and recharges the groundwater system (Royba, 1991). Any discharge from the groundwater system occurs from evaporation, evapotranspiration, wells, springs, seeps, and Salt Creek (WSMR 2001). The sediments in the Tularosa and Jornada del Muerto basins contain large amounts of water; however, almost all of this water is highly saline and poor quality.

Groundwater at SHIST site is transitory and effectively limited by the shallow bedrock contact in the area. Alluvial cover within the SHIST boundaries reaches approximately 49 feet. Groundwater is expected to accumulate in the alluvium atop the bedrock following significant rainfall events but does not persist for long. In this area any subsurface water would flow southeastward into the Tularosa Basin (Weir 1965). The Mockingbird Gap well is nearest to SHIST, with a reported depth to water of 75 feet (Weir 1965). Alt. SHIST, located in the foothills north of Capitol Peak, is situated on granite bedrock covered by a veneer of alluvium in places. There are seismic boreholes drilled for past tests, but no water wells in the immediate vicinity. Burris Well, located approximately 1 mile west of Alt. SHIST, was drilled in valley-fill alluvium and has a reported water table depth of 36 feet and dissolved solids concentration of 1,290 milligrams per liter (Weir 1965). In the HTD test bed area, depth to water from wells in the region, within approximately 9 miles, ranges from 20-138 feet. Any subsurface water would drain towards the Tularosa Basin.

4.7.6 Geology and Soils

4.7.6.1 Geology

Geology and soil resources vary considerably on WSMR. The Jornada del Muerto Basin was formed by a syncline (a down-warped region of the earth's crust) and subsequently filled by a thick sequence of Santa Fe Group (Tertiary-Quaternary) and Late Quaternary sediments. These deposits were formed by a combination of geologic processes: alluvial (by moving water), lacustrine (in lakes), and eolian (wind-generated). The materials are comprised of interbedded sands, silts, and clays. In addition, alluvial fan deposits slope westward from the nearby Mockingbird Gap Hills and Oscura Mountains and taper into the basin. Throughout much of the basin there are low-lying dunes and sheet deposits of gypsum and quartz sands that were formed

by wind activity in the Late Holocene. Evidence of playas and lake plains (vegetated former lake bed surfaces [Peterson 1981]), consisting of mostly silt deposits, is also visible in the basin.

The San Andres is a fault-block mountain range dissected by numerous north-south-trending faults throughout the area. Rocks in this region range from Precambrian granite to Permian-Pennsylvanian Panther Seep Formation (DTRA 2007). Quaternary alluvium occurs in the bottoms of canyons and valleys between bedrock outcrops. The upper boundary of the HTD test beds on the flanks of Capitol Peak occurs at the contact between granite and a sequence of generally darker, cliff forming Paleozoic rocks (Bachman 1968). The west side of Capitol Canyon consists of a section of Pennsylvanian Lead Camp Limestone. These rocks form massive cliffs and contain beds of chert and shale. Capitol Peak (and the HTD test beds) lies within the Salinas Peak mining district and contains scattered small mineral deposits. A shallow pit near Capitol Peak had low assays reported (DTRA 2007).

4.7.6.2 *Soils*

The soils from the middle to the western edge of the Jornada del Muerto Basin are mapped as Onite-Bluepoint-Wink and Yesum-Holloman associations (DTRA 2007). These soils are highly susceptible to erosion when subjected to disturbances. Coarser alluvial sediments make up the Marcial-Ubar, Berino-Doña Ana, and Nickel-Tencee associations (DTRA 2006), which occur closer to the San Andres and Oscura mountains.

The Nickel-Tencee soil association occurs extensively throughout the eastern margins of PHETS, mainly on alluvial fans derived from the nearby mountains (DTRA 2007). Soils within this association include gravelly fine sandy loam (Nickel) and very gravelly loam (Tencee). West of the Nickel-Tencee occurrence, the Berino-Dona Ana association (mostly sandy loams) is perhaps the most extensive soil-mapping unit within PHETS. Other soil-mapping units occurring at PHETS are Yesum-Holloman association, Lozier- Rock outcrop complex, and Gilland-Rock outcrop complex (DTRA 2007).

4.7.6.3 *Seismicity*

WSMR is located in the Rio Grande Rift, a region characterized by active movement along faults and earthquakes. Faulting and associated earthquakes continue today as the Rio Grande Rift continues to widen. In the WSMR area, expansion along the rift has resulted in major faults located at the eastern and western boundaries of the Tularosa Basin. Three of these major fault zones occur partly within WSMR boundaries (DTRA 2007).

Only two earthquakes greater than an intensity of III (on the Modified Mercalli Intensity Scale) have occurred within the boundaries of WSMR since 1869. Although only minor earthquakes have occurred within WSMR boundaries during historical times, based on the geological and seismological history of the area the possibility of a major earthquake exists (DTRA 2007).

In 2000 an analysis of the long history of recurrent movements along the major Quaternary (1.8 million years ago to present) faults that comprise the western Tularosa fault system. They estimated that a major surface-rupturing earthquake ($M > 6.5$), caused by reactivation of pre-

existing faults, could affect WSMR about once every 2,000-4,000 years. However, because most Quaternary faults in the rift have long recurrence intervals (>50,000 to 250,000 years) and low movement rates (Wong et al. 2001), the risk of a major earthquake on WSMR is low. This is consistent with occurrence of primarily low- to moderate- magnitude ($M < 6$) earthquakes that have been recorded or felt historically in New Mexico (DTRA 2007).

Although only minor earthquakes have occurred within WSMR boundaries during historical times, based on the geological and seismological history of the area the possibility of a major earthquake exists (DTRA 2007). Figure 4.7.6-1 displays a tectonic map of Southern New Mexico and Texas.

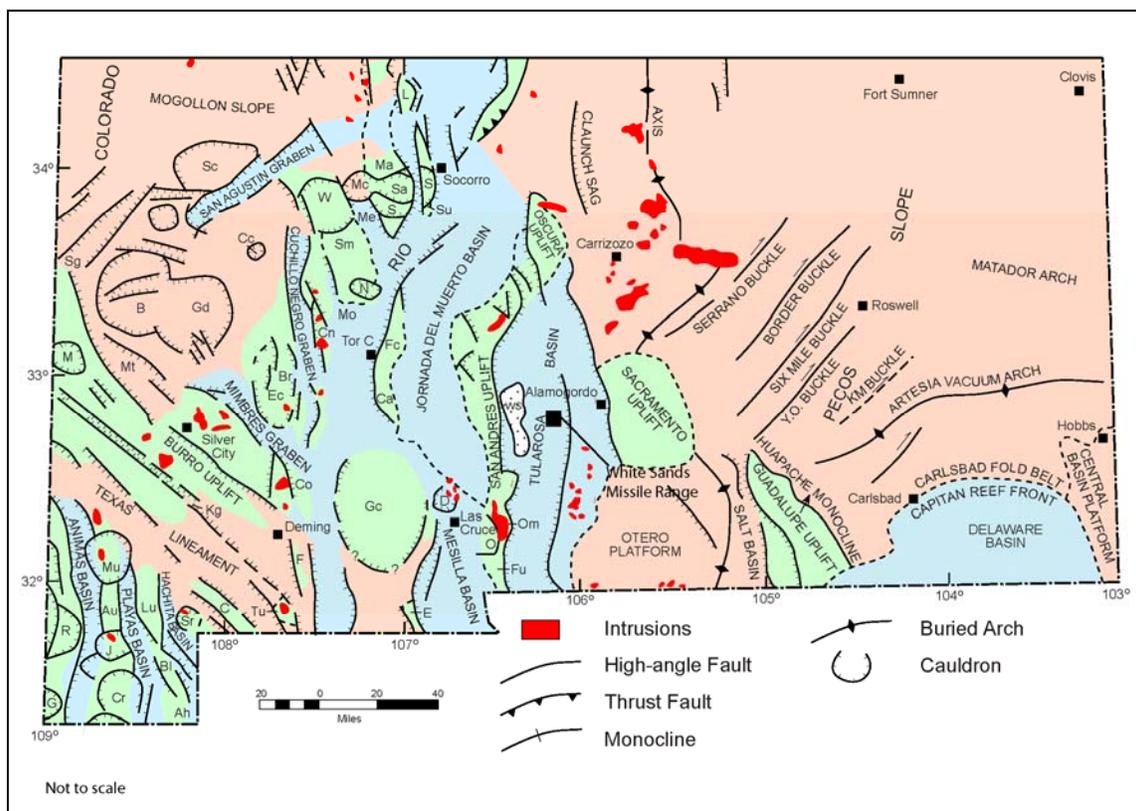


Figure 4.7.6-1 — Tectonic Map of Southern New Mexico and Texas

4.7.7 Biological Resources

4.7.7.1 Terrestrial Resources

Variations in elevation and topography control much of the broad distribution of vegetation types on WSMR. Generally, increasing elevation equates to an increase in moisture availability and a decrease in temperature, which in turn influence the type of vegetation occurring in a given area. The lowland areas of the Tularosa and Jornada del Muerto basins have lower moisture availability, resulting in lowland scrublands and grasslands. Woodlands and coniferous forests occur in the higher elevations of the San Andres and Oscura mountains due to higher moisture availability. Figure 4.7.7-1 displays major vegetation types found on WSMR.

Seventy mammal species have been documented on WSMR (DTRA 2007). Large herbivores commonly found on WSMR include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and oryx (*Oryx gazella*). Predator species commonly found on WSMR include coyotes (*Canis latrans*), bobcats (*Lynx rufus*), mountain lions (*Felis concolor*) and badgers (*Taxidea taxus*). Small mammals occurring on WSMR include black-tailed jackrabbits (*Lepus californicus*), desert cottontails (*Sylvilagus auduboni*), and desert shrews (*Notiosorex crawfordi*). Rodents make up the most diverse order of mammals occurring on WSMR, consisting of five families: Sciuridae, Geomyidae, Heteromyidae, Muridae, and Erethizontidae (WSMR 2001).

Habitats within WSMR support nearly 300 documented avian species, many of which are seasonal or year-round residents (WSMR 2001). WSMR has resident populations of raptors, game birds, and songbirds. Raptor species common on WSMR include red-tailed hawks (*Buteo jamaicensis*), northern harriers (*Circus cyaneus*), and prairie falcons (*Falco mexicanus*). Game birds found on WSMR include Gambel's quail (*Callipepla gambellii*), scaled quail (*Callipepla squamata*), white-winged dove (*Zenaida asiatica*) and mourning dove (*Zenaida macroura*). Songbirds common to WSMR include American robins (*Turdus migratorius*), pyrrhuloxia (*Cardinalis sinuatus*), and horned larks (*Eremophila alpestris*).

WSMR has a wide assortment of reptiles mostly comprised of snake and lizard species. Three families of snakes are represented on the range: Leptotyphlopidae (blind snakes), Colubridae, and Viperidae (vipers). Two species of turtles, ornate box turtles (*Terrepenne ornata*) and yellow mud turtles (*Kinosternon flavescens*), also inhabit the range. Amphibian species are less abundant than reptiles. More common amphibian species include four species of Bufonidae (true toads) and three species of spadefoot toads (Pelobatidae). One species of salamander, the tiger salamander (*Ambystoma tigrinum*), occurs on WSMR. This species can occur wherever suitable habitat, such as temporary rain pools and stock ponds, are available.

Common orders of insects found on WSMR include Coleoptera (beetles), Hemiptera (true bugs), Hymenoptera (ants, bees, and wasps), Lepidoptera (butterflies and moths), and Diptera (flies). Other common arthropod orders include Scholopenromorpha (centipedes), Pedipalpida (vinegaroons), Scorpionida (scorpions), and Araneida (spiders). Twenty-three species of land snails have been identified on WSMR, many of which occur in the San Andres Mountains (DRTA 2007).

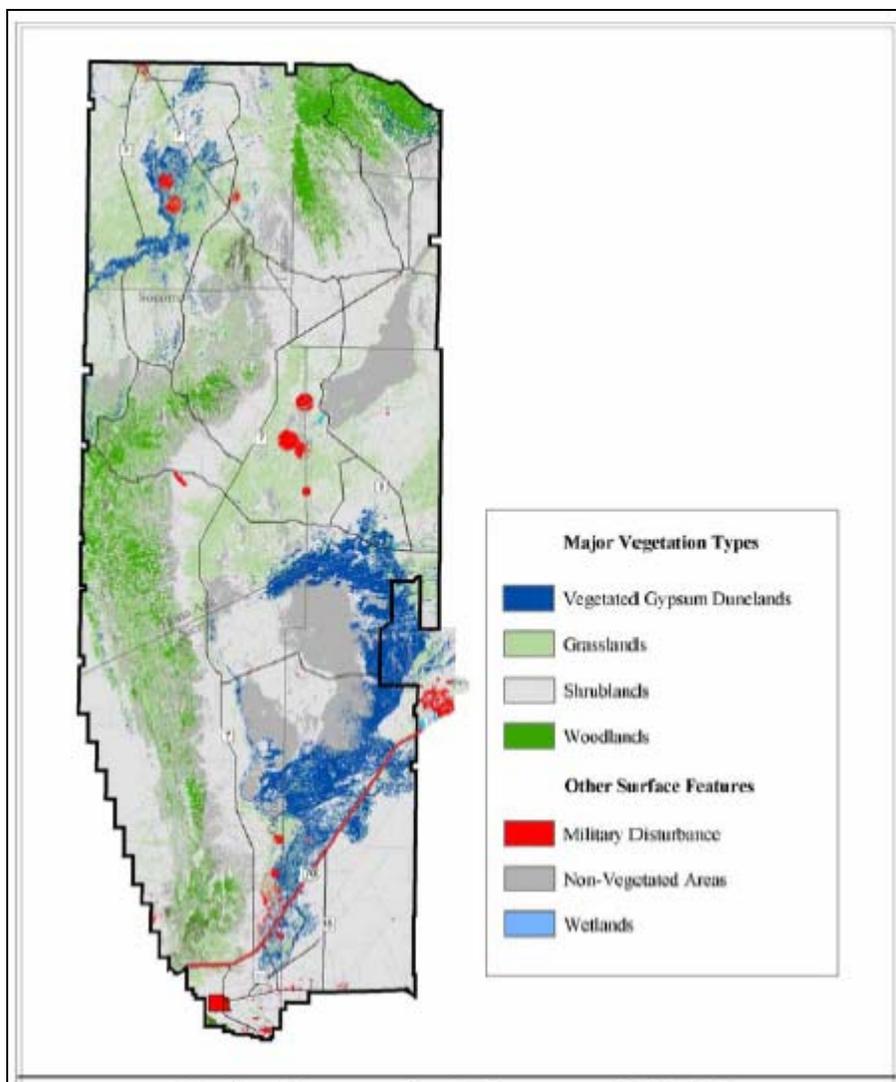


Figure 4.7.7-1 — Major Vegetation Types on WSMR

4.7.7.2 *Floodplains and Wetlands*

4.7.7.2.1 **Wetlands**

Perennial surface water bodies on WSMR are essentially limited to the Tularosa Basin and Salt Creek is the only major perennial stream. Salt Creek is located in the northwestern portion of the basin and flows from north to south (Figure 4.7.7-2). The source of its water is brackish to saline shallow ground water flowing through the underlying alluvium.

The stream flow eventually disappears into the ground or empties into the playas north of Lake Lucero. Lake Lucero is located in the southwestern portion of the basin, and it contains saline to brine water most of the time. Flow rate depends on precipitation runoff events and can quickly change. Stream flow measured (since 1995) at the USGS gauging station on Salt Creek, located at RR 316, showed a high of 2,492 liters per second (88 cubic feet per second) and a low of zero (WSMR 2001). The water in Salt Creek has high concentrations of TDS and is classified as

saline, and water quality has been shown to depend on location and flow rate at time of collection (WSMR 2001). There are several perennial ponds associated with Mound Springs and Malpais Spring (Figure 4.7.7-2), with Malpais Spring providing sufficient water to form a wetland.

4.7.7.3 *Aquatic Resources*

There are no federally Wild and Scenic Rivers onsite. The only fish species native to WSMR is the White Sands pupfish (*Cyprinidon tularosa*). This small fish is endemic to the Tularosa Basin, occurring in four separate habitats: Salt Creek, Malpais Spring, Mound Spring, and Lost River (Pittenger and Springer 1999). Within its limited habitat, populations are often dense, but their numbers can experience wide fluctuations due to natural climatic perturbations such as flood or drought. The White Sands pupfish is omnivorous, feeding mainly on aquatic insects and larvae, algae, and organic detritus (Propst and Pittenger 1994). Other fish species such as largemouth bass (*Micropterus salmoides*), mosquitofish (*Gambusia affinis*), goldfish (*Carassius auratus*), and sunfish (*Lepomis* spp.) have been introduced into springs, ponds and tanks (WSMR 2001).

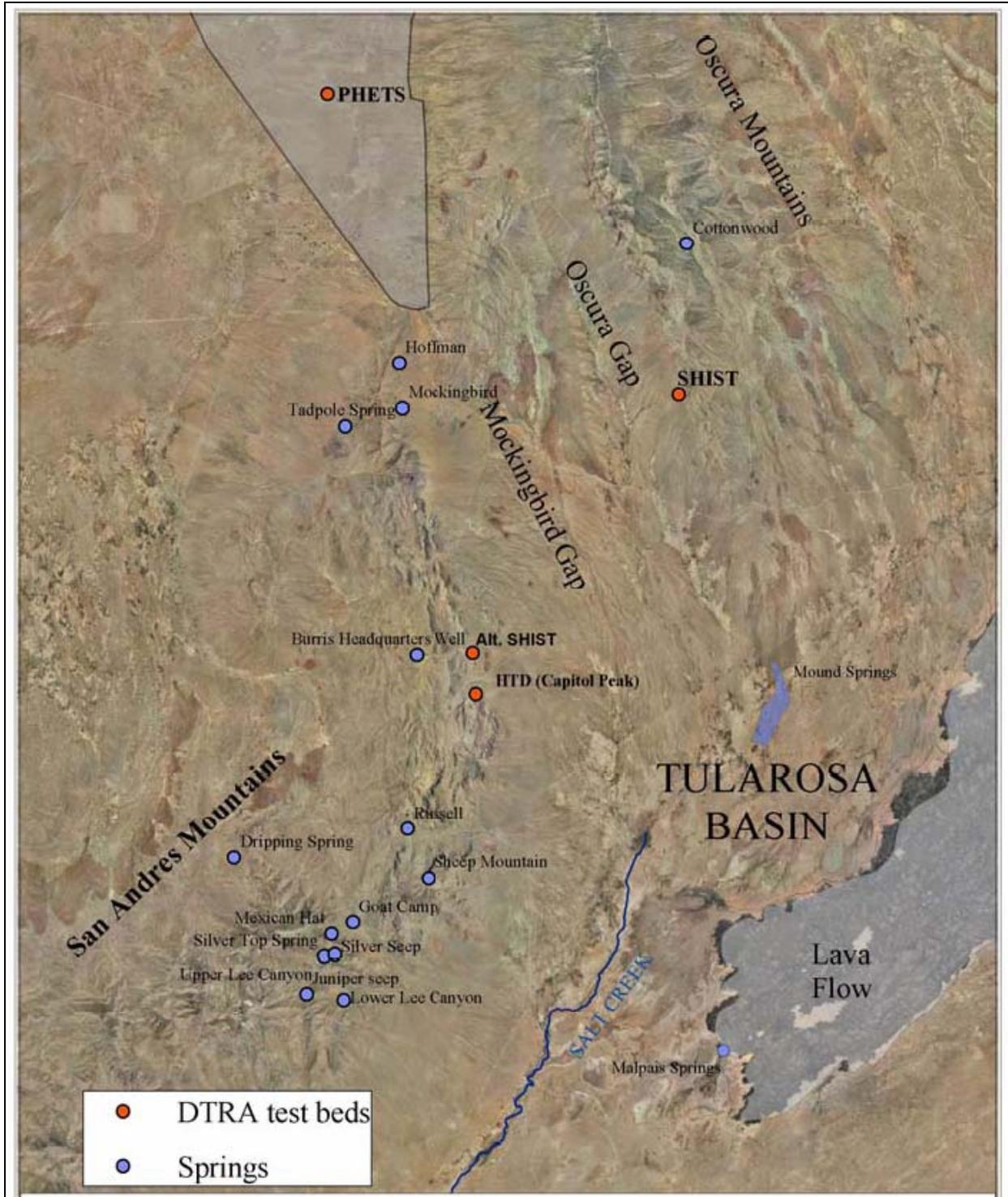


Figure 4.7.7-2 — Springs Near DTRA Test Beds on WSMR

4.7.7.4 Threatened, Endangered, or Sensitive Species

Table 4.7.7-1 lists the species potentially occurring on WSMR which have Federal or State status.

Table 4.7.7-1 — Federal and State Listed Species Potentially Occurring at WSMR

Species	Scientific Name	Federal Status	NM Status
American Peregrine Falcon	<i>Falco peregrinus anatum</i>		T
Northern aplomado Falcon	<i>Falco femoralis septentrionalis</i>	E	E
Baird's Sparrow	<i>Ammodramus bairdii</i>		T
Gray Vireo	<i>Vireo vicinior</i>		T
Lucifer Hummingbird	<i>Calthorax lucifer</i>		T
Violet-crowned Hummingbird	<i>Amazalia violiceps</i>		T
Desert Bighorn Sheep	<i>Ovis canadensis mexicano</i>		E
Oscura Mountains Chipmunk	<i>Tamias quadrivittatus oscuraensis</i>		T
Organ Mountain Colorado Chipmunk	<i>Tamias quadrivittatus australis</i>	SOC	T
Spotted Bat	<i>Euderma maculatum</i>		T
Todsen's pennyroyal	<i>Hedeoma todsenii</i>	E	E
Desert Night-blooming cereus	<i>Cereus greggii greggii</i>	SOC	E
Mescalero milkwort	<i>Polygala rimulicola mescalerorum</i>	SOC	E
Alamo beardtongue	<i>Penstemon alamosensis</i>	SOC	SOC
Organ Mountain evening primrose	<i>Oenothera organensis</i>	SOC	SOC
Mosquito plant	<i>Agastache cana</i>		NSOC
Cliff brittlebrush	<i>Apacheria chiricahuensis</i>		NSOC
Castetter's milkvetch	<i>Astragalus castetteri</i>		NSOC
Sandberg's pincushion cactus	<i>Escobaria sandbergii</i>		NSOC
Vasey's bitterweed	<i>Hymenoxys vaseyi</i>		NSOC
Lanceleaf beardtongue	<i>Penstemon ramosus</i>		NSOC
San Andres cross daisy	<i>Perityle staurophylla</i> var. <i>homoflora</i> and var. <i>staurophylla</i>		NSOC
Desert parsley	<i>Pseudocymopterus longiradiatus</i>		NSOC
Plank's catchfly	<i>Silene plankii</i>		NSOC
Claret cup cactus	<i>Echinocerrus triglochidiatus</i>		SOI
Tall prairie gentian	<i>Eustoma exaltatum</i>		SOI
Trans-Pecos sea lavender	<i>Limonium limbatum</i>		SOI
Club cholla	<i>Opuntia clavata</i>		SOI
Gramagrass cactus	<i>Pediocactus papyracanthus</i>		SOI
New Mexico scorpion weed	<i>Phacelia neomexicana</i>		SOI
Gypsumwort	<i>Pseudoclapia arenaria</i>		SOI
Hot Springs globemallow	<i>Sphaeralcea polychroma</i>		SOI

SOI: Species of Interest
 SOC: Species of Concern
 NSOC: Nominated as SOC
 T: Threatened
 E: Endangered
 Source: DTRA 2007

The desert bighorn sheep (*Ovis canadensis mexicanus*), an endangered species for the State of New Mexico, is confined to steep and inaccessible areas of the San Andres Mountains.

The Oscura Mountains chipmunk, listed as threatened by the State, only occurs in the Oscura Mountains. Once considered a population of the Organ Mountains Colorado chipmunk, it has recently been described as a separate subspecies. Both subspecies are considered Threatened by the State of New Mexico (DTRA 2007).

The spotted bat is listed as threatened by the State of New Mexico and is considered a “probable species” on WSMR (Burkett and Kamees 1998). Spotted bats have been observed in a variety of habitats, from riparian and pinyon-juniper woodlands to ponderosa pine and spruce-fir forests (Findley 1987). In New Mexico, the species has been collected from the lower Rio Grande Valley near Las Cruces (elevation 3,936 feet) to near the peak of Mt. Taylor (elevation 10,594 feet), but most records are in or near wooded areas. This species prefers to roost in rock crevices in cliff faces (DTRA 2007).

T&E bird species that have been documented on WSMR include the northern aplomado falcon (*Falco femoralis septentrionalis*), American peregrine falcon (*Falco peregrinus anatum*) and Baird’s sparrow (*Ammodramus bairdii*). The northern aplomado falcon, an endangered species on Federal and State lists, is found in grasslands and shrublands at lower elevations from approximately 2,800-5,500 feet (Hubbard 1978). Potential habitat for the aplomado falcon is shown in. This falcon prefers open terrain with scattered trees and low ground cover with a good supply of suitable nesting platforms, particularly mesquite and yuccas. WSMR represents the northern boundary of the historical range of the aplomado falcon. White Sands Environment and Safety (WS-ES) Directorate and USFWS have classified two regions on WSMR as potentially suitable aplomado falcon habitat (WSMR 1997). These are limited to desert grasslands in the lower Three Rivers drainage, and in the Jornada del Muerto basin (WSMR 1997). A single transient aplomado falcon was sighted on WSMR at Rita Site and Black Site on 2 separate occasions in 1991 and 1992 (DTRA 2007).

The American peregrine falcon is listed as threatened by the State. This species breeds in mountainous areas and, in New Mexico, occurs mainly west of the eastern plains in migration. The peregrine falcon occurs on WSMR, mainly in the breeding months (March-August). These falcons have not been found to breed on WSMR, but transient individuals have been seen on WSMR at two locations: in 1995, in the mouth of Texas Canyon in the Organ Mountains; and in 1994 about 1.3 miles north of Malpais Springs on RR 9. There have also been several sightings on lands adjacent to WSMR (WSMR 2001). Baird’s sparrow is listed as threatened by the State. In New Mexico, it has been found in a variety of habitats, ranging from desert grasslands in the south to prairies in the northeast, and in mountain meadows. This sparrow occurs in the eastern plains and southern lowlands during migration, mainly in autumn and is considered rare to uncommon (Hubbard 1978). Baird's sparrow occurs mainly in winter months (late October - February) at WSMR (DTRA 2007).

A total of 61 floral species having Federal or State status occur or potentially occur on WSMR. Most are restricted to mountainous habitat away from most WSMR testing activities. Todsens’ pennyroyal (*Hedeoma todsenii*) is the only Federal endangered flora species documented on

WSMR. Six populations have been found on high pinyon-juniper slopes on the western edge of the San Andres Mountains in the WSMR. These 2 parcels have been designated as critical habitat. There are 4 Federal listed floral species of concern occurring on WSMR, the desert night-blooming cereus (*Peniocereus greggii greggii*), Mescalero milkwort (*Polygala rimulicola mescalerorum*), Alamo beardtongue (*Penstemon alamosensis*), and Organ Mountain evening primrose (*Oenothera organensis*). Desert night-blooming cereus is widely distributed in gravelly soils of arroyos and lower piedmonts in the San Andres Mountains, while Mescalero milkwort and Alamo beardtongue are found at higher elevations on limestone slopes and cliffs. The Organ mountain evening primrose has been identified in riparian habitats only in the Organ Mountains.

There are 11 listed flora on WSMR that are nominated as species of concern (SOC) by the state of New Mexico. These species are mosquito plant (*Agastache cana*), cliff brittlebrush (*Apacheria chiricahuensis*), Castetter's milkvetch (*Astragalus castetteri*), Sandberg's pincushion cactus (*Escobaria sandbergii*), Vasey's bitterweed (*Hymenoxys vaseyi*), Organ Mountain evening primrose, Alamo beardtongue, lanceleaf beardtongue (*Penstemon ramosus*), San Andres cross daisy (*Perityle staurophylla* var. *homoflora* and var. *staurophylla*), desert parsley (*Pseudocymopterus longiradiatus*), and Plank's catchfly (*Silene plankii*). All of these species are found in mountainous habitat associated with canyons, woodlands, cliffs, boulders, and rocky outcrops.

In addition, 46 floral species have been designated by WS-ES as WSMR species of interest (SOI). SOI species are plants that WS-ES monitors for location and abundance based on four criteria including: 1) previous Federal or State listing; 2) rarity on WSMR; 3) species useful for land rehabilitation; and 4) species with spatially restricted habitat. Although SOIs are not afforded legal protection, they are closely monitored by WS-ES. The majority of WSMR SOI floral species occur in mountainous habitat on WSMR; only 8 SOI floral species occur on the basin floors. The eight SOIs occurring within the basins include claret cup cactus (*Echinocerrus triglochidiatus*); tall prairie gentian (*Eustoma exaltatum*); Trans-Pecos sea lavender (*Limonium limbatum*); club cholla (*Opuntia clavata*); gramagrass cactus (*Pediocactus papyracanthus*); New Mexico scorpion weed (*Phacelia neomexicana*); gypsumwort (*Pseudocappia arenaria*); and Hot Springs globemallow (*Sphaeralcea polychroma*).

4.7.8 Cultural and Archaeological Resources

4.7.8.1 Archaeological Resources

Evidence in the material record suggests continued prehistoric human occupation of the WSMR region spanning approximately 11,000 years. As the environment gradually became drier and more extreme, humans inhabiting the area adapted by changing food procurement and living strategies.

According to the environmental assessment for LB/TS (McMullan and Gould 1988), 29 prehistoric archaeological sites were recorded in the Stallion area in a 1986 survey. Described as large areas with low artifact densities, no sites were located within the LB/TS project fence line. Within the Trinity NHL are two National Register-listed sites. Trinity site was the test area for the first manmade nuclear detonation and McDonald Ranch House is a historic homestead that was used to assemble the bomb.

Notable components include Ground Zero, the location of the first nuclear bomb detonation in 1945, the base camp that housed scientists and the support team, four instrumentation bunkers, and three observation bunkers. The site encompasses a total of approximately 36,413 acres. Located approximately 2.3 miles to the southeast of Trinity Site, McDonald Ranch House is a historic homestead that was used to assemble the bomb. Over a dozen test-specific archaeological surveys have been conducted in the PHETS area. One hundred thirty-six archaeological sites have been recorded, both prehistoric and historic (U.S. Army 2002b).

Geery and Hoyt (1977) and Webb (1993) conducted archaeological surveys of the original SHIST Site. A large Archaic period site was recorded in the SHIST area and is currently fenced for protection. Another smaller prehistoric site was identified immediately outside the original SHIST Site in 2000 and other archaeological sites have been documented in the vicinity, but none that are directly affected by activities at SHIST Site. The site was recently expanded to the north following completion of an archaeological survey (U.S. Army 2002a).

Several cultural resource surveys have been conducted in and around the area encompassing Alt. SHIST (DTRA 2006). A number of Archaic period sites were recorded that may contain information significant to the prehistory of the area. One large site with components dating from Paleoindian through the Jornada Mogollon was also recorded and tested to determine potential for buried resources. The site did contain subsurface artifacts and is considered to be eligible for NRHP (Russel and Kirkpatrick 1997). Mockingbird South. An archaeological survey conducted in May 2001 recorded two sites (LA 132538 and LA 132539) along the dirt road leading into Mockingbird South from Range Road 7 and re-visited a previously recorded site (LA 51474) in the valley floor of the proposed test bed.

Previous archaeological projects in the Capitol Peak area have identified over 40 cultural resource sites. Most of these sites represent Archaic period occupation of the area, although some sites also exhibit Paleoindian and Formative period components. In addition, several historic period sites in the region have also been identified. An archaeological survey of 391 acres in the Capitol Peak project area was completed in May 2001 and four archaeological sites were recorded.

4.7.8.2 *Historic Resources*

The Trinity National Historic Landmark boundary overlaps much of the PHETS project area. Within the landmark are two National Register-listed sites: Trinity site and McDonald Ranch House. Trinity Site was the test area for the first manmade nuclear detonation. Notable components include Ground Zero, the location of the first nuclear bomb detonation in 1945, the base camp that housed scientists and the support team, four instrumentation bunkers, and three observation bunkers (DTRA 2007).

The site encompasses a total of approximately 36,413 acres. Located approximately 2.3 miles to the southeast of Trinity Site, McDonald Ranch House is a historic homestead that was used to assemble the bomb. Over a dozen test-specific archaeological surveys have been conducted in the PHETS area. One hundred thirty-six (136) archaeological sites have been recorded, both prehistoric and historic (DTRA 2007).

Several cultural resource surveys have been conducted in and around the area encompassing Alt. SHIST. A number of Archaic period sites were recorded that may contain information significant to the prehistory of the area. One large site with components dating from Paleoindian through the Jornada Mogollon was also recorded and tested to determine potential for buried resources. The site did contain subsurface artifacts and is considered to be eligible for NRHP (DTRA 2007).

4.7.9 Socioeconomic Resources

Socioeconomic characteristics addressed at WSMR include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current WSMR employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

The center for operations at WSMR is located in Dona Ana County, New Mexico. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Dona Ana, Lincoln, Otero, Sierra, and Socorro Counties. Figure 4.7.9-1 presents a map of the counties composing the WSMR ROI.

4.7.9.1 *Employment and Income*

Labor force statistics are summarized in Table 4.7.9-1. The civilian labor force of the ROI grew by approximately 11 percent from 104,619 in 2000 to 115,604 in 2005. The overall ROI employment experienced a growth rate of 11 percent with 98,643 in 2000 to 109,164 in 2005 (BLS 2007).

The ROI unemployment rate was 5.6 percent in 2005 and 5.7 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 4.6 percent in Lincoln and Otero Counties to a high of 5.8 percent in Dona Ana County. The unemployment rate in New Mexico in 2005 was 5.3 percent (BLS 2007).

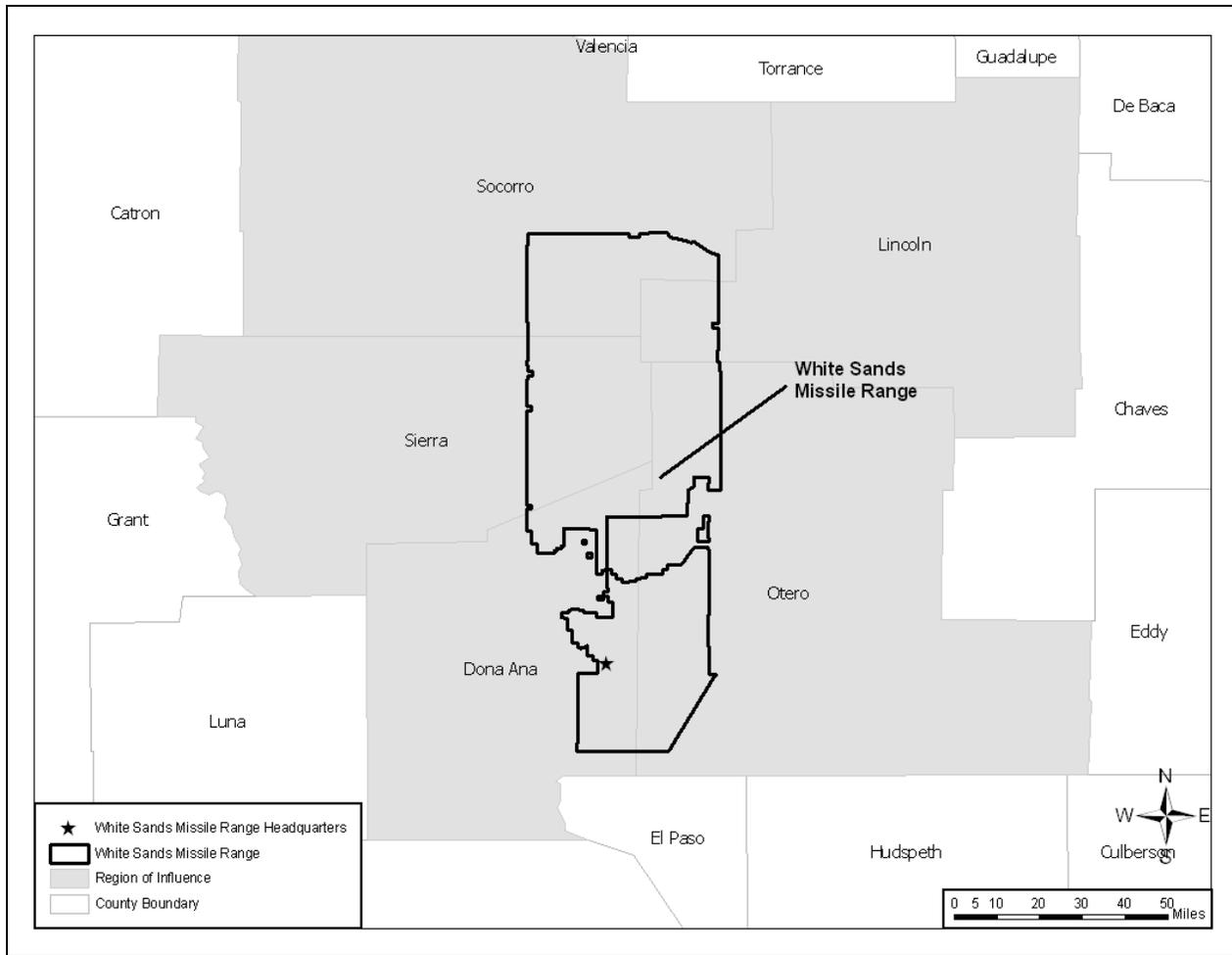


Figure 4.7.9-1 — Region of Influence for WSMR

Table 4.7.9-1 — Labor Force Statistics for ROI and New Mexico

	ROI		New Mexico	
	2000	2005	2000	2005
Civilian Labor Force	104,619	115,604	852,293	915,489
Employment	98,643	109,164	810,024	867,317
Unemployment	5,976	6,440	42,269	48,172
Unemployment Rate (percent)	5.7	5.6	5.0	5.3

Source: BLS 2007.

Income information for the WSMR ROI is provided in Table 4.7.9-2. Sierra County is at the low end of the ROI with a median household income in 2004 of \$23,821 and a per capita income of \$19,626. Lincoln County had the highest 2004 median household income in the ROI (\$33,642). Dona Ana County had the highest 2004 per capita income in the ROI (\$22,082) (BEA 2007).

Table 4.7.9-2 — Income Information for the WSMR ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Dona Ana	22,082	30,740
Lincoln	21,974	33,642
Otero	20,588	32,400
Sierra	19,626	23,821
Socorro	20,452	26,622
New Mexico	26,679	37,838

Source: BEA 2007.

4.7.9.2 Population and Housing

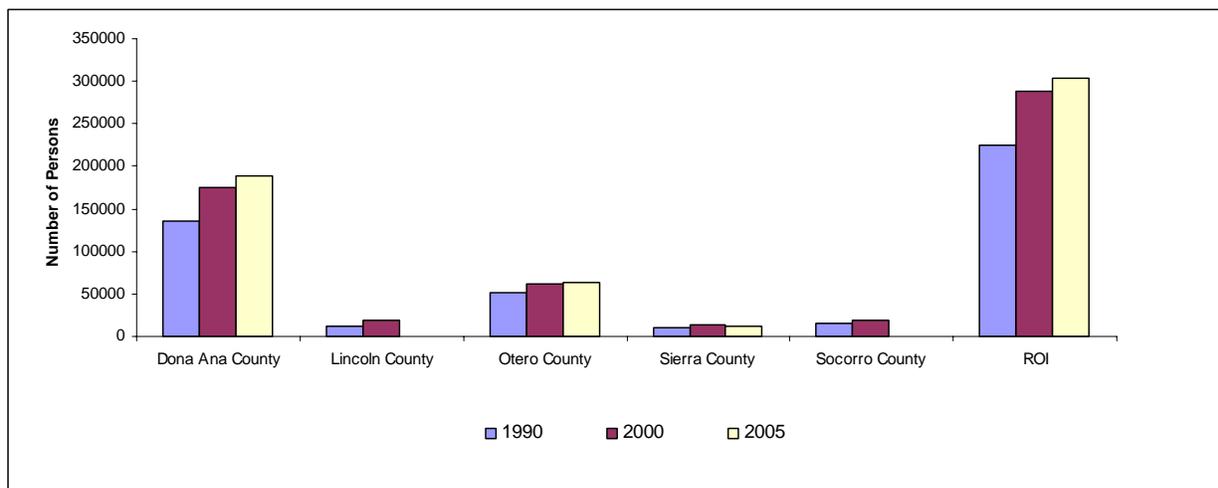
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.7.9-3 presents historic and projected population in the ROI and the state.

Table 4.7.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Dona Ana County	135,510	174,682	189,306	218,523	255,057
Lincoln County	12,219	19,411	20,976	23,792	27,100
Otero County	51,928	62,298	63,128	67,018	70,508
Sierra County	9,912	13,270	12,777	16,723	19,857
Socorro County	14,764	18,078	18,194	21,421	24,493
ROI	224,333	287,739	304,381	347,477	397,015
New Mexico	1,515,069	1,819,046	1,925,985	2,112,986	2,383,116

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 28 percent from 224,333 in 1990 to 287,739 in 2000. From 2000 to 2005, the population of the ROI increased 6 percent to 304,381 in 2005. Dona Ana County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 8 percent while Sierra County experienced a decrease of 4 percent (USCB 2007). Figure 4.7.9-2 presents the trends in population within the WSMR ROI.



Source: USCB 2007.

Figure 4.7.9-2 — Trends in Population for the WSMR ROI, 1990-2005

Table 4.7.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 126,315 with 103,530 occupied (81.9 percent). There were 71,240 owner-occupied housing units and 32,290 rental units. The median value of owner-occupied units in Lincoln County was the greatest of the counties in the WSMR ROI (\$108,400). The vacancy rate was the lowest in Dona Ana County (8.7 percent) and the highest in Lincoln County (46.4 percent) (USCB 2007).

Table 4.7.9-4 — Housing in the WSMR ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Dona Ana County	65,210	59,556	40,208	19,348	5,654	8.7	90,900
Lincoln County	15,298	8,202	6,336	1,866	7,096	46.4	108,400
Otero County	29,272	22,984	15,372	7,612	6,288	21.5	78,800
Sierra County	8,727	6,113	4,578	1,535	2,614	30.0	77,800
Socorro County	7,808	6,675	4,746	1,929	1,133	14.5	80,900
ROI	126,315	103,530	71,240	32,290	22,785	18.0	88,337

Source: USCB 2007.

4.7.9.3 *Community Services*

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 14 school districts with 127 schools serving the WSMR ROI. Educational services are provided for approximately 54,892 students by an estimated 3,690 teachers for the 2005 to 2006 school year (IES 2006a). The student-to-teacher ratio in these school districts ranges from a high of 16:1 in the Gadsden Independent School District in Dona Ana County to a low of 7:1 in the Hondo Valley Public School District in Lincoln County. The student-to-teacher ratio in the ROI is 15:1 (IES 2006a).

The counties within the ROI employ approximately 1,923 public safety workers (firefighters and law enforcement). There are eight hospitals that serve residents of the ROI with a total bed capacity of 650 (ESRI 2007).

4.7.10 *Environmental Justice*

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of WSMR Headquarters. Figure 4.1.10-1 shows counties potentially at risk from the current missions performed at WSMR. There are five counties included in the potentially affected area. The environmental justice analysis uses WSMR Headquarters as the center of operations; therefore, the counties evaluated are different from those analyzed in the socioeconomic resources. Table 4.7.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

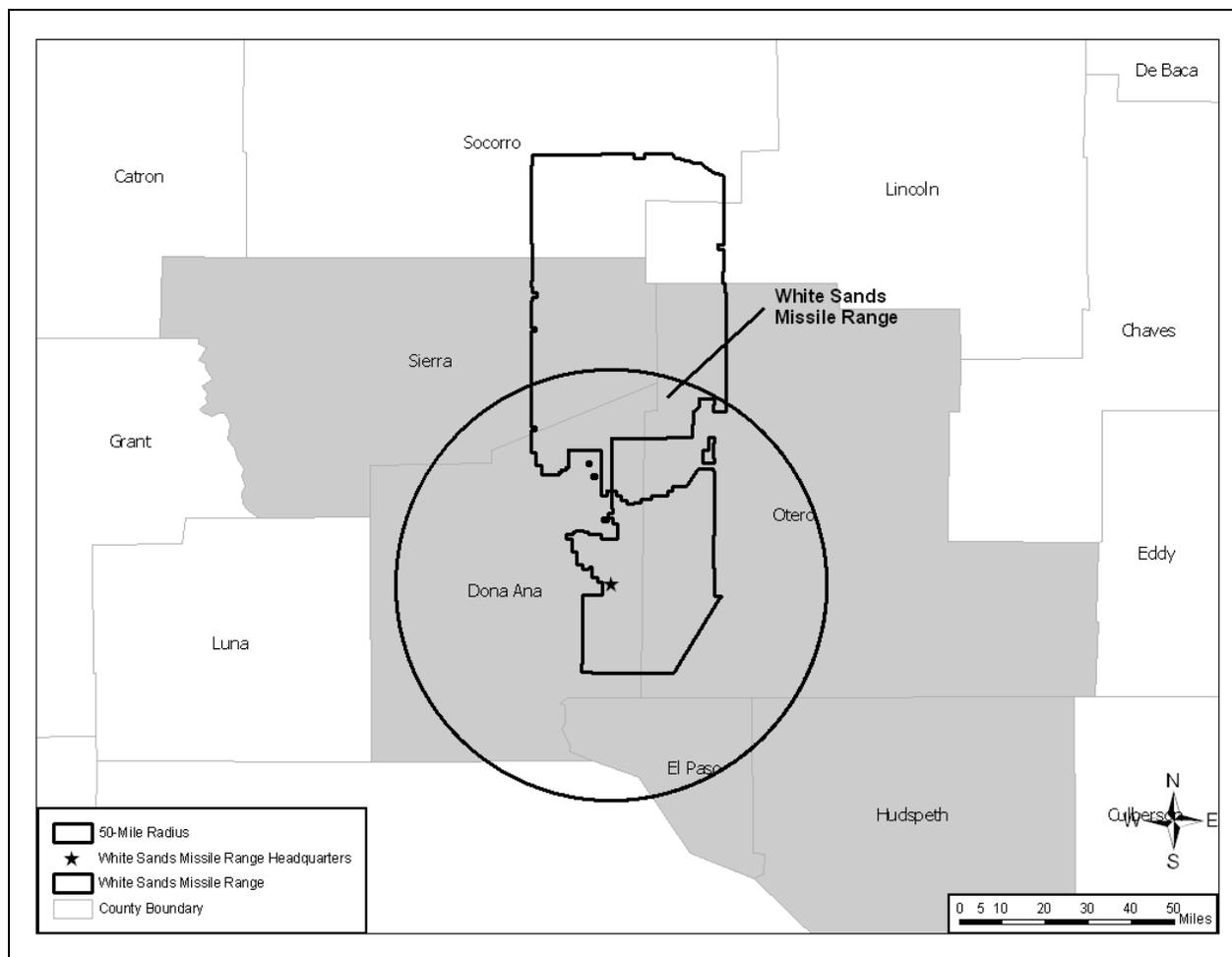


Figure 4.7.10-1 — Potentially Affected Counties Surrounding WSMR

Table 4.7.10-1 — Demographic Profile of the Potentially Affected Area Surrounding WSMR, 2000

Population Group	Population	Percent
Minority	733,069	75.5
Hispanic alone	471,391	48.6
Black or African American	26,231	2.7
American Indian and Alaska Native	14,350	1.5
Asian	8,979	0.9
Native Hawaiian and Other Pacific Islander	901	0.1
Some other race	179,416	18.5
Two or more races	31,801	3.3
White alone	237,636	24.5
Total Population	970,705	100.0

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 75.5 percent of the total population. This minority population is composed largely of

Hispanic residents. As a percentage of the total resident population in 2000, New Mexico had a minority population of 55 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.7.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 193,898 individuals residing within census tracts in the 50-mile radius of WSMR were identified as living below the Federal poverty threshold, which represents approximately 23 percent of the census tracts population within the 50-mile radius. There was one census tract located in Dona Ana County, New Mexico and nine census tracts in El Paso, Texas with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 18.4 percent of individuals for whom poverty status is determined were below the poverty level in New Mexico and 12.4 percent in the U.S. (USCB 2007).

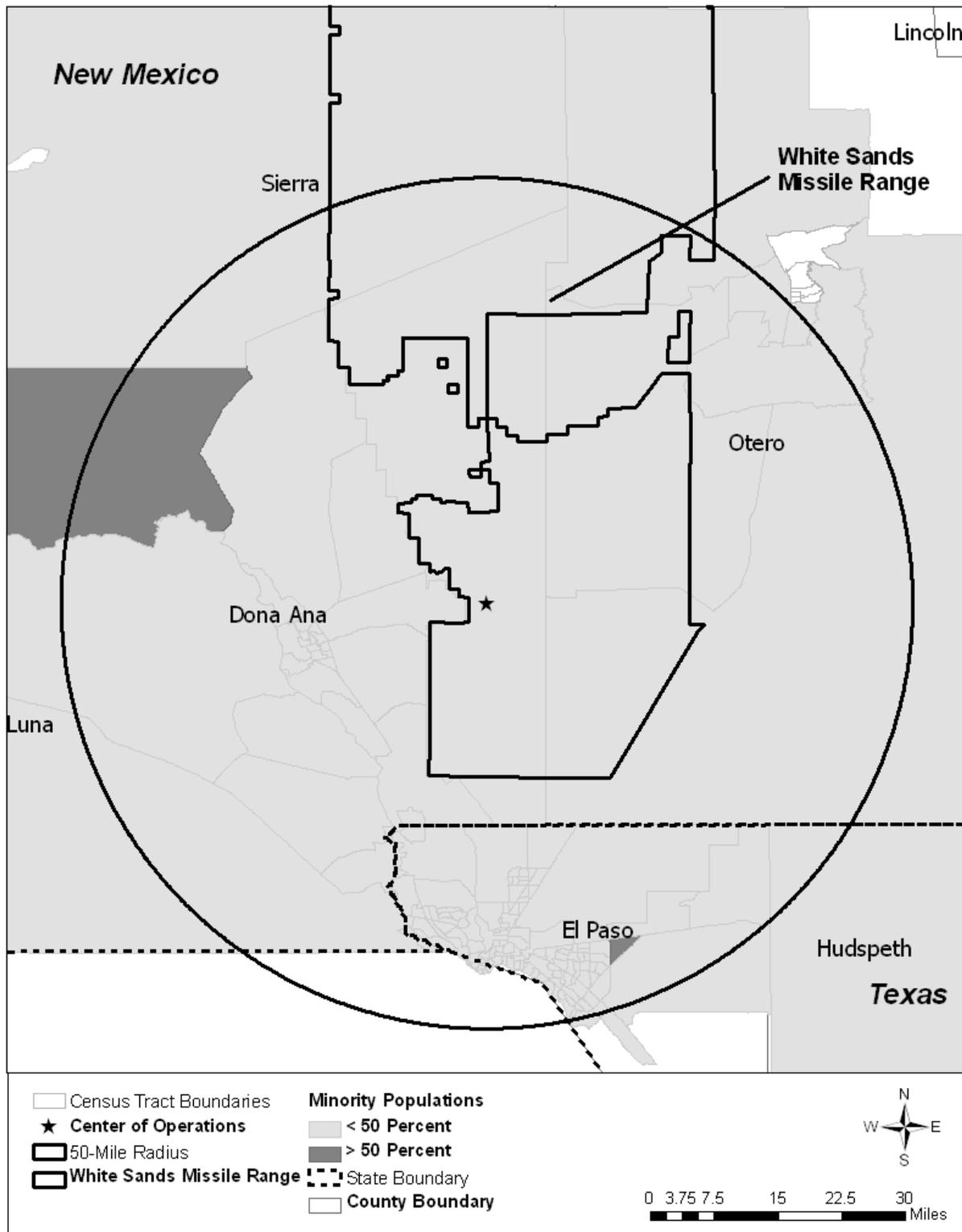


Figure 4.7.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of WSMR

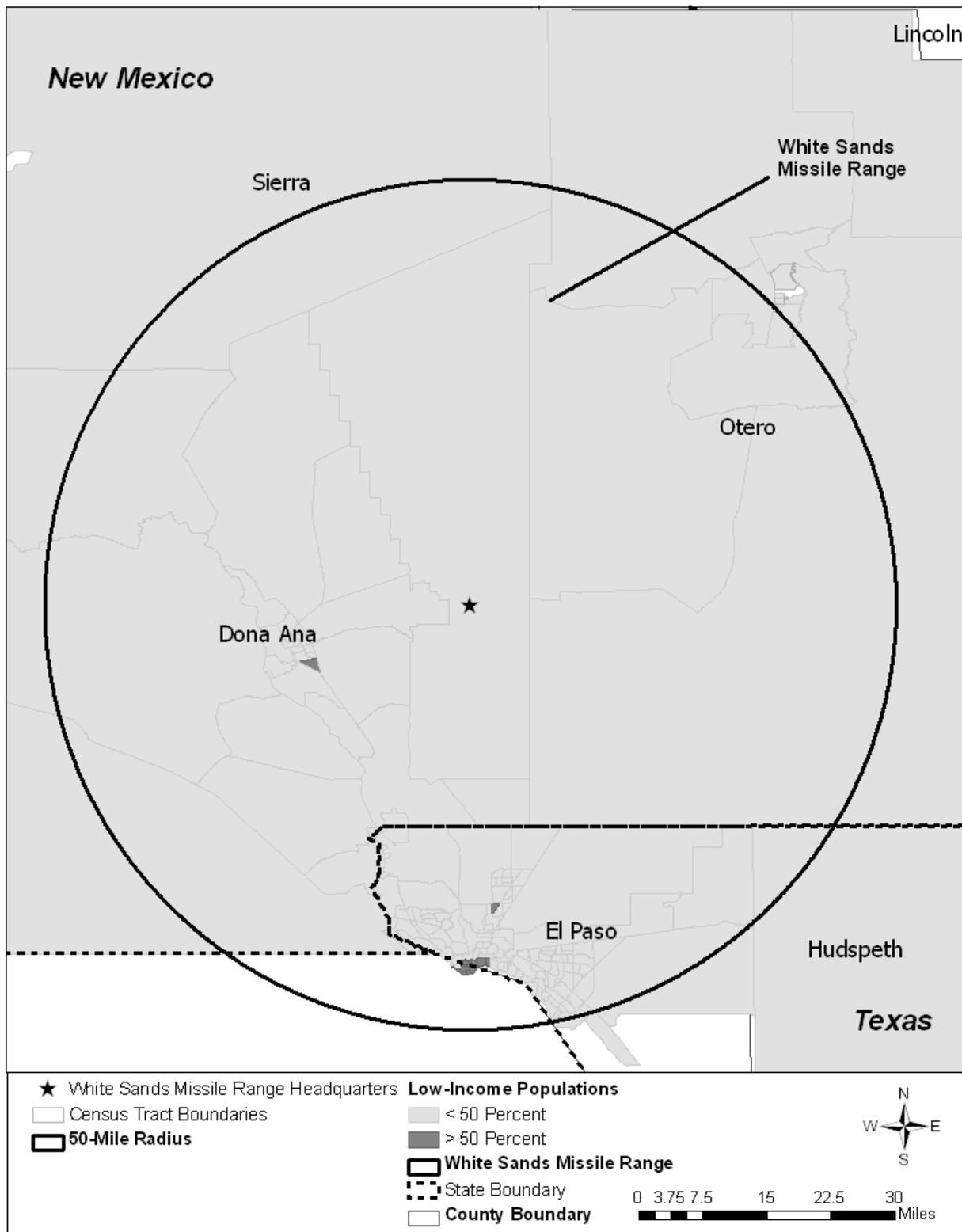


Figure 4.7.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of WSMR

4.7.11 Health and Safety

4.7.11.1 Public Health

Potential hazards to human health and safety from activities at WSMR include non-ionizing radiation, ionizing radiation, high voltage equipment, noise, exposure to hazardous materials, and other site-specific characteristics such as the sun and biologics. General health and safety protocols for DTRA areas and facilities are addressed in various Federal, State, and WSMR guidelines, rules and regulations. Detailed standard operating procedures (SOPs) have been established to fulfill health and safety requirements.

Non-ionizing radiation refers to lower energy electromagnetic radiation, mostly in microwave and thermal wavelengths. Potential sources of non-ionizing radiation include lasers and radars. Lasers emit high-intensity light and are used for tracking and sighting purposes. Radar units produce microwave (heat) radiation in addition to x-ray (ionizing) radiation. The regulatory limit for hazardous human exposure is expressed by power density (mW per centimeter squared). It can be as low as 1 mW per centimeter squared or as high as 10 mW per centimeter squared, depending on the frequency. Sources of ionizing radiation previously used in program activities include instrumentation fielded for large-scale explosive testing and the testing of chemical agent detectors. Sources of non-ionizing radiation previously used by DTRA activities include laser guidance and tracking systems, radar guidance and tracking systems, site illumination, communication, and electro-optical countermeasures.

High voltage radar equipment is a common source of x-rays on WSMR but proper shielding reduces this hazard to all site personnel. Background ionizing radiation is generated from the decay of radioactive minerals in rocks (at WSMR and virtually everywhere) at the approximate rate of 55 millirem per year.

Trinity Site, the location of the first atomic bomb detonation in 1945, is within PHETS and continues to produce low levels of ionizing radiation (approximately 0.5 millirem during a one-hour visit). This amount is similar to what a person would receive flying in a jet airliner for one hour (DTRA 2007).

Exposure to noise can be a public health hazard, causing hearing impairment and undue psychological stress. Extreme noise environments include loud impulse noise events (where people are subjected to sudden loud noise, such as a closed-room detonation), or high noise levels over extended periods of time (such as from a riveting machine or pneumatic hammer operations). The loud impulsive events can especially have a severe effect on auditory capabilities and the health of the ear. WSMR activities require adherence to the OSHA Hearing Conservation Standard (29 CFR 1910.95), which protects workers from potentially hazardous occupational noise exposures. OSHA regulations establish a maximum noise level of 90 dBA for a continuous 8-hr exposure during a working day, and higher sound levels for shorter exposure times.

Additional potential health and safety concerns for workers on WSMR and in the DTRA areas include exposure to hazardous materials, exposure to explosive devices, unexploded ordnance (UXO). All personnel involved in testing activities are required by WSMR to receive UXO training.

Dehydration and heat stress are potential concerns, given the generally high temperatures in the region. Moreover, excessive exposure to the ultraviolet rays of the sun can result in sunburn and repeated exposure may produce skin damage and cause skin cancer. There is also a potential for contact with venomous snakes, insects, and thorny/spiny vegetation. Hantavirus Pulmonary Syndrome (HPS) may occur on WSMR, which causes disease in humans through contact with urine or droppings of deer mice (*Peromyscus maniculatus*) and other rodents. Rodents may nest in buildings and vehicles, creating an HPS hazard. West Nile virus, transmitted to humans by infected mosquitoes has also been detected on WSMR. On WSMR, mosquitoes may concentrate in areas such as wildlife watering ponds and springs, standing bodies of water, sewage outflows or water collecting in barrels (DTRA 2007).

4.7.12 Transportation

WSMR is bounded by U.S. Highway 380 to the north and U.S. Highway 54 to the east. U.S. Highway 70 crosses the southern portion of WSMR. No major access points exist along the western boundary of WSMR. An agreement with the State of New Mexico allows WSMR to establish off-range roadblocks on U.S. Highways 70 and 380 as a safety precaution during missile tests. Under the agreement, roadblocks may last no longer than 1 hr 15 minutes. U.S. Highway 70 is subject to an average of one roadblock per day, while U.S. Highway 380 experiences approximately one roadblock per month (DTRA 2007). U.S. Highway 70 provides Las Cruces and Alamogordo access to WSMR via Range Road 1. U.S. Highway 70 is in good condition with traffic volumes averaging approximately 8,740 vehicles per day (MDA 2002). Generally residents of WSMR require 21 minutes for a one way commute to the workplace. About 76.20 percent of the people commute to work alone in the car while 18.49 percent of the people carpool. More than 50 percent of the population has a commute of 15 minutes or less while approximately 15 percent of the population has 45-59 minutes commute to their workplace.

An extensive road network connects most areas within WSMR, with the exception of less accessible areas in the San Andres and Oscura mountains. LB/TS is adjacent to Range Road 5 near Stallion Range Center and is easily accessible. Range Road 7 provides access to PHETS, and an extensive internal network of roads both exists throughout the area. The size, surface, and condition of these roads vary; range roads 7, 20, and 13 are paved two-lane roads, and others are gravel or dirt. SHIST is a relatively isolated site and admittance is usually through the Aerial Cable Range. Access to HTD test beds at Capitol Peak and Alt. SHIST is provided through dirt and gravel roads intersecting Range Road 7.

WSMR controls a complex of 19 restricted areas. Any aircraft that have not been authorized and scheduled by the controlling agency are prohibited from entering active restricted airspace. During part of the day, WSMR may return some of the restricted airspace to FAA control for use by aircraft under a shared-use agreement between WSMR and the FAA. Missile firings, which include air-to-air, air-to-surface, surface-to-surface, and surface-to-air, are some of the major operations performed in the airspace. All areas are joint-use except R-5107B, which is in continuous use by WSMR and is not released back to the FAA. Many of the restricted areas are used extensively by Holloman AFB for advanced training missions (MDA 2002).

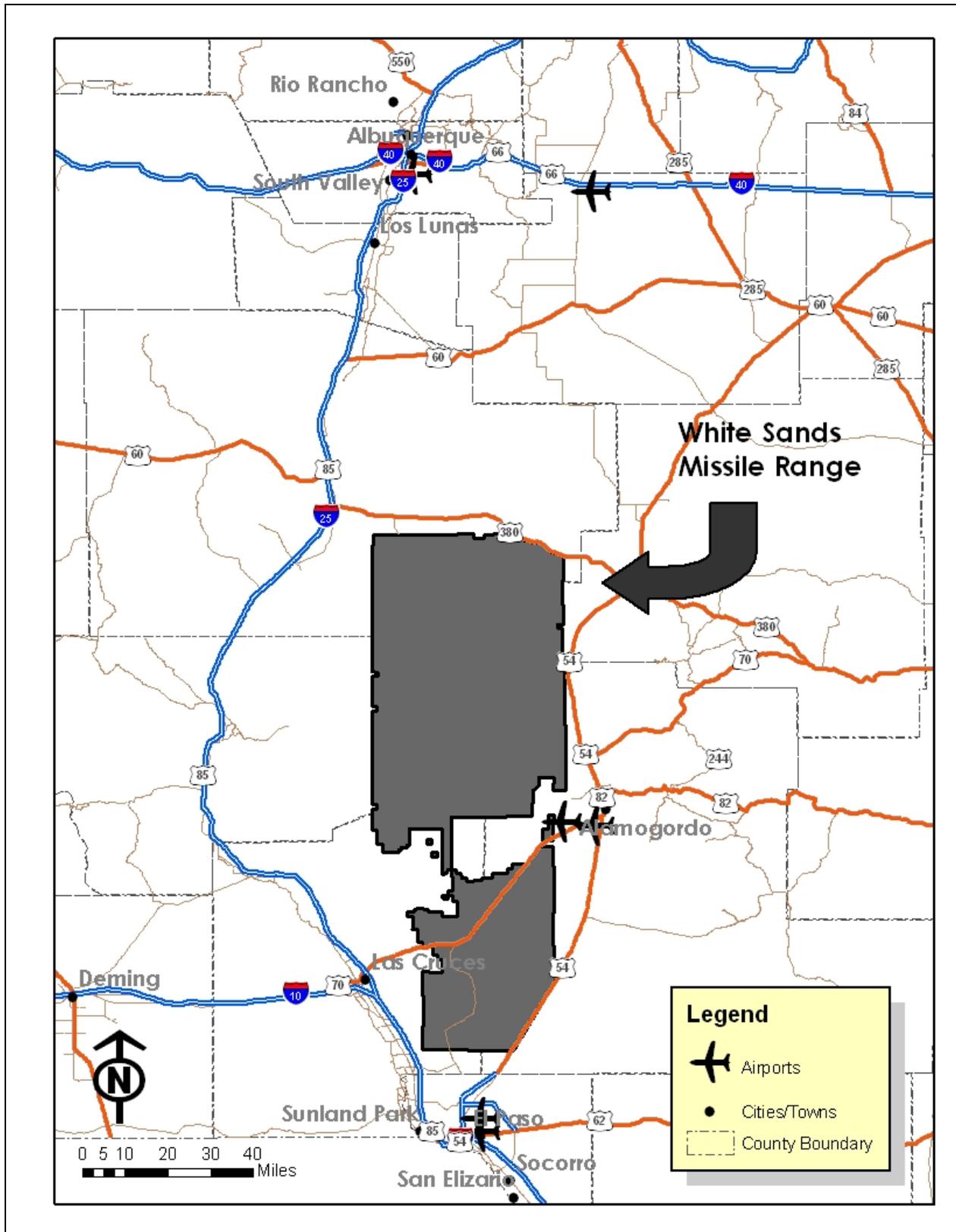


Figure 4.7.12-1 — Roads in the Vicinity of WSMR

4.7.13 Waste Management

Hazardous wastes produced by DTRA activities include a variety of liquid, solid and gaseous wastes. The generation, recovery, storage and disposal of hazardous wastes is regulated under the RCRA and the New Mexico Hazardous Waste Act (1985). Guidelines for the management and disposal of hazardous wastes generated by DTRA on WSMR are provided in WSMR Regulation 200-1. WSMR has developed an Environmental Disaster Plan as part of the WSMR Disaster Control Plan to prevent and/or control (i.e., minimize the impact) accidental discharges of oil and hazardous substances and includes all actions taken before, during, and after the spill event to reduce the probability of damage, minimize its effects and initiate recovery (DTRA 2007).

Sanitary sewage would be contained in an approved septic system which would periodically be emptied and disposed at an approved sewage treatment facility. Alumina dust discharged into the air is classified as simple dust and no fuels are or would be burned at the facility. The liquid nitrogen facility does not and would not produce hazardous by-products. Explosive charges are and would be used to rupture the diaphragms. No hazardous gasses, liquids, or solids would be used during testing. There is a satellite accumulation point (SAP) on site for containment of waste and recyclable petroleum, oils, and lubricants (POLs) generated by facility maintenance.

Hazardous materials at PHETS include HE, chemical and biological materials, construction products, and POLs. Waste products from DTRA that could potentially be defined as hazardous (e.g., spent or excess test materials, paints, glues, and POL products) would be analyzed for such determination. If the product is deemed hazardous it is and would be handled in accordance with WSMR Regulation 200-1. There is a SAP area in the PHETS Administration Park for collection of small amounts of POL waste. Non-hazardous waste is and will be handled as solid waste or non-regulated waste.

No hazardous or toxic materials would be stored at SHIST or Alt. SHIST. Wastes potentially occurring at these sites include POL products from vehicles and equipment that are and would be managed of at the PHETS SAP site.

Hazardous wastes produced by DTRA activities at HTD test beds include a variety of liquid, solid, and gaseous wastes. POLs are the most widely used hazardous materials. Other products containing hazardous materials include batteries and cleaning solvents. Presently there is a SAP set up at HTD to pick up POL materials generated on site.

4.8 SAVANNAH RIVER SITE

SRS is located in south-central South Carolina and occupies an area of approximately 198,400 acres in Aiken, Barnwell, and Allendale Counties as shown in Figure 4.8-1. The site is approximately 15 miles southeast of Augusta, Georgia and 12 miles south of Aiken, South Carolina. With respect to activities supporting the nuclear weapons complex, SRS extracts tritium, and provides loading, unloading, and surveillance of tritium reservoirs. SRS does not maintain Category I/II quantities of SNM associated with weapons activities, but does maintain Category I/II quantities of SNM associated with other Department activities (e.g., environmental management).

4.8.1 Land Use

4.8.1.1 *Onsite Land Uses*

Currently, production and support facilities, infrastructure, research and development (R&D), and waste management facilities account for approximately 10 percent (approximately 19,000 acres) of land on the SRS (DOE 2002a). Of the remaining 90 percent (approximately 191,000 acres), approximately 70 percent is planted pine forest managed by the USFS under an interagency agreement with DOE (SRS 2006a). In 1972, the entire site was designated as a National Environmental Research Park (NERP) (DOE 2005d). About 15 percent of the soils at SRS are considered prime farmland (White and Gains 2000).

The 19,000 acres of developed SRS land includes 5 non-operational nuclear production reactors, 2 chemical separations facilities (1 is operational and 1 is being deactivated), waste treatment, storage and disposal facilities (including two tank farms [F and H] and the Defense Waste Processing Facility), and various supporting facilities. In 2002, SRS began extensive decommissioning activities. Site D&D continued extensive operations through 2005 (SRS 2006c). The site was designed with a buffer zone that provides security and mitigates accidental exposure to the general public (SRS 2006c). A major new facility, the Salt Waste Processing Facility, is under construction, and construction of the Mixed Oxide (MOX) Fuel Fabrication Facility began in August 2007.

4.8.1.2 *Surrounding Land Uses*

SRS is approximately 12 miles south of Aiken, South Carolina, and 15 miles southeast of Augusta, Georgia. Aiken is the closest populated area to SRS. Land uses in areas surrounding SRS are varied and include residential, industrial, commercial, transportation, recreation, and agricultural activities. Although this land use is primarily forest and agricultural, there is a substantial amount of open water and non-forested wetland along the Savannah River Valley. Regional industrial land uses include a commercial nuclear power plant near Waynesboro, Georgia; a regional, low-level nuclear waste repository in Barnwell, South Carolina; a variety of conventional chemical industries near Augusta; and a variety of manufacturing industries in Aiken, South Carolina (DOE 2002a).

4.8.2 Visual Resources

The dominant aesthetic settings in the vicinity of SRS are agricultural and forest, with limited industrial and residential areas. SRS is almost completely forested with 10 percent (19,000 acres) in use for industrial and administrative purposes. The industrial areas, including the reactors and large facilities, are primarily located in the interior of the site away from public access. SRS facilities are not generally visible from public access roads due to the distance to the boundary from the industrialized areas, the gently rolling terrain, and heavy vegetation. The limited public areas that have views of some SRS structures (other than the administrative areas) are approximately 5 miles or more away from viewable structures. These views have low visual sensitivity levels because most of these structures were built as many as 40 years ago and are well established in the viewer's expectations (DOE 2002a).

SRS land is heavily wooded (predominantly pine forest, which minimizes seasonal differences), with developed areas occupying approximately 10 percent of the total land area. The facilities are scattered across SRS and are brightly lit at night. Typically, the reactors and principal processing facilities are large concrete structures as much as 100 feet tall adjacent to shorter administrative and support buildings and parking lots. These facilities are visible in the direct line-of-sight when approaching them on SRS access roads. The only structure visible from a distance is the K-Reactor Cooling Tower. Since this tower will not be operated, the absence of a steam plume ensures no further visual impact. Otherwise, heavily wooded areas that border the SRS road system and public highways crossing the SRS limit views of the facilities.

4.8.3 Site Infrastructure

Table 4.8.3-1 briefly describes the existing infrastructure of the SRS as it pertains to the proposed action. Site infrastructure includes utilities, roads, and railroads needed to support construction and operation of the facilities.

Table 4.8.3-1 — SRS Site Infrastructure Characteristics

Resource	Site Usage	Site Capacity
Transportation		
Paved Roads (miles)	143	143
Unpaved Roads (miles)	1,200	1,200
Railroads (miles)	64	64
Electricity		
Energy consumption (MWh/year)	370,000	4,400,000
Peak energy (MWe)	70	330
Fuel		
Natural gas (cubic yards per year)	0	a
Fuel oil (heating) (gallons per year)	500,000	a
Diesel fuel (gallons per year)	132,086	a
Gasoline (gallons per year)	138,690	a
Coal (tons per year)	850,000	a
Propane (gallons per year)	1,000	A
Water		
Water Use (gallons per year)	3,500,000,000	

a — not limited

Source: DOE 1999b, DOE 2000g.

4.8.3.1 *Electricity*

SRS uses a 115-kV power line system in a ring arrangement to supply electricity to the operations areas. Power is supplied by three transmission lines from the South Carolina Electric and Gas Company. The total SRS usage of electrical power is 370,000 MWh per year out of a site capacity of 4,400,000 MWh per year.

4.8.3.2 *Fuel*

Coal and oil are used at SRS to power steam plants located in A-, D-, H- and K-Areas. The produced steam is distributed across the site in an aboveground pipeline distribution system. Coal is delivered by rail and is stored at coal piles in A-, D-, and H-Areas. Number 2 grade fuel oil is delivered by truck and is used in the K-Area. Fuel oil consumption is approximately 500,000 gallons per year. Natural gas is not used at SRS. Annual gasoline consumption is about 525,000 liters.

4.8.3.3 *Water*

Domestic water supplies at SRS come from a system composed of several wells and water treatment plants. The system includes three wells and a water treatment plant in the A-Area and two wells and a backup water treatment plant in the B-Area. A 27 mile pipe loop provides domestic water from the A- and B-Areas to other SRS operations areas. The regional drainage is dominated by the north to south running Savannah River. The Savannah River is classified as a freshwater source that is suitable for primary and secondary contact recreation, drinking after appropriate treatment, balanced native aquatic species development, and industrial and agricultural purposes. Data from the river's monitoring locations generally indicate that South Carolina's freshwater standards are being met. SRS is expected to continue using approximately 3.5 billion gallons of water per year.

4.8.4 **Air Quality and Noise**

4.8.4.1 *Air Quality*

4.8.4.1.1 **Meteorology and Climatology**

The climate at the SRS is characterized by short, mild winters and long, humid summers. Mountains to the north and west prevent or delay the approach of many cold air masses. The annual average wind speed is 6.1 miles per hour (mph) at Bush Field, which is located in Augusta, Georgia, about 15 miles northwest of SRS.

SRS averages approximately 49.5 inches of annual precipitation. Average monthly precipitation ranges from 2.7 inches in November to 4.6 inches in March. The average annual temperature at Bush Field is 63.1 degrees Fahrenheit (°F). January is the coldest month, with an average temperature of 44.8 °F, and July the warmest, averaging 80.8 °F.

4.8.4.1.2 Ambient Air Quality

The SRS is located in the Augusta-Aiken Interstate AQCR. All areas within this region are classified as achieving attainment with the NAAQS (40 CFR 50). The nearest area not in attainment with the NAAQS is Atlanta, Georgia, which is approximately 150 miles west of SRS. Because the Aiken-Augusta area has been out of compliance with the fine particulate (PM_{2.5}) standards for 3 of the last 4 years, and the last 2 years show an upward trend the EPA may declare the area non-attainment for fine particulate matter in 2009. Table 4.8.4-1 shows the actual criteria pollutant emissions from all SRS sources in 2004.

Ambient air quality data collected during 2005 from monitoring stations operated by South Carolina Department of Health and Environmental Control (SCDHEC) in Aiken and Barnwell Counties, South Carolina, are summarized in Table 4.8.4-2. This data indicates that ambient concentrations of the measured criteria pollutants are generally much less than the standards.

Table 4.8.4-1— 2004 Criteria Pollutant Air Emissions

Pollutant Name	Actual Emissions (Tons/Year)
Sulfur dioxide (SO ₂)	2.15×10 ³
Total suspended particulates (TSP)	4.82×10 ²
Particulate matter 10 microns (PM ₁₀)	1.89×10 ²
Carbon monoxide (CO)	9.82×10 ²
Ozone (volatile organic compounds) (VOC)	5.44×10 ²
Gaseous fluorides (as hydrogen fluoride) (HF)	1.39×10 ⁻¹
Nitrogen (NO _x)	4.24×10 ³
Lead (Pb)	1.58×10 ⁻¹

Source: SRS 2006c.

Table 4.8.4-2 — National Ambient Air Quality Standards and 2005 Background Ambient Air Concentration

Pollutant	Averaging Times	NAAQS Primary Standard	South Carolina Standard	Background Ambient Air Concentration	Locations (city, county, state)
Carbon Monoxide	8-hour ⁽¹⁾	10 µg/m ³	Same	(7)	(7)
	1-hour ⁽¹⁾	40 µg/m ³	Same	(7)	(7)
Lead	Quarterly Average	1.5 µg/m ³	Same	0.001 µg/m ³	Aiken, SC
Nitrogen Dioxide	Annual	100 µg/m ³	Same	7.9 µg/m ³	Aiken, SC
Particulate Matter (PM ₁₀)	Annual ⁽²⁾	50 µg/m ³	Same	17.6 µg/m ³	Aiken, SC
	24-hour ⁽¹⁾	150 µg/m ³	Same	36 µg/m ³	Aiken, SC
Particulate Matter (PM _{2.5})	Annual ⁽³⁾	15 µg/m ³	Same	13.5 µg/m ³	Aiken, SC
	24-hour ⁽⁴⁾	35 µg/m ³	Same	32.1 µg/m ³	Aiken, SC
Ozone	8-hour ⁽⁵⁾	0.08 ppm	Same	0.069 ppm	Aiken, SC
	1-hour ⁽⁶⁾	0.12 ppm	Same	0.082 ppm	Aiken, SC
Sulfur Oxides	Annual	80 µg/m ³	Same	4.5 µg/m ³	Barnwell, SC
	24-hour ⁽¹⁾	365 µg/m ³	Same	18.3 µg/m ³	Barnwell, SC
	3-hour ⁽¹⁾	NA	1300 µg/m ³	34.0 µg/m ³	Barnwell, SC
Total Suspended Particulates	Annual Geometric Mean	NA	75 µg/m ³	38.2 µg/m ³	Aiken, SC

Source: SCDHEC 2005.

¹ Not to be exceeded more than once per year.

² To attain this standard, the 3-year average of the weighted annual mean PM₁₀ concentration at each monitor within an area must not exceed 50 µg/m³.

³ To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m³.

⁴ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³.

⁵ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

⁶ (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1, as determined by appendix H.

(b) As of June 15, 2005 EPA revoked the [1-hour ozone standard](#) in all areas except the fourteen 8-hour ozone non-attainment [Early Action Compact \(EAC\) Areas](#).

⁷ No CO data in vicinity of SRS for 1990 – 2005.

Radiological Air Emissions

Atmospheric emissions of radionuclides from DOE facilities are limited under the EPA regulation NESHAP,” 40 CFR Part 61, Subpart H. The EPA annual effective dose equivalent limit of 10 millirem per year to members of the public for the atmospheric pathway is also incorporated in DOE Order 5400.5, “Radiation Protection of the Public and the Environment.”

In the SRS region, airborne radionuclides originate from natural (i.e., terrestrial and cosmic) sources, worldwide fallout, and SRS operations. Process area stacks that release, or have the potential to release, radioactive materials are monitored continuously by applicable online monitoring and/or sampling systems (SRS EM Program 2001).

Depending on the processes involved, discharge stacks also may be monitored with “real-time” instrumentation to determine instantaneous and cumulative atmospheric releases to the environment. Tritium is one of the radionuclides monitored with continuous real-time instrumentation. Tritium in elemental and oxide forms accounted for more than 99 percent of the

total radioactivity released to the atmosphere from SRS operations. During 2005, about 40,800 curies of tritium were released from SRS, compared to about 61,300 curies in 2004 (SRS 2006c).

Average concentrations of radionuclides in airborne emissions are calculated by dividing the amount of each radionuclide released annually from each stack by the respective yearly stack-flow volumes. These average concentrations then can be compared to the DOE DCGs in DOE Order 5400.5, "Radiation Protection of the Public and the Environment," as a screening method to determine if existing effluent treatment systems are proper and effective. DCGs are used as reference concentrations for conducting environmental protection programs at all DOE sites. DCGs are applicable at the point of discharge (prior to dilution or dispersion) under conditions of continuous exposure (SRS 2006c).

Most of the SRS radiological facilities release small quantities of radionuclides at concentrations below the DOE DCGs. However, tritium (in the oxide form) from the reactor (K-Area and L-Area main stacks) and tritium facilities was emitted in 2005 at concentration levels above the DCGs. The offsite dose from all atmospheric releases, however, remained well below the DOE and EPA annual atmospheric pathway dose standard of 10 millirem (SRS 2006c).

4.8.4.2 *Noise*

Major noise sources in active areas at the SRS include industrial facilities and equipment such as cooling systems, transformers, engines, vents, paging systems; construction and materials handling equipment; and vehicles. Outside of active operational areas, vehicles and trains generate noise. Most industrial facilities at the SRS are located far enough from the site boundary that the associated noise levels at the boundary would be barely distinguishable from background levels.

4.8.5 **Water Resources**

4.8.5.1 *Surface Water*

The regional drainage is dominated by the north to south running Savannah River. This major river forms with the confluence of the Seneca and the Tugaloo rivers in Lake Hartwell. The Savannah River drains a watershed of 10,577 square miles in the mountains of North Carolina, South Carolina and Georgia. In the western part of the upper basin, the Chatooga and the Tallulah Rivers meet to form the Tugaloo River. In the eastern part, the confluence of Twelve Mile Creek and the Keowee River form the Seneca River. In the upper reaches of Lake Hartwell the Seneca and Tugaloo Rivers join to form the Savannah River.

From the headwaters of the Savannah River to the Atlantic Ocean near Savannah, GA, the waters travel about 300 miles through 4 physiographic regions, the Blue Ridge Mountains, the piedmont, the upper coastal plain and the lower coastal plain. There are 5 main streams that originate on, or pass through the SRS before discharging into the Savannah River Swamp. These are Upper Three Runs, Steel Creek, Pen Branch, Fourmile Branch, and Lower Three Runs (Figure 4.8.5-1). There are 2 major artificial bodies of water onsite, Par Pond and L-Lake. Par Pond covers 2,640 acres and has an average depth of 20 feet, while L-Lake covers 1,000 acres.

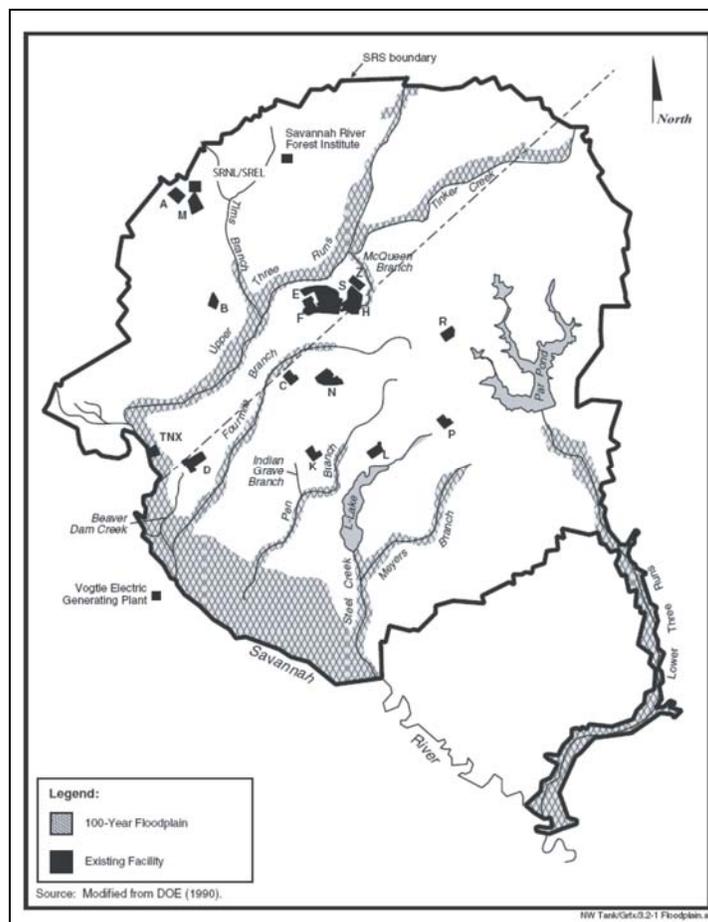


Figure 4.8.5-1 — Water Resources at SRS

Upper Three Runs is a 20-mile backwater stream that drains an area of approximately 210 square miles. The mean monthly discharge for the Upper Three Runs is 171.2 cubic feet per second (USGS Water Website).

The Steel Creek originates near the P-Reactor and drains a total area of about 35 square miles. Currently, the flow rate is closer to the natural flow rate of 1 cubic meter per second, and the mean monthly discharge for the Steel Creek is 26.2 cubic feet per second. In the 1980s, DOE built the L-Lake Dam on Steel Creek to form a cooling reservoir for L-Reactor cooling water discharges.

Pen Branch is approximately 15 miles long and follows a southwesterly path from its headwaters draining an area of about 21 square miles. The mean monthly discharge for the Pen Branch is 15.8 cubic feet per second.

The Fourmile Branch follows a southwesterly route for approximately 15 miles and drains an area of about 21 square miles. The mean monthly discharge of the Fourmile Branch is 20.9 cubic feet per second.

Lower Three Runs drains about 286 square miles and flows about 24 miles before entering the Savannah River. The mean monthly discharge of the Lower Three Runs is 21.5 cubic feet per second. In the 1950s, DOE built the PAR Pond Dam on Lower Three Runs to form a cooling reservoir for cooling water discharges from P- and R-Reactors.

4.8.5.1.1 Surface Water Quality

The Savannah River is classified as a freshwater source that is suitable for primary and secondary contact recreation, drinking after appropriate treatment, balanced native aquatic species development, and industrial and agricultural purposes. Primary contact is direct contact with the water, such as while swimming. Secondary contact is having some direct contact with the water but where swallowing is unlikely to occur, such as while fishing. Data from the river's monitoring locations generally indicate that South Carolina's freshwater standards are being met (NRC 2005).

The Fourmile Branch watershed drains approximately 22 square miles and includes several facilities at SRS: C Area (reactor), F and H Areas (separations facilities, tank farms, and seepage basins), and the SWDF. Fourmile Branch receives NPDES-permitted discharges from C, F, and H Areas as well as the 1.05MGD Centralized Sanitary Wastewater Treatment Facility. From 1977 to 1995, the mean flow was 113 cubic feet per second, the 7-day low flow was 7.6 cubic feet per second, and the 7Q10 (streamflow that occurs over 7 consecutive days and has a 10-year recurrence interval period, or a 1 in 10 chance of occurring in any one year) was 8.2 cubic feet per second (SRS 2005).

The Upper Three Runs watershed drains approximately 20.9 square miles with the southernmost 20.9 square miles located within the boundaries of SRS (Mast and Turk 1999). Upper Three Runs receives NPDES-permitted discharges from the F-/H-Area ETF (including the 200-F and 200-H Separation Areas), fuel fabrication facilities (300-M Area), and the SRNL (700-A Area). Streamflow is strongly controlled by ground-water discharge, and mean monthly discharge varies over a narrow range from 96.8 cubic feet per second in October to 114.8 cubic feet per second in March (Mast and Turk 1999) (SRS 2005).

Steel Creek received cooling water from L-Reactor and ash basins runoff, non-process cooling water, powerhouse wastewater, reactor process effluents, sanitary treatment plant effluents, and vehicle wash waters. From October 1990 to September 1991, the mean flow rate of Steel Creek at SRS Road A was 185 cubic feet per second, with an average temperature of 66°F (UG SREL 2002). During reactor operation, the mean water temperatures of Pen Branch ranged from 92 to 119°F.

The University of Georgia SREL (2006) reports on the historical studies of radioactive contamination on the water, sediments and fauna in and around SRS. Their findings show the presence of radiocesium on soils, plants, snakes, green tree frogs, herons, wood ducks, and arthropods from Steel Creek. Releases of radioactive materials to surface water were highest during the early and middle 1960s. Tritium, cesium-137, and strontium-90 were the main radioactive materials of concern for releases to surface streams at SRS. Meyer et al. (1999) estimated that, for all years of operation at SRS, the total tritium released to the Savannah River

is 1.8 million curies, the total cesium-137 released is about 250 curies and the total strontium-90 released to the river for all years is about 100 curies. Other contaminants of concern that have been detected on the waters at SRS are trichloroethylene, cadmium, hydrogen sulfide, lead, mercury, nickel and nitrate. Table 4.8.5-1 shows a summary of the water quality at the two main creeks at SRS, Four Mile Branch and Upper Three Runs. As shown in Table 4.8.5-1 Four Mile Branch exceeded the criterion levels of mercury and tritium while Upper Three Runs exceeded criterion levels of mercury.

Table 4.8.5-1 – Surface Water Quality at SRS

Parameter	Unit	Four Mile Branch (FM-6)	Upper Three Runs (U3R-4)	Water Quality Criterion ^a (MCL ^b or DCG ^c)
Dissolved Oxygen	mg/L	9.25	8.92	>=5
Temperature	C	19.18	18.41	32.2
Total Suspended Solids	mg/L	2.83	4	NA
pH	SU	6.98	6.78	6 – 8.5
Aluminum	mg/L	0.12265	0.179508333	0.087
Chromium	mg/L	0.0012	0.0011	0.11
Copper	mg/L	0.00317	0.002835667	0.0065
Iron	mg/L	0.87587	0.479558333	1
Mercury	ug/L	0.06275	0.101763333	0.000012
Manganese	mg/L	0.04865	0.019683333	
Nickel	mg/L	0.0022	0.008	0.088
Lead	mg/L	0.00223	0.003	0.0013
Zinc	mg/L	0.01439	0.115	0.059
Tritium	picocuries per liter	103,000	694	20,000 ^{b2}
Cesium-137	picocuries per liter	3.35	ND	120 ^c
Uranium-234	picocuries per liter	0.028	2.63	20 ^c
Uranium-235	picocuries per liter	ND	0.063	24 ^c
Uranium-238	picocuries per liter	0.026	0.154	24 ^c
Plutonium-238	picocuries per liter	0.005	0.049	1.6 ^c
Plutonium-239	picocuries per liter	ND	0.015	1.2 ^c

Source: SRS 2006c.

a. Water Quality Criterion (WQC) is Aquatic Chronic Toxicity unless otherwise indicated.

b. MCL = Maximum Contaminant Level; State Primary Drinking Water Regulations [d1 = Chapter 61-58.5 (b)(2)h; d2=Chapter 61-58.5(h)(2)b].

c. DCG = DOE Derived Concentration Guides for Water (DOE Order 5400.5). DCG values are based on committed effective dose of 100 millirem per year; however, because drinking water MCL is based on 4 millirem per year, value listed is 4 percent of DCG.

d. Concentration exceeded WQC; however, these criteria are for comparison only. WQCs are not legally enforceable.

e. NR = Not reported.

f. NA = Not applicable.

g. ND = Not detected.

h. Shall not be increased more than 2.8°C (5°F) above natural temperature conditions or exceed a maximum of 32.2°C (90°F) as a result of the discharge of heated liquids unless appropriate temperature criterion mixing zone has been established.

Direct discharges of liquid effluents are quantified at the point of release to the receiving stream, prior to dilution by the stream. The release totals are based on measured concentrations and flow rates. Tritium accounts for more than 99 percent of the total amount of radioactivity released from the site to the Savannah River. In 2005, a total of 4,480 curies of tritium were released to the river (SRS 2006c). Based on the measured tritium concentration at River Mile 118.8, this total includes releases from Georgia Power Company's Vogtle Electric Generating Plant (1,860 curies).

The 12-month average tritium concentration measured in Savannah River water near River Mile 118.8 (5.46×10^{-4} picocuries per liter) was 17 percent less than the 2004 concentration of 6.61×10^{-4} picocuries per liter. The concentrations at the Beaufort-Jasper Water and Sewer Authority Chelsea (4.45×10^{-4} picocuries per liter) and Purrysburg (4.48×10^{-4} picocuries per liter); and at the Port Wentworth (4.96×10^{-4} picocuries per liter) water treatment plant, remained below the EPA MCL of 0.2 picocuries per liter.

SRS monitors nonradioactive liquid discharges to surface waters through the NPDES, as mandated by the CWA. As required by EPA and SCDHEC, SRS has NPDES permits in place for discharges to the waters of the United States and South Carolina. These permits establish the specific sites to be monitored, parameters to be tested, and monitoring frequency, as well as analytical, reporting, and collection methods.

Under the CWA, SRS's NPDES compliance rate was 99.9 percent. DOE reported 3 exceedances. Corrective actions were taken to address each of these permit noncompliances. Two Notices of Violation were received under NPDES from SCDHEC. Results from only one of the 3,493 sample analyses performed during 2005 exceeded permit limits (a 99.99 percent compliance rate). The single exceedance (of daily maximum limit for TSS) occurred March 5 at outfall A-11, as a result of stream bank erosion upstream of the sampling location. At every sampling site, most water quality parameters and metals were detected in at least one sample. Only three samples had detectable pesticides/herbicides in 2006. These results continue to indicate that SRS discharges are not significantly affecting the water quality of the onsite streams or the river (SRS 2006a).

4.8.5.2 *Groundwater*

The SRS is underlain by southeast-dipping wedges of unconsolidated sediments of the Atlantic Coastal Plain that extends from its contact with the Piedmont Province at the Fall Line to the edge of the continental shelf. These sediments range from Late Cretaceous to Miocene in age and comprise layers of sand, muddy sand, and clay with subordinate calcareous sediments. These unconsolidated sediments rest on crystalline and sedimentary basement rock (SRS 2006c).

The hydrostratigraphic units of primary interest beneath SRS are part of the Southeastern Coastal Plain Hydrogeologic Province. Within this sequence of aquifers and confining units are two principal subcategories, the overlying Floridan Aquifer System and the underlying Dublin-Midville Aquifer System. These systems are separated from one another by the Meyers Branch Confining System. In turn, each of the systems are subdivided into 2 aquifers, which are separated by a confining unit (SRS 2006c).

4.8.5.2.1 Groundwater Quality

The shallower groundwater aquifers underneath the SRS are contaminated with a variety of elements that range from organic compounds to metals and radionuclides. The sources of the detected groundwater contamination included burial grounds, waste management facilities, canyon buildings, seepage basins, and saltstone disposal facilities (NRC 2005). The shallower Upper Three Runs Aquifer is contaminated with solvents, metals, and low levels of radionuclides near several SRS areas and facilities, including the F-Area. Tritium has been reported in the Gordon Aquifer under the Separation Areas (F- and H-Areas). The deep Crouch Branch Aquifer is generally unaffected by site operations, except for a location near A-Area, where trichloroethylene (TCE) contamination has been found.

One of the most contaminated areas at SRS is near the F-Area seepage basins and inactive process sewer line. There is widespread radionuclide contamination and a subsurface plume of tritium and strontium contamination. Near the F-Area Tank Farm, tritium, mercury, nitrate-nitrite (as nitrogen), cadmium, gross alpha, and lead were detected in concentrations that exceeded drinking water standards in one or more wells. At the Sanitary Sludge Application Site, tritium, specific conductance, lead, and copper values exceeded their drinking water standards in one or more wells. The contaminant plume appears to originate inside F-Area and extend beneath the MOX Fuel Fabrication Facility site, with movement in a fan-like direction of groundwater flow under the proposed MOX facility site (NRC 2005).

There is another large chlorinated solvent plume near the A-Area/M-Area. DOE uses more than 200 wells in this area's groundwater monitoring program and some of the contaminated wells lie within a half-mile of the site boundary. While DOE believes that the major component of groundwater flow is not directly toward the site boundary, flow in the area is complex and difficult to predict (SRS 2006c). This area has been the subject of extensive groundwater cleanup efforts.

The groundwater beneath the Old F-Area Seepage Basin (OFASB) contains iodine-129, nitrate, radium-226, radium-228, strontium-90, tritium, uranium (total), and lead (NRC 2005). A small component of the contaminant plume from OFASB flows beneath the westernmost corner of the proposed MOX site. Contaminant fate and transport models predict that the aquifer is expected to return to an uncontaminated state within 2 to 115 years, depending on the specific contaminant (NRC 2005).

4.8.5.2.2 Groundwater Availability

In the central to southern portion of SRS, the Floridan Aquifer System is divided into the overlying Upper Three Runs Aquifer and the underlying Gordon Aquifer, which are separated by the Gordon Confining Unit. The water table surface can be as deep as 160 feet below ground surface, but intersects the ground surface in seeps along site streams. The top of the Gordon Aquifer typically is encountered at depths of 150–250 feet below ground surface. North of Upper Three Runs Creek, these units are collectively referred to as the Steed Pond Aquifer, in which the Upper Three Runs Aquifer is called the M-Area Aquifer Zone, and the Gordon Aquifer is referred to as the Lost Lake Aquifer Zone. There is an aquitard that separates them,

referred to as the Green Clay Confining Zone unit above, which the water table usually occurs at SRS; hence, it is referred to informally as the “Water Table” aquifer (SRS 2006c).

The Dublin-Midville Aquifer System is divided into the overlying Crouch Branch Aquifer and the underlying McQueen Branch Aquifer, which are separated by the McQueen Branch Confining Unit. The top of the Crouch Branch Aquifer typically is encountered at depths of 350–500 feet bgs. The top of the McQueen’s Branch Aquifer typically is encountered at depths of 650–750 feet bgs. In aquitards, groundwater velocities range from several inches to several feet per year and in aquifers, from tens to hundreds of feet per year (SRS 2006c).

4.8.6 Geology and Soils

SRS is on the Aiken Plateau of the Upper Atlantic Coastal Plain, about 25 miles southeast of the Fall Line that separates the Atlantic Coastal Plain from the Piedmont. The Aiken Plateau, the subdivision of the Coastal Plain that includes SRS, is highly dissected and characterized by broad, flat areas between streams and narrow, steep-sided valleys. It slopes from an elevation of approximately 650 feet at the Fall Line to an elevation of about 250 feet on the southeast edge of the plateau.

4.8.6.1 Geology

The sediments of the Atlantic Coastal Plain dip gently seaward from the Fall Line thickening from essentially 0 feet thick at the Fall Line to more than 4,000 feet at the coast. The topmost sediment layer (known as the Tinker/Santee Formation) consists of 60 feet of Paleocene-age clayey and silty quartz sand, and silt (SRS 2006c). Within this layer, there are occasional beds of clean sand, gravel, clay, or carbonate. Deposits of pebbly, clayey sand, conglomerate, and Miocene and Oligocene-age clay occur at higher elevations. This layer is noteworthy because it contains small, discontinuous, thin calcareous sand zones (i.e., sand containing calcium carbonate) that are potentially subject to dissolution by water. These “soft-zone” areas have the potential to subside, causing settling of the ground surface (SRS 2006c). The second layer of sediments overlies bedrock and consists of about 700 feet of Upper Cretaceous-age quartz sand, pebbly sand, and kaolinitic clay. The underlying bedrock consists of sandstones of Triassic age and older metamorphic and igneous rocks (SRS 2006c).

Because of the proximity of SRS to the Piedmont Province, it has more relief than areas that are nearer the coast, with onsite elevations ranging from 89 to 420 feet above mean sea level.

Subsidence (lowering of the ground surface) and soil liquefaction are two geologic processes that are potentially problematic at SRS. Rock strata under some areas of SRS include layers of pockets of carbonate rock that are subject to dissolution, which would cause subsidence and could lead to soil liquefaction. Sites underlain by these “soft zones” are considered unsuitable for structural formations unless extensive soil stabilization is done. Because the topography is generally flat at the Site, rockfalls and landslides are unlikely occurrences except along the banks of drainage valleys that are widely spaced across the SRS.

4.8.6.2 *Soils*

The surface soils at the SRS consist of Coastal Plain sediments. The surface soils are primarily sands and sandy loams with sporadic clay layers (DOE 1999) overlying a subsoil containing a mixture of sand, silt, and clay. These soils are gently sloping to moderately steep (0 to 10 percent grade) and have a slight erosion hazard (USDA 1990). Some soils on uplands are nearly level, and those on bottomlands along the major streams are level. Soils in small, narrow drainage valleys are steep. Most of the upland soils are well drained to excessively drained. The well-drained soils have a thick, sandy surface layer that extends to a depth of 7 feet or more in some areas. The soils on bottomlands range from well-drained to very poorly drained. Some soils on the abrupt slope breaks have a dense, brittle subsoil (DOE 1998).

4.8.6.3 *Seismology*

The Atlantic Coastal Plain tectonic province in which SRS is located is characterized by generally low seismic activity that is expected to remain subdued (Haselow et al. 1989). There are no active faults on SRS, but several fault systems occur offsite, northwest of the Fall Line. The most active seismic zones in the southeastern United States are all located over 100 miles away from the site. Faults identified onsite include the Pen Branch, Steel Creek, Advanced Tactical Training Area, Crackerneck, Ellenton, and Upper Three Runs. The Upper Three Runs Fault, which passes approximately 1 mile northwest of F-Area, is a Paleozoic fault that does not cut Coast Plain sediments (SRS 2006a).

None of the faults discussed in this section are considered “capable,” as defined by the Nuclear Regulatory Commission in 10 CFR 100.23. The capability of a fault is determined by several criteria, one of which is whether the fault has moved at or near the ground surface within the past 35,000 years.

Two major earthquakes have occurred within 186 miles of SRS. The Charleston, South Carolina, earthquake of 1886 had an estimated Richter scale magnitude of 6.8; it occurred approximately 90 miles from the SRS area, which experienced an estimated peak horizontal acceleration of 0.1 g (gravitational acceleration) (URS/Blume 1982). The Union County, South Carolina, earthquake of 1913 had an estimated Richter scale magnitude of 6.0 and occurred about 99 miles from the site (Bollinger 1973).

Other minor earthquakes occurring off-site of the SRS boundary all had magnitudes on the Richter scale of less than 4.2. In recent years, three minor earthquakes occurred inside the SRS boundary. In 1985, an earthquake occurred with a local Richter scale magnitude of 2.6. Another occurred in 1988 with a local Richter scale magnitude of 2.0. The most recent earthquake inside the SRS boundary was in 1997 with a Richter scale magnitude of 2.3.

4.8.7 **Biological Resources**

This section describes ecological resources at SRS including terrestrial and aquatic resources, T&E species, and floodplains and wetlands.

4.8.7.1 *Terrestrial Resources*

Currently, nearly 90 percent of the land (180,000 acres) at the SRS is forested with upland pine, hardwood, mixed (pine and hardwood), and bottomland hardwood forests. Loblolly-longleaf slash pine plantation (*Pinus taeda*, *P. palustris*, *P. elliottii*) is the dominant habitat covering approximately 65 percent of the site. Swamp forests and bottomland hardwood forests are found along the Savannah River. SRS is near the transition between northern oak-hickory-pine forest and southern mixed forest. Thus, species typical of both forest types are found on SRS.

Farming, fire, soil, and topography have influenced SRS vegetation patterns. A variety of plant communities occur in the upland areas. Typically, scrub oak communities are found in the drier, sandier areas. Longleaf pine, turkey oak (*Quercus laevis*), bluejack oak (*Q. incana*), and blackjack oak (*Q. marilandica*) dominate these communities, which typically have understories of wire grass and huckleberry (*Vaccinium* spp.). Oak-hickory communities are usually located on more fertile, dry uplands; characteristic species are white oak (*Q. alba*), post oak (*Q. falcata*), mockernut hickory (*Carya tomentosa*), pignut hickory (*Carya glabra*), and loblolly pine, with and understory of sparkleberry (*Vaccinium arboretum*), holly (*Ilex* spp.), greenbriar (*Smilax* spp.), and poison ivy (*Toxicodendron radicans*).

Wildlife management includes control of white-tailed deer (*Odocoileus virginianus*) and wild pig (*Sus scrofa*) populations through supervised hunts. SRS, which was designated as the first National Environmental Research Park in 1972, is one of the most extensively-studied environments in this country (DOE 2004a).

SRS supports numerous animal species, including 44 amphibians, 59 reptiles, 258 birds and 54 mammals (NUREG 2005). The SRS has among the highest biodiversity of herpetofauna (reptiles and amphibians) in the United States because of the areas' warm, moist climate and its wide variety of habitats (NUREG 2005). Snakes that commonly occur at SRS include eastern hognose snake, eastern garter snake, eastern coachwhip, scarlet king snake, rat snake, corn snake, and pine snake. Lizards that are common include the green anole, southern fence lizard, several species of skinks, and the eastern glass lizard. Amphibians include the southern toad and oak toad. The southern leopard frog, bullfrog, and other frogs and toads commonly occur in the small drainage basins, while amphibians such as tree frogs and salamanders occur within the smaller tributaries (NUREG 2005).

Bird species at the SRS that are common to abundant include black vulture, eastern kingbird, Acadian flycatcher, common crow, northern mockingbird, blue-gray gnatcatcher, ruby-crowned kinglet, red-eyed vireo, northern parula, black-throated blue warbler, ovenbird, northern cardinal, savannah sparrow, white-throated sparrow, and song sparrow. Large numbers of ducks and coots are winter migrants at the SRS (DOE 1996b).

4.8.7.2 *Wetlands and Floodplains*

4.8.7.2.1 *Wetlands*

Wetlands on the SRS encompass approximately 49,030 acres (over 20 percent of the SRS area) and are extensively and widely distributed. These wetlands include bottomland hardwood forests, cypress-tupelo swamp forests, floodplains, creeks, impoundments, and over 300 isolated upland Carolina bays and wetland depressions. A major wetland area is the Savannah River swamp that borders the Savannah River and covers about 19 square miles of SRS.

4.8.7.2.2 *Floodplains*

The 100 year flood event could affect the southern section of SRS in the Savannah River Swamp as well as Upper Three Runs, Lower Three Runs, and most of the drainage channels of Steel Creek, Meyers Branch, Four Mile Branch and Pen Branch. Figure 4.8.5-1 displays the 100-year floodplain and major stream systems in the vicinity of the SRS.

4.8.7.3 *Aquatic Resources*

At least 81 fish species have been identified at the SRS (NUREG 2005). Man-made ponds support populations of bass and sunfish. Commercial and recreational fish species include American shad, hickory shad, striped bass, largemouth bass, chain pickerel, crappie, bream, sunfish, and catfish (NUREG 2005).

Some SRS surface waters are classified as Category I resources. These waters are defined by the U.S. DOI as unique and irreplaceable on a national or eco-regional basis. These areas include Carolina bays and cypress-tupelo swamps. Any surface waters supporting species of concern and areas containing high-quality wetlands or headwater streams (e.g., portions of Upper Three Runs Creek) would also be considered for Category I status (NUREG 2005). Aquatic invertebrates (e.g., aquatic insects, snails, clams and worms) and fish surveys indicate that Upper Three Runs Creek is unaffected by SRS NPDES-permitted discharges (NUREG 2005). Figure 4.8.5-1 displays the major stream systems in the vicinity of the SRS.

4.8.7.4 *Threatened and Endangered Species*

Seven Federally-listed threatened and endangered species are known to occur on SRS. These are smooth purple coneflower (*Echinacea laevigata*), pondberry (*Lindera melissifolia*), shortnose sturgeon (*Acipenser brevirostrum*), American alligator (*Alligator mississippiensis*), wood stork (*Mycteria americana*), red-cockaded woodpecker (*Picoides borealis*), and bald eagle (*Haliaeetus leucocephalus*) (Wike et al. 2006). Table 4.8.7-1 presents the federally- and state-listed species that occur or may occur at SRS.

Table 4.8.7-1 — Listed Federal- and State-Threatened and Endangered Species that Occur or May Occur at the SRS, South Carolina

Common Name	Scientific Name	Status	
		Federal	State
Plants			
Relict trillium	<i>Trillium reliquum</i>	Endangered	Endangered
Canby's dropwort	<i>Oxypolis canbyi</i>	Endangered	Endangered
Harperella	<i>Ptilimnium nodosum</i>	Endangered	Endangered
Pondberry	<i>Lindera melissifolia</i>	Endangered	Endangered
American chaffseed	<i>Schwalbea americana</i>	Endangered	Endangered
Smooth purple coneflower	<i>Echinacea laevigata</i>	Endangered	Endangered
Reptiles			
American alligator	<i>Alligator mississippiensis</i>	Listed Threatened for similarity in appearance to crocodiles	Not Listed
Gopher tortoise	<i>Gopherus polyphemus</i>	Not Listed	Endangered
Spotted Turtle	<i>Clemmys guttata</i>	Not Listed	Threatened
Amphibians			
Gopher frog	<i>Rana capito capito</i>	Not Listed	Endangered
Birds			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened	Endangered
Red-cockaded woodpecker	<i>Picoides borealis</i>	Endangered	Endangered
Wood stork	<i>Mycteria americana</i>	Endangered	Endangered
Mammals			
Rafinesque's Big-eared bat	<i>Corynorhinus rafinesquii</i>	Not Listed	Endangered
Southeastern myotis	<i>Myotis austroriparius</i>	Not Listed	Threatened
Fish			
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	Endangered	Endangered

Sources: SCDNR 2006, DOE 2002a, NUREG 2005.

4.8.7.5 Biological Monitoring and Abatement Programs

Environmental surveillance at and near the SRS is designed to survey and quantify any effects that routine and non-routine operations could have on the site and on the surrounding area and population. As part of the radiological surveillance program, routine surveillance of all radiation exposure pathways is performed on all environmental media that could lead to a measurable annual dose at and beyond the site boundary. Non-radioactive environmental surveillance at SRS involves the sampling and analysis of surface water, drinking water, sediment, groundwater, and fish. Terrestrial and aquatic food products are also sampled. Food products include meat (beef), fruit, green vegetables (collards), fish (freshwater and saltwater) and shellfish. Survey results are discussed in the *Savannah River Site Annual Environmental Reports* (SRS 2007).

4.8.8 Cultural and Archaeological Resources

4.8.8.1 *Archaeological Resources*

Prehistoric resources at SRS consist of villages, base camps, limited-activity sites, quarries, and workshops. Evidence of prehistoric use of the area is present at approximately 800 recorded archaeological sites. Fewer than 8 percent of these sites have been evaluated for NRHP eligibility (DOE 2002a).

Archaeological resources at the SRS date from the Eocene Age (54 to 39 million years ago) and include fossil plants, numerous invertebrate fossils, and deposits of giant oysters, other mollusks, and bryozoa. All resources from SRS are marine invertebrate deposits and, with the exception of the giant oysters, are relatively widespread and common fossils. Therefore, the assemblages have relatively low research potential or scientific value (DOE 2002a).

4.8.8.2 *Historic Resources*

Historic resources at SRS consist of farmsteads, tenant dwellings, mills, plantations and slave quarters, rice farm dikes, dams, cattle pens, ferry locations, towns, churches, schools, cemeteries, commercial building locations, and roads. Evidence of historic use of the area has been found at approximately 400 of the recorded archaeological sites. About 10 percent of the historic sites have been evaluated for National Register eligibility (DOE 2002a). Systematic historic building surveys have not yet been conducted at SRS. Many of the pre-SRS historic structures were demolished during the initial establishment of SRS in 1950. No nuclear production facilities have been nominated to the NRHP and there are no plans for nominations. Existing SRS facilities lack architectural integrity and do not contribute to the broad historic theme of Manhattan Project or World War II-era nuclear materials.

From a Cold War perspective, SRS has been involved in tritium operations and other nuclear material production for more than 40 years; therefore, some existing facilities and engineering records may become significant as they attain the 50-year age criterion. Given the Site's ongoing missions, the SR and the NNSA-SRSO recognized that site operations may impact Cold War NRHP-eligible properties over the next decade and a plan was needed to avoid, minimize, or mitigate adverse affects to these properties. As a result, the Cold War Built Environment Cultural Resources Management Plan (CRMP) was developed. The CRMP contained a process for reaching decisions concerning the future treatment of SRS Cold War NRHP-eligible historic properties, taking into account their historical significance, integrity, future interpretation and treatment.

4.8.8.3 *Native American Resources*

Native American groups with traditional ties to the SRS area include the Apalachee, Cherokee, Chickasaw, Creek, Shawnee, Westo, and Yuchi. At different times, each of these groups was encouraged by the English to settle in the area to provide protection from French, Spanish, or other Native American groups. During the 1800s, most of the remaining Native Americans residing in the region were relocated to Oklahoma Territory (DOE 2002a). Native American

resources in the region include villages, ceremonial lodges, burials, cemeteries, and natural areas containing traditional plants used in ceremonies. In 1991, DOE conducted a survey of Native American concerns about religious rights in the central Savannah River valley. Six Native American groups - the Yuchi Tribal Organization, the National Council of Muskogee Creek, the Indian People's Muskogee Tribal Town Confederacy, the Pee Dee Indian Nation, the Ma Chis Lower Alabama Creek Indian Tribe, and the United Keetoowah Band of the Cherokee - have expressed concerns about sites and items of religious significance within SRS, including plant species traditionally used by them in ceremonies that exist on the SRS (DOE 2002a). DOE has continued to consult with the interested tribal organizations by notifying them about major planned actions at SRS and by providing environmental reports that address proposed actions at the SRS to the organizations for their review and comment (DOE 2002a).

4.8.9 Socioeconomic Resources

Socioeconomic characteristics addressed at SRS include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current SRS employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

Portions of SRS are located in Aiken and Barnwell counties. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Aiken and Barnwell, South Carolina and Burke and Richmond Georgia. Figure 4.8.9-1 presents a map of the counties composing the SRS ROI.

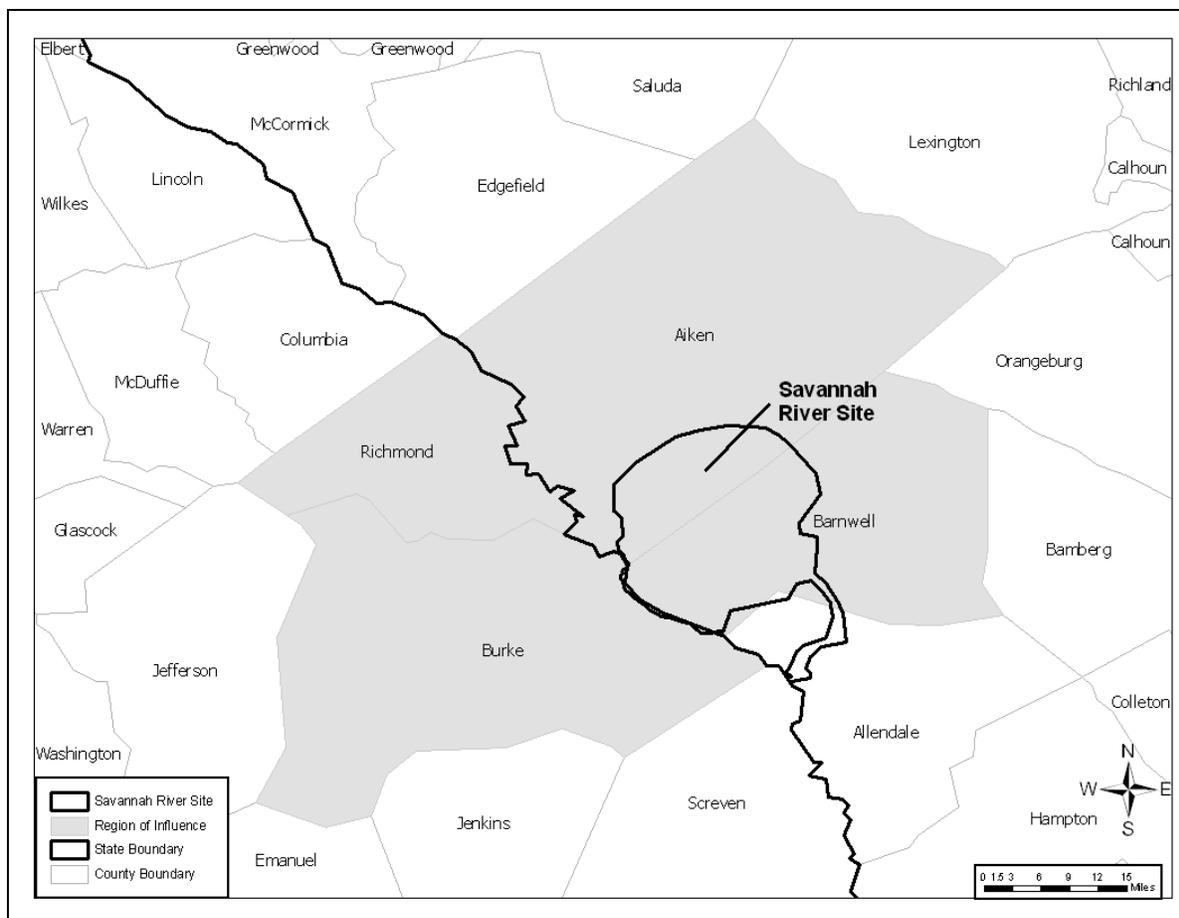


Figure 4.8.9-1 —Region of Influence for SRS

4.8.9.1 Employment and Income

Labor force statistics are summarized in Table 4.8.9-1. The available labor force (e.g., those greater than 16 years of age and able to work) of the ROI grew by approximately 5 percent from 176,248 in 2000 to 184,646 in 2005. The overall ROI employment experienced a growth rate of 2 percent with 168,894 in 2000 to 172,751 in 2005 (BLS 2007).

The ROI unemployment rate was 6.4 percent in 2005 and 4.2 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 5.8 percent in Aiken County, South Carolina to a high of 9 percent in Barnwell County, South Carolina. The unemployment rate in South Carolina in 2005 was 6.7 percent and 5.2 percent in Georgia (BLS 2007).

Table 4.8.9-1 — Labor Force Statistics for ROI, South Carolina, and Georgia

	ROI		South Carolina		Georgia	
	2000	2005	2000	2005	2000	2005
Civilian Labor Force	176,248	184,646	1,972,850	2,079,339	4,242,889	4,622,105
Employment	168,894	172,751	1,902,029	1,939,646	4,095,362	4,384,030
Unemployment	7,354	11,895	70,821	139,693	147,527	238,075
Unemployment Rate (percent)	4.2	6.4	3.6	6.7	3.5	5.2

Source: BLS 2007.

Income information for the SRS ROI is provided in Table 4.8.9-2. Barnwell County, South Carolina is at the low end of the ROI with a median household income in 2004 of \$27,194 and a per capita income of \$19,774. Aiken County, South Carolina, at the high end, had a household income of \$40,052 and a per capita income of \$27,524 (BEA 2007).

Table 4.8.9-2 — Income Information for the SRS ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Aiken	27,524	40,052
Barnwell	19,774	27,194
Burke	19,215	29,159
Richmond	25,343	32,775
South Carolina	27,090	39,454
Georgia	29,628	42,679

Source: BEA 2007.

4.8.9.2 *Population and Housing*

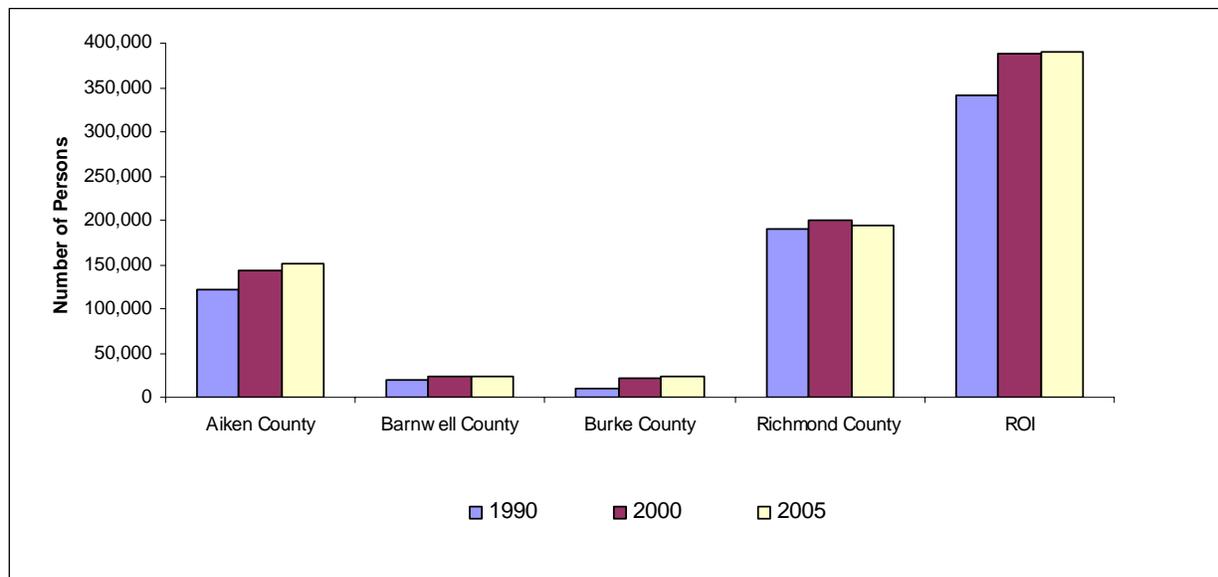
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.8.9-3 presents historic and projected population in the ROI and the state.

Table 4.8.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2015
Aiken County	120,940	142,552	150,053	160,020	169,820
Barnwell County	20,293	23,478	23,289	24,340	25,350
Burke County	9,912	22,243	23,154	24,561	25,765
Richmond County	189,719	199,775	194,135	193,194	191,563
ROI	340,864	388,048	390,631	402,115	412,498
South Carolina	3,486,703	4,012,012	4,246,933	4,486,700	4,717,890
Georgia	6,478,216	8,186,453	9,132,553	10,554,171	10,813,573

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 14 percent from 340,864 in 1990 to 388,048 in 2000. From 2000 to 2005, the population of the ROI increased 1 percent to 390,631 in 2005. Aiken County, South Carolina experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 5 percent while Richmond County, Georgia experienced a decrease of 3 percent (USCB 2007). Figure 4.1.9-2 presents the trends in population within the SRS ROI.



Source: USCB 2007.

Figure 4.8.9- 2 — Trends in Population for the SRS ROI, 1990-2005

Table 4.8.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 163,332 with 146,462 occupied (90 percent). There were 97,716 owner-occupied housing units and 48,746 rental units in the ROI. The median value of owner-occupied units in Aiken County, South Carolina was the greatest of the counties in the SRS ROI (\$87,600). The vacancy rate was the lowest in Richmond County, Georgia (10.2 percent) and the highest in Barnwell County, South Carolina (11.5 percent) (USCB 2007).

Table 4.8.9-4 — Housing in the SRS ROI, 2000

	Total Units	Occupied Housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Aiken County	61,987	55,587	42,036	13,551	6,400	10.3	87,600
Barnwell County	10,191	9,021	6,810	2,211	1,170	11.5	66,600
Burke County	8,842	7,934	6,030	1,904	908	10.3	59,800
Richmond County	82,312	73,920	42,840	31,080	8,392	10.2	76,800
ROI	163,332	146,462	97,716	48,746	16,870	10.3	79,686

Source: USCB 2007.

4.8.9.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 7 school districts with 116 schools serving the SRS ROI. Educational services are provided for approximately 67,899 students by an estimated 4,521 teachers for the 2005 to 2006 school year (IES 2006e). The student-to-teacher ratio in these school districts ranges from a high of 15:1 in the Richmond County School District to a low of

14:1 in the Barnwell County School District 19. The average student-to-teacher ratio in the ROI is 15:1 (IES 2006e).

The counties within the ROI employ approximately 4,800 firefighters and law enforcement officers. There are seven hospitals that serve residents of the ROI with the majority located in Richmond County. These hospitals have a total bed capacity of 2,220 (ESRI 2007).

4.8.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of SRS. Figure 4.1.10-1 shows counties potentially at risk from the current missions performed at SRS. There are 20 counties included in the potentially affected area. Table 4.8.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

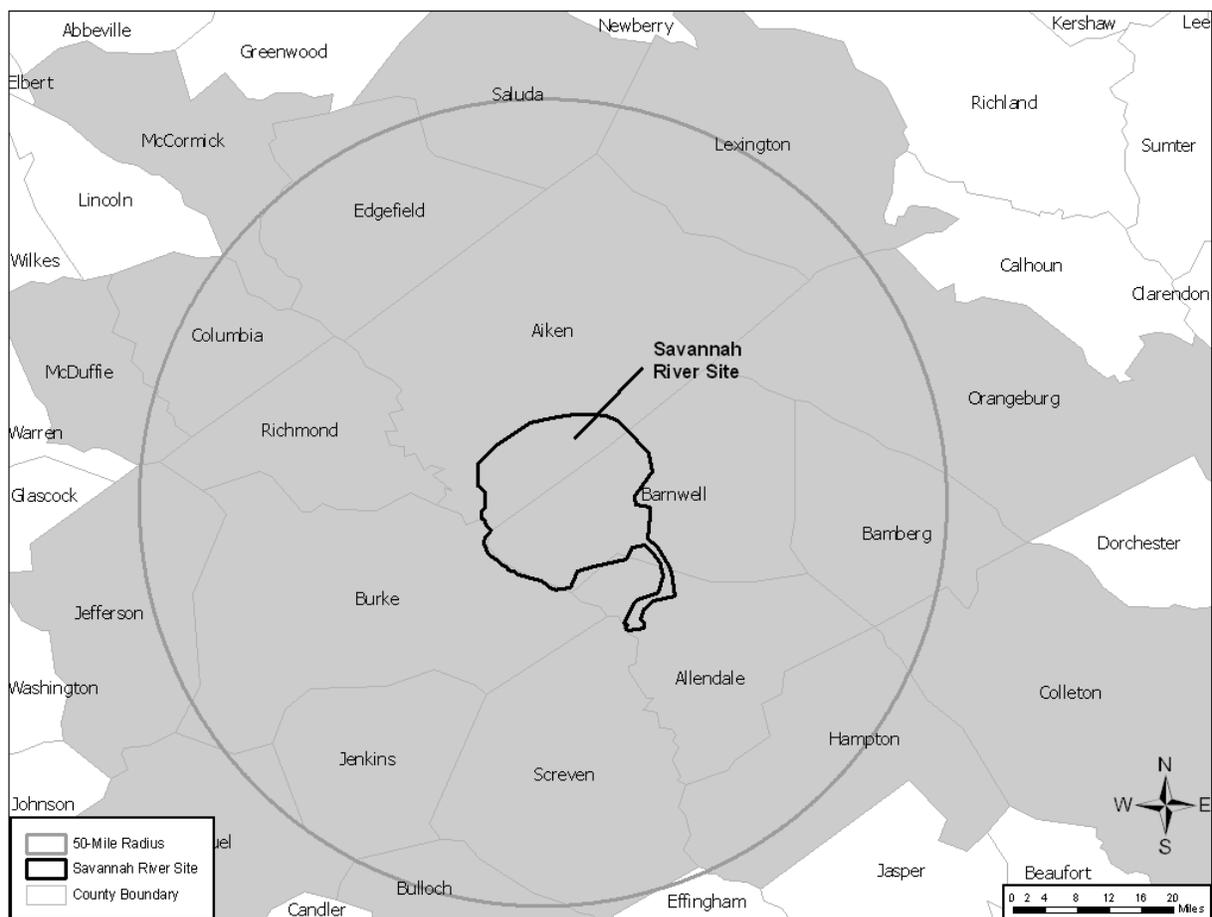


Figure 4.8.10-1 — Potentially Affected Counties Surrounding SRS

Table 4.8.10-1 — Population in Potentially Affected Counties Surrounding SRS, 2000

Population Group	Population	Percent
Minority	419,197	39.3
Hispanic	14,795	1.4
Black or African American	369,417	34.6
American Indian and Alaska Native	3,348	0.3
Asian	10,647	1.0
Native Hawaiian and Other Pacific Islander	551	0.1
Some other race	8,846	0.8
Two or more races	11,593	1.1
White alone	647,254	60.7
Total Population¹	1,485,648	100.0

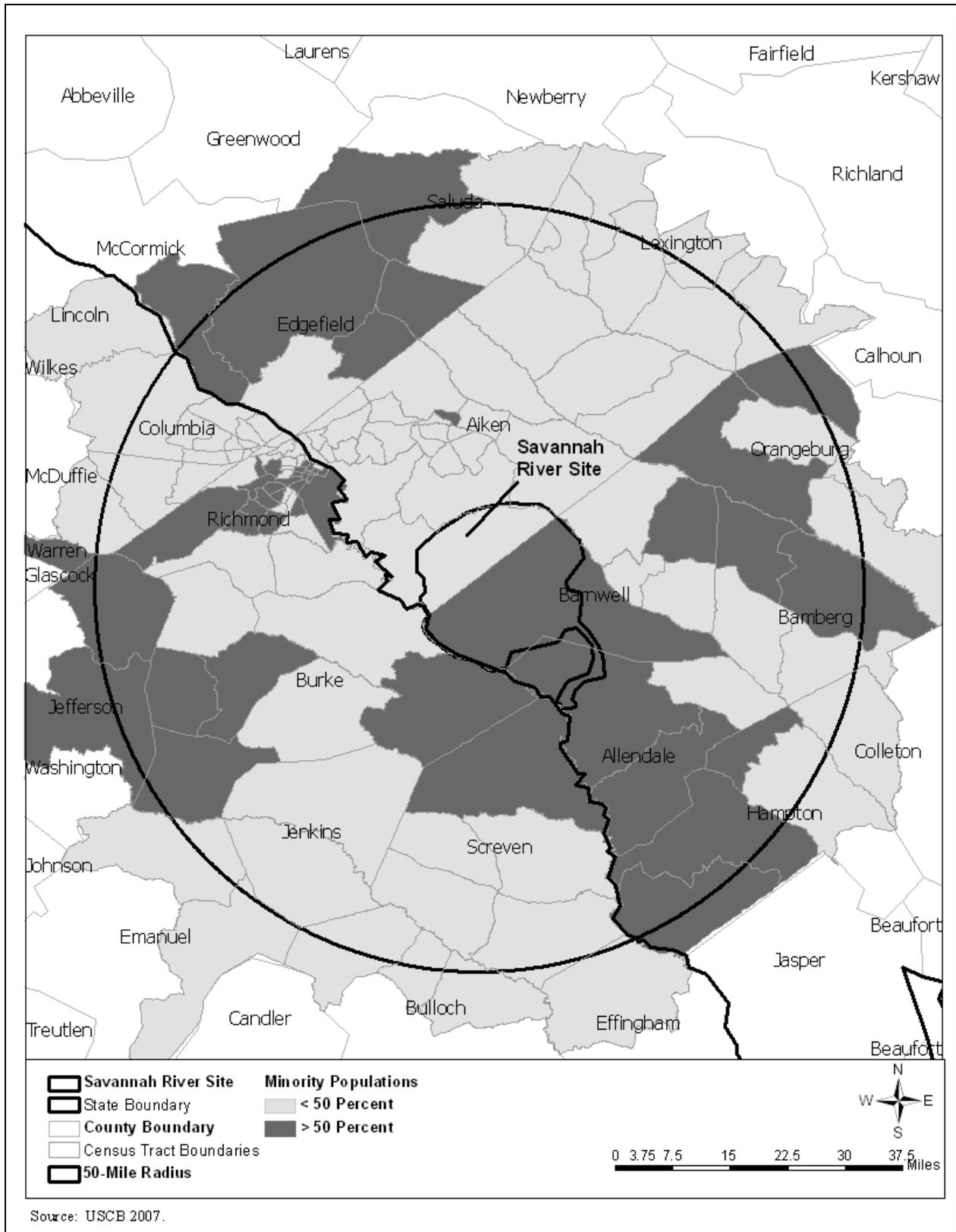
¹ total population in this table reflects the 50-mile population surrounding SRS, which is significantly higher than the ROI population discussed in Section 4.8.9.

Source: USCB 2007.

In 2000, minority populations represented 39.3 percent of the total population of counties within the 50-mile radius of SRS. Based on 2000 census data, Figure 4.8.10-2 shows minority census SRS census tracts within the 50-mile radius where more than 50 percent of the census SRS population is minority.

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.8.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 109,296 individuals residing within census tracts in the 50-mile radius of SRS were identified as living below the Federal poverty threshold, which represents approximately 16.4 percent of the census tracts population within the 50-mile radius. There two census tracts located in Richmond County, Georgia with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 14.1 percent of individuals for whom poverty status is determined were below the poverty level in South Carolina, 13 percent in Georgia, and 12.4 percent in the U.S. (USCB 2007).



Source: USCB 2007.

Figure 4.8.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of SRS

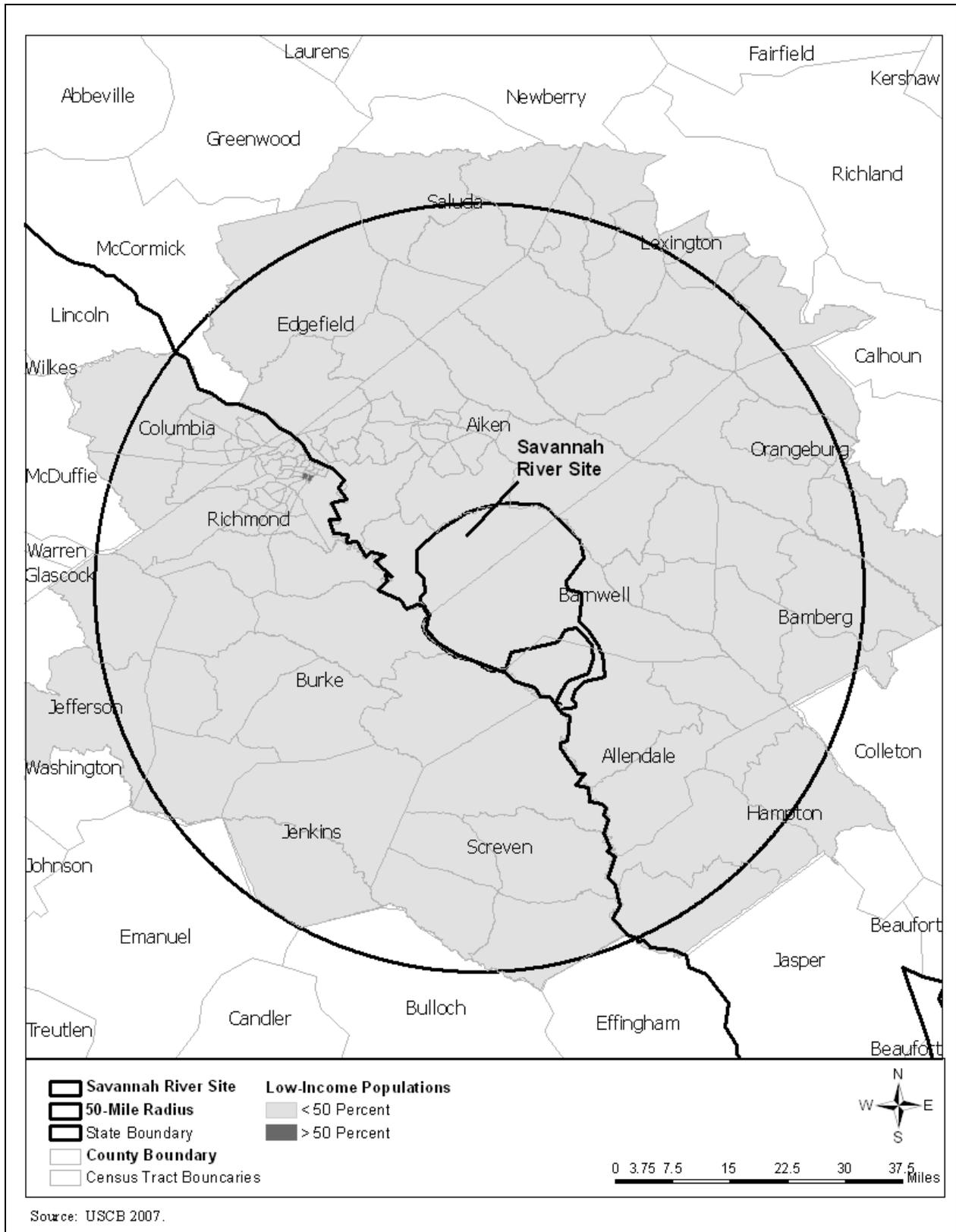


Figure 4.8.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of SRS

4.8.11 Health and Safety

Current activities associated with routine operations at SRS have the potential to affect worker and public health. The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at SRS. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.8.11.1 Public Health

4.8.11.1.1 Radiological

Releases of radionuclides to the environment from SRS operations are a source of radiation exposure to individuals in the vicinity of SRS. During 2005, SRS' environmental radiological monitoring program was conducted according to DOE Orders 450.1, "Environmental Protection Program," and 5400.5, "Radiation Protection of the Public and the Environment." The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to DCGs listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with this criterion is demonstrated by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for air emissions of radionuclides other than radon established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual member of the general public. This individual is a person who resides near SRS, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from SRS operations. Calculations are performed using the EPA's CAP88-PC model (EPA, 1992).

The dose received by the MEI and the collective population dose are tabulated in Table 4.8.11-1. As shown in that table, the highest potential dose to the MEI from liquid releases in 2005 was estimated at 0.08 millirem. This dose is 0.08 percent of the DOE Order 5400.5 ("Radiation Protection of the Public and the Environment") 100-millirem all-pathway dose standard for annual exposure and is 11 percent less than the 2004 dose of 0.09 millirem. Approximately 57

percent of the 2005 dose to the MEI resulted from the ingestion of cesium-137, mainly from the consumption of fish, and about 32 percent resulted from the ingestion (via drinking water) of tritium. In 2005, the collective dose from SRS liquid releases was estimated at 2.5 person-rem. This is 19 percent less than the 2004 collective dose of 3.1 person-rem (SRS 2006c).

In 2005, the estimated dose from atmospheric releases to the MEI was 0.05 millirem, which is 0.5 percent of the DOE Order 5400.5 air pathway standard of 10 millirem per year. This dose is slightly less than the 2004 MEI dose of 0.06 millirem. Tritium oxide releases accounted for 66 percent of the dose to the MEI, and iodine-129 emissions accounted for 10 percent of the dose. No other radionuclide accounted for more than 5 percent of the MEI dose. The major pathways contributing to the dose to the MEI from atmospheric releases were inhalation (43 percent) and the consumption of vegetation (41 percent), cow milk (10 percent), and meat (4 percent). In 2005, the collective dose was estimated at 2.5 person-rem, which is less than 0.01 percent of the collective dose received from natural sources of radiation (about 214,000 person-rem). Tritium oxide releases accounted for about 68 percent of the collective dose. The 2005 collective dose is 14 percent less than the 2004 collective dose of 2.9 person-rem (SRS 2006c).

**Table 4.8.11-1 — Radiation Doses to the Public from Normal SRS Operations in 2004
(Total Effective Dose Equivalent)**

Members Of the Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual
Offsite MEI (mrem)	10	0.05	4	0.08	100	0.13
Population within 50 miles ^b (person-rem)	None	2.5	None	2.5	None	5.0

^a The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10-mrem/yr limit from airborne emissions is required by the *Clean Air Act* (40 CFR 61) and the 4-mrem/yr limit is required by the *Safe Drinking Water Act* (40 CFR 141). For this EIS, the 4-mrem/yr value is conservatively assumed to be the limit for the sum of doses from all liquid pathways. The total dose of 100 mrem/yr is the limit from all pathways combined. If the potential collective dose to the offsite population exceeds the 100 person-rem value, the contractor operating the facility would be required to notify DOE.

^b 50-mile population is approximately 808,000 based on 2000 census data
Source: SRS 2006c.
mrem=millirem

SRS workers receive the same dose as the general public from background radiation, but they also may receive an additional dose from working in facilities with nuclear materials. The current DOE worker exposure limit is 5,000 millirem per year, and the SRS administrative control level for the whole body is 500 millirem per year. SRS worker doses have typically been well below DOE worker exposure limits.

As shown in Table 4.8.11-2, the average radiation dose recorded for workers at SRS in 2005 was 51.4 millirem (SRS 2006c). The cumulative dose to all workers at SRS from operations in 2001 was 121.3 person-rem. These doses fall within the radiological regulatory limits of 10 CFR 835.

Table 4.8.11-2 – Radiation Doses to Workers From Normal SRS Operations in 2005 (Total Effective Dose Equivalent)

Occupational Personnel	Standard	Actual
Average radiation worker dose (mrem)	5,000 ^a	51.4
Collective radiation worker dose ^b (person-rem)	None	121.3

^a DOE’s goal is to maintain radiological exposure as low as is reasonably achievable. The SRS Administrative Control Level (ACL) for 2001 was 800 mrem.

^b There were 2,360 workers with measurable doses in 2005.

Source: SRS 2006c.

4.8.11.1.2 Non-Radiological

In 2004, the annual air compliance inspection was conducted in two phases—the first phase by both SCDHEC and EPA as part of a multimedia inspection and the second by the SCDHEC District Air manager. During these inspections, all SRS permitted sources were found to be in compliance with their respective permit conditions and limits, and all required reports were determined to have been submitted to SCDHEC within specified time limits (SRS 2006c).

Under existing regulations, SRS is not required to conduct onsite monitoring for ambient air quality; however, the site is required to show compliance with various air quality standards. To accomplish this, air dispersion modeling was conducted during 2004 for new emission sources or modified sources as part of the sources’ construction permitting process. The modeling analysis showed that SRS air emission sources were in compliance with applicable regulations (SRS 2006c).

4.8.12 Transportation

SRS is surrounded by a system of interstate highways, U. S. highways, state highways, and railroads. The regional transportation network services the 4 South Carolina counties (Aiken, Allendale, Bamberg, and Barnwell) and 2 Georgia counties (Columbia and Richmond) that generate nearly all of the SRS commuter traffic. Figure 4.8.12.1–1 shows the regional transportation infrastructure.

I-20 serves the SRS region, providing the primary east-west corridor. I-520 provides a loop around Augusta, Georgia. Truck shipments to (or from) the SRS or from (or to) other DOE sites normally enter the region from the west on I-20. In Augusta, Georgia, the trucks typically take I-520 to the Georgia/South Carolina border where U.S. 278 and S.C. 125 route the trucks into site at the Jackson Gate.

There are 6 principal access roads to the site: 3 from the north (S.C. 125, S.C. 57, and S.C. 19) and 3 from the east and south (S.C. 125, S.C. 64, and S.C. 39). The eastern and southern accesses are from rural areas and do not bear a large fraction of the SRS commuting traffic. Those from the north, however, provide access to SRS from the metropolitan areas surrounding Augusta, Georgia, and Aiken and North Augusta, South Carolina. The traffic on these access roads can be heavy at times, with a significant contribution from SRS traffic. The average commute is assumed to be a 20 mile round trip, with an average occupancy of 1.5 passengers per car. Information is based on best data available.

Transportation of Surplus Plutonium to SRS

DOE will ship plutonium materials compliant with the DOE-STD-3013 in 3013 packages inside Type B shipping containers (e.g., 9975 containers) from Hanford, LLNL, and LANL to KAMS at SRS using safe secure trailers (SST). DOE will ship unirradiated FFTF fuel from Hanford to SRS in Type B shipping packages (e.g., the Hanford Un-irradiated Fuel Package) in SSTs. At KAMS, the 9975 containers will be received and stored; the 3013 packages will not be removed from the 9975 shipping containers. The Type B shipping packages containing the unirradiated FFTF fuel will be stored in the K-Area complex at SRS.

In the *Surplus Plutonium Disposition (SPD) EIS* (DOE/EIS-0283, 1999), DOE estimated that normal (incident-free) transportation operations could result in 0.024 latent cancer fatalities (LCF) among transportation workers and 0.034 LCF in the total affected population over the duration of the transportation activities. In preparing the SPD EIS, DOE used a dose conversion factor of 5×10^{-4} deaths per rem of dose to the affected population. Currently, DOE recommends a dose conversion factor of 6×10^{-4} deaths per rem. Using the currently recommended dose conversion factor, the estimated risk would be about 0.029 LCF among transport workers and about 0.041 LCF in the total affected population.

In addition, DOE estimated that 0.019 non-radiological fatalities could occur as a result of vehicular emissions. DOE also estimated the impacts of accident scenarios, and in all cases the risk of a fatality is less than one. No accidents occurred during shipment of the RFETS plutonium to the SRS.

4.8.12.1 *Aircraft Operations*

Aiken Municipal Airport serves Aiken and Aiken County and is owned by the city of Aiken. This airport is approximately 5 miles from Aiken and provides general aviation services. The nearest commercial airport is Augusta Regional Airport in Augusta, Georgia, approximately 35 miles from Aiken. Augusta Regional Airport and Columbia Metropolitan Airport in Columbia, South Carolina, approximately 60 miles from Aiken, receive jet air passenger and cargo service from both national and local carriers. There also are numerous smaller private airports located in Aiken and surrounding areas.

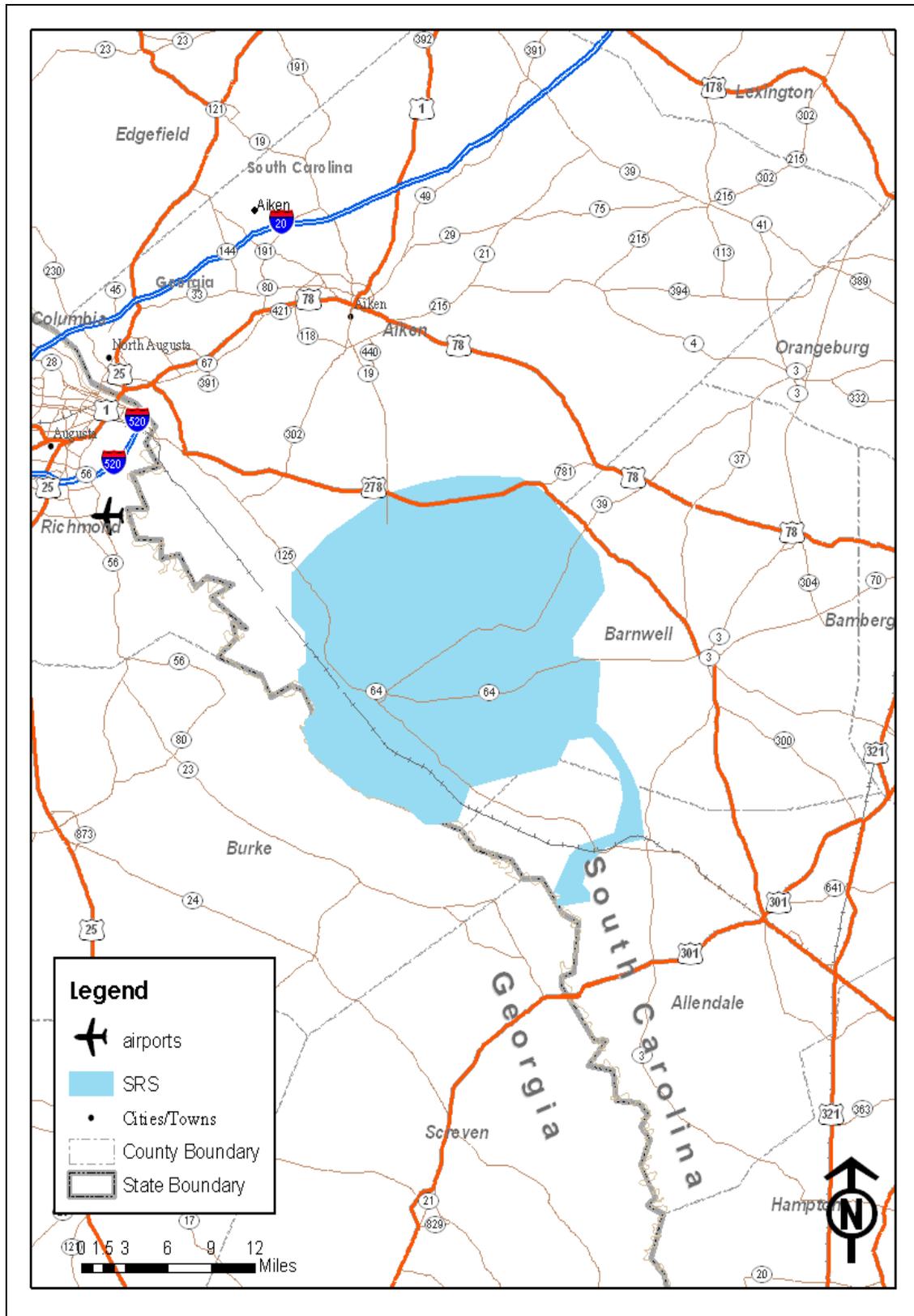


Figure 4.8.12-1 — Roads in the Vicinity of the SRS

4.8.13 Waste Management

SRS manages spent nuclear fuel, high-level waste (HLW), LLW, MLLW, TRU waste, hazardous waste, sanitary solid waste, low-level wastewater, and sanitary sewage. Table 4.8.13–1 provides the routine waste generation rates at SRS. Table 4.8.13–2 summarizes the waste management capabilities at SRS.

Each operation at SRS has the goal of identifying and implementing measures that minimize waste and prevent pollution. Pollution prevention is integral to the SRS Environmental Management System. SRS's Pollution Prevention Program establishes the preference of source reduction and recycling over treatment, storage, and disposal. Accomplishment during 2004 included completion of 51 pollution prevention projects, resulting in an annualized avoidance of 9,277 cubic yards of waste, with an accompanying cost avoidance of \$41.5 million (SRS 2006c).

SRS is also engaged in cleanup and decommissioning and demolition projects. SRS is responsible for cleaning up more than 500 waste and groundwater units to reduce risk and protect human health and the environment. In 2004, SRS had completed more than 300 of the units. By 2025, all inactive SRS waste sites that pose a risk to human health or the environment will be remediated and controlled, and contaminated surface and groundwater will be remediated, in remediation, or closely monitored. Across the site, there are about 6,000 buildings, encompassing about 10 million square feet. D&D work is expected to continue until about 2025 (SRS 2006c).

4.8.13.1 *Low-Level Waste*

DOE uses a number of methods for treating and disposing of LLW at SRS, depending on the waste form and activity. Some LLW that is not technically or economically suitable for disposal at SRS is shipped to the NTS or the Energy Solutions Disposal Facility in Utah for disposal (DOE 2002a). SRS completed disposing of its legacy LLW in 2005 (SRS 2006c).

4.8.13.2 *Mixed Low-Level Waste*

Storage facilities for MLLW are located in several SRS areas (see Table 4.8.13-2). These facilities are dedicated to solid, containerized, or bulk liquid waste and all are approved under RCRA as interim status or permitted facilities, or as CWA-permitted tank systems.

SRS is utilizing offsite permitted vendors for MLLW treatment and disposal. In 2005, 343 cubic yards were shipped offsite for disposal (SRS 2006c). In December 2005, the NTS received a RCRA permit that would allow disposal of mixed waste generated at other DOE sites (DOE 2006). SRS plans to dispose of mixed waste at the NTS. Mixed waste not suitable for existing treatment and disposal facilities will continue to be stored at SRS, while DOE pursues treatment options.

4.8.13.3 *High-Level Waste*

SRS continues to manage approximately 36 million gallons of HLW in 49 underground tanks. The waste separates into 2 parts, sludge that settles on the bottom of the tank containing most of the radioactivity and a watery supernate that occupies the area above the sludge. The supernate is volume reduced by an evaporator. As the concentrated supernate cools, salts precipitate and form a solid salt cake (SRS 2006c).

Sludge is transferred to the Extended Sludge Processing Facility where it is washed to reduce the concentration of sodium salts. The washed sludge is then processed in the Defense Waste Processing Facility (DWPF) where it is vitrified with glass frit and sealed in stainless steel canisters. The sealed canisters will be stored at SRS until a federal repository is available.

The salt cake and concentrated supernate will be processed in the Salt Waste Processing Facility. The start of radioactive operations is planned for 2011. In order to ensure that tank space is available to operate the DWPF, the Modular Caustic Side Solvent Extraction Unit and the Actinide Removal Process will be used for salt waste processing until a full-scale facility is operational.

4.8.13.4 *Transuranic Waste*

DOE TRU waste is to be disposed of at the WIPP in New Mexico. SRS stores transuranic waste from past DOE onsite and offsite operations on concrete pads. In 2001, SRS initiated its program to re-package TRU waste and ship it to the WIPP. DOE uses a vendor for the inspection, characterization, and shipment of TRU waste. The vendor's equipment was set up on TRU Pads 3 and 4 and began operations in 2001 using three mobile systems; a real-time radiography trailer, nondestructive assay trailer, and drum headspace gas sampling system. After inspection/characterization of the waste is completed, a mobile loading unit places the drums into Transuranic Package Transporter (TRUPACT-II) containers for transport. The vendor processes are supported by the SRS Visual Examination Facility located on Pad 6 (Washington SRC 2006).

4.8.13.5 *Hazardous Waste*

At present, DOE stores hazardous wastes in three buildings and on three pads that have RCRA permits. SRS hazardous waste streams consist of a variety of materials, including mercury, chromate, lead, paint solvents, and various laboratory equipment. Hazardous waste is sent to offsite treatment and disposal facilities. DOE also plans to continue to recycle, reuse, or recover certain hazardous wastes, including metals, excess chemicals, solvents, and chlorofluorocarbons (DOE 2002a).

4.3.13.6 *Nonhazardous Solid Waste*

SRS sanitary waste volumes have declined due to increased recycling and the decreasing workforce. DOE sends sanitary waste that is not recycled or reused to the Three Rivers Regional Landfill located on SRS (DOE 2002a). It is expected that the level of sanitary waste at SRS could increase in the next several years.

The construction and demolition debris generated by SRS operations is disposed of at a planned facility.

4.3.13.7 Waste Generation

Average annual amounts of waste generated from normal operations at SRS are listed in Table 4.8.13-1.

Table 4.8.13-1 — Annual Routine Waste Generation from SRS Operations (m³)

Waste type	1996	1997	1998	1999	2000	2001
Transuranic	165	119	61.9	42.4	54	64.1
Low-level	5,780	6,620	6,520	4,970	5,220	4,610
Mixed	452	286	463	402	290	380
Hazardous ^a	57.0	55.0	177	26.5	30.8	45.3
Sanitary ^b	2,780	2,770	2,640	1,760	1,550	1,560

^aHazardous waste reported in metric tons.

^bFrom DOE 2002o (1996 data) and DOE's Central Internet Database. Sanitary waste reported in metric tons.
Source: DOE 2002o.

4.8.13.8 Waste Management Facilities

Facilities at SRS used for the management of hazardous and nonhazardous waste are listed in Table 4.8.13-2.

Table 4.8.13-2 — Waste Management Facilities at SRS

Facility Name/Description	Capacity	Status	Waste Type							
			High-level	Spent fuel	Low-level	Mixed	TRU	Hazardous	Non-hazardous solid	Sanitary sewage
Treatment Facility (cubic meters per year)										
TRU waste characterization/certification		Operational					X			
Saltstone Manufacturing and Disposal Facility		Operational			X	X				
Defense Waste Processing Facility		Operational	X							
Extended Sludge Processing Facility		Operational	X							
Modular Caustic Side Solvent Extraction Unit		Planned	X							
Salt Waste Processing Facility		Planned	X							
Effluent Treatment Facility		Operational			X	X				
Centralized Sanitary Wastewater Treatment Facility		Operational								X
Waste Sort Facility		Operational			X					
Supercompacter Facility		Operational			X					
Storage Facility (cubic meters)										
Hazardous Waste Storage Facility	2,956 ^a	Operational							X	
Mixed Waste Storage Building 643-29E	504 ^a	TBD				X				
Mixed Waste Storage Building 643-43E	1,651 ^a	TBD								
Mixed Waste Storage Building 316-M	117 ^a	TBD								
TRU Waste Pads 1-19	15,257 ^a	Operational					X			
Long-lived waste storage buildings	140 ^a	Operational								
Glass waste storage buildings (number of canisters)	TBD	Operational	X							
SRTC Mixed Waste Storage Tanks	198 ^a	TBD				X				

Table 4.8.13-2 — Waste Management Facilities at SRS (continued)

Facility Name/Description	Capacity	Status	Waste Type							
			High-level	Spent fuel	Low-level	Mixed	TRU	Hazardous	Non-hazardous solid	Sanitary sewage
Storage Facility (cubic meters) (continued)										
Liquid Waste Solvent Tanks S33-S36	454 ^a	TBD				X				
F-Area Tank Farm		Operational	X							
H-Area Tank Farm		Operational	X							
Disposal Facility										
E-Area shallow land disposal trenches		Operational			X					
E-Area low-activity waste vaults	30,500 ea. ^a	Operational			X					
E-Area intermediate-activity waste vaults	5,300 ea. ^a	Operational			X					
Saltstone Manufacturing and Disposal Facility	80,000 per vault ^a	Operational	X							
Three Rivers Landfill		Operational							X	

^aSource: DOE 2002a.

4.9 Y-12 SITE

The Oak Ridge Reservation (ORR) was established in 1943 as one of the three original Manhattan Project sites, and includes the Y-12 Site, the Oak Ridge National Laboratory (ORNL), and the East Tennessee Technology Park (ETTP). Most of ORR lies within the corporate limits of the city of Oak Ridge, Tennessee. The ORR is bordered on the north and east by the city of Oak Ridge and on the south and west by the Clinch River/Melton Hill Lake impoundment. ORR is approximately 15 miles west of Knoxville, Tennessee. The ORR covers approximately 35,000 acres in Oak Ridge, TN (Figure 4.9-1).

Y-12 is the primary site for enriched uranium (EU) processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile. Y-12 is unique in that it is the only source of secondaries, cases, and other weapons components within the Complex. Y-12 also dismantles weapons components, safely and securely stores and manages SNM, supplies SNM for use in naval and research reactors, and disposes surplus materials. Y-12's nuclear nonproliferation programs play a critical role in securing our Nation and the globe by combating the spread of weapons of mass destruction by removing, securing, and dispositioning special nuclear threats. Other activities at Y-12 are not defense-related, and include environmental monitoring, remediation, and D&D activities; management of waste materials from past and current operations; research activities operated by ORNL; and support of other Federal agencies.

4.9.1 Land Resources

4.9.1.1 Onsite Land Uses

DOE classifies land use on the ORR according to five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives (LMER 1999b). Remote sensing data from 1994 showed 70 percent of the ORR in forest cover while 20 percent was transitional, consisting of old fields, agricultural areas, cutover forest lands, roadsides, and utility corridors (LMER 1999a). Less than 2 percent of ORR is still open agricultural fields. The finer textured soils of the Armuchee-Montellallo-Hamblen association have been designated as prime farmland when drained.

As shown on Figure 4.9.1-1, the main area of Y-12 is largely developed and encompasses approximately 800 acres, nearly 600 of which are enclosed by perimeter security fences. The main site, which has restricted access, is roughly 2.5 miles in length and 0.5 mile wide. At the end of FY 2005, real property included 440 buildings and other structures with a floor area of approximately 7.1 million square feet. While NNSA is the site landlord and is responsible for approximately 74 percent of the floor space (5.3 million square feet), other DOE program offices have responsibility for the remaining 26 percent. DOE's Offices of Science and Nuclear Energy own approximately 1.2 million square feet, and the Office of Environmental Management (EM) owns approximately 0.6 million square feet (NNSA 2007c). As a result of the site's defense support, manufacturing, and storage facilities, the land in the Y-12 area is classified as industrial.

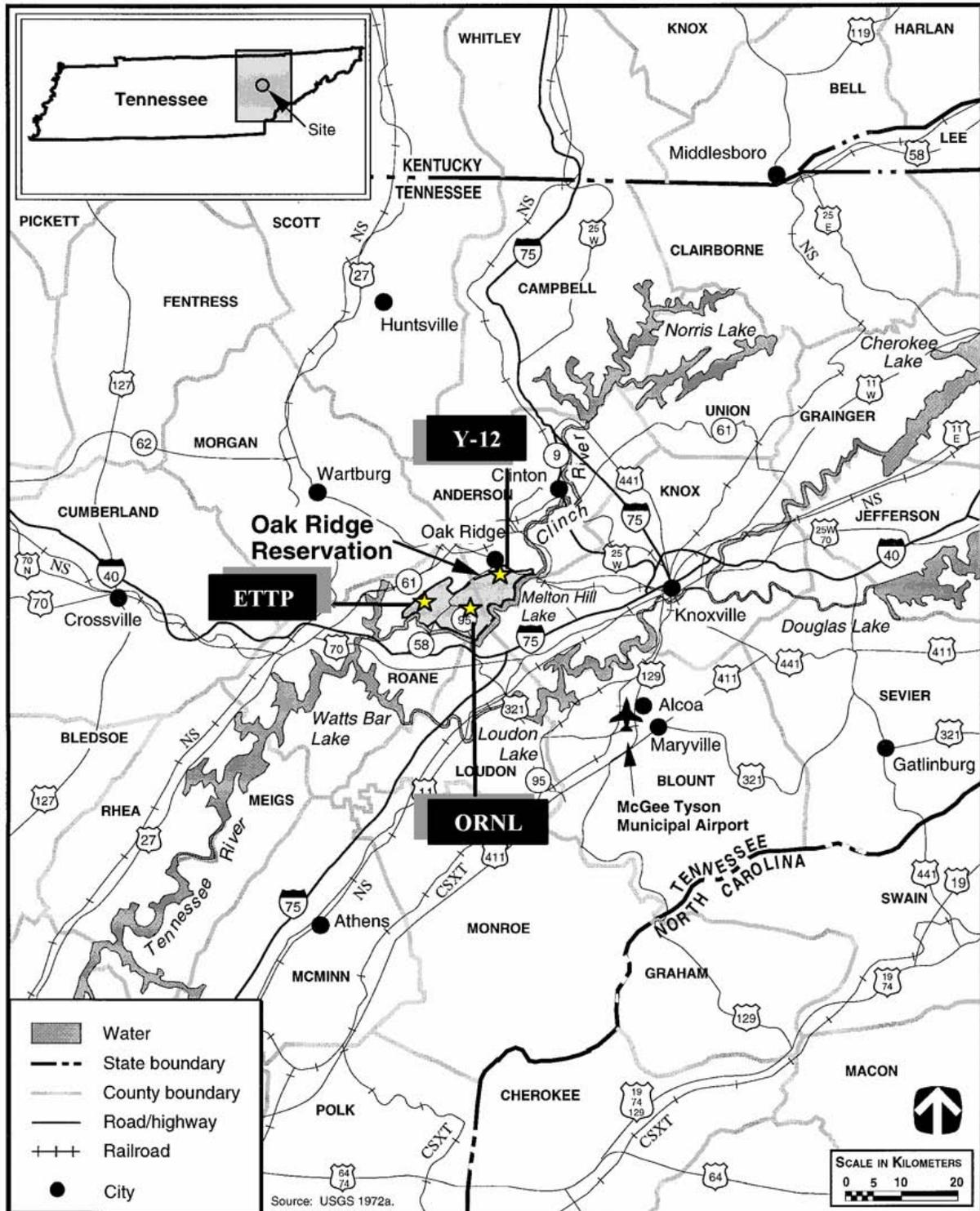


Figure 4.9- 1 — Location of the Y-12 Site

The eastern portion of Y-12 is occupied by Lake Reality and the former New Hope Pond (now closed), maintenance facilities, office space, training facilities, change houses, and former ORNL Biology Division facilities. The far western portion of Y-12 consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions of the Y-12 Site encompass the high-security portion, which supports core NNSA missions.

4.9.1.2 *Surrounding Land Uses*

The city of Oak Ridge lies within the Great Valley of Eastern Tennessee between the Cumberland and Great Smoky Mountains and is bordered on two sides by the Clinch River. The Cumberland Mountains are 10 miles to the northwest; and the Great Smoky Mountains are 32 miles to the southeast (Figure 4.2-1).

Lands bordering ORR and Y-12 are predominantly rural and are used primarily for residences, small farms, forest land, and pasture land. The city of Oak Ridge, Tennessee, has a typical urban mix of residential, public, commercial, and industrial land uses. It also includes almost all of ORR. The residential section of Oak Ridge forms the northern boundary of the reservation. There are four residential areas along the northern boundary of ORR, several of which have houses located within 98 ft of the site boundary.

4.9.2 **Visual Resources**

The landscape at ORR is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. The vegetation is dominated by deciduous forest mixed with some coniferous forest. The majority of the original open field space at the site has been planted in shortleaf and loblolly pine, although smaller areas have been planted in a variety of deciduous and coniferous trees. The viewshed, which is the extent of the area that may be viewed from the ORR, consists mainly of rural land. The city of Oak Ridge is the only adjoining urban area. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake, and the bluffs on the opposite side of the Clinch River. Views are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric conditions. Some partial views of the city of Oak Ridge Water Treatment Plant facilities, located at Y-12, can be seen from the urban areas of the city of Oak Ridge.

Y-12 is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night, making them especially visible. However, structures at Y-12 are mostly low profile, reaching heights of three stories or less, and built in the 1940s of masonry and concrete. The tallest structure is the meteorological tower erected in 1985 located on the west end of the Complex. There was also an east tower constructed in 1985 but has since been removed. Although the west tower only reaches a height of 197 feet, it is actually higher in elevation than the east tower was. There are no visible daytime plumes over Y-12 (DOE 2001a).

The Scarboro Community is the closest developed area to Y-12 (approximately 0.6 mile), and is located to the north of Y-12. However, as a result of their separation by Pine Ridge, Y-12 is not visible from the Scarboro Community (DOE 2001a).

For the purpose of rating the scenic quality of Y-12 and surrounding areas, the BLM Visual Resources Management Classification System (Table 4.9.2-1) was used. Although this classification system is designed for undeveloped and open land managed by BLM, this is one of the only systems of its kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12; however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

Table 4.9.2-1 — BLM Visual Resource Management Rating System

Class	Objective
Class I	To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention
Class II	To retain the existing character of the landscape. The level of change to the characteristic landscape should be low
Class III	To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
Class IV	To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Source: BLM 1980.

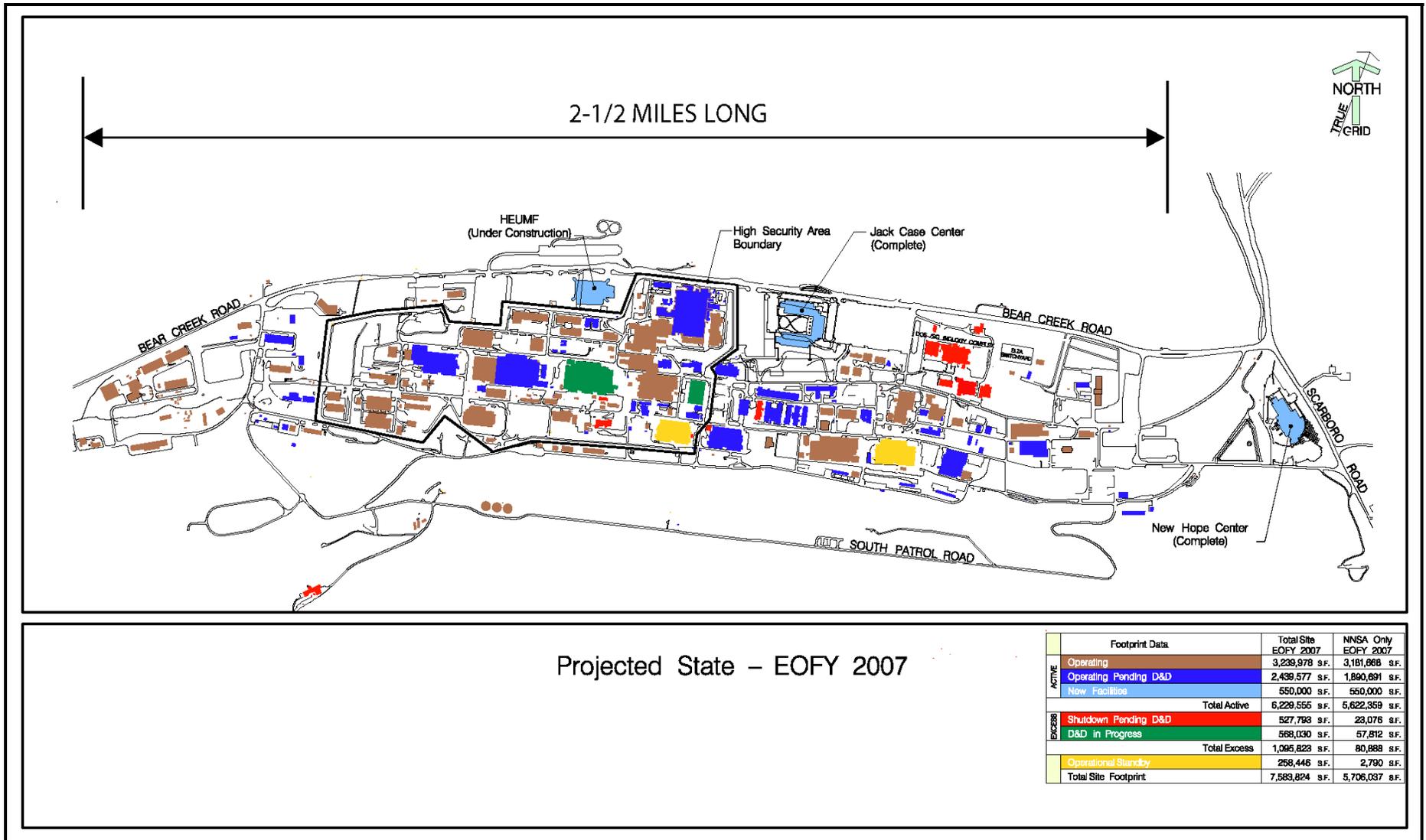


Figure 4.9.1-1 — Y-12 Site Map

4.9.3 Site Infrastructure

An extensive network of existing infrastructure supports Y-12 facilities and activities. Site infrastructure available at Y-12 includes an extensive roads and railroad system; electric power provided by the Tennessee Valley Authority (TVA); natural gas supplied by the East Tennessee Natural Gas Company and Sigcorp Energy Services; steam; raw, treated, demineralized, and chilled water; sanitary sewer; industrial gases; and telecommunications. The baseline characteristics of these systems are presented in Table 4.9.3-1.

Table 4.9.3-1 — Baseline Characteristics for Y-12 Site

Characteristics	Current Value	Site Capacity
Land		
Area (acres)	800	800
Roads (miles)	65	65
Railroads (miles)	4	4
Electrical		
Energy consumption (MWh/yr)	349,251	3,766,800
Available capacity (MWe)	40	390
Steam		
Generation	1.5 billion lbs/yr	1.7 billion lbs/yr at 500°
Water		
Treated Water Usage (gallons/yr)	2,000,000	Not limited

Source: BWXT 2002.

4.9.3.1 Electricity

Electric power is supplied by TVA and is distributed throughout the Y-12 Site via three 161-kilovolt (kV) overhead radial feeders; these, in turn, feed eleven 13.8-kV distribution systems consisting of high-voltage transformers, switch gear, and 15-kV feeder cables; and the 13.8-kV feeders distribute power to approximately 400 distribution transformers located throughout the Y-12 Site. In addition, there is one 161-kV interconnecting overhead header. Thirteen 13.8-kV distribution systems ranging in size from 20 megavolt ampere (MVA) to 50 MVA are located within many Y-12 buildings. Each system consists of a high-voltage outdoor transformer with indoor switchgear, 15-kV feeder cables, power distribution transformers, and auxiliary substation equipment. There are more than 30 miles of overhead electrical lines on Y-12 and more than 10 miles of underground cables (BWXT 2002).

4.9.3.2 Water

Raw water for ORR is obtained from the Clinch River south of the eastern end of Y-12 and pumped to the water treatment plant located on the ridge northeast of Y-12. Ownership and operation of the treated water system was transferred from DOE to the city of Oak Ridge in April 2000. The water treatment plant can deliver water to two water storage reservoirs at a potential rate of 24 million gallons per day. Water from the reservoirs is distributed to the Y-12 Plant, ORNL, and the city of Oak Ridge. Separate underground piping systems provide distribution of raw and treated water within Y-12. Raw water is routed to Y-12 by two lines: a 16-inch main from the booster station, installed in 1943, and an 18-inch main from the 24-inch filtration plant feed line. The raw water system has approximately 5 miles of pipes with diameters ranging from

4 inch to 18 inch. The primary use of the raw water is to maintain a minimum flow of 7 million gallons/day in the East Fork Poplar Creek (EFPC). Treated water is routed to Y-12 by three lines: one 24-inch main and two 16-inch mains. The total treated water system contains approximately 19 miles of pipe ranging in size from 1 inch to 24 inches in diameter. The treated water system supplies water for fire protection, process operations, sanitary sewerage requirements, and boiler feed at the steam plant. Treated water usage at Y-12 averages 4.2 million gallons/day or 1,538 million gallons/year.

4.9.3.3 *Natural Gas*

Sigcorp Energy Services supplies natural gas to ORR and Y-12. Natural gas, which is used for furnaces, the Y-12 Steam Plant, and laboratories, is supplied via a pipeline from the East Tennessee Natural Gas Company at "C" Station located south of Bethel Valley Road near the eastern end of Y-12. A 14-inch, 125-psig line is routed from "C" Station to the southwest corner of the Y-12 perimeter fence. From this point, an 8-inch line feeds the steam plant and a 6-inch branch line serves the process buildings and laboratories on the eastern end of Y-12. The western end of Y-12 is served by 4-inch and 2-inch headers that are fed from the steam plant line. Two pressure-reducing stations reduce the gas pressure from 125 pounds per square inch gauge (psig) to 25 psig and 35 psig, respectively. The gas pressure is further reduced and the flow metered at each use point (BWXT 2002).

4.9.4 *Air Quality and Noise*

4.9.4.1 *Air Quality*

4.9.4.1.1 *Meteorology and Climatology*

Oak Ridge lies in a valley between the Cumberland and Great Smoky Mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are located about 10 miles to the northwest; and the Great Smoky Mountains are 32 miles to the southeast (DOE 2005a). The ROI specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The mean annual temperature for the Oak Ridge area is 57.6°F. Local winters consist of migratory cyclones that produce significant precipitation events every 3 to 5 days. The coldest month is usually January with an average temperature of about 36.7°F and low temperatures that occasionally drop as low as -23.8°F. Summers are characterized by warm, humid conditions. July is typically the hottest month of the year with an average temperature of about 77.4°F and high temperatures that occasionally exceed 100°F. In the course of a year, the average difference between the maximum and minimum daily temperatures is 22.7°F. Average temperature in 2004 was 59.7°F (DOE 2005a).

The 30-year annual average precipitation is 55 inches which includes about 9.6 inches of snowfall. Precipitation in the region is greatest in the winter months, December through February. Precipitation in the spring exceeds the summer rainfall, but the summer rainfall may be locally heavy because of thunderstorm activity. The driest periods generally occur during the fall months when high-pressure systems are most frequent (DOE 2005a).

4.9.4.1.2 Ambient Air Quality

The ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207, and Y-12 is completely within Anderson County. The EPA has designated Anderson County as a basic non-attainment area for the 8-hour ozone standard, as part of the larger Knoxville basic 8-hour ozone non-attainment area that encompasses several counties; and for PM_{2.5} based on a revision to the standards (EPA 2005a). For all other criteria pollutants for which EPA has made attainment designations, existing air quality in the greater Knoxville and Oak Ridge areas is in attainment with the NAAQS.

Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by the EPA, the Tennessee Department of Environment and Conservation (TDEC) Division of Air Pollution Control, and DOE Orders. Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne emissions satisfy all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed on the ORR include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role to regulate emissions (DOE 2005a).

Concentration of regulated pollutants observed during 1999 at locations near the ORR are presented in Table 4.9.4-1. Sample results show that the ORR operations have an insignificant effect on local air quality (DOE 2005a).

The primary source of criteria pollutants at Y-12 is the steam plant, where coal and natural gas are burned. In fact, more than 90 percent of the Y-12 pollutant emissions to the atmosphere are attributed to the operation of the steam plant (DOE 2005a). However, actual emissions from the steam plant are well below allowable emissions.

Radiological Air Emissions

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs as a result of plant production, maintenance, and waste management activities. Atmospheric emissions of radionuclides from DOE facilities are limited by EPA regulations found under NESHAP regulations (40 CFR Part 61, Subpart H), which have been delegated to TDEC for implementation. All three ORR facilities are operated in accordance with the Tennessee regulatory dose limits for HAPs for Radionuclides and have met all emission and test procedures. The NESHAP establishes a dose limit of 10 millirem per year for any member of the public. The total 2004 dose to the MEI from the Y-12 activities was 0.4 millirem (DOE 2005a). Details on the annual radionuclide compliance modeling and other NESHAP that cover asbestos and specific source categories on the ORR are reported in the 2004 *Oak Ridge Reservation Annual Site Environmental Report* (DOE 2005a).

Table 4.9.4-1 — Comparison of Baseline Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines at Y-12/Oak Ridge Reservation

Pollutant	Averaging Time	Maximum standard (g/m ³)	Measured Concentration (g/m ³)
SO ₂	3-hr	1,700.3	520.2 ¹
	24-hr	477.4	61.6 ²
	Annual	104.6	13.7 ²
PM ₁₀	Annual ¹	65.4	33.2 ²
	24-Hour ²	150	100.6 ¹
PM _{2.5}	Annual ¹	19.6	No Data
	24-Hour ²	85	63 ¹
CO	1-hr	52,280	16,615
	8-hr	13,070	5,867 ²
Ozone	1-hr	307.1	294 ¹
	8-hr	205.2	246 ¹
NO ₂	Annual	130.7	19.7 ¹
Lead	Calendar quarterly mean	2.0	0 ¹
Gaseous Flourides (as HF)	30-day	1.6	No Data
	7-day	2.1	0.1 ¹
	24-hr	3.8	No Data
	12-hr	4.8	No Data

Source: DOE 2000a.
1= TDEC 2005c.
2= DOE 2001a.

An estimated 0.01 curies (2.17 kilograms) of uranium was released into the atmosphere in 2004 as a result of Y-12 activities. The specific activity of enriched uranium is much greater than that of depleted uranium, and about 80 percent of the curies release was composed of emissions of enriched uranium particulate, even though approximately 6 percent of the total mass of uranium released was enriched material (DOE 2005a).

The TDEC also conducts a perimeter air monitoring program on the ORR using low volume air samplers. Surveillance of airborne radionuclides includes measurement of ambient levels of alpha-, beta-, and gamma-emitting radionuclides and tritium. This program, in conjunction with associated air monitoring programs, provides information used to assess the impact of DOE activities on the local environment and public health. In the program, samples are collected biweekly from twelve air monitors stationed near the boundaries of the reservation and at a background location (i.e., Fort Loudoun Dam). Each sample is analyzed for gross alpha and gross beta radiation at the state radiochemistry laboratory. A composite sample from each location is analyzed annually for gamma emitters. Results from the perimeter monitoring stations are compared to the background measurements and environmental standards provided in the CAA. The data for 2004 did not indicate a significant impact on local air quality from activities on the reservation (TDEC 2005a).

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. NESHAP regulations for radionuclides require continuous emission sampling of major sources (a “major source” is considered to be any emission point that potentially can contribute more than 0.1 millirem per year estimated dose equivalent to an off-site individual). During 2004, 42 of the 55 stacks suitable for continuous monitoring were judged to be major

sources. Eighteen of the stacks with the greatest potential to emit significant amounts of uranium are equipped with alarmed breakthrough detectors, which alert operations personnel to process-upset conditions or to a decline in filtration-system efficiencies, allowing them to investigate and correct the problem before a significant release occurs. As of January 1, 2004, Y-12 had continuous monitoring capability on a total of 55 stacks, 46 of which were active and 9 of which were temporarily shut down. Emissions from unmonitored process and laboratory exhausts, categorized as minor emission sources, are estimated according to calculation methods approved by the EPA. In 2004, there were 46 unmonitored processes operated by Y-12. These are included as minor sources in the Y-12 source term (DOE 2005a).

4.9.4.2 *Noise*

The acoustic environment along the Y-12 site boundary, in rural areas, and at nearby residences away from traffic noise, is typical of a rural location with a Day-Night Average Sound Level (DNL) in the range of 35 to 50 adjusted dBA. Areas near the Y-12 site within Oak Ridge are typical of a suburban area, with a DNL in the range of 53 to 62 dBA. Traffic is the primary source of noise at the Y-12 site boundary and at residences located near roads. During peak hours, the Y-12 worker traffic is a major contributor to traffic noise levels in the area (DOE 2001a).

Major noise emission sources within Y-12 include various industrial facilities, and equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so that noise levels at the boundary from these sources are not distinguishable from background noise levels. Within the Y-12 site boundary, noise levels from Y-12 mission operations are typical of industrial facilities, ranging from 50 to 70 dBA (DOE 2001a).

4.9.5 **Water Resources**

4.9.5.1 *Surface Water*

Within the Y-12 area, the two major surface water drainage basins are those of Bear Creek and East Fork Poplar Creek (EFPC). The upper reaches of the EFPC drain the majority of the industrial facilities at Y-12. The in-plant portion of EFPC has been designated as upper EFPC (UEFPC). EFPC, which discharges into Poplar Creek east of the ETTP, flows northeast along the south side of Y-12. Various Y-12 wastewater discharges to the UEFPC from the late 1940s to the early 1980s left a legacy of contamination, such as mercury, PCBs, and uranium that has been the subject of water quality improvement initiatives over the past 22 years (DOE 2005a).

The Clinch River is the source of potable water for Oak Ridge, which provides potable water for Y-12 and ORNL. The Clinch River has an average flow of 4,662 cubic feet per second as measured at the downstream side of Melton Hill Dam at mile 23.1. The average flow of Bear Creek near Y-12 is 3.88 cubic feet per second. Base flow without augmentation in UEFPC, measured downstream of Y-12 averages 45.9 cubic feet per second. Y-12 uses approximately 2,000 million gallons per year of water while the ORR uses approximately twice as much. The

ORR water supply system, which includes the city of Oak Ridge treatment facility and the ETPP treatment facility, has a capacity of 11,715 million gallons per year (DOE 2005b).

Clinch River water levels in the vicinity of the ORR are regulated by a system of dams operated by the TVA. Melton Hill Dam controls the flow of the Clinch River along the northeast and southeast sides of the ORR. Watts Bar Dam, located on the Tennessee River downstream of the lower end of the Clinch River, affects the flow of the Clinch River along the southeast side of the ORR.

4.9.5.1.1 Surface Water Quality

The streams and creeks of Tennessee are classified by TDEC and defined in the State of Tennessee Water Quality Standards. Classifications are based on water quality, designated uses, and resident aquatic biota. The Clinch River is the only surface water body on the ORR classified for domestic water supply. Most of the streams at the ORR are classified for fish and aquatic life, livestock watering, wildlife, and recreation. White Oak Creek and Melton Branch are the only streams not classified for irrigation, while portions of Poplar Creek and Melton Branch are not classified for recreation.

There are seven wastewater treatment facilities which operate under NPDES permits at Y-12. Another facility known as Big Spring Water Treatment Facility began operation in 2005 as an interim remedial action to remove mercury under a CERCLA Record of Decision. Sanitary and certain industrial wastewaters are permitted for discharge to the City of Oak Ridge wastewater collection and treatment systems.

The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. While stormwater, groundwater, and wastewater flows may contribute contaminants to UEFPC, the water quality and ecological health of this stream has greatly improved over the last 20 years. This is primarily due to rerouting of discharge pipes, construction and operation of wastewater treatment facilities, dechlorination of process waters, and other ongoing environmental protection activities at Y-12.

Among the three hydrogeologic regimes at Y-12, the UEFPC regime contains most of the known and potential sources of surface water contamination. Surface water contaminants in UEFPC include metals (particularly mercury and uranium), organics, and radionuclides (especially uranium isotopes). Water quality in Bear Creek is influenced significantly by a groundwater hydraulic connection either directly to Bear Creek or to tributaries of Bear Creek. Contaminants in Bear Creek, from multiple formerly used waste ponds, burial trenches and pits, include nitrates, metals (e.g., uranium), radionuclides (e.g., uranium isotopes, technetium), and chlorinated organics (DOE 2005a).

The current Y-12 NPDES permit requires sampling, analysis, and reporting for approximately 90 outfalls. Currently, Y-12 has outfalls and monitoring points in the following water drainage areas: EFPC, Bear Creek, and several unnamed tributaries on the south side of Chestnut Ridge. These creeks and tributaries eventually drain to the Clinch River. Routine surface water surveillance monitoring, above and beyond that required by the NPDES permit, is performed as a

best management practice. Monitoring is conducted at Station 17, in EFPC, near the junction of Scarboro and Bear Creek roads. A 1999 TDEC consent order mandates management of mercury concentrations in EFPC. DOE has been unable to achieve an interim guideline of 5 grams per day, averaged over 3 months (DOE 2005a).

More than 6,000 surface water samples were collected in 2004. As shown in Table 4.9.5-1, comparisons with the Tennessee water quality criteria indicate that only mercury, cadmium, zinc and copper from samples collected at Station 17 were detected above the criteria maximum (DOE 2005a). Of all the parameters measured in the surface water as a best management practice, mercury is the only demonstrated contaminant of concern (DOE 2005a).

Table 4.9.5-1 — Surface Water Surveillance Measurements Exceeding Tennessee Water Quality Criteria at Y-12, 2004

Parameter Detected	Location	Number Of samples	Concentration (milligrams per liter)			Water quality criteria (milligrams per liter)	Number exceeding criteria
			Detection limit	Max	Avg		
Cadmium	Station 17	149	0.01	0.0128	<0.01	0.0039	1
Copper	Station 17	149	0.02	0.0504	<0.02	0.0177	2
Mercury	Station 17	398	0.0002	0.0081	<0.0005	0.000051	284
Zinc	Station 17	149	0.05	0.216	<0.05	0.177	1
Mercury	Station 304	12	0.0002	0.0081	<0.0005	0.000051	1

Source: DOE 2005a.

Additionally, TDEC conducts an ambient surface water monitoring program that monitors 26 sites semi-annually for the purpose of detecting possible contamination from DOE sites. The sampling data set up a baseline for comparison to previous sampling events. In the case of an unplanned release or an accident, the sampling data may help to reflect the amount and extent of the pollution. Samples were analyzed for *Escherichia coli*, Enterococcus, ammonia, chemical oxygen demand, dissolved residue, NO₃ & NO₂ nitrogen, suspended residue, total hardness, total kjeldahl nitrogen, total phosphate, arsenic, cadmium, copper, iron, lead, manganese, mercury, chromium, and zinc. The water quality of the Clinch River and the tributaries sampled is good. Lab results indicate that there is no threat to human health or wildlife. (TDEC 2005b).

4.9.5.1.2 Surface Water Rights and Permits

In Tennessee, the state's water rights are codified in the *Water Quality Control Act*. In effect, the water rights are similar to riparian rights in that the designated uses of a body of water cannot be impaired. The only requirement to withdraw from surface water would be a TDEC Chapter 1200-5-8 Water Registration Requirement, and the USACE and TVA permits to construct intake structures.

4.9.5.2 Groundwater

Y-12, bound on the north by Pine Ridge and on the south by Chestnut Ridge, is located near the boundary between the Knox Aquifer and the ORR aquitards. The ORR aquitards underlie Pine Ridge and Bear Creek Valley, which contains the main plant area of Y-12 and the disposal

facilities of western Bear Creek Valley. The Knox Aquifer underlies Chestnut Ridge and the stream channels of Bear Creek and the UEFPC. Bedrock formations comprising the aquitards are hydraulically upgradient of the aquifer, which functions as a hydrologic drain in Bear Creek Valley. Fractures provide the principal groundwater flowpaths in both the aquifer and aquitards. Dissolution of carbonates in the aquifer has enlarged fractures and produced solution cavities and conduits that greatly enhance its hydraulic conductivity relative to the aquitards.

4.9.5.2.1 Groundwater Quality

More than 200 sites have been identified at Y-12 that represent known or potential sources of contamination to the environment as a result of past waste management practices. Because of that contamination, extensive groundwater monitoring is performed to comply with regulations and DOE orders. Compliance requirements were met by the monitoring of 254 wells and 51 surface water locations, springs, and one building sump. Historical monitoring efforts have shown that four types of contaminants have affected groundwater quality at Y-12: nitrate, VOCs, metals, and radionuclides. Of those, nitrate and volatile organic compounds are the most widespread. Some radionuclides, particularly uranium and technetium, are significant, principally in the Bear Creek regime and the western and central portions of the UEFPC regime. Trace metals, the least extensive groundwater contaminants, generally occur in the unconsolidated zone close to sources of contamination due to their typically low solubility in groundwater (DOE 2005a).

Nitrate concentrations in groundwater at Y-12 exceed the 10 milligrams per liter drinking water standard in a large part of the western portion of the UEFPC regime. The extent of the nitrate plume is defined in the unconsolidated and shallow bedrock zones. An increasing trend in nitrate concentrations at monitoring wells in the eastern portion of Y-12 has been observed. This increase possibly indicates that the nitrate plume in the Maynardville Limestone has migrated into the eastern area of Y-12 from the S-2 and/or the S-3 sites. Historical results from monitoring wells in near source areas indicate generally decreasing trends (DOE 2005a).

Concentrations of barium, cadmium, chromium, lead, nickel, thallium, and uranium exceeded drinking water standards during 2004 in samples collected from various monitoring wells and surface water locations downgradient of the S-2 Site, the S-3 Site, the Salvage Yard, and throughout the complex. Elevated concentrations of these metals in groundwater were most commonly observed from monitoring wells in the unconsolidated zone. Concentrations of uranium exceed the standard (0.03 milligrams per liter) in a number of source areas (e.g., production areas, the Uranium Oxide Vault, and the Former Oil Skimmer Basin) and contribute to the uranium concentration in the UEFPC (DOE 2005a).

Groundwater concentrations of trace metals exceeded regulatory standards during 2004 at three locations. Concentrations above the drinking water standard for nickel were observed in samples from one monitoring well. Two surface water monitoring stations showed elevated concentrations of arsenic. Nickel concentrations above the drinking water standard (0.1 milligrams per liter) were observed from one well at the Industrial Landfill IV (DOE 2005a).

In CY 2004, gross alpha activities were above the drinking water standard of 15 picocuries per liter at only one monitoring station. One of the 2 samples obtained from the surface water monitoring location upgradient of the Filled Coal Ash Pond wetlands slightly exceeded the standard. Gross beta activities were below the screening level of 50 picocuries per liter at all monitoring stations except at a monitoring well at the United Nuclear Corporation site. This location has consistently exceeded the screening level since August 1999.

4.9.5.2.2 Groundwater Availability

Groundwater at Y-12 is divided into three hydrogeologic regimes, which are delineated by surface water drainage patterns, topography, and groundwater flow characteristics. The regimes are further defined by the waste sites they contain. These regimes include the Bear Creek Hydrogeologic Regime, the UEFPC Hydrogeologic Regime, and the Chestnut Ridge Hydrogeologic Regime.

Recharge occurs over most of the area but is most effective where overburdened soils are thin or permeable. Groundwater flow in the aquitard and the aquifer is primarily parallel to bedding planes. There are no Class I sole-source aquifers that lie beneath the ORR. All aquifers are considered Class II aquifers, current potential sources of drinking water. Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at the ORR.

4.9.6 Geology and Soils

ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion along fault traces, consist of less-resistant shales and shale-rich carbonates (DOE 2001a).

The topography within the ORR ranges from a low of 750 feet above mean sea level (AMSL) along the Clinch River to a high of 1,260 feet AMSL along Pine Ridge. Within the ORR, the topographic relief between the valley floors and ridge crests is generally about 300 to 350 feet (DOE 2001a).

4.9.6.1 Geology

Several geologic formations are present in the ORR area. The Rome Formation, which is present north of Y-12 and forms Pine Ridge, consists of massive to thinly bedded sandstones interbedded with minor amounts of thinly bedded, silty mudstones, shales, and dolomites. In the ORR area, the stratigraphic thickness of the Rome Formation is uncertain because of the displacement caused by the White Oak Mountain Thrust Fault. The Conasauga Group, which underlies Bear Creek Valley, consists primarily of calcareous shales, siltstone, and limestone. The Knox Group, which is present immediately south of Y-12, can be divided into five formations of dolomite and limestone, which have all been identified at the ORR. The Knox Group, which underlies Chestnut Ridge, is estimated to be approximately 2,400 feet thick. The

Knox Group weathers to a thick, orange-red, clay residuum that consists of abundant chert and contains karst features (DOE 2001a).

Y-12 is located within Bear Creek Valley, which is underlain by Middle to Late Cambrian strata of the Conasauga Group (see Figure 4.5.2–1). The Conasauga Group consists primarily of highly fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the site area. The upper part of the group is mainly limestone, while the lower part consists mostly of shale (LMER 1999a).

Y-12 is situated on carbonate bedrock such that groundwater flow and contaminant transport are controlled by solution conduits in the bedrock. These karst features, including large fractures, cavities, and conduits, are most widespread in the Maynardville Limestone and the Knox Group. These cavities and conduits are often connected and typically found at depths greater than approximately 1000 feet (DOE 2001a).

Karst features are dissolutional features occurring in carbonate bedrock. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to caves large enough for a person to walk into. Numerous surface indications of karst development have been identified at ORR. Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst and overflow springs, accessible caves, and numerous sinkholes of varying size. In general, karst appears most developed in association with the Knox Group carbonate bedrock, as the highest density of sinkholes occurs in this group (DOE 2001a).

Unconsolidated materials overlying bedrock in the UEFPC watershed include alluvium (stream-laid deposits), colluvium (material transported downslope), man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite (a transitional mixture of fine-grained residuum and bedrock remains), and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 40 feet. In the undeveloped areas of Y-12, the saprolite retains primary texture features of the unweathered bedrock including fractures.

4.9.6.2 *Soils*

Y-12 is located in Bear Creek Valley at the eastern boundary of the ORR. Bear Creek Valley lies on well to moderately well-drained soils underlain by shale, siltstone, and silty limestone. Developed portions of the valley are designated as urban land. Soil erosion from past land uses has ranged from slight to severe. Erosion potential is very high in those areas that have been eroded in the past with slopes greater than 25 percent. Erosion potential is lowest in the nearly flat-lying permeable soils that have a loamy texture. Additionally, shrink-swell potential is low to moderate and the soils are generally acceptable for standard construction techniques (DOE 2001a).

Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskingum associations (DOE 2001a). Due to extensive cut-and-fill grading during the construction of Y-12, very few areas within the UEFPC watershed have a sequence of natural soil horizons. Soil erosion due to past land use has ranged from slight to severe.

4.9.6.3 *Seismology*

The Oak Ridge area lies in seismic Zones 1 and 2 of the Uniform Building Code, indicating that the probability of a strong earthquake occurrence is low. Y-12 is cut by many inactive faults formed during the late Paleozoic Era and there is no evidence of capable faults in the immediate area of Oak Ridge, as defined by 10 CFR Part 100 (surface movement within the past 35,000 years or movement of a recurring nature within the past 500,000 years). The nearest capable faults are approximately 300 miles west of the ORR in the New Madrid Fault zone. Since the New Madrid earthquakes of 1811 to 1812, at least 26 other earthquakes with a Modified Mercalli Intensity (MMI) of III to VI have been felt in the Oak Ridge area, the majority of these having occurred in the Valley and Ridge Province. One of the closest and most intense seismic events to the ORR occurred in 1930; its epicenter was 5 miles from the ORR with an MMI of V at the site (DOE 2001a).

The largest recent earthquake in eastern Tennessee registered 4.6 on the Richter scale and occurred on November 30, 1973, in Maryville, Tennessee, about 32 kilometers (20 miles) southeast of ORR. This earthquake produced an MMI of V to VI at ORNL (as estimated at HFIR) (DOE 2000f). The region has continued to be seismically active, with 55 earthquakes recorded within a radius of 100 kilometers (62 miles) of ORNL since 1973. The closest of those events occurred on June 17, 1998, with an epicenter within ORR, registering a magnitude 3.6 (USGS 2005d).

4.9.7 **Biological Resources**

This section describes ecological resources at ORR including terrestrial and aquatic resources, threatened and endangered (T&E) species, and floodplains and wetlands. Information for Y-12 is also included.

4.9.7.1 *Terrestrial Resources*

The ORR is mostly contiguous native eastern deciduous forest. Forested areas are found throughout the reservation. Local plantlife is characteristic of the intermountain regions of central and southern Appalachia; pine and pine-hardwood forest and oak-hickory forest are the most extensive plant communities found at the ORR (DOE 2001a). The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout the ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests. Over 1,100 vascular plant species are found on the ORR (ORNL 2002). Animal species found on the ORR include approximately 59 species of amphibians and reptiles; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals (DOE 2001a). Less than 2 percent of the ORR remains as open agricultural fields (ORNL 2002).

At ORR, DOE has set aside large tracts of land for conservation, including approximately 3,000 acres set-aside in April 2005. This conservation land is located on the western end of the ORR and features mature forests, wetlands, river bluffs, cliffs and caves and is home to several rare species. Another conservation easement is Parcel G which contains a palustrine emergent/scrub-shrub wetland system totaling approximately 3.4 acres.

Within the fenced, developed portion of Y-12, grassy and unvegetated areas surround the entire facility. Building and parking lots dominate the landscape at Y-12, with limited vegetation present. Fauna within the Y-12 area is limited due to the lack of large areas of natural habitat. Aquatic habitat on or adjacent to the ORR ranges from small, free-flowing streams in undisturbed watersheds to larger streams with altered flow patterns due to dam construction. These aquatic habitats include tailwaters, impoundments, reservoir embayments, and large and small perennial streams. Aquatic areas within the ORR also include seasonal and intermittent streams (DOE 2001a).

4.9.7.2 Wetlands and Floodplains

4.9.7.2.1 Wetlands

Approximately 600 acres of wetlands have been identified on the ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands (DOE 2005a). Most occur at low elevation primarily in riparian zones of headwater streams and their receiving streams. A wetlands survey of the Y-12 area found palustrine, scrub/shrub, and emergent wetlands. An emergent wetland was found at the eastern end of Y-12, at a seep by a small tributary of EFPC, between New Hope Cemetery and Bear Creek Road. Eleven small wetlands have been identified north of Bear Creek Road in remnants of the UEFPC. A relatively undisturbed, forested wetland was identified in the stream bottomland of Bear Creek Tributary 1, between Bear Creek Road and the powerline right-of-way (LMES 1997).

4.9.7.2.2 Floodplains

A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. The TVA has conducted floodplain studies along the Clinch River, Bear Creek, and EFPC. Eastern Portions of Y-12 lie within the 100- and 500-year floodplains of EFPC.

4.9.7.3 Aquatic Resources

Sixty-four fish species have been collected on or adjacent to the ORR. Fish species representative of the Clinch River in the vicinity of the ORR include shad and herring (Clupeidae), common carp (*Cyprinus carpio*), catfish and bullheads (Ictaluridae), bluegill (*Lepomis macrochirus*), crappie (*Pomoxis* spp.), and freshwater drum (*Aplodinotus grunniens*) (ORNL 1981a). The most important fish species taken commercially in the ORR area are common carp and catfish. Commercial fishing is permitted on the Clinch River downstream from Melton Hill Dam (TWRA 1995). Recreational species consist of crappie, largemouth bass (*Micropterus salmonides*), sauger (*Stizostedion canadense*), sunfish (*Lepomis* spp.), and catfish. Sport fishing is not permitted within the ORR.

4.9.7.4 Threatened and Endangered Species

Forty-five Federal- or state-listed threatened, endangered, and other special status species have been identified on the ORR; however none have been observed at Y-12. Among these, 20

Federal- or state-protected vertebrate species have been confirmed in recent surveys (Table 4.9.7-1) (ORNL 2002). State threatened and endangered species observed on the ORR include 22 plants, 1 mammal, and 2 raptor species (DOE 2005a). A number of rare or state-listed animals and plants are present in the vicinity of Y-12. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act*, exists on the ORR (DOE 2001a). There are no federally-listed threatened or endangered plant species on the ORR but 4 plant species of federal special concern have been reported from the ORR (Table 4.9.7-2).

Table 4.9.7-1 — Federal and State Listed Species Potentially Occurring at the ORR^a

Scientific name	Common name	Status ^b		
		Federal	State	PIF ^c
	Fish			
<i>Phoxinus tennesseensis</i>	Tennessee dace		NM	
<i>Cyprinella monacha</i>	Spotfin chub	T	T	
	Amphibians and reptiles			
<i>Hemidactylum scutatum</i>	Four-toed salamander		NM	
	Birds		NM	
<i>Accipiter striatus</i>	Sharp-shinned hawk		NM	
<i>Anhinga anhinga</i>	Anhinga		NM	
<i>Ardea alba</i>	Great egret		NM	
<i>curiesrcus cyaneus</i>	Northern harrier		NM	
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow			C
<i>Contopus cooperi</i>	Olive-sided flycatcher		NM	
<i>Dendroica caerulescens</i>	Black-throated blue warbler			C
<i>Dendroica cerulean</i>	Cerulean warbler		NM	C
<i>Dendroica discolor</i>	Prairie warbler			C
<i>Egretta caerulea</i>	Little blue heron		NM	
<i>Egretta thula</i>	Snowy egret		NM	
<i>Falco peregrinus</i>	Peregrine falcon	d	E	
<i>Haliaeetus leucocephalus</i>	Bald eagle	T ^e	NM	
<i>Helmitheros vermivorus</i>	Worm-eating warbler			C
<i>Hylocichla mustelina</i>	Wood thrush			C
<i>Lanius ludovicianus</i>	Loggerhead shrike		NM	
<i>Oporornis formosus</i>	Kentucky warbler			C
<i>Poocetes gramineus</i>	Vesper sparrow		NM	
<i>Protonotaria citrea</i>	Prothonotary warbler			C
<i>Seiurus motacilla</i>	Louisiana waterthrush			C
<i>Sitta pusilla</i>	Brown-headed nuthatch			C
<i>Sphyrapicus varius</i>	Yellow-bellied sapsucker		NM	
<i>Spizella pusilla</i>	Field sparrow			C
<i>Tyto alba</i>	Barn Owl			C
<i>Vermivora chrysoptera</i>	Golden-winged warbler		NM	C
<i>Vermivora pinus</i>	Blue-winged warbler			C

**Table 4.9.7- 1 — Federal and State Listed Species Potentially Occurring at the ORR^a
(continued)**

Scientific name	Common name	Status ^b		
		Federal	State	PIF ^c
<i>Myotis grisescens</i>	Gray bat	E	E	
<i>Sorex longirostris</i>	Southeastern shrew		NM	

a=Land and surface waters of the ORR exclusive of the Clinch River, which borders the ORR.

b=E = endangered T= threatened, NM = in need of management, C = birds of concern.

c=Partners in Flight.

d=The peregrine falcon was federally delisted on August 25, 1999.

e= The comment period on the 1999 proposal to remove the Bald Eagle from Endangered Species Act protection (i.e., delisting) was re-opened

Source: DOE 2005a.

Table 4.9.7-2 — Vascular Plant Species Listed by State or Federal Agencies, 2005

Species	Common name	Habitat on ORR	Status code ^e
Currently known or previously reported from the ORR			
<i>Aureolaria patula</i>	Spreading false-foxglove	River bluff	FSC, T
<i>Carex gravida</i>	Heavy sedge	Varied	S
<i>Carex oxylepis</i> var. <i>pubescens</i> ^b	Hairy sharp-scaled sedge	Shaded wetlands	S
<i>curiesmicifuga rubifolia</i>	Appalachian bugbane	River slope	FSC, T
<i>Cypripedium acaule</i>	Pink lady's-slipper	Dry to rich woods	E, CE
<i>Delphinium exaltatum</i>	Tall larkspur	Barrens and woods	FSC, E
<i>Diervilla lonicera</i>	Northern bush-honeysuckle	River bluff	T
<i>Draba ramosissima</i>	Branching whitlow-grass	Limestone cliff	S
<i>Elodea nuttallii</i>	Nuttall waterweed	Pond, embayment	S
<i>Fothergilla major</i>	Mountain witch-alder	Woods	T
<i>Hydrastis canadensis</i>	Golden seal	Rich woods	S, CE
<i>Juglans cinerea</i>	Butternut	Slope near stream	FSC, T
<i>Juncus brachycephalus</i>	Small-head rush	Open wetland	S
<i>Lilium canadense</i>	Canada lily	Moist woods	T
<i>Lilium michiganense</i> ^c	Michigan lily	Moist woods	T
<i>Liparis loeselii</i>	Fen orchid	Forested wetland	E
<i>Panax quinquefolius</i>	Ginseng	Rich woods	S, CE
<i>Platanthera flava</i> var. <i>herbiola</i>	Tuberculed rein-orchid	Forested wetland	T
<i>Populus grandidentata</i> ^a	Large-tooth aspen	Dry, woodlands	S
<i>Ruellia purshiana</i>	Pursh's wild-petunia	Dry, open woods	S
<i>Scirpus fluviatilis</i>	River bulrush	Wetland	S
<i>Spiranthes lucida</i>	Shining ladies-tresses	Boggy wetland	T
<i>Thuja occidentalis</i>	Northern white cedar	Rocky river bluffs	S
<i>Viola tripartite</i> var. <i>tripartita</i>	Three-parted violet	Rocky woods	S
Rare plants that occur near and could be present on the ORR			
<i>Agalinis auriculata</i>	Earleaf false foxglove	Calcareous barren	FSC, E
<i>Allium burdickii</i> or <i>A. tricoccom</i> ^e	Ramps	Moist woods	S, CE
<i>Berberis canadensis</i>	American barberry	Rocky bluff, creek bank	S
<i>Gnaphalium helleri</i>	Catfoot	Dry woodland edge	S
<i>Lathyrus palustris</i>	A vetch	Moist meadows	S
<i>Liatris cylindracea</i>	Slender blazing star	Calcareous barren	E
<i>Lonicera dioica</i>	Mountain honeysuckle	Rocky river bluff	S
<i>Meehanian cordata</i>	Heartleaf meehania	Moist calcareous woods	T

**Table 4.9.7-3 — Vascular Plant Species Listed by State or Federal Agencies, 2005
(continued)**

Species	Common name	Habitat on ORR	Status code ^a
<i>Pedicularis lanceolata</i>	Swamp lousewort	Calcareous wet meadow	T
<i>Pycnanthemum torrei</i>	Torrey's mountain-mint	Calcareous barren edge	S
<i>Solidago ptarmicoides</i>	Prairie goldenrod	Calcareous barren	E

FSC Federal Special Concern; formerly designated as C2. See Federal Register, February 28,1996.

E Endangered in Tennessee.

T Threatened in Tennessee.

S Special concern in Tennessee.

CE Status due to commercial exploitation.

a: Status codes:

b*Carex oxylepis* var. *pubescens* has not been observed during recent surveys.

c*Lilium michiganense* is believed to have been extirpated from the ORR by the impoundment at Melton Hill.

d*Populus grandidentata* was reported in two ORR locations in 2003. One of the reports was confirmed, but the tree died during the year. In 2004 additional trees were found in the vicinity of the dead tree.

eRamps have been reported near the ORR, but there is not sufficient information to determine which of the two species is present or if the occurrence may have been introduced by planting. Both species of ramps have the same state status.

Source: DOE 2005a.

4.9.7.5 *Biological Monitoring and Abatement Programs*

The NPDES permit issued to Y-12 in 1995 mandates a biological monitoring and abatement program with the objective of demonstrating that the effluent limitations established for the facility protect the classified uses of the receiving stream, EFPC. Mercury and PCB levels in EFPC fish have historically been elevated relative to fish in uncontaminated reference streams. Mercury concentrations remained much higher during 2004 in fish from EFPC than in fish from reference streams. Elevated mercury concentrations in fish from the upper reaches of EFPC indicate that Y-12 remains a continuing source of mercury to fish in the stream. Although concentrations have leveled off in recent years, mercury concentrations in water in UEFPC have decreased significantly over much of the last decade. In contrast, mercury concentrations in fish have remained relatively constant since the late 1980s. PCB concentrations measured in EFPC sunfish during 2004 were within ranges typical of past monitoring efforts at these sites. The health and reproductive condition of fish from sites upstream in EFPC remain lower in several respects than in fish from reference sites or downstream EFPC.

4.9.8 *Cultural and Archaeological Resources*

4.9.8.1 *Archaeological Resources*

The ORR is underlain by bedrock formations predominated by calcareous siltstones, limestones, sandstones, siliceous shales, and siliceous dolostones. The majority of geologic units with surface exposures on the ORR contain Archaeological materials. All of these Archaeological materials consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

Human occupation and use of the East Tennessee Valley between the Cumberland Mountains and the southern Appalachians is believed to date back to the Late Pleistocene, at least 14,000 years ago. Archaeologists have traditionally believed that these Paleo-Indian bands subsisted primarily by hunting the large game of that era and collecting wild plant foods.

4.9.8.2 *Historic Resources*

During the Mississippian cultural periods (900 A.D. to historic times), larger scale, permanent communities developed, first along the alluvial terraces, and later on the second river terraces in rich bottomlands suitable for intensive agriculture. These expanding villages included multiple structures, storage pits, hearths, mounds, stockades, plazas, and semisubterranean earth lodges. Archaeological evidence reflects an increasingly complex and specialized society with a high degree of organization, which included the development of elite social classes. Just prior to Euro-American contact in the late 17th century, however, there appears to have been a breakdown in the hierarchies and a scaling-back of both village size and elaborate public structures. The first Euro-Americans to visit the region were French and English traders and trappers, soon followed by permanent settlers. These newcomers introduced a variety of domesticated animals, fruit trees, food crops, beads, metal, glass, and other raw materials and derived products to the native inhabitants, now known as the Overhill Cherokee. After a series of conflicts, most of the Cherokee were forcibly relocated to the Oklahoma Territory in 1838. Small, close-knit, agricultural communities developed and continued until 1942 when 58,575 acres were purchased by the U.S. government as a military reservation. To contribute to the development of nuclear weapons for the World War II effort, three production facilities (including Y-12) and a residential townsite were built inside the reservation. New facilities were constructed on the ORR after the War and new missions continued through the Cold War period to the present.

Approximately 90 percent of the ORR has been surveyed, on a reconnaissance level, for prehistoric and historic archaeological resources. Less than 5 percent has been intensely surveyed. To date, over 44 prehistoric sites and 254 historic sites, including 32 cemeteries, have been recorded within the current boundaries of the ORR. Fifteen prehistoric sites and 35 historic archaeological resources are considered eligible for listing on the NRHP (Souza 1997).

A total of 248 properties were individually recorded and evaluated, and the remaining 325 facilities were identified and categorized by use. At least 10 major archaeological reconnaissance-level surveys have been conducted on the ORR. Y-12 contains only one known archaeological site. A survey conducted of Y-12 in the early 1990s identified one archeological site (40AN68) which is located on a flat rise overlooking the EFPC within the boundaries of Y-12. This site is of an ephemeral nature and is not eligible for inclusion in the NRHP pursuant to 36 CFR Part 60.4 (DuVall and Associates 1999). It was concluded that the potential is low for identifying significant archeological sites within Y-12 proper which meet the criteria for inclusion in the NRHP. All buildings and structures in Y-12 have been surveyed and evaluated.

While no cultural resources at Y-12 are currently listed on the NRHP, Y-12 has 76 existing historic properties (Figure 4.9.4-1) (NNSA 2005c). The Tennessee State Historic Preservation Officer (SHPO) has concurred with this determination (Thomason and Associates 2003). The district and its contributing properties are eligible under Criterion A for its historical associations with the Manhattan Project, development as a nuclear weapons component plant within the post-World War II scientific movement, and early nuclear activities. The historic district is also eligible under Criterion C for the engineering merits of many of the properties and their contributions to science.

There are at least 32 cemeteries located within the boundaries of the ORR, 7 of which are located on the Y-12 site. These cemeteries are associated with Euro-American use of the area prior to World War II and are likely to have religious or cultural importance to descendants and the local community (DOE 2001a). All are currently maintained and protected. No other traditional, ethnic, or religious resources have been identified on the Y-12 site.

4.9.8.3 *Native American Resources*

Ancestors of the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the Y-12 area. Procedures for consulting with the Cherokee regarding traditional cultural places are in place. No Native American traditional use areas or religious sites are known to be present on the Y-12 site. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the Y-12 site (DOE 2001a).

4.9.9 **Socioeconomic Resources**

Socioeconomic characteristics addressed at Y-12 include employment, regional economy, and population, housing, and community services. Socioeconomic characteristics are presented for a ROI. The ROI was identified based on the distribution of residences for current Y-12 employees. The ROI is defined as those counties where approximately 90 percent of the workforce lives.

Y-12 is located in Anderson County, Tennessee. Statistics for socioeconomic characteristics are presented for the ROI, a region consisting of Anderson, Knox, Loudon, and Roane Counties. Figure 4.9.9-1 presents a map of the counties composing the Y-12 ROI.

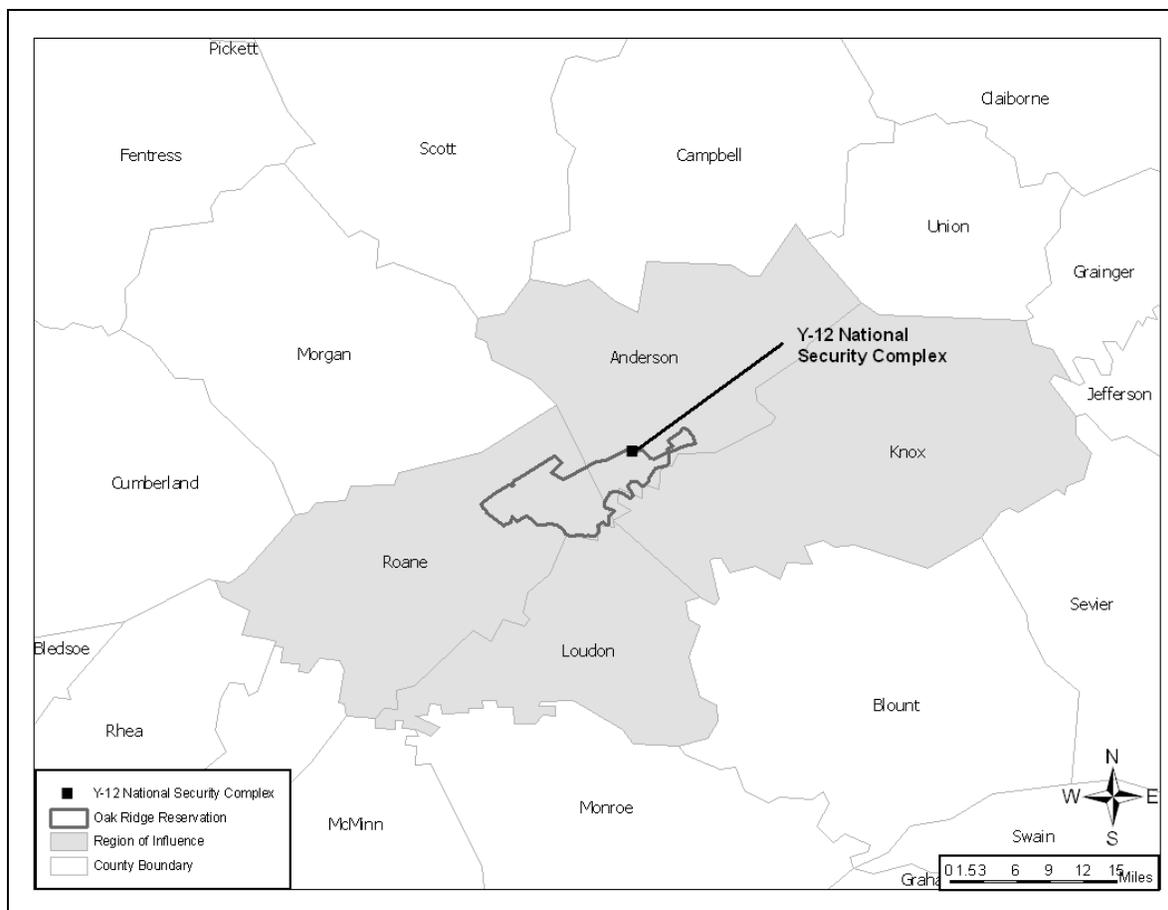


Figure 4.9.9-1 — Region of Influence for Y-12

4.9.9.1 *Employment and Income*

Labor force statistics are summarized in Table 4.9.9-1. The available labor force (e.g., those greater than 16 years old and capable of work) of the ROI grew by approximately 6 percent from 280,986 in 2000 to 297,049 in 2005. The overall ROI employment experienced a growth rate of 4.6 percent with 271,363 in 2000 to 283,721 in 2005 (BLS 2007).

The ROI unemployment rate was 4.5 percent in 2005 and 3.4 percent in 2000. In 2005, unemployment rates within the ROI ranged from a low of 4.2 percent in Knox County to a high of 5.8 percent in Roane County. The unemployment rate in Tennessee in 2005 was 5.6 percent (BLS 2007).

Table 4.9.9-1 — Labor Force Statistics for ROI and Tennessee

	ROI		Tennessee	
	2000	2005	2000	2005
Civilian Labor Force	280,986	297,049	2,871,539	2,920,400
Employment	271,363	283,721	2,756,498	2,758,184
Unemployment	9,623	13,328	115,041	162,216
Unemployment Rate (percent)	3.4	4.5	4.0	5.6

Source: BLS 2007.

Income information for the Y-12 ROI is provided in Table 4.9.9-2. Roane County is at the low end of the ROI with a median household income in 2004 of \$38,172 and a per capita income of \$26,447. Loudon County, at the high end of the ROI, had a median household income of \$45,595 in 2004. Knox County, at the high end fo the ROI, had a per capita income of \$31,417 in 2004 (BEA 2007).

Table 4.9.9-2 — Income Information for the Y-12 ROI, 2004

	Per capita income (dollars)	Median household income (dollars)
Anderson	28,055	38,954
Knox	31,417	41,618
Loudon	29,554	45,595
Roane	26,447	38,172
Tennessee	29,641	38,945

Source: BEA 2007.

4.9.9.2 *Population and Housing*

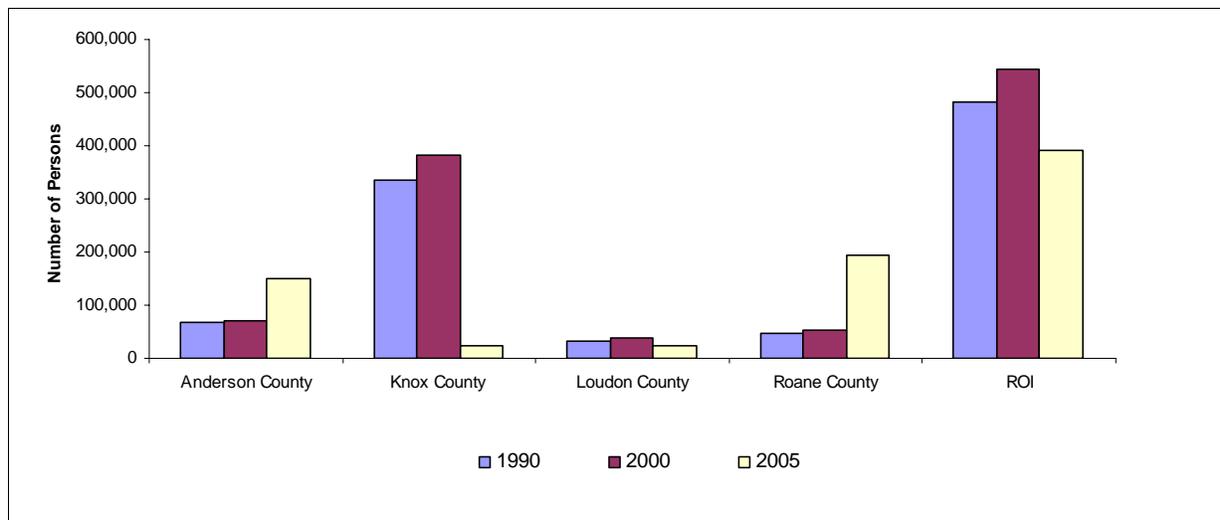
The ROI is used to analyze the primary economic impacts on population and housing. Table 4.2.9-3 presents historic and projected population in the ROI and the state.

Table 4.9.9-3 — Historic and Projected Population

Region	1990	2000	2005	2010	2020
Anderson County	68,250	71,330	72,518	76,000	79,275
Knox County	335,749	382,032	405,355	404,666	432,866
Loudon County	31,255	39,086	43,411	44,941	50,238
Roane County	47,227	51,910	52,753	54,433	58,113
ROI	482,481	544,358	574,037	580,040	620,492
Tennessee	3,486,703	4,012,012	5,885,597	6,062,695	6,593,194

Source: USCB 2007.

Between 1990 and 2000, the ROI population increased 13 percent from 482,481 in 1990 to 544,358 in 2000. From 2000 to 2005, the population of the ROI increased 5 percent to 574,037 in 2005. Loudon County experienced the largest population growth within the ROI between 2000 and 2005 with an increase of 10 percent. Anderson County experienced an increase of 2 percent (USCB 2007). Figure 4.9.9-2 presents the trends in population within the Y-12 ROI.



Source: USCB 2007.

Figure 4.9.9-2 — Trends in Population for the Y-12 ROI, 1990-2005

Table 4.9.9-4 lists the total number of housing units and vacancy rates in the ROI. In 2000, the total number of housing units in the ROI was 244,537 with 224,796 occupied (91.9 percent). There were 156,219 owner-occupied housing units and 68,577 rental units. The median value of owner-occupied units in Loudon County was the greatest of the counties in the Y-12 ROI (\$97,300). The vacancy rate was the lowest in Loudon County (7.7 percent) and the highest in Roane County (9.3 percent) (USCB 2007).

Table 4.9.9-4 — Housing in the Y-12 ROI, 2000

	Total Units	Occupied housing Units	Owner Occupied Units	Renter Occupied Units	Vacant units	Vacancy Rate (percent)	Median value of Owner Occupied Units (dollars)
Anderson County	32,452	29,780	21,592	8,188	2,671	8.2	87,500
Knox County	171,439	157,872	105,562	52,310	13,567	7.9	98,500
Loudon County	17,277	15,944	12,612	3,332	1,333	7.7	97,300
Roane County	23,369	21,200	16,453	4,747	2,169	9.3	86,500
ROI	244,537	224,796	156,219	68,577	19,740	8.1	95,619

Source: USCB 2007.

4.9.9.3 Community Services

Community services analyzed in the ROI include public schools, law enforcement, fire suppression and medical services. There are 7 school districts with 145 schools serving the Y-12 ROI. Educational services are provided for approximately 81,729 students by an estimated 5,216 teachers for the 2005 to 2006 school year (IES 2006f). The student-to-teacher ratio in these school districts ranges from a high of 18:1 in the Lenoir City School District in Loudon County to a low of 14:1 in the Oak Ridge School District. The student-to-teacher ratio in the ROI was 16:1 (IES 2006f).

The counties within the ROI employ approximately 46,000 firefighters and law enforcement officers. Security at Y-12 is provided by Wackenhut Services, Inc. (DOE 2001a). There are eleven hospitals that serve residents of the ROI with the majority located in Knox County. These hospitals have a total bed capacity of 2,195 (ESRI 2007).

4.9.10 Environmental Justice

The potentially affected area considered for environmental justice analysis is the area within a 50-mile radius of Y-12. Figure 4.9.10-1 shows counties potentially at risk from the current missions performed at Y-12. There are 19 counties that are included in the potentially affected area. Table 4.9.10-1 provides the demographic profile of the potentially affected area using data obtained from the 2000 Census.

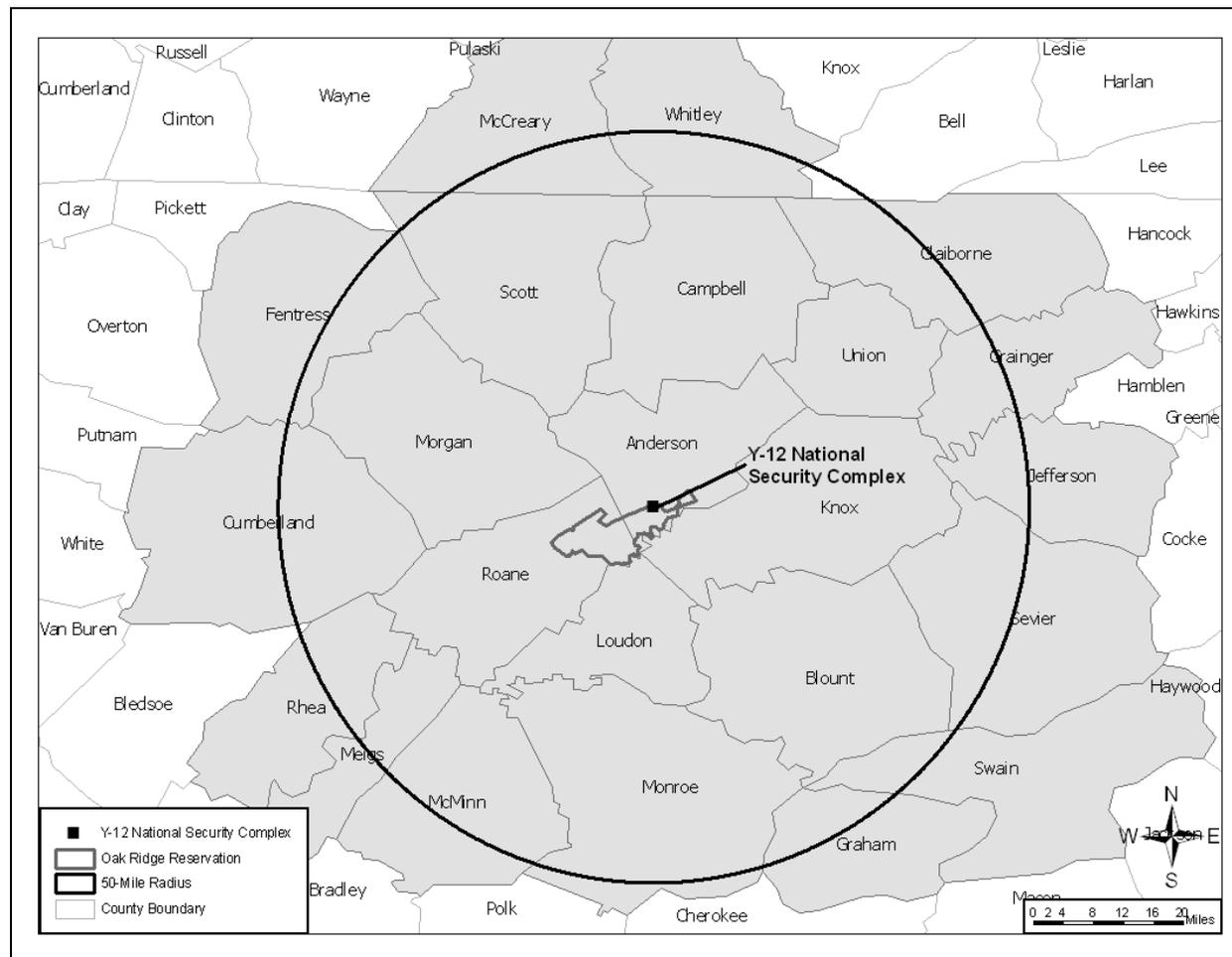


Figure 4.9.10-1 — Potentially Affected Counties Surrounding Y-12

Table 4.9.10-1 — Demographic Profile of the Potentially Affected Area Surrounding Y-12, 2000

Population Group	Population	Percent
Minority	81,942	7.4
Hispanic alone	7,115	0.6
Black or African American	46,871	4.2
American Indian and Alaska Native	3,058	0.3
Asian	8,053	0.7
Native Hawaiian and Other Pacific Islander	267	0.02
Some other race	5,185	0.5
Two or more races	11,393	1.0
White alone	1,023,659	92.6
Total Population	1,105,601	100.0

Source: USCB 2007.

In 2000, persons self-designated as minority individuals in the potentially affected area comprised 7.4 percent of the total population. This minority population is composed largely of Black or African American residents. As a percentage of the total resident population in 2000, Tennessee had a minority population of 20.8 percent and the U.S. had a minority population of 30.9 percent (USCB 2007).

Census tracts were considered low-income census tracts if the percentage of the populations living below the poverty threshold exceeded 50 percent. Based on 2000 Census data, Figure 4.9.10-3 shows low-income census tracts within the 50-mile radius where more than 50 percent of the census tracts population is living below the Federal poverty threshold.

According to 2000 census data, approximately 122,216 individuals residing within census tracts in the 50-mile radius of Y-12 were identified as living below the Federal poverty threshold, which represents approximately 13 percent of the census tracts population within the 50-mile radius. There were five census tracts located in Knox County with populations greater than 50 percent identified as living below the Federal poverty threshold. In 2000, 13.5 percent of individuals for whom poverty status is determined were below the poverty level in Tennessee and 12.4 percent in the U.S. (USCB 2007).

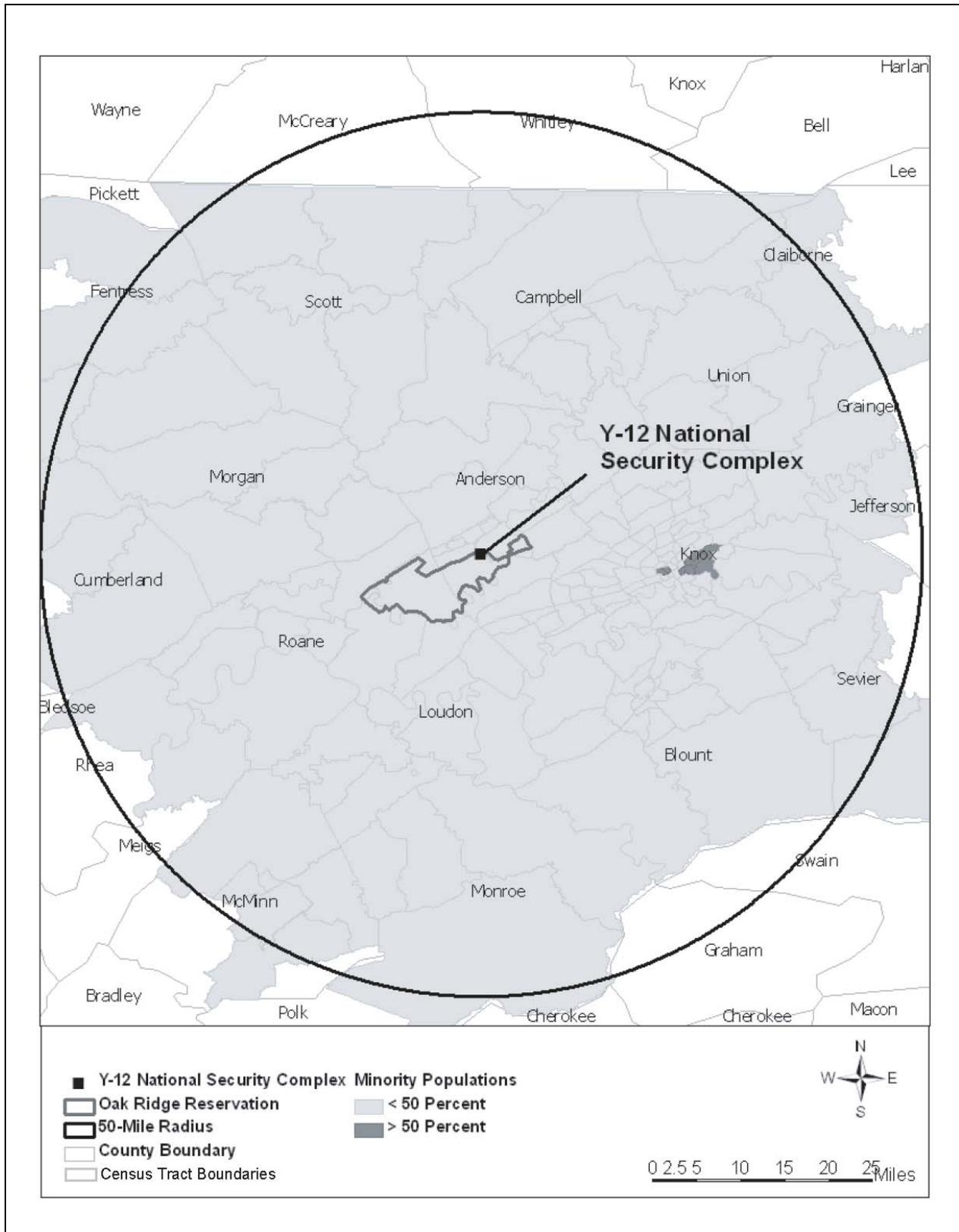


Figure 4.9.10-2 — Minority Population – Census Tracts with More than 50 Percent Minority Population in a 50-Mile Radius of Y-12

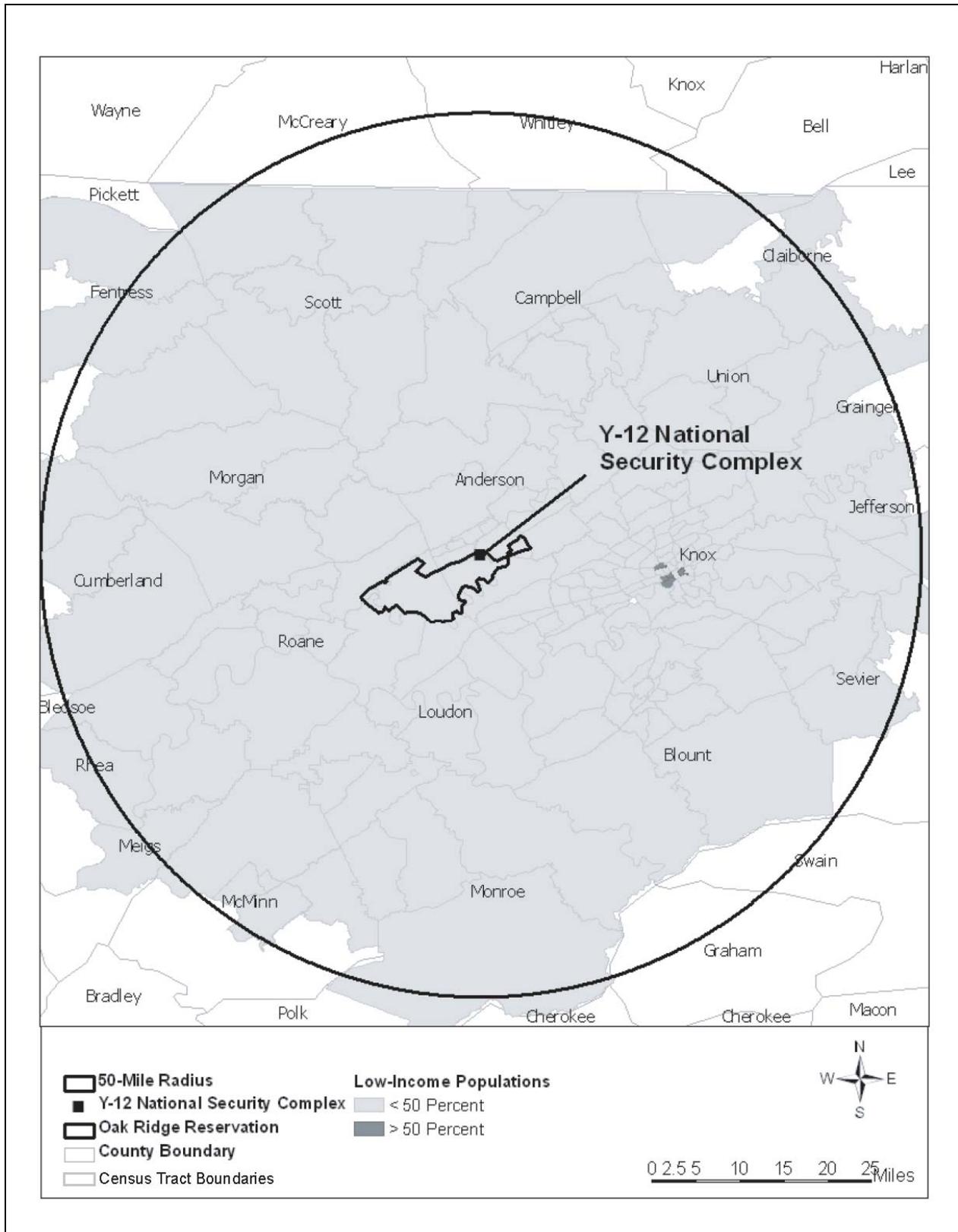


Figure 4.9.10-3 — Low-Income Population – Census Tracts with More than 50 Percent Low-Income Population in a 50-Mile Radius of Y-12

4.9.11 Health and Safety

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at Y-12. It is against this baseline that the potential incremental and cumulative impacts associated with the alternatives are compared and evaluated.

4.9.11.1 Public Health

4.9.11.1.1 Radiological

Releases of radionuclides to the environment from Y-12 operations provide a source of radiation exposure to individuals in the vicinity of Y-12. During 2005, Y-12' environmental radiological monitoring program was conducted according to DOE Orders 450.1, "Environmental Protection Program,"¹ and 5400.5, "Radiation Protection of the Public and the Environment". The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public.

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 millirem. Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to DCGs listed in Chapter III of DOE Order 5400.5. The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective dose equivalent in a year to 4 millirem. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 millirem per year. This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92.

Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual member of the general public. This individual is a person who resides near Y-12, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Plant operations. Calculations are performed using the EPA's CAP88-PC model (EPA, 1992).

The dose received by the MEI is found in Table 4.9.11-1. A hypothetical MEI could have received a total dose of about 0.4 millirem from radionuclides emitted into the atmosphere from all of the sources in the ORR in 2004. This dose is 0.4 percent of the DOE Order 5400.5 ("Radiation Protection of the Public and the Environment") 100-millirem all-pathway dose

standard for annual exposure. The standard for airborne releases is 10 millirem per year and applies to the sum of doses from all airborne pathways, e.g. inhalation, submersion in a plume, exposure to radionuclides deposited on the ground, and consumption of foods contaminated as a result of deposition of radionuclides. Inhalation and ingestion of uranium radioisotopes (i.e., U-232, U-233, U-234, U-235, U-236, and U-239) accounted for more than 99 percent of the dose.

As shown on Table 4.9.11-2, the calculated collective dose from airborne releases to the entire population within 50 miles of the ORR (about 1.1 million persons) was about 10.4 person-rem, which is approximately 0.003 percent of the 312,012 person-rem that this population received from natural sources of radiation. The contribution of Y-12 emissions to the 50-year dose the population residing within 50-miles of the ORR was calculated to be about 5.8 person-rem, which is approximately 56 percent of the collective dose for the ORR.

Table 4.9.11-1 — Calculated Radiation Doses to Maximally Exposed Individuals from Airborne Releases during 2004

Total effective dose equivalents [mrem]		
Plant	At plant max	At ORR max
ORNL	0.1	0.02
ETTP	0.08	0.005
Y-12	0.4	0.4
Entire ORR	<i>a</i>	0.4

a Not applicable. The maximally exposed individual for the entire ORR is the Y-12 MEI.
 Source: DOE 2005a.

Table 4.9.11- 2 — Calculated Collective Effective Dose Equivalents from Airborne Releases during 2004

Effective dose equivalents ^a	
Plant	(Person-rem)
ORNL	2.5
ETTP	2.1
Y-12	5.8
Entire ORR	10.4

^a Collective effective dose equivalents to the approximately 1.1 million persons within 50 miles of the ORR.
 Source: DOE 2005a.

Radionuclides discharged to surface waters from the ORR enter the Tennessee River system by way of the Clinch River. Adding worst-case doses for all pathways in a water-body segment gives a maximum individual dose of about 0.4 millirem to a person obtaining his or her full annual complement of fish, drinking water, and participation in other water uses from the Upper Clinch River. This dose is based on a person eating 46 pounds per year of the most contaminated accessible fish, drinking 193 gallons per year of the most contaminated drinking water, and using the shoreline near the most contaminated stretch of water for 60 hours per year. The maximum collective dose to the 50-mile population could be as high as 5 person-rem. These are small percentages of individual and collective doses attributable to natural background radiation, about 0.1 percent and 0.002 percent, respectively. The DOE standard is 4 millirem per year to the MEI from the drinking water pathway (DOE 2005a).

Table 4.9.11-3 presents the potential radiological impacts to the public, from all sources, resulting from normal operations at Y-12.

The average annual dose to an involved worker at Y-12 during 2004 was 17.1 millirem. The dose to the involved workforce of 3,699 radiation workers was estimated to be 63.4 person-rem. The 2004 values are in-line with doses received during the past five years. Table 4.9.11-4 lists the individual and collective doses for all radiation (involved) workers from 2000 to 2004, as presented in the Y-12 Dosimetry Records System database.

Table 4.9.11-3 — Potential Radiological Impacts to the Public Resulting from Normal Operations at Y-12

Affected Environment	Individual Dose (millirem-year)	Percentage of Standard ^a	Collective Dose (person-rem)
Atmospheric Releases	0.4	4	10.4
Waterborne Releases	0.4 ^b	N /A	5
Totals	0.8	0.8	15.4

^a Radionuclide NESHAP standard is 10 millirem per year from atmospheric releases. DOE Order 5400.5 Change 2 radiological standard for atmospheric releases is 10 millirem per year, 4 millirem per year for drinking water pathway, and 100 millirem per year from all exposures.

^b Maximum potential exposure to the individual based on radionuclide discharges to the Clinch-Poplar Creek system, based on a person eating 21 kg/year of the most contaminated accessible fish, drinking 730 L/year of the most contaminated drinking water, and using the shoreline near the most contaminated stretch of water for 60 h/year.

Source: DOE 2005a.

Table 4.9.11-4 — Y-12 Radiological Worker Annual Individual and Collective Radiation Doses

Year	Number of Radiological Workers	Average Individual Worker Dose (millirem)	Radiological Worker Collective Dose (person-rem)
2000	3,264	20.5	66.9
2001	3,069	17.2	52.7
2002	3,376	18.1	61.2
2003	3,675	16.2	59.7
2004	3,699	17.1	63.4

Source: DOE 2005d.

4.9.11.1.2 Non-radiological

DOE submits an annual toxic release inventory report to EPA and TDEC on or before July 1 of each year. Operations involving toxic release inventory chemicals were compared with regulatory thresholds to determine which chemicals exceeded the reporting thresholds based on amounts manufactured, processed, or otherwise used at each facility.

Total 2004 reportable toxic releases to air, water, and land and waste transferred off site for treatment, disposal, and recycling remained about the same compared with the amounts reported for Y-12 in 2003. Releases for most metals decreased in 2004 as a result of declining machining and welding operations. In contrast, nitrate and nitric acid releases increased slightly as a result of increased waste treatment activities.

4.9.12 Transportation

Y-12 is located within 50 miles of three interstate highways: I-40, I-75, and I-81 (Figure 4.9.12-1). Interstate 40, an east-west highway, extends from North Carolina to California. Interstate 75 is a north-south highway extending from Michigan to Florida. Interstate 81 is a north-south interstate extending from New York to Tennessee. Interstate 81 connects with I-40 east of Knoxville, and I-40 and I-75 connect west of Knoxville near the city of Oak Ridge. In addition, SR 61, SR 162, and US25W at Clinton serve Y-12 transportation needs off site (DOE 2001a). Primary roads on the ORR serving Y-12 include SRS 95, 58, 62, and 170 (Bethel Valley Road). Traffic on Bear Creek Road, north of Y-12, flows in an east-west direction and connects Scarboro Road on the east end of the plant with SRs 95 and 58. Bear Creek Road has restricted access around Y-12 and is not a public thoroughfare. Bethel Valley Road is also closed to public access. The average commute is assumed to be 20 miles round trip, with an average occupancy of 1.5 passengers per car. The daily traffic numbers for various public roads at the ORR are given in Table 4.9.12-1.

Table 4.9.12-1 — Existing Average Daily Traffic Counts on the ORR Serving Y-12

Road	To	From	Average Daily Traffic Vehicles/day
TSR 58	TSR 95	I-40	13,970
TSR 95	TSR 62	TSR 58	25,150
TSR 62	TSR 170	N/A	31,620
TSR 170 (Bethel Valley Road)	TSR 62	N/A	9,350

4.9.12.1 Onsite Shipments

On-site circulation consists of materials handling, movement of personnel between buildings, and contractor and vendor personnel movement. The main onsite road is Bethel Valley Road, which is currently closed to non-authorized traffic. This east-west road provides access to the site and leads to all the parking lots. Completion of several construction and expansion projects has helped alleviate some of the chronic parking problems experienced at the Bethel Valley site. Several main roads and access roads provide on-site transportation. The primary north and south corridors are First, Second, Third, Fourth, and Fifth streets. The major east and west corridors are White Oak and Central Avenues. Materials are transported via the same routes used by employees and visitors. The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, and Melton Valley Access Road.

4.9.12.2 Offsite Shipments

Various chemicals and other materials being used for Y-12 operations are transported by truck using the above-addressed roads (TSRs 58, 62, 95, and 170; I-40, I-75, and I-81). LLW, hazardous waste, and municipal and solid wastes are being generated by Y-12 operations. LLW is being stored on-site in temporary storage facilities and would eventually be disposed off-site at a DOE Site (DOE 2001a).

4.9.12.2.1 Aircraft Operations

Air transportation to and from the Y-12 National Security Complex is offered through the McGhee Tyson Airport, approximately 27.5 miles southeast of the Oak Ridge Reservation. The airport is located in the city of Alcoa in Blount County.

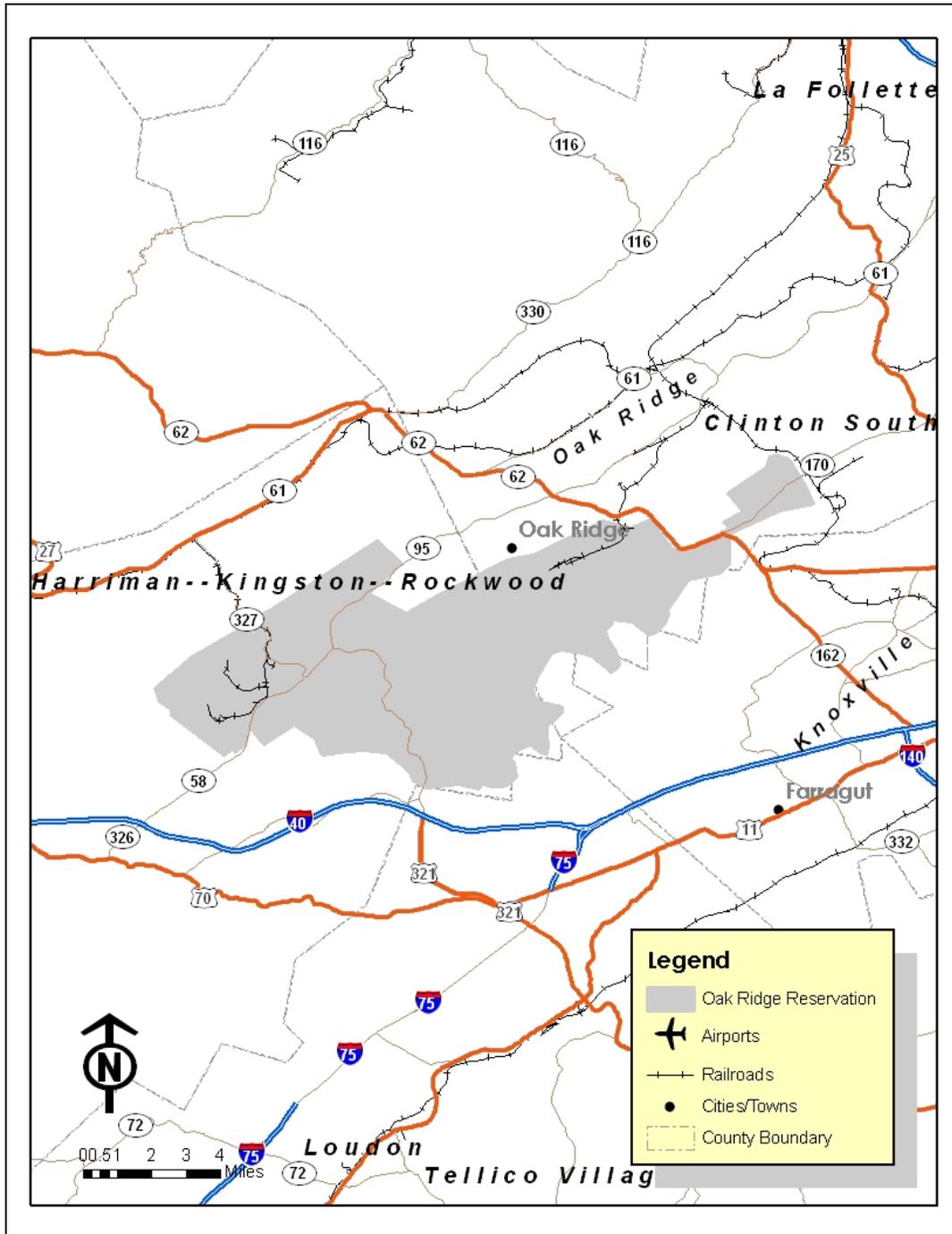


Figure 4.9.12-1 – Roads in the Vicinity of ORR

4.9.13 Waste Management

The disposal facilities and landfills are operated by the EM Program. The majority of the waste management, treatment and storage facilities are operated by NNSA. Waste management facilities are located in buildings or on the sites where they are needed, or are collocated with other waste management facilities or operations.

The TDEC Division of Solid Waste Management (DSWM) regulates the management of waste streams under the *Tennessee Solid Waste Management Act* (TSWMA). Onsite waste disposal facilities in operation at Y-12 include industrial, construction/demolition landfills, and a CERCLA waste landfill.

The major waste types generated at Y-12 from routine operations include LLW, MLLW, hazardous waste, and nonhazardous waste (Table 4.9.13-1). Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse, and medical wastes. Y-12 does not generate or manage high-level radiological waste or TRU waste.

Table 4.9.13-1 — Waste Generation Totals by Waste Type for Routine Operations at Y-12

Waste Type	Waste Volume (FY-2003)
LLW (Liquid)	17.42 cubic yards
LLW (Solid)	7796.69 cubic yards
MLLW (Liquid)	17.87 cubic yards
MLLW (Solid)	21.12 cubic yards
RCRA Waste	14.37 short tons
TSCA Waste	14.84 short tons
Mixed TSCA	32.04 short tons
Sanitary Waste	7923.71 short tons

Source: Gilbert 2003.

Waste Management PEIS RODs affecting ORR and Y-12 are shown in Table 4.9.13-2 for the waste types analyzed in this SPEIS. Decisions on the various waste types are being announced in a series of RODs that have been issued under the *Waste Management PEIS*. The initial transuranic (TRU) waste ROD was issued on January 20, 1998 (63 FR 3629) with several subsequent amendments; the hazardous waste ROD was issued on August 5, 1998 (63 FR 41810); the high-level radioactive waste ROD was issued on August 12, 1999 (64 FR 46661), and the low-level radioactive waste and mixed low-level radioactive waste ROD was issued on February 18, 2000 (65 FR 10061). The TRU waste ROD states that DOE will develop and operate mobile and fixed facilities to characterize and prepare TRU waste for disposal at WIPP. Y-12 does not generate TRU waste. Each DOE site that has or will generate TRU waste will, as needed, prepare and store its TRU waste onsite until the waste is shipped to WIPP. The hazardous waste ROD states that most DOE sites will continue to use offsite facilities for the treatment and disposal of major portions of the non-wastewater hazardous waste, with ORR and the SRS continuing to treat some of their own non-wastewater hazardous waste onsite in existing facilities where it is economically feasible.

The high-level radioactive waste ROD states that immobilized high-level radioactive waste will be stored at the site of generation until transferred to a geologic repository. The ROD for low-level waste (LLW) and mixed-LLW states that, for the management of LLW, minimal treatment

will be performed at all sites and disposal will continue, to the extent practicable, onsite at Idaho National Environmental Laboratory (INEL), LANL, ORR, and SRS. In addition, the Hanford Site and NTS will be available to all DOE sites for LLW disposal.

Mixed-LLW will be treated at the Hanford Site, INL, ORR, and SRS and disposed of at the Hanford Site and the NTS. More detailed information concerning DOE's preferred alternatives for the future configuration of waste management facilities at ORR is presented in the *Waste Management PEIS* as well as the high-level radioactive waste, TRU waste, hazardous waste, and LLW and mixed-LLW waste RODs.

Table 4.9.13-2 — Waste Management PEIS Records of Decision Affecting Oak Ridge Reservation and Y-12

Waste Type	Preferred Action
High-level radioactive	ORR does not currently manage high-level radioactive waste. ^a
Transuranic and mixed transuranic	DOE has decided that ORR should prepare and store its transuranic waste onsite pending disposal at WIPP. ^b
Low-level radioactive	DOE has decided to treat ORR liquid low-level radioactive waste onsite. ^c Separate from the <i>Waste Management PEIS</i> , DOE prefers offsite management of ORR solid low-level radioactive waste after temporary onsite storage.
Mixed low-level radioactive	DOE has decided to regionalize treatment of mixed low-level radioactive waste at ORR. This includes the onsite treatment of ORR waste and could include treatment of some mixed low-level radioactive waste generated at other sites. ^d
Hazardous	DOE has decided to use commercial and onsite ORR facilities for treatment of ORR nonwastewater hazardous waste. DOE will also continue to use onsite facilities for wastewater hazardous waste. ^e

^a From the ROD for high-level radioactive waste (64 FR 46661).

^b From the ROD for transuranic waste (63 FR 3629).

^c From the ROD for low-level waste (65 FR 10061).

^d From the ROD for mixed low-level waste (65 FR 10061).

^e From the ROD for hazardous waste (63 FR 41810).

4.9.13.1 *Low-Level Waste*

Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In FY2003, Y-12 generated approximately 7,797 cubic yards of solid LLW. Liquid LLW is treated in several facilities, including the West End Treatment Facility (WETF). Y-12 is the largest generator of routine LLW at Oak Ridge. In FY2003, Y-12 generated 42 cubic yards of liquid LLW.

4.9.13.2 *Mixed Low-Level Waste*

Mixed waste subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at Y-12. DOE is under a State Commissioner's Order (October 1, 1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* and to comply with a *Federal Facilities Compliance Act* (FFC Act) that went into effect on June 12, 1992. *Toxic Substance Control Act* (TSCA)-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate Federal Facilities Compliance Agreement (FFCA), first effective February 20, 1992.

4.9.13.3 *Hazardous Waste*

RCRA-hazardous waste is generated through a wide variety of production and maintenance operations. The majority of RCRA-hazardous waste is in solid form. In FY 2003, Y-12 generated 14 short tons of RCRA waste. The hazardous waste is shipped offsite for treatment and disposal at either DOE or commercially-permitted facilities.

4.9.13.4 *Nonhazardous Waste*

During 2004, the sanitary wastewater flow averaged about 663,000 gallons per day. Treated sanitary wastewater is discharged to the sanitary system in accordance with the Industrial and Commercial User Wastewater Discharge Permit No. 1-91. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to a Y-12 sanitary industrial landfill, as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill at Y-12.

4.9.13.5 *Waste Generation Capacities*

Excess treatment and disposal capacity for hazardous waste exist both onsite and offsite at Y-12. Storage capacities at Y-12 are currently adequate for hazardous, MLLW, and LLW.

4.9.13.6 *Waste Management Facilities*

The majority of waste management facilities at Y-12 are operated by NNSA. Waste management facilities are located in buildings, or on sites, dedicated to their individual functions, or are collocated with other waste management facilities or operations. Many of the facilities are used for more than one waste stream.

Chapter 5
ENVIRONMENTAL IMPACTS

Chapter 5 ENVIRONMENTAL IMPACTS

Chapter 5 describes the potential environmental impacts of the alternatives. The potential environmental impacts of the programmatic alternatives (Distributed Centers of Excellence [DCE] Alternative, Consolidated Centers of Excellence [CCE Alternative], Capability-Based Alternative, and the No Action Alternative) are assessed at Los Alamos, Nevada Test Site (NTS), Pantex Site (Pantex), Savannah River Site (SRS), and the Y-12 National Security Complex (Y-12). This Chapter discusses the impacts of each alternative by resource area, in a format consistent with Chapter 4. The potential impacts of the project-specific alternatives (High Explosives [HE] Research and Development [R&D], Tritium R&D, Major Hydrodynamic Test Facilities, Flight Testing, Major Environmental Test Facilities [ETFs], and Sandia National Laboratories (SNL) Weapon Support Functions) are also assessed in this chapter.

5.0 ENVIRONMENTAL IMPACTS

The environmental impacts analysis addresses potentially affected areas in a manner commensurate with the significance of the potential effects on each area. The methodologies used for preparing the assessments for the resource areas are discussed in Appendix B of this SPEIS.

Chapter 5 is organized by site. For example, Section 5.1 discusses the environmental impacts at Los Alamos. Los Alamos is potentially affected by the programmatic alternatives, which include the No Action Alternative, the Distributed Centers of Excellence (DCE) Alternative, the Consolidated Centers of Excellence (CCE) Alternative, and the Capability-Based Alternative. Sections 5.3, 5.5, 5.8, and 5.9 discuss the environmental impacts of the programmatic alternatives at the NTS, Pantex, SRS, and the Y-12. Because there are no programmatic alternatives for Lawrence Livermore National Laboratory (LLNL) (Section 5.2), Tonopah Test Range (TTR) (Section 5.4), Sandia National Laboratories (Section 5.6), and White Sands Missile Range (WSMR) (Section 5.7), there are no discussions of programmatic impacts for those sites. Section 5.10 discusses complex-wide transportation impacts. Section 5.11 provides a qualitative sensitivity analysis of hypothetically smaller stockpiles than the one established by the Moscow Treaty to identify any potential significant effects on the proposed actions and alternatives. Section 5.12 assesses the impacts of consolidating Category I/II special nuclear material (SNM).

A draft classified appendix to this SPEIS has been prepared that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Appendix B (Section B.12.3) discusses the methodology used to evaluate potential impacts associated with a terrorist threat and the methodology by which NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems. As discussed in that section, the NNSA strategy for the mitigation of environmental impacts resulting from extreme events, including intentional destructive acts or terrorism, has three distinct components: (1) prevent or deter

terrorists from making successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. These data will provide NNSA with information upon which to base, in part, decisions regarding transformation of the Complex. The draft classified appendix evaluates several intentional destructive act scenarios for alternatives at the following sites (LANL [both at TA-16 and TA-55], LLNL, NTS, SRS, Pantex, and Y-12) and calculates consequences to the noninvolved worker, maximally exposed individual, and population in terms of radiation dose and LCFs. Although the results of the analyses cannot be disclosed in this unclassified SPEIS, the following general conclusion can be made: the potential consequences of intentional destructive acts are highly dependent upon distance to the site boundary and size of the surrounding population- the closer and higher the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities, as new security features can be incorporated into their design. In other words, protection forces needed to defend new facilities may be smaller due to inherent security features included in a new facility.

In addition to the discussion of the environmental impacts from the programmatic alternatives, Sections 5.13 through 5.18 discuss the potential impacts for the project-specific alternatives. These include the HE R&D, Tritium R&D, Flight Test Operations, Major Hydrodynamic Test Facilities, Major ETFs, and SNL/CA Weapon Support Functions.

5.1 LOS ALAMOS NATIONAL LABORATORY

This section discusses the potential environmental impacts associated with the following programmatic alternatives at Los Alamos:

- **No Action Alternative:** under the No Action Alternative, NNSA would continue operations to support national security requirements using the nuclear weapons complex as it exists today. LANL would continue to perform its existing missions as described in Section 3.2.1, including production of up to 20 pits per year.
- **DCE Alternative:** this alternative includes a Consolidated Plutonium Center (CPC). For LANL, this SPEIS evaluates three approaches: (1) the Greenfield CPC in which an entirely new set of nuclear facilities would be constructed with a single-shift production capacity of 125 pits per year; (2) an Upgrade Alternative that would use existing and planned facilities at LANL with additional new construction to provide the capability to produce 125 pits per year; and (3) the 50/80 Alternative, which would use existing and planned facilities at LANL with minor additional construction that would be capable of producing approximately 50 to 80 pits per year (the “50/80 Alternative”).
- **CCE Alternative:** this alternative includes two options: (1) a Consolidated Nuclear Production Center (CNPC), which would consist of a CPC, the Consolidated Uranium Center (CUC), and the Assembly/Disassembly/High Explosives (A/D/HE) Center at one site; and (2) Consolidated Nuclear Centers (CNC), which would be a CPC and a CUC at one site, and the A/D/HE Center at Pantex or NTS. In general, the CCE facilities would produce additive construction impacts because construction activities would occur sequentially as follows: CUC, 2011-2016; CPC, 2017-2022; A/D/HE Center, 2020-2025).
- **Capability-Based Alternative:** In the 1999 LANL SWEIS and the 2006 LANL Draft SWEIS, NNSA assessed an alternative of establishing an interim pit fabrication capacity to provide 50 pits annually. Under the Capability-Based Alternative, NNSA would achieve that level of production but no more. Manufacturing pits in TA-55 at this level would likely cause only minor differences in impacts on land use, visual resources, water resources, geology and soils, air quality, noise, ecological resources, public health, cultural resources, and infrastructure (LANL 2006a). As such, these resources are not discussed for the Capability-Based Alternative. This SPEIS focuses on impacts to worker health, socioeconomics, waste management, and transportation.

The impacts are presented below for each of the following resource areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, and waste management. Additionally, this section analyzes the potential impacts associated with phasing out Category I/II SNM operations at LANL if it is not selected for a CPC or CNPC/CNC. That analysis, which focuses on the changes to socioeconomics, human health, accidents, and waste generation, is contained in the relevant resource areas within Section 5.1. For example, the discussion of socioeconomic impacts is contained in Section 5.1.9.5.

5.1.1 Land Use

This section presents a discussion of the potential impacts to land associated with the No Action Alternative, the DCE Alternative, and the CCE Alternative. Table 5.1.1-1 describes the potential effects on land use from construction and operation of facilities under the DCE and CCE Alternatives.

Table 5.1.1-1. Potential Effects on Land Use at the Proposed Sites.

CPC Alternatives		
	Construction (acres)	Operation (acres)
Greenfield Alternative	140	110 ^a
		PIDAS
	40	70
Upgrade Alternative	13	6.5 (All within PIDAS)
50/80 Alternative	6.5	2.5 (All within PIDAS)
CUC		
Construction (acres)	50	
Operation (acres)	Total Area: 35 ^b	
	PIDAS	Non-PIDAS
	15	20
A/D/HE CENTER ^d		
Construction (acres)	300	
Operation (acres)	Total Area: 300 ^e	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120
CNC		
	Total Area: 195 ^f	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 55	Total: 140
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50
CNPC		
	Total Area: 545 ^g	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 235	Total: 310
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100

^a Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^b At Y-12, a UPF would be constructed (see Section 3.4.2).

^c Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^d At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

^e Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^f Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

^g Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

5.1.1.1 No Action Alternative

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. No additional buildings or facilities would be built beyond those that NNSA has already decided to build, and no additional impacts

on land use would occur at LANL beyond those of existing and future activities that are independent of this action. LANL has approximately 2,000 structures with approximately 8.6 million square feet under roof, spread over an area of approximately 25,600 acres. Table 5.1.1-2 presents the major LANL Technical Areas and associated facilities.

Table 5.1.1-2 — Major LANL Technical Areas and Associated Facilities

Technical Area ^a	Activities
TA-0 (Offsite Facilities)	This TA designation is assigned to structures leased by DOE that are located outside LANL's boundaries in the Los Alamos townsite and White Rock.
TA-2 (Omega Site or Omega West Reactor)	This TA in Los Alamos Canyon was home to the now demolished Omega West Reactor.
TA-3 (Core Area or South Mesa Site)	This TA is LANL's core scientific and administrative area, with approximately half of LANL's employees and total floor space. It is the location of a number of the LANL's Key Facilities, including the Chemistry and Metallurgy Research Building, the Sigma Complex, the Machine Shops, the Material Sciences Laboratory, and the Nicholas C. Metropolis Center for Modeling and Simulation. It is also the location proposed for operating the existing Biosafety Level 3 Facility.
TA-5 (Beta Site)	This TA is largely undeveloped. Located between East Jemez Road and the San Ildefonso Pueblo, it contains physical support facilities, an electrical substation, and test wells.
TA-6 (Two-Mile Mesa Site)	This TA, located in the northwestern part of LANL, is mostly undeveloped. It contains a meteorological tower, gas-cylinder-staging buildings, and aging vacant buildings that are awaiting demolition.
TA-8 (GT-Site [Anchor Site West])	This TA, located along West Jemez Road, is a testing site where nondestructive dynamic testing techniques are used for the purpose of ensuring the quality of materials in items ranging from test weapons components to high-pressure dies and molds. Techniques used include radiography, radioisotope techniques, ultrasonic and penetrant testing, and electromagnetic test methods.
TA-9 (Anchor Site East)	This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this TA, and new organic compounds are investigated for possible use as explosives.
TA-11 (K-Site)	This TA is used for testing explosives components and systems, including vibration analysis and drop-testing materials and components under a variety of extreme physical environments. Facilities are arranged so that testing may be controlled and observed remotely, allowing devices that contain explosives, radioactive materials, and nonhazardous materials to be safely tested and observed.
TA-14 (Q-Site)	This TA, located in the northwestern part of LANL, is one of 14 firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning.
TA-15 (R-Site)	This TA, located in the central portion of LANL, is used for high explosives research, development, and testing, mainly through hydrodynamic testing and dynamic experimentation. TA-15 is the location of two firing sites, the Dual Axis Radiographic Hydrodynamic Test Facility, which has an intense high-resolution, dual-machine radiographic capability, and Building 306, a multipurpose facility where primary diagnostics are performed.

Table 5.1.1-2 — Major LANL Technical Areas and Associated Facilities (continued)

Technical Area ^a	Activities
TA-16 (S-Site)	TA-16, in the western part of LANL, is the location of the Weapons Engineering Tritium Facility, a state-of-the-art tritium processing facility. The TA is also the location of high explosives research, development, and testing, and the High Explosives Wastewater Treatment Facility.
TA-18 (Pajarito Site)	This TA, located in Pajarito Canyon, is the location of the Los Alamos Critical Experiment Facility, a general-purpose nuclear experiments facility. It is the location of the Solution High-Energy Burst Assembly and is also used for teaching and training related to criticality safety and applications of radiation detection and instrumentation. In December 2002, NNSA decided to relocate all TA-18 Security Category I and II materials and activities to the Nevada Test Site; this transfer is in process.
TA-21 (DP-Site)	TA-21 is on the northern border of LANL, next to the Los Alamos townsite. In the western part of the TA is the former radioactive materials (including plutonium) processing facility that has been partially decontaminated and decommissioned. In the eastern part of the TA are the Tritium Systems Test Assembly and the Tritium Science and Fabrication Facility. Operations from both facilities have been transferred elsewhere as of the end of 2006.
TA-22 (TD-Site)	This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. Research, development, and fabrication of high-energy detonators and related devices are conducted at this facility.
TA-28 (Magazine Area A)	TA-28, located near the southern edge of LANL, was an explosives storage area. The TA contains five empty storage magazines that are being decontaminated and decommissioned.
TA-33 (HP-Site)	TA-33 is a remotely-located TA at the southeastern boundary of LANL. The TA is used for experiments that require isolation, but do not require daily oversight. The National Radioastronomy Observatory's Very Long Baseline Array telescope is located at this TA.
TA-35 (Ten Site)	This TA, located in the north central portion of LANL, is used for nuclear safeguards research and development, primarily in the areas of lasers, physics, fusion, materials development, and biochemistry and physical chemistry research and development. The Target Fabrication Facility, located at this TA, conducts precision machining and target fabrication, polymer synthesis, and chemical and physical vapor deposition. Additional activities at TA-35 include research in reactor safety, optical science, and pulsed-power systems, as well as metallurgy, ceramic technology, and chemical plating. Additionally, there are some Biosafety Level 1 and 2 laboratories at TA-35.
TA-36 (Kappa-Site)	TA-36, a remotely-located area in the eastern portion of LANL, has four active firing sites that support explosives testing. The sites are used for a wide variety of non-nuclear ordnance tests.
TA-37 (Magazine Area C)	This TA is used as an explosives storage area. It is located at the eastern perimeter of TA-16.
TA-39 (Ancho Canyon Site)	TA-39 is located at the bottom of Ancho Canyon. This TA is used to study the behavior of non-nuclear weapons (primarily by photographic techniques) and various phenomenological aspects of explosives.
TA-40 (DF-Site)	TA-40, centrally located within LANL, is used for general testing of explosives or other materials and development of special detonators for initiating high explosives systems.
TA-41 (W-Site)	TA-41, located in Los Alamos Canyon, is no longer actively used. Many buildings have been decontaminated and decommissioned; the remaining structures include historic properties.

Table 5.1.1-2 — Major LANL Technical Areas and Associated Facilities (continued)

Technical Area ^a	Activities
TA-43 (the Bioscience Facilities, formerly called the Health Research Laboratory)	TA-43 is adjacent to the Los Alamos Medical Center at the northern border of LANL. Two facilities are located within this TA: the Bioscience Facilities (formerly called the Health Research Laboratory) and NNSA's local Site Office. The Bioscience Facilities have Biosafety Level 1 and 2 laboratories and are the focal point of bioscience and biotechnology at LANL. Research performed at the Bioscience Facilities includes structural, molecular, and cellular radiobiology; biophysics; radiobiology; biochemistry; and genetics.
TA-46 (WA-Site)	TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL's basic research sites. Activities have focused on applied photochemistry operations and have included development of technologies for laser isotope separation and laser enhancement of chemical processes. The Sanitary Wastewater Systems Plant is also located within this TA.
TA-48 (Radiochemistry Site)	TA-48, located in the north central portion of LANL, supports research and development in nuclear and radiochemistry, geochemistry, production of medical radioisotopes, and chemical synthesis.
TA-49 (Frijoles Mesa Site)	TA-49, located near Bandelier National Monument, is used as a training area and for outdoor tests on materials and equipment components that involve generating and receiving short bursts of high-energy, broad-spectrum microwaves. A fire support building and helipad located near the entrance to the TA are operated by the U.S. Forest Service.
TA-50 (Waste Management Site)	TA-50, located near the center of LANL, is the location of waste management facilities including the Radioactive Liquid Waste Treatment Facility and the Waste Characterization, Reduction, and Repackaging Facility. The Actinide Research and Technology Instruction Center is also located in this TA.
TA-51 (Environmental Research Site)	TA-51, located on Pajarito Road in the eastern portion of LANL, is used for research and experimental studies on the long-term impacts of radioactive materials on the environment. Various types of waste storage and coverings are studied at this TA.
TA-52 (Reactor Development Site)	TA-52 is located in the north central portion of LANL. A wide variety of theoretical and computational research and development activities related to nuclear reactor performance and safety, as well as to several environmental, safety, and health activities, are carried out at this TA.
TA-53 (Los Alamos Neutron Science Center)	TA-53, located in the northern portion of LANL, includes the LANSCE. LANSCE houses one of the largest research linear accelerators in the world and supports both basic and applied research programs. Basic research includes studies of subatomic and particle physics, atomic physics, neutrinos, and the chemistry of subatomic interactions. Applied research includes materials science studies that use neutron spallation and contributes to defense programs. LANSCE has also produced medical isotopes for the past 20 years.
TA-54 (Waste Disposal Site)	TA-54, located on the eastern border of LANL, is one of the largest TAs at LANL. Its primary function is management of solid radioactive and hazardous chemical wastes, including storage, treatment, decontamination, and disposal operations.
TA-55 (Plutonium Facility Complex Site)	TA-55, located in the center of LANL, is the location of the Plutonium Facility Complex and is the chosen location for the Chemistry and Metallurgy Research Building Replacement. The Plutonium Facility provides chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into many compounds and forms. The Chemistry and Metallurgy Research Building Replacement, currently under construction, will provide chemistry and metallurgy research, actinide chemistry, and materials characterization capabilities.

Table 5.1.1-2 — Major LANL Technical Areas and Associated Facilities (continued)

Technical Area ^a	Activities
TA-57 (Fenton Hill Site)	TA-57 is located about 20 miles (32 kilometers) west of LANL on land administered by the U.S. Forest Service. The primary purpose of the TA is observation of astronomical events. TA-57 houses the Milagro Gamma Ray Observatory and a suite of optical telescopes. Drilling technology research is also performed in this TA.
TA-58 (Twomile North Site)	TA-58, located near LANL's northwest border on Twomile Mesa North, is a forested area reserved for future use because of its proximity to TA-3. The TA houses a few LANL-owned storage trailers and a temporary storage area.
TA-59 (Occupational Health Site)	This TA is located on the south side of Pajarito Road adjacent to TA-3. This is the location of staff who provide support services in health physics, risk management, industrial hygiene and safety, policy and program analysis, air quality, water quality and hydrology, hazardous and solid waste analysis, and radiation protection. The Medical Facility at TA-59 includes a clinical laboratory and provides bioassay sample analytical support.
TA-60 (Sigma Mesa)	TA-60 is located southeast of TA-3. The TA is primarily used for physical support and infrastructure activities. The Nevada Test Site Test Fabrication Facility and a test tower are also located here. Due to the moratorium on testing, these buildings have been placed in indefinite safe shutdown mode.
TA-61 (East Jemez Site)	TA-61, located in the northern portion of LANL, contains physical support and infrastructure facilities, including a sanitary landfill operated by Los Alamos County and sewer pump stations.
TA-62 (Northwest Site)	TA-62, located next to TA-3 and West Jemez Road in the northwest corner of LANL, serves as a forested buffer zone. This TA is reserved for future use.
TA-63 (Pajarito Service Area)	TA-63, located in the north central portion of LANL, contains physical support and infrastructure facilities. The facilities at this TA serve as localized storage and office space.
TA-64 (Central Guard Site)	This TA is located in the north central portion of LANL and provides offices and storage space.
TA-66 (Central Technical Support Site)	TA-66 is located on the southeast side of Pajarito Road in the center of LANL. The Advanced Technology Assessment Center, the only facility at this TA, provides office and technical space for technology transfer and other industrial partnership activities.
TA-67 (Pajarito Mesa Site)	TA-67 is a forested buffer zone located in the north central portion of LANL. No operations or facilities are currently located at the TA.
TA-68 (Water Canyon Site)	TA-68, located in the southern portion of LANL, is a testing area for dynamic experiments that also contains environmental study areas.
TA-69 (Anchor North Site)	TA-69, located in the northwestern corner of LANL, serves as a forested buffer area. The new Emergency Operations Center, completed in 2003, is located here.
TA-70 (Rio Grande Site)	TA-70 is located on the southeastern boundary of LANL and borders the Santa Fe National Forest. It is a forested TA that serves as a buffer zone.
TA-71 (Southeast Site)	TA-71 is located on the southeastern boundary of LANL and is adjacent to White Rock to the northeast. It is an undeveloped TA that serves as a buffer zone for the High Explosives Test Area.

Table 5.1.1-2 — Major LANL Technical Areas and Associated Facilities (continued)

Technical Area ^a	Activities
TA-72 (East Entry Site)	TA-72, located along East Jemez Road on the northeastern boundary of LANL, is used by protective force personnel for required firearms training and practice purposes.
TA-73 (Airport Site)	TA-73 is located along the northern boundary of LANL, adjacent to Highway 502. The County of Los Alamos manages, operates, and maintains the community airport under a leasing arrangement with DOE. Use of the airport by private individuals is permitted with special restrictions.
TA-74 (Otowí Tract)	TA-74 is a forested area in the northeastern corner of LANL. A large portion of this TA has been conveyed to Los Alamos County or transferred to the Department of the Interior in trust for the Pueblo of San Ildefonso and is no longer part of LANL.

TA = technical area, LANSCE = Los Alamos Neutron Science Center.

^a Names in parentheses are common or historical names that are sometimes used to refer to the Technical Areas.

5.1.1.2 *DCE Alternative*

5.1.1.2.1 **Greenfield CPC**

Construction

As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. At LANL, which has an R&D facility (the Plutonium Facility [PF-4] at TA-55), there would be three separate nuclear buildings: Material Receipt, Unpacking, and Storage; Feed Preparation; and Manufacturing. These buildings would be surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS) and a buffer area. The area outside the PIDAS would have a number of smaller support facilities, a Waste Staging/Transuranic (TRU) Packaging Building, roads and parking areas, and a runoff retention area. In addition to these structures, a construction laydown area and a concrete batch plant would be used for the construction phase only. Upon construction completion, they would be removed and the area could be returned to its original state.

All buildings would be either one or two stories. The site would require two heating, ventilation, and air conditioning (HVAC) exhaust stacks; the tallest, standing 100 feet, would be located inside the PIDAS. Facility exhausts would be High Efficiency Particulate Air (HEPA)-filtered prior to discharge through the stacks. The reference location for the CPC is Technical Area (TA)-55, a 93-acre site 1.1 miles from the townsite of Los Alamos. Approximately one-half of TA-55 is developed. A CPC would change land use in this area. In addition, there might be a modification to the current land use designation, Nuclear Materials R&D, for this area.

An estimated 140 acres of land for buildings, walkways, access, parking, buffer space, and construction-related workspace would be required to construct a CPC. NNSA believes that, should Los Alamos be selected as the CPC site, the proposed facility design could be adapted to the available space. For example, approximately 40 acres of the CPC would require protection within a PIDAS. TA-55 has adequate land available to accommodate this protected area. Additionally, the Greenfield CPC includes acreage for support facilities, waste management facilities, and parking. These would not necessarily be located at TA-55 if Los Alamos were

selected for a Greenfield CPC. If the Los Alamos site were selected to host a CPC, a tiered EIS would serve to explore all reasonable siting options. The land required for the proposed CPC construction would represent approximately 0.55 percent of LANL's total land area of 25,600 acres. The developed area after construction would be approximately 110 acres.

Operation

An estimated 110 acres of land would be required to operate a CPC. The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the concrete batch plant upon construction completion. The land required for the proposed CPC operations would represent approximately 0.4 percent of Los Alamos' total land area of 25,600 acres. Although there would be a change in land use (to nuclear materials production), the proposed CPC is compatible with land use plans. No impacts to LANL land use plans or policies are expected.

5.1.1.2.2 Upgrade Alternative

Construction

As described in Section 3.4.1.6.1, in the Upgrade Alternative, NNSA would build the Chemistry and Metallurgy Research Replacement- Nuclear Facility (CMRR-NF), and construct a new facility (known as the "Manufacturing Annex") to augment pit-manufacturing capacity and related infrastructure capacity. The reference location for the CPC under this approach is in the area of TA-55. Land use at TA-55 has been categorized as R&D. TA-55 is a 93-acre site that is situated 1.1 miles from the townsite of Los Alamos. An estimated 13 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the CMRR-NF and Manufacturing Annex at TA-55. The land required for this facility would represent approximately 14 percent of the total area at TA-55, and approximately 28 percent of the undeveloped area at TA-55.

Operation

As described in Section 3.4.1.6.1, the Upgrade Alternative would be expected to operate similar to the Greenfield CPC at LANL. An estimated 6.5 acres of additional land for buildings, walkways, building access, parking, and buffer space would be required to operate the Upgrade Alternative. Although there would be a change in land use (to nuclear materials production), the proposed CPC is compatible with land use plans. No impacts to LANL land use plans or policies are expected.

5.1.1.2.3 50/80 Alternative

Construction

As described in Section 3.4.1.6.2, the 50/80 Alternative would involve expanding the current pit production capabilities of plutonium facilities in Building PF-4 to produce approximately 80 pits for the stockpile per year. To do this, a number of plutonium processing activities that are not related to pit production or stockpile certification would be relocated to other facilities or

consolidated within PF-4. Additionally, this alternative includes the CMRR-NF facility,¹ which would be expanded by approximately 9,000 square feet to approximately 209,000 square feet, to accommodate pit manufacturing operations. The construction activities would result in an addition of approximately 2.5 acres to the permanent TA-55 footprint, with 6.5 acres of total area disturbed during construction. The area required for the permanent footprint would represent approximately 2.7 percent of the total land area at TA-55, and approximately 5.4 percent of the undeveloped land at TA-55.

Operation

The operation of the 50/80 Alternative would result in an addition of approximately 2.5 acres to the permanent TA-55 footprint. Although there would be a change in land use (to nuclear materials production), the 50/80 Alternative is compatible with land use plans. No impacts to LANL land use plans or policies are expected.

5.1.1.3 CCE Alternative

5.1.1.3.1 CNC (CPC + CUC)

Land use impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.1.2 as well as the impacts discussed below.

Construction

CUC. As described in Section 3.5.1.1, the CUC would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state. Once constructed, operations at the CUC would require approximately 35 acres. All buildings would be either one or two stories.

The land required for the proposed CUC construction would represent approximately 0.20 percent of LANL's total land area of 25,600 acres. Approximately 15 acres of the CUC would require protection within a PIDAS. TA-55 has adequate land available to accommodate this protected area. NNSA believes that, should Los Alamos be selected for the CUC (as part of a CNPC), the proposed facility design could be adapted to the space available. For example, some of the walkway, building access, parking and buffer space already allocated for TA-55 facilities could serve the CNC buildings as well so that less total acreage would be required. If the Los Alamos site were selected to host the CUC, a tiered EIS would serve to explore all reasonable siting options. Additionally, as explained in Section 5.1.1.3.2, the reference site for the full CNPC is TA-16, which affords a significant amount of undeveloped land at Los Alamos to host facilities such as the CUC.

Although there would be a change in land use, the proposed CUC is compatible with land use plans for this area. No impacts to Los Alamos land use plans or policies are expected.

¹ The CMRR, which is approximately 400,000 square feet, consists of both a nuclear and non-nuclear facility. The nuclear facility is approximately one-half of the CMRR.

Operation

CNC. As described in Section 3.5.2, an estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CNC. Of this, approximately 55 acres would be located within a PIDAS. This would be approximately 10 acres more than the undeveloped land available at TA-55. NNSA believes that, should Los Alamos be selected for the CUC (as part of a CNC), the facility design could be adapted to the space available. Administrative support buildings and non-nuclear component production would require approximately 90 acres area outside of the PIDAS. A 50-acre buffer zone would also be located outside the PIDAS. The total land required to support CNC operations would represent approximately 1 percent of LANL's total land area of 25,600 acres.

The CNC could be located in the existing TA-55 location, which would change land use in this area. Additionally, as explained in the next section, there is an alternative to locate the CNC at TA-16, as part of a full CNPC.

5.1.1.3.2 CNPC (CPC + CUC + A/D/HE Center)

Land use impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.1.2.1, the CUC construction impacts discussed in Section 5.1.1.3.1, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. As described in Section 3.5, the Assembly/Disassembly/High Explosives (A/D/HE) Center would consist of a nuclear facility within the PIDAS and high explosives facilities and non-nuclear support facilities outside the PIDAS. Approximately 300 acres would be required for the A/D/HE Center. Approximately 180 acres would be protected within a PIDAS.

The reference location for the A/D/HE Center (and CNPC) at LANL is TA-16, which consists of approximately 1,900 acres. TA-16, located in the western part of LANL, is the site of the Weapons Engineering Tritium Facility, which is a state-of-the-art tritium processing facility, and the High Explosives Wastewater Treatment Facility. The TA's high explosives research, development, and testing capabilities include high explosives processing; powder manufacturing; casting, machining, and pressing; inspection and radiography of high explosives components to guarantee integrity and ensure quality control; test device assembly; and chemical analysis. There are also some biological laboratories here. Approximately one-third of TA-16 is developed, and the other two-thirds of the TA are undeveloped. As such, there are a total of approximately 1,350 acres available at TA-16 for Complex Transformation facilities.

The land required for the proposed A/D/HE Center construction would represent approximately 1.2 percent of LANL's total land area of 25,600 acres, and approximately 22% of the available land at TA-16. Although there would be a change in land use, the proposed A/D/HE Center would be compatible with land use plans, although there might be a modification to the current land use designation, High Explosive R&D, for this area.

Operation

CNPC. As described in Section 3.5.1.2, an estimated 545 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the full CNPC. Of this, approximately 235 acres would be located within a PIDAS. Administrative support buildings, non-nuclear component production, and high explosives fabrication activities would occur on approximately 210 acres outside the PIDAS. A 100-acre buffer zone would also be located outside the PIDAS. The land required for CNPC operations would represent approximately 2.3 percent of LANL's total land area of 25,600 square miles.

5.1.2 Visual Resources

5.1.2.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional impacts to visual resources beyond current and planned activities that are independent of this action. The Cerro Grande Fire of 2000 altered views of LANL from various locations in Los Alamos County. While many LANL facilities are still generally screened from view, some developed areas that were previously screened by vegetation are now more visible to passing traffic (LANL 2006a).

5.1.2.2 *DCE Alternative (CPC)*

5.1.2.2.1 Greenfield CPC

Construction

As described in Section 3.4.1, the CPC would consist of multiple aboveground facilities. Activities related to the construction of new buildings required for the Greenfield CPC Alternative would result in a change to the visual appearance at TA-55 due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. Native grasses, shrubs, trees, and pines would be cleared from the site. These changes would be temporary and, because of its interior location on the LANL site, would only be noticeable from higher elevations to the west along the upper reaches of the Pajarito Plateau rim. Thus, impacts on visual resources during construction would be minimal.

Operation

The Greenfield CPC, which would include one- and two-story buildings, storage tanks, and two HVAC exhaust stacks, would change the appearance of TA-55. While not visible from lower elevations, the new facilities would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-55 area). However, this change would be consistent with the currently developed areas of TA-55. Thus, new construction within TA-55 boundaries would not change the current Class IV Bureau of Land Management (BLM) Visual Resource

Management rating of developed areas within TA-55.

5.1.2.2.2 Upgrade Alternative

Construction

Activities related to the construction of new buildings (CMRR-NF and Manufacturing Annex) required for the Upgrade Alternative would result in a change to the visual appearance at TA-55 due to the presence of construction equipment, new buildings being constructed, and possibly increased dust. Native grasses, shrubs, trees, and pines would be cleared from the site. These changes would be temporary and, because of its interior location on the LANL site, would only be noticeable from higher elevations to the west along the upper reaches of the Pajarito Plateau rim. Moreover, this change would be consistent with the currently developed areas of TA-55. Thus, impacts on visual resources during construction would be minimal.

Operation

The Upgrade Alternative would include two new two-story buildings. While not visible from lower elevations, the new facilities would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-55 area). However, this change would be consistent with the currently developed areas of TA-55. Thus, new construction within TA-55 boundaries would not change the current Class IV BLM Visual Resource Management rating of developed areas within TA-55.

5.1.2.2.3 50/80 Alternative

Construction

Activities related to the construction of the CMRR-NF required for the 50/80 Alternative would result in a change to the visual appearance at TA-55 due to the presence of construction equipment, a new building, and possibly increased dust. Native grasses, shrubs, trees, and pines would be cleared from the site. These changes would be temporary and, because of its interior location on the LANL site, would only be noticeable from higher elevations to the west along the upper reaches of the Pajarito Plateau rim. Thus, impacts on visual resources during construction would be minimal.

Operation

The 50/80 Alternative would not change the appearance of TA-55. While not visible from lower elevations, the CMRR-NF would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-55 area). However, this change would be consistent with the currently developed areas of TA-55. Thus, new construction within TA-55 boundaries would not change the current Class IV BLM Visual Resource Management rating of developed areas within TA-55.

5.1.2.3 *CCE Alternative*

5.1.2.3.1 **CNC (CPC + CUC)**

Visual resources impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.2.2 as well as the impacts discussed below.

Construction

CUC. Construction activities for the CUC are described in Section 3.5.1.1.1. While not visible from lower elevations, the new facilities would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-55 area). However, this change would be consistent with the currently developed areas of TA-55. Thus, new construction within TA-55 boundaries would not change the current Class IV BLM Visual Resource Management rating of developed areas within TA-55.

Operation

CNC. The CNC (consisting of the CPC and CUC) would include one- and two-story buildings that would change the appearance of the reference location. While not visible from lower elevations, the new facilities would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-55 area). However, this change would be consistent with the currently developed areas of TA-55. Thus, new construction within TA-55 would not change the current Class IV BLM Visual Resource Management rating of developed areas.

5.1.2.3.2 **CNPC (CPC + CUC + A/D/HE Center)**

Visual Resources impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.2.2, the CUC construction and CNC operational impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. Construction activities for the A/D/HE Center are described in Section 3.5.1.2. In 2000, the Cerro Grande Fire swept across TA-16, burning V-Site (an inoperable historic Manhattan Project era site), but all other buildings were placed into a safe closed condition, and fire personnel bulldozed a fire line around the Weapons Engineering Tritium Facility. While not visible from lower elevations, the new facilities at TA-16 would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures (as well as the entire TA-16 area). However, this change would be consistent with the currently developed areas of TA-16. Thus, new construction within TA-16 boundaries would not change the current Class IV BLM Visual Resource Management rating of developed areas within TA-16.

Bandelier National Monument is an important area from which LANL may be viewed. Separate units of the Monument border LANL to the south (Main Unit) and northeast (Tsankawi Unit). Views from the Main Unit along NM 4 are of a generally natural landscape, although there are instances where LANL structures are visible. These include miscellaneous buildings and infrastructure located in TA-33, several facilities and infrastructure associated with TA-49, and TA-16 facilities located east of NM 501 near where it meets NM 4.

Operation

CNPC. The CNPC would be a large complex of industrial facilities, parking lots, and a buffer area encompassing approximately 545 acres. While not visible from lower elevations, the new facilities would be visible from higher elevations beyond the LANL boundary. As a result of the Cerro Grande Fire, there would be an increased visibility of newly built structures. However, this change would be consistent with the currently developed areas of TA-16. Thus, new construction within TA-16 boundaries would likely not change the current Class IV BLM Visual Resource Management rating of developed areas within TA-16.

5.1.3 Site Infrastructure

The analysis of site infrastructure focuses on the ability of the site to provide the electrical power needed to support the programmatic alternatives. The ability of the site to provide the water requirements is addressed in the water resource section (Section 5.1.5). Other infrastructure demands, such as fuels or industrial gases, are commodities that not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS. In general, these commodities are readily available, could be purchased, and would not affect site selection decisions.

5.1.3.1 No Action Alternative

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional impacts to infrastructure beyond current/planned activities that are independent of this action. The current power pool peak load capacity is 130 megawatts-electric [MWe]). The available site capacity is 43 MWe.

5.1.3.2 DCE Alternative (CPC)

Construction

The projected demand on electrical resources associated with construction activities of the three approaches for the DCE Alternative at LANL (Greenfield CPC, Upgrade Alternative, and 50/80 Alternative) are shown in Table 5.1.3–1. The existing electrical infrastructure at LANL would be adequate to support annual construction requirements for the CPC.

Table 5.1.3-1 — Annual Electrical Requirements for Construction of CPC, CUC, and the A/D/HE Center at LANL

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity^a	1,138,800	130
Available site capacity^a	587,930	43
No Action Alternative		
Total site requirement ^b	550,870	87
Percent of site capacity	48%	67%
Greenfield CPC		
CPC requirement	13,000	3.0
Percent of site capacity	1.1%	2.3%
Percent of available capacity	2.2%	7.0%
Upgrade Alternative		
CPC requirement	8,760	2.0
Percent of site capacity	<1%	1.5%
Percent of available capacity	<1%	4.7%
50/80 Alternative		
CPC requirement	4,380	1.0
Percent of site capacity	<1%	<1%
Percent of available capacity	<1%	2.3%
CUC		
CUC requirement	10,950	2.5
Percent of site capacity	1.0%	1.9%
Percent of available capacity	1.9%	5.8%
A/D/HE Center		
A/D/HE Center requirement	55,000	12.7
Percent of site capacity	4.8%	10%
Percent of available capacity	9.3%	29%

Source: NNSA 2007.

^a Not limited due to offsite procurement.

^b Electrical site capacity and requirements are for Los Alamos Power Pool, which include LANL and other Los Alamos County users.

5.1.3.2.2 Operation

The estimated annual electrical requirements for the three approaches for the DCE Alternative at LANL (Greenfield CPC, Upgrade Alternative, and 50/80 Alternative) are shown in Table 5.1.3–2. The existing electrical infrastructure would be adequate to support annual operations.

5.1.3.3 CCE Alternative

5.1.3.3.1 CNC (CPC + CUC)

Site electrical impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.3.2 as well as the impacts discussed below.

Construction

CUC. The estimated site electrical requirements for construction of the CUC are presented in Table 5.1.3-1. The existing electrical infrastructure would be adequate to support annual construction requirements for the CUC.

Table 5.1.3-2 — Annual Site Infrastructure Requirements for Operation of the CPC, CUC, CNC, A/D/HE Center and the CNPC at LANL

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity^a	1,138,800	130
Available site capacity^a	587,930	43
No Action Alternative		
Total site requirement ^b	550,870	87
Percent of site capacity	48%	67%
Greenfield CPC/Upgrade		
CPC requirement	48,000	11
Percent of site capacity	4.2%	8.5%
Percent of available capacity	8.2%	26%
50/80 Alternative		
CPC requirement	44,000	10
Percent of site capacity	3.8%	7.7%
Percent of available capacity	7.5%	23%
CUC		
CUC requirement	168,000	18.4
Percent of site capacity	14.7%	14.2%
Percent of available capacity	28.6%	42.8%
CNC (Greenfield or Upgrade Alternative CPC + CUC)		
CNC requirement	216,000	29.4
Percent of site capacity	18.9%	22.6%
Percent of available capacity	36.7%	68%
CNC (50/80 Alternative + CUC)		
CNC requirement	212,000	28.4
Percent of site capacity	18.6%	21.8%
Percent of available capacity	36%	66%
A/D/HE Center		
A/D/HE Center requirement	52,000	11.9
Percent of site capacity	4.6%	9.1%
Percent of available capacity	8.8%	27.6%
CNPC (Greenfield and Upgrade Alternative + CUC + A/D/HE Center)		
CNPC requirement	264,000	41.3
Percent of site capacity	23.2%	31.8%
Percent of available capacity	45%	96%
CNPC (50/80 Alternative + CUC + A/D/HE Center)		
CNPC requirement	260,000	40.3
Percent of site capacity	19.3%	31%
Percent of available capacity	44%	94%

^a Not limited due to offsite procurement.

^a Electrical site capacity and current requirements are for the entire Los Alamos Power Pool, which include LANL and other Los Alamos County users.

Source : NNSA 2007.

Operation

CNC. The core operations of the CNC would be similar to the CPC and CUC operations described in Sections 3.4.2 and 3.5.1.1. The estimated annual site electrical requirements for operation of the CNC are presented in Table 5.1.3-2. Although the CNC operations would not

exceed LANL electrical power capacity, the peak load could approach approximately 70 percent of the system capacity.

5.1.3.3.2 CNPC (CPC + CUC + A/D/HE Center)

Site infrastructure impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.3.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. The estimated site infrastructure requirements for construction of the A/D/HE Center are presented in Table 5.1.3-1. The existing electrical infrastructure at LANL would be adequate to support annual construction requirements for the A/D/HE Center for the projected 6-year construction period.

Operation

CNPC. The core operations of the CNPC are discussed in Section 3.5.1. The estimated annual site infrastructure requirements for operation of the CNPC are presented in Table 5.1.3-2. The current power pool total electric energy capacity is 1,138,800 megawatt-hours (MWh) (based on a nominal peak load of approximately 130 megawatts-electric [MWe]). The most recent data shows a peak load of approximately 69.5 MWe from LANL and 18.3 MWe from the county for a total peak load of 87 MWe (LANL 2006a). Operation of a CNPC would have the potential to use approximately 96 percent of the peak power capacity that is available.

5.1.4 Air Quality and Noise

5.1.4.1 No Action Alternative

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional impacts to air quality and noise beyond current and planned activities that are independent of this action. The area encompassing LANL and Los Alamos County is classified as an attainment area for all six criteria pollutants. Simultaneous operation of LANL's air emission sources at maximum capacity, as described in the Title V permit application, would not exceed any state or Federal ambient air quality standards.

5.1.4.2 DCE Alternative (Greenfield CPC, Upgrade, 50/80)

5.1.4.2.1 Air Quality

Construction

Non-radiological Impacts. Construction of a CPC, or upgrades to existing facilities at LANL, would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur

dioxide, nitrogen oxide, particulate matter less than 10 microns in diameter (PM₁₀), total suspended particulates, and carbon monoxide. The calculation of emissions from construction equipment was based on emission factors provided in the U.S. Environmental Protection Agency (EPA) document AP-42, “Compilation of Air Pollutant Emission Factors” (EPA 1995). For highway vehicles (worker commuting vehicles and delivery vehicle) emission factors were obtained from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA 2002).

Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 1.20 tons per acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. Facility construction would necessitate a concrete batch plant at the building site. Particulate matter, consisting primarily of cement dust, would be the only regulated pollutant emitted in the concrete mixing process. Emission factors for the concrete batch plant were obtained from AP-42 (EPA 1995).

The estimated maximum annual pollutant emissions resulting from construction activities are presented in Table 5.1.4–1. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities would be too small to result in violations of the National Ambient Air Quality Standards (NAAQS) beyond the LANL site boundary (DOE 2003d). A site-specific EIS, if required, would address this issue, and any potential need for mitigation, in greater detail.

Table 5.1.4-1 — Estimated Peak Non-radiological Air Emissions for CPC – Construction

Pollutant	Estimated Annual Emission Rate (metric tons/yr)	Estimated Annual Emission Rate (metric tons/yr)	Estimated Annual Emission Rate (metric tons/yr)
	Greenfield CPC	Upgrade ^a	50/80
Carbon monoxide	409.6	NA	57
Carbon dioxide	7,084.2	NA	52
Nitrogen dioxide	177.7	NA	0.12
Sulfur dioxide	11.6	NA	0.04
Volatile organic compounds	28.7	NA	3.2
PM ₁₀	686	NA	0.34
Total Suspended Particulates	915	NA	46.8

^a Construction of the Upgrade Alternative would be similar in size and scope as the CMRR construction. See Table 5.1.4-2 for the maximum incremental concentrations associated with construction.
Source: NNSA 2007.

Table 5.1.4-2 — Incremental Concentrations for CPC Upgrade Alternative – Construction

Pollutant	Averaging Period	Most Stringent Standard or Guideline ^a (µg/m ³)	Maximum Incremental Concentration (µg/m ³) ^b	
			Baseline ^b	Upgrade
Carbon monoxide	8-hour	7,900	192.4	22.8
	1-hour	11,900	1,071	182
Nitrogen dioxide	Annual	75	7.0	0.86
	24-hour	150	40.2	23.1
Sulfur dioxide	Annual	42	10.2	0.079
	24-hour	209	83.5	2.26
	3-hour	1,050	397.3	18.1
PM ₁₀	Annual	50	5.24	2.02
	24-hour	150	101.6	34.4
Total Suspended Particulates	Annual	60	5.7	3.96
	24-hour	150	135	66.7

NA = not available.

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic mean PM10 standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. Standards and monitored values for pollutants other than particulate matter are stated in parts per million (ppm). These values have been converted to micrograms per cubic meter (µg/m³) with appropriate corrections for temperature (21 degrees C [60 degrees F]) and pressure (elevation 7,005 feet) following New Mexico dispersion modeling guidelines (revised 1998) (NMAQB 1998).

^b The annual concentrations were analyzed at locations to which the public has access – the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access.

Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, U.S. Department of Energy (DOE) would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

Non-radiological Impacts. Pit manufacturing activities would result in the release of criteria and toxic pollutants into the surrounding air. The primary volume contributors are primarily nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Carbon dioxide would be used as a cleaning agent and helium would be used for leak testing operations. Hydrogen and nitrogen dioxide are reaction products from aqueous purification operations (pyrochemical purification would produce lower amounts of hydrogen and nitrogen dioxide). The chemicals used for dye-penetrant testing of welds are assumed to be volatilized and released to the atmosphere. Organic solvents used for cleaning and chemicals used in the Analytical Laboratory for various analyses would not be expected to contribute any appreciable quantities of any other chemicals to the annual non-radioactive air emissions. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, volatile organic compounds (VOCs), and total suspended particulates. The estimated emission rates for non-radiological pollutants emitted are presented in Table 5.1.4–3. For a Greenfield CPC, a portion of these emissions would be offset by the transfer of current pit manufacturing activities to the new facilities. However, in general, the emissions would be incremental to the LANL baseline. If LANL is selected as the site for a CPC, a prevention of significant deterioration (PSD) increment analysis would be performed to

determine whether the pit manufacturing activities would cause a significant pollutant emission increase.

As part of a previous evaluation of the impact of air emissions, NNSA consulted the Guidance on *Clean Air Act* (CAA) Conformity requirements (DOE 2000a). It determined that the General Conformity rule does not apply because LANL is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

The maximum concentrations (micrograms per cubic meter) at the LANL site boundary that would be associated with the release of criteria pollutants were modeled and are presented in Table 5.1.4-4. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. For most pollutants, incremental concentration increases would generally be small (less than 5 percent). The greatest increase would occur for total suspended particulates (TSP), which could increase by approximately 28 percent. Because of the relatively high baseline concentration of TSP, ambient concentrations could exceed the 24-hour standard. However, because estimated emissions are maximum potential emissions, and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. A site-specific EIS, if required, would address this issue, and the potential need for mitigation, in greater detail.

Table 5.1.4-3 — Annual Non-radiological Air Emissions for the CPC-Operations

Chemical Released	Quantity Released (kg/yr)
	200 ppy
Carbon dioxide	1,843,600
Carbon monoxide	8,580
Nitrogen dioxide	42,803.2
PM ₁₀	1,042.8
Sulfur dioxide	2,626.8
Total suspended particulates	2,820.4
Volatile organic compounds	2,626.8

Source: NNSA 2007.

Radiological Impacts. Radioactive air emissions from pit manufacturing activities would involve plutonium, americium, and enriched uranium. The pit manufacturing activities would be performed within gloveboxes or vaults for radiological containment; and include plutonium recovery using aqueous or pyrochemical processes, foundry, machining, assembly, post assembly operations, inspection and certification, waste handling, and preparing the final product (pits) for shipment. Analytical operations would normally be conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before being released to the air via a 100-foot tall stack. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of entrained particles from the exhaust air.

Table 5.1.4-4 — Criteria Pollutant Concentrations for CPC Operations

Pollutant	Averaging Period	Most Stringent Standard or Guideline ^a (µg/m ³)	Maximum Incremental Concentration (µg/m ³) ^b			
			Baseline ^b	CPC	Upgrade	50/80
Carbon monoxide	8-hour	7,900	192.4	2.58	2.58	1.0
	1-hour	11,900	1,071	3.66	3.66	1.4
Nitrogen dioxide	Annual	75	7.0	1.28	1.28	0.51
	24-hour	150	40.2	NA	NA	NA
Sulfur dioxide	Annual	42	10.2	0.06296	0.06296	0.03
	24-hour	209	83.5	0.454	0.454	0.17
	3-hour	1,050	397.3	0.992	0.992	0.38
PM ₁₀	Annual	50	5.24	0.0356	0.0356	0.01
	24-hour	150	101.6	0.18	0.18	0.07
Total Suspended Particulates	Annual	60	5.7	NA	NA	NA
	24-hour	150	135	38.2	38.2	15

NA = not available.

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic mean PM₁₀ standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. Standards and monitored values for pollutants other than particulate matter are stated in parts per million (ppm). These values have been converted to micrograms per cubic meter (µg/m³) with appropriate corrections for temperature (21 degrees C [60 degrees F]) and pressure (elevation 7,005 feet) following New Mexico dispersion modeling guidelines (revised 1998) (NMAQB 1998).

Source: Janke 2007.

NNSA estimated routine radionuclide air emissions (see Table 5.1.4-5). To ensure that total emissions are not underestimated, NNSA's method for estimating emissions was conservative. Therefore, actual emissions from pit manufacturing operations are expected to be smaller. NNSA estimated the radiation doses to the offsite maximally exposed individual (MEI) and the offsite population surrounding LANL. As shown in Table 5.1.4-6, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 millirem (mrem) per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the CPC resulting from radiological air emissions are presented in Section 5.1.11.

Table 5.1.4-5 — Annual Radiological Air Emissions for CPC at LANL—Operations

Isotope	Baseline ^{a, b}	Annual Emissions (Curies [Ci]/yr) ^c	Annual Emissions (Ci/yr) ^c
		CPC (200 ppy) ^d	50/80
Americium-241	2.6×10^{-7}	3.12×10^{-7}	1.72×10^{-8}
Plutonium-239		1.02×10^{-5}	5.38×10^{-7}
Plutonium-240		2.66×10^{-6}	1.40×10^{-7}
Plutonium-241		1.96×10^{-4}	1.03×10^{-5}
Total Plutonium	9.3×10^{-6}	2.09×10^{-4}	1.1×10^{-5}
Uranium-234		5.02×10^{-9}	2.52×10^{-10}
Uranium-235		1.58×10^{-10}	7.95×10^{-12}
Uranium-236		2.56×10^{-11}	1.28×10^{-12}
Uranium-238		1.42×10^{-12}	7.14×10^{-14}
Total Uranium	7.3×10^{-6}	5.21×10^{-9}	2.62×10^{-10}
Total	1.7×10^{-5}	2.09×10^{-4}	1.1×10^{-5}

^a Based on calendar year 2001 data.

^b The No Action Alternative is represented by the baseline.

^c Source: NNSA 2007.

^d Data for a CPC producing 200 ppy is applicable to both the Greenfield CPC and the Upgrade Alternative.

Table 5.1.4-6 — Annual Doses Due to Radiological Air Emissions from CPC Operations at LANL

Receptor	CPC	50/80
Offsite MEI ^a (mrem/yr)	5.6×10^{-8}	3.0×10^{-9}
Population within 50 miles (person-rem per year) ^a	4.66×10^{-7}	2.5×10^{-8}

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.1.4-5 and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary.
Source: Tetra Tech 2007.

5.1.4.2.2 Noise

Construction

Construction of new buildings would involve the movement of workers and construction equipment and would result in some temporary increase in noise levels near the area. Noise sources associated with construction would not include loud intermittent sources such as blasting. Although noise levels in construction areas could be as high as 110 A-weighted decibels (dBA), these high local noise levels would not extend far beyond the boundaries of the construction site. Table 5.1.4-7 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55-85 dBA. The *Environmental Impact Data Book* (Golden et al. 1980) suggests that noise levels higher than 80-85 dBA are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing wildlife outside a 400-foot radius of the construction site. Given the distance to the site boundary (more than 1 mile) there would be no change in noise impacts on the public as a result of construction activities, except for a small increase in traffic noise levels from construction employees and material shipments.

Table 5.1.4-7 — Peak and Attenuated Noise Levels Expected from Operation of Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by Occupational Safety and Health Administration (OSHA) in its noise regulations (29 CFR

1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Operation

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations at the new buildings would be expected to be similar to those from existing operations. There would be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (approximately 1 mile) noise emissions from equipment would not likely disturb the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. But these noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur onsite and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with the operation of these facilities would increase traffic noise levels along roads used to access the site.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.1.4.3 *CCE Alternative*

5.1.4.3.1 CNC (CPC + CUC)

Air Quality and Noise impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.4.2 as well as the impacts discussed below for the CUC.

5.1.4.3.1.1 Air Quality

Construction

CUC Non-radiological Impacts. Construction impacts would be similar to the construction impacts for the CPC (discussed above), as both facilities are similarly sized (approximately 650,000 square feet of floorspace) and have the same construction durations (6 years). As such, the non-radiological emissions presented in Table 5.1.4–1 would be representative of the CUC. Actual construction emissions of the CUC are expected to be less, since conservative emission factors and other assumptions were used to model the CPC construction activities and tend to overestimate impacts.

CUC Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

CUC and CNC Non-radiological Impacts. CUC (and CNC) activities would result in the release of criteria and toxic pollutants into the surrounding air. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates. The estimated emission rates for non-radiological pollutants were derived from existing Y-12 operations. This derivation did not include steam production at Y-12, which is responsible for approximately 90 percent of the non-radiological emissions at Y-12. The non-radiological pollutants were modeled to determine the incremental concentrations from the CUC to the LANL baseline. The results are presented in Table 5.1.4–8. Because estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. The CUC contribution to non-radiological emissions would not cause any standard or guideline to be exceeded; however, as noted in Section 5.1.2.1, because of the relatively high baseline concentration of TSP, ambient concentrations could exceed the 24-hour standard for the CNC.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because LANL is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

Table 5.1.4-8 — Criteria Pollutant Concentrations for CNC Operations at Los Alamos

Pollutant	Averaging Period	Most Stringent Standard or Guideline ^a (µg/m ³)	Maximum Incremental Concentration(µg/m ³)			
			Baseline	CPC	CUC	CNC
Carbon monoxide	8-hour	7,900	192.4	2.58	NA	2.58
	1-hour	11,900	1,071	3.66	NA	3.66
Nitrogen dioxide	Annual	75	7.0	1.28	0.9	2.18
	24-hour	150	40.2	NA	NA	NA
Sulfur dioxide	Annual	42	10.2	0.06296	2.1	2.16
	24-hour	209	83.5	0.454	2.1	2.5
	3-hour	1,050	397.3	0.992	52.4	53.4
PM ₁₀	Annual	50	5.24	0.0356	17.5	17.5
	24-hour	150	101.6	0.18	17.5	17.7
Total Suspended Particulates	Annual	60	5.7	NA	NA	NA
	24-hour	150	135	38.2	NA	38.2

NA = not available.

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic mean PM10 standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. Standards and monitored values for pollutants other than particulate matter are stated in parts per million (ppm). These values have been converted to micrograms per cubic meter (µg/m³) with appropriate corrections for temperature (21 degrees C [60 degrees F]) and pressure (elevation 7,005 feet) following New Mexico dispersion modeling guidelines (revised 1998) (NMAQB 1998).

Source: Janke 2007.

CUC and CNC Radiological Impacts. The CUC would release radiological contaminants, primarily uranium, into the atmosphere during operations. The current design of the CUC nuclear facility calls for appropriately sized filtered HVAC systems. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from existing Enriched Uranium (EU) facilities at Y-12, and are likely to be less due to the incorporation of newer technology into the facility design. However, because detailed design information does not yet exist, these reductions cannot be quantified. As a result, for purposes of this SPEIS, the radiological airborne emissions from the CUC are conservatively estimated² from existing operations at Y-12. An estimated 0.010 curies (2.17 kilograms) of uranium was released into the atmosphere in 2004 as a result of Y-12 activities (DOE 2005a). After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding LANL, and LANL workers. The CAP88 code is a Gaussian plume dispersion model used to demonstrate compliance with the radionuclide National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61). Specific parameters, including meteorological data, source characteristics, and population data, were used to estimate the radiological doses.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding LANL. As shown in Table 5.1.4-9, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the CUC resulting from radiological air emissions are presented in Section 5.1.11, Human Health and Safety.

Table 5.1.4-9 — Annual Doses^a Due to Radiological Air Emissions from CUC and CNC Operations at LANL

Receptor	CUC	CNC
Offsite MEI ^b (mrem/yr)	0.046	0.046
Population within 50 miles (person-rem per year)	0.376	0.376

^a MEI and population dose estimates for the CUC and CNC operations were calculated using the uranium emission rates from the Y-12 ASER and using the CAP88 computer code.

^b The offsite MEI is assumed to reside at the site boundary.

Source: Tetra Tech 2007.

5.1.4.3.1.2 Noise

Construction

CUC. Anticipated noise impacts from the construction of the CUC are similar to those described for the CPC in Section 5.1.4.2.2.

² This estimate is considered “conservative” because it is expected that a new uranium facility would produce smaller radiological airborne emissions than radiological airborne emissions from existing EU facilities at Y-12 due to the incorporation of newer technology into the facility design.

Operation

CUC and CNC. Anticipated noise impacts from the operation of the CNC are similar to those described for the CPC in Section 5.1.4.2.2.

5.1.4.3.2 CNPC (CPC + CUC + A/D/HE Center)

Air Quality and Noise impacts from the construction and operation of the CNPC would include the CPC impacts discussed in Section 5.1.4.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Air Quality

Construction

A/D/HE Center Non-radiological Impacts. Non-radiological impacts of A/D/HE Center construction are expected to be similar to the impacts described above for the CPC and CUC. However, due to the potential to disturb approximately 300 acres of land during construction, modeling was performed to determine if PM₁₀ emissions (which were considered to be the most likely criteria pollutant to exceed regulatory limits) at the site boundary would exceed regulatory limits. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. Fugitive emissions were estimated based on the EPA emission factor of 1.20 tons per acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent.

The estimated maximum annual PM₁₀ emissions resulting from construction activities are presented in Table 5.1.4–10. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts.

Table 5.1.4–10 – A/D/HE Center Construction — PM₁₀ Impacts

Parameter	Guideline or limit (µg/m ³)	Concentration at Site Boundary (µg/m ³)
Particulate Matter emitted: 1,620 tons/year		
Annual	50	267
24-hour	150	1,950

Source: Janke 2007.

The results presented above represent a bounding estimate of PM₁₀ emissions at the site boundary. These estimates are very conservative in choice of the stability class and the source term. The source strength was assumed to come from a relatively concentrated area for application to the Gaussian Plume equation. Use of an area source would not reduce the emissions by an order of magnitude. Therefore, the results in the table potentially overestimate the impact by about a factor of 5. Based on this analysis, a more detailed site-specific analysis would need to be performed, using project-specific information, if Los Alamos is selected for a

CNPC. If that analysis shows that regulatory limits would be exceeded, then mitigation measures would need to be developed.

A/D/HE Center Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the nature and extent of any contamination and what would be required to remediate any contamination in accordance with established site procedures.

Operation

A/D/HE Center and CNPC Non-radiological Impacts. The CNPC would release non-radiological contaminants into the atmosphere during operations. The CPC and CUC non-radiological emissions are discussed in sections 5.1.4.2.1 and 5.1.4.3.1 respectively, and are not repeated here. The total non-radiological air impacts of the CNPC would be additive of the CPC, CUC, and the A/D/HE Center (which is discussed in this section). During normal operations, the A/D/HE Center would release the non-radionuclides to the air in the quantities indicated in Table 5.1.4-11. These emissions would add to the LANL baseline.

Table 5.1.4-11 — Annual Non-radiological Air Emissions, A/D/HE Center—Operations

NAAQS Emissions	Emissions
Oxides of Nitrogen (tons/year)	91
Carbon Monoxide (tons/year)	31
Volatile Organic Compounds (tons/year)	31
Particulate Matter (tons/year)	18
Sulfur Dioxide (tons/year)	5
Hazardous Air Pollutants and Effluents (tons/yr)	22

Source: NNSA 2007.

The maximum concentrations (micrograms per cubic meter) at the LANL site boundary that would be associated with the release of criteria pollutants presented in Table 5.1.4-12. These concentrations were compared to the more stringent (Federal or state) ambient air quality standards. As shown in that table, there would be a potential to exceed the 24-hour standard for nitrogen dioxide and the 24-hour standard for TSP. However, because estimated emissions are maximum potential emissions, and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are over estimated. A site-specific EIS, if required, would address this issue, and the potential need for mitigation, in greater detail.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because LANL is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

Table 5.1.4-12 — Criteria Pollutant Concentrations for CNPC—Operations

Pollutant	Averaging Period	More Stringent Standard or Guideline ^a (µg/m ³)	Maximum Incremental Concentration (µg/m ³)			Total ^b
			Baseline	A/D/HE	CNPC	Maximum Concentration (µg/m ³)
Carbon monoxide	8-hour	7,900	192.4	90.6	93.2	285.6
	1-hour	11,900	1,071	274.7	278.4	1,349.4
Nitrogen dioxide	Annual	75	7.0	16.5	18.7	25.7
	24-hour	150	40.2	120.9	120.9	161.1
Sulfur dioxide	Annual	42	10.2	0.9	3.1	13.3
Sulfur dioxide	24-hour	209	83.5	6.6	9.1	92.6
	3-hour	1,050	397.3	29.2	82.6	479.9
PM ₁₀	Annual	50	5.2	3.3	20.8	26
	24-hour	150	101.6	23.9	41.6	143.2
Total Suspended Particulates	Annual	60	5.7	4	4	9.7
	24-hour	150	135	29.2	67.4	202.4

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic mean PM10 standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. Standards and monitored values for pollutants other than particulate matter are stated in parts per million (ppm). These values have been converted to micrograms per cubic meter (µg/m³) with appropriate corrections for temperature (21 degrees C [60 degrees F]) and pressure (elevation 7,005 feet) following New Mexico dispersion modeling guidelines (revised 1998) (NMAQB 1998).

Source: Janke 2007.

^bThe Total concentration for each criteria pollutant is comprised of the baseline concentration and the CNPC concentration for each criteria pollutant.

A/D/HE Center and CNPC Radiological Impacts. The CNPC would release radiological contaminants into the atmosphere during operations. The CPC and CUC radiological emissions are discussed in sections 5.1.4.2.1 and 5.1.4.3.1 respectively, and are not repeated here. The total radiological air impacts of the CNPC would be additive of the CPC, CUC, and the A/D/HE Center (which is discussed in this section).

During normal operations, the A/D/HE Center would release radionuclides to the air in the quantities indicated in Table 5.1.4-13.

Table 5.1.4-13 — Annual Radiological Air Emissions for A/D/HE Center Operations

Radionuclide	Emissions (Ci)
Tritium (Ci)	1.41 × 10 ⁻²
Total Uranium (Ci)	7.50 × 10 ⁻⁵
Total Other Radiological Releases (Ci)	2.17 × 10 ⁻¹⁵

Source: NNSA 2007.

After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding LANL, and LANL workers. NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding LANL. As shown in Table 5.1.4-14, the expected annual radiation dose to the offsite MEI would be

much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the A/D/HE Center resulting from radiological air emissions are presented in Section 5.1.11, Human Health and Safety.

Table 5.1.4-14 — Annual Doses Due to Radiological Air Emissions from A/D/HE Center Operations at LANL

Receptor	A/D/HE	CNPC
Offsite MEI ^a (mrem/yr)	3.52×10 ⁻⁴	0.046
Population within 50 miles (person-rem per year)	2.83×10 ⁻³	0.379

^a The offsite MEI is assumed to reside at the site boundary.

Source: Tetra Tech 2007.

5.1.4.3.2.2 Noise

Construction

A/D/HE Center. Anticipated noise impacts from the construction of the CNPC would be similar to those described for the CPC in Section 5.1.4.2.

Operation

A/D/HE Center and CNPC. Anticipated noise impacts from the operation of the A/D/HE Center and CNPC would be similar to those described for the CPC in Section 5.1.4.2.

5.1.4.4 *Capability-Based Alternative*

LANL is presently reestablishing an interim pit fabrication capacity that could provide up to 50 pits annually. Under the Capability-Based Alternative, this effort would continue and would not change. If this alternative were selected, NNSA would increase actual pit production above the current level of 20 pits annually. Increases in the level of activities at the Plutonium Facility Complex would cause a small increase in plutonium emissions. The higher level of activity would result in the annual emission of an additional 0.000019 curies per year of plutonium from the Plutonium Facility Complex. The impacts to human health from this increase are addressed in Section 5.11.

5.1.5 Water Resources

Environmental impacts associated with the programmatic alternatives at Los Alamos could affect groundwater resources. No impacts to surface water are expected. In 2005, LANL used approximately 359 million gallons of groundwater. Discharges were in compliance with permits.

5.1.5.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. Tables 5.1.5-1 and 5.1.5-2 summarize existing surface water and groundwater resources at Los Alamos, the total water

resource requirements for each alternative, and the potential changes to water resources resulting from the programmatic alternatives.

Table 5.1.5–1 — Potential Changes to Water Resources from the Construction of the CPC, CUC and A/D/HE Center at LANL

Proposed Alternatives	Water Availability and Use
Annual Water Rights (gal):	542,000,000
No Action Alternative	
Water Use (gal)	359,000,000
Greenfield CPC and Upgrade Alternative	
Water Requirement (gal)	20,900,000
Percent Change from No Action	5.8%
50/80 Alternative	
Water Requirement (gal)	550,000
Percent Change from No Action	<1%
CUC	
Water Requirement (gal)	5,200,000
Percent change from No Action Alternative	1.4%
A/D/HE Center	
Water Requirement (gal)	2,022,000
Percent change from No Action Alternative	<1%

Source: DOE 2002k, NNSA 2007.

Table 5.1.5–2 — Water Requirements for Operation of the CPC, CUC and A/D/HE Center

Proposed Alternatives	Water Availability and Use
Annual Water Rights (gal)	542,000,000
Water Use (gal)	359,000,000
Greenfield CPC and Upgrade Alternative	
Water Requirement (gal)	80,000,000
Percent Change from No Action Alternative	22.2%
Total Water Use/ Water Rights Exceeded?	468,000,000/No
50/80 Alternative	
Water Requirement (gal)	43,000,000
Percent Change from No Action Alternative	11.9%
Total Water Use/ Water Rights Exceeded?	431,000,000/No
CUC	
Water Requirement (gal)	105,000,000
Percent Change from No Action Alternative	29.2%
Total Water Use/ Water Rights Exceeded?	464,000,000/No
CNC (Greenfield CPC or Upgrade Alternative + CUC)	
Water Requirement (gal)	185,000,000
Percent Change from No Action Alternative	51.5%
Total Water Use/ Water Rights Exceeded?	544,000,000/Yes

**Table 5.1.5–2 — Water Requirements for Operation of the CPC, CUC and A/D/HE Center
 (continued)**

Proposed Alternatives	Water Availability and Use
A/D/HE Center	
Water Requirement (gal)	130,000,000
Percent Change from No Action Alternative	36.2%
Total Water Use/ Water Rights Exceeded?	489,000,000/No
CNPC (Greenfield CPC or Upgrade Alternative + CUC)	
Water Requirement (gal)	395,000,000
Percent Change from No Action Alternative	110%
Total Water Use/ Water Rights Exceeded?	754,000,000/Yes

Source: NNSA 2007.

5.1.5.2 DCE Alternative

5.1.5.2.1 Greenfield CPC

Surface Water

Construction. Construction requirements for the CPC are described in Section 3.4.1. Surface water would not be used to support the construction of the CPC at LANL as groundwater is the source of water at LANL. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. Water runoff from construction would be handled according to the LANL discharge permit for stormwater involving construction activities.

The potential for stormwater runoff from construction areas to impact surface water quality is small. Although runoff from the vicinity of the site drains toward the Rio Grande, surface drainages in general are ephemeral, and infiltration is rapid on alluvium. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. LANL would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at LANL is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

The CPC reference location at TA-55 is not within the 100- or 500-year floodplains. Therefore, no impacts to floodplains are anticipated. New and existing DOE facilities are subject to numerous safety analyses, including threats posed by Natural Phenomena Hazards such as earthquakes, high winds/tornadoes, and flooding.

Operation. Operation requirements for the CPC are described in Section 3.4.1. No impacts on surface water resources are expected as a result of CPC operations at LANL. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds according to permit requirements. No industrial or other regulated discharges to surface waters are anticipated.

The CPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CPC liquid process waste facilities for the plutonium purification process.

Groundwater

Construction. Construction requirements for the CPC are described in Section 3.4.1. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.1.5–1. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. As a result, it is estimated that construction activities would require a total of approximately 20.9 million gallons of groundwater mainly to support CPC construction. Site water requirements are not expected to exceed LANL's maximum water allotment. The percent change from the No Action Alternative would be approximately 5.8 percent.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

Operation. Operation requirements for the CPC are described in Section 3.4.1. Activities at LANL under the Greenfield CPC would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. A summary of water usage by category and total is listed in Table 5.1.5–2. Site water requirements for the operation of the Greenfield CPC Alternative would increase LANL's annual use by approximately 22 percent.

Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.1.5.2.2 Upgrade Alternative

Construction

Construction requirements for the Upgrade Alternative are described in Section 3.4.1.2. Impacts to water during construction activities would be similar to those discussed above for the Greenfield CPC.

Operation

Operation requirements for the Upgrade Alternative are described in Section 3.4.1.2. Impacts to water during construction activities would be similar to those discussed above for the Greenfield CPC.

5.1.5.2.3 50/80 Alternative

Surface Water

Construction. Construction requirements for the 50/80 Alternative are described in Section 3.4.1.2. Impacts to surface water during construction activities would be similar to those discussed above for the Greenfield CPC.

Operation. Operation requirements for the 50/80 Alternative are described in Section 3.4.1.2. Impacts to surface water during operation activities would be similar to those discussed above for the Greenfield CPC.

Groundwater

Construction. Construction requirements for the 50/80 alternative are described in Section 3.4.1.2. It is estimated that construction activities would require a total of approximately 550,000 gallons of groundwater mainly to support CPC construction under the 50/80 Alternative. This would increase LANL's annual water use by less than 1 percent.

Operation. Activities at LANL under the 50/80 Alternative would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. A summary of water usage by category and total is listed in Table 5.1.5–2. Site water requirements for the operation of the 50/80 Alternative would increase LANL's annual use by approximately 12 percent. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.1.5.3 *CCE Alternative*

5.1.5.3.1 CNC (CPC + CUC)

Water resources impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.5.2 as well as the impacts discussed below.

Surface Water

CUC Construction. Construction requirements for the CUC are described in Section 3.5.1.1. Surface water would not be used to support the construction of the CUC at LANL as groundwater is the source of water at LANL. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. Water runoff from construction would be handled according to the LANL discharge permit for stormwater involving construction activities.

The potential for stormwater runoff from construction areas to impact surface water quality is small. Although runoff from the vicinity of the site drains toward the Rio Grande, surface drainages are ephemeral, and infiltration is rapid on alluvium. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. LANL would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at LANL is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

The CUC reference locations (TA-55 and TA-16) are not within the 100- or 500-year floodplains. Therefore, no impacts to floodplains are anticipated. New and existing DOE facilities are subject to numerous safety analyses, including threats posed by Natural Phenomena Hazards such as earthquakes, high winds/tornadoes, and flooding.

CNC Operation. Operation requirements for the CNC are described in Section 3.5.2. No impacts on surface water resources are expected as a result of CNC operations at LANL. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds according to permit requirements. No industrial or other regulated discharges to surface waters are anticipated.

The CNC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CNC liquid process waste facilities for the plutonium purification process.

Groundwater

CUC Construction. Construction requirements for the CUC are described in Section 3.5.1.1. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.1.5-1. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. The percent change in water consumption from the No Action Alternative would be approximately 1.4 percent.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNC Operation. Operation requirements for the CNC are described in Section 3.5.2. A summary of water usage by category and total is listed in Table 5.1.5-2. Impacts from the operation of the CNC would vary depending upon the LANL CPC alternative that is selected (Greenfield CPC, Upgrade, or 50/80). The increase in water consumption for the CNC could be as much as 51.5% compared to the No Action Alternative (for Greenfield CPC and Upgrade Alternative). The total water use for this CNC would be 544 million gallons/year, which would exceed the LANL water allotment by 2 million gallons/year.

Los Alamos County continues to pursue the use of San Juan-Chama water as a means of preserving water rights. On September 19, 2006, New Mexico Governor Richardson signed new repayment contracts on behalf of five towns and cities and two counties, including Los Alamos County, that formally secured water rights with the Bureau of Reclamation for San Juan-Chama project water. Unlike the previous purchase form contracts, the repayment contract has no termination date, giving Los Alamos County and other municipalities perpetual rights and thus negating the need to renegotiate and renew contracts in the future. Los Alamos County will have permanent use of the water as long as it meets the terms of the contract. Use of the San Juan-Chama project along with conservation are integral to the County's Long-Range Water Supply Plan, which was commissioned to provide a sustainable water supply for the next 40 years and was completed in August 2006 (DOE 2006a).

Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.1.5.3.2 CNPC (CPC + CUC + A/D/HE Center)

Water resource impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.5.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Surface Water

A/D/HE Center Construction. Construction requirements for the A/D/HE Center are described in Section 3.5.1.2. Surface water would not be used to support the construction of the A/D/HE Center at LANL as groundwater is the source of water at LANL. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. Water runoff from construction would be handled according to the LANL discharge permit for stormwater involving construction activities.

The potential for stormwater runoff from construction areas to impact surface water quality is small. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. LANL would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at LANL is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

The A/D/HE Center reference location at TA-16 is not within the 100- or 500-year floodplains. Therefore, no impacts to floodplains are anticipated. New and existing DOE facilities are subject to numerous safety analyses, including threats posed by Natural Phenomena Hazards such as earthquakes, high winds/tornadoes, and flooding.

CNPC Operation. No impacts on surface water resources are expected as a result of CNPC operations at LANL. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds according to permit requirements. No industrial or other regulated discharges to surface waters are anticipated.

The CNPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CNPC liquid process waste facilities for the plutonium purification process.

Groundwater

A/D/HE Center Construction. Construction requirements for the A/D/HE Center are described in Section 3.5.1.1. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.1.5-1. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. The percent change in water consumption from the No Action Alternative would be less than 1 percent.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNPC Operation. LANL would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. A summary of water usage by category and total is listed in Table 5.1.5-2. A/D/HE Center operations would increase water usage by 36.2 percent compared to the No Action Alternative. Impacts from the operation of the CNPC would vary depending upon the LANL CPC alternative that is selected (Greenfield CPC, Upgrade, or 50/80). The percent change in water consumption from the No Action Alternative for the operation of the CNPC would be as much as 110 percent, and the potential increase in water demands from a CNPC would result in a total water use of approximately 754 million gallons/year, which would exceed LANL's existing water rights (542 million gallons/year) by 212 million gallons. LANL would need to obtain greater water rights.

Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.1.6 Geology and Soils

5.1.6.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on geology and soils would occur at LANL beyond those of existing and future activities that are independent of this action.

In May 2000, the Cerro Grande Fire burned approximately 43,000 acres, including about 7,700 acres on LANL (Balice, Bennett, and Wright 2004). The fire severely burned much of the mountainside that drains onto LANL (Gallaher and Koch 2004). The effects of the fire included increased soil erosion due to loss of vegetative cover, formation of hydrophobic soils, and soil disturbance during construction of fire breaks, access roads, and staging areas (DOE 2000f). The increased potential for flooding and erosion led to construction of mitigation structures to retain floodwaters and reinforce road crossings (DOE 2002i).

Los Alamos County continues to pursue the use of San Juan-Chama water as a means of preserving water rights. On September 19, 2006, New Mexico Governor Richardson signed new repayment contracts on behalf of five towns and cities and two counties, including Los Alamos County, that formally secured water rights with the Bureau of Reclamation for San Juan-Chama project water. Unlike the previous purchase form contracts, the repayment contract has no termination date, giving Los Alamos County and other municipalities perpetual rights and thus negating the need to renegotiate and renew contracts in the future. Los Alamos County will have permanent use of the water as long as it meets the terms of the contract. Use of the San Juan-Chama project along with conservation are integral to the County's Long-Range Water Supply Plan, which was commissioned to provide a sustainable water supply for the next 40 years and was completed in August 2006 (DOE 2006a).

The dominant contributor to seismic risk at LANL is the Pajarito Fault System. Five small earthquakes (magnitudes of 2 or less on the Richter scale) have been recorded in the Pajarito Fault since 1991. These small events, which produced effects felt at the surface, are thought to be associated with ongoing tectonic activity within the Pajarito Fault zone (LANL 2006a).

5.1.6.2 *DCE Alternative*

5.1.6.2.1 Greenfield CPC

Construction

As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. The construction of the Greenfield CPC is expected to disturb land adjacent to existing facilities at TA-55.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in New Mexico. In addition to aggregate and other geologic resources (e.g., sand) would be required to support construction activities at TA-55, but these resources are abundant in Los Alamos County. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's Environmental Restoration (ER) program and in accordance with LANL's Hazardous Waste Facility Permit. Construction of the Greenfield CPC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

With respect to an earthquake, a comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the Design Basis Earthquake (DBE) ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet.

Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CPC. The operation of the CPC would not be expected to result in impacts on geologic and soil resources. TA-55 is approximately 2.8 miles from the Pajarito Fault (LANL 2007). New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1B, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.1.6.2.2 Upgrade Alternative

Construction

As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. An estimated 13 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the Upgrade Alternative. The land required for the proposed CPC construction would represent approximately 0.05 percent of LANL's total land area of 25,600 acres.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in New Mexico. In addition to aggregate and other geologic resources (e.g., sand) would be required to support construction activities at TA-55, but these resources are abundant in Los Alamos County. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER program and in accordance with LANL's Hazardous Waste Facility Permit. Construction of a Greenfield CPC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

With respect to an earthquake, a comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the DBE ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet.

Operation

Impacts from the operation of the Upgrade Alternative would be similar to those discussed for a Greenfield CPC (Section 5.1.6.2.1).

5.1.6.2.3 50/80 Alternative

Construction

As described in Section 3.4.1.2, the LANL 50/80 Alternative would involve expanding the current pit production capabilities of plutonium facilities in Building PF-4 up to approximately 80 pits per year without expanding the size of the building. To do this, a number of plutonium processing activities that are not related to pit production or stockpile certification would be relocated to other facilities or downsized and consolidated within PF-4. Additionally, the currently planned CMRR would be constructed.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in New Mexico. In addition to aggregate and other geologic resources (e.g., sand) would be required to support construction activities at TA-55, but these resources are abundant in Los Alamos County. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly

other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER program and in accordance with LANL's Hazardous Waste Facility Permit.

With respect to an earthquake, a comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the DBE ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration. Thus, site geologic conditions would not likely affect the facilities.

Operation

The operation of the 50/80 Alternative is described in Section 3.4.1.2. New facilities would result in an addition of approximately 2.5 acres to the permanent TA-55 footprint. The operation of the 50/80 Alternative would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.1.6.3 *CCE Alternative*

5.1.6.3.1 *CNC (CPC + CUC)*

Geologic and soil resource impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.6.2 as well as the impacts discussed below.

Construction

CUC. The CUC would primarily be made up of a new structure to contain a nuclear facility composed of the UPF and HEU storage (described in Sections 3.4.2 and 3.5.1.1) within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at TA-55, but these resources are abundant in Los Alamos County. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact

on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER program and in accordance with LANL's Hazardous Waste Facility Permit. Construction of the CUC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

With respect to an earthquake, a comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the DBE ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet.

Operation

CNC. As described in Section 3.5.2, an estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CNC. Of this, approximately 55 acres would be located within a PIDAS. The administrative support buildings and non-nuclear component production would be located on a 90-acre area outside the PIDAS. A 50-acre buffer zone would also be located outside the PIDAS. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.1.6.3.2 CNPC (CPC + CUC + A/D/HE Center)

Geologic and soil resource impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.6.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. As described in Section 3.5.1.2, the A/D/HE Center would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Approximately 300 acres would be required for the A/D/HE Center. An area of 180 acres would be provided in the PIDAS for the weapons assembly and disassembly facilities, and the associated weapons and plutonium component storage. Located outside the PIDAS area would be non-nuclear facilities, HE fabrication, and administrative support. This area would be approximately 120 acres.

The reference location for the A/D/HE Center at LANL is in TA-16. TA-16 is an approximate 1,900 acre site. In the vicinity of TA-16, deformation associated with the Pajarito Fault extends

at least 5,000 feet to the east of the Pajarito Fault escarpment (LANL 2004e). The west-central area of LANL, generally between TA-3 and TA-16, lies within a part of the Pajarito Fault made up of subsidiary or distributed ruptures. Deformation extends at least 5,000 feet to the east of the Pajarito Fault Escarpment. The general north-south trend of Pajarito Fault structure is disrupted in TA-62, TA-58, and TA-3 by some east-west trending faults. These faults may be related to the Pajarito Fault, the Rendija Canyon Fault, or be independent structures. These are areas of generally higher potential for seismic surface rupture, relative to locations farther removed from the Pajarito Fault zone. A comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the DBE ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at TA-16, but these resources are abundant in Los Alamos County. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER program and in accordance with LANL's Hazardous Waste Facility Permit. Construction of the A/D/HE Center would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

Operation

CNPC. As described in Section 3.5.1.2, an estimated 545 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CNPC. Of this, approximately 235 acres would be located within a PIDAS. The administrative support buildings, HE fabrication, and non-nuclear component production would be located on a 210-acre area outside the PIDAS. A 100-acre buffer zone would also be located outside the PIDAS. The reference location for the A/D/HE Center at LANL is in TA-16. Probabilistic analyses of surface rupture potential at TA-16 indicate that, even in consideration of 1-in-10,000-year events, seismic surface rupture only becomes a significant hazard on the principal or main trace of the Pajarito Fault (LANL 2004e).

5.1.7 Biological Resources

5.1.7.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. No additional impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered (T&E) species would occur at LANL beyond those of existing and future activities that are independent of this action.

5.1.7.2 *DCE Alternative*

As discussed in Section 5.1, the DCE Alternative at LANL includes the evaluation of three approaches, the Greenfield CPC, the Upgrade Alternative, and the 50/80 Alternative. Biological impacts from the construction and operation will be very similar regardless of the CPC approach selected.

5.1.7.2.1 Terrestrial Resources

Construction

Construction would take place within the TA-55 built environment. Wildlife and vegetation present are characteristic of species adapted to build environments with open settings, i.e., nonforested. Vegetation is comprised primarily of grasses, weeds, and plants used for landscaping. Wildlife is common to the region and primarily small mammals, lizards, and birds. Depending upon the CPC approach selected, approximately zero to 140 acres of low value vegetation and habitat would be affected during construction. During site clearing activities, highly mobile wildlife species such as some small mammals and birds would be able to relocate to adjacent less developed areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. For less mobile species (reptiles and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

Operation

The major difference between the LANL CPC approaches is the size of the modification or loss of low-value plant communities and wildlife habitat. The acreage modified or lost would range from zero to 110 acres depending upon the LANL CPC approach selected. It is important to note that the impacts would be within a previously and substantially developed location. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations would minimize the potential for any adverse effects to plant and animal communities (terrestrial resources) surrounding TA-55.

5.1.7.2.2 Wetlands

Construction

Construction requirements for the CPC are described in Section 3.4.1. There would be no direct impacts to wetlands as there are no wetlands within the area proposed for the construction of the CPC or any of the associated construction staging and laydown areas. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid the indirect degradation of any adjacent wetland areas.

Operation

There are no adverse impacts predicted to any adjacent wetland area from implementation of any of the CPC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CPC operations are not expected to adversely affect wetlands downstream of the TA-55 watershed.

5.1.7.2.2 Aquatic Resources

Construction

There are no perennial or seasonal aquatic habitats within the TA-55 location proposed for the CPC. Thus there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downstream and within the TA-55 watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

Operation

There would be no direct discharge of untreated operational effluent from CPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other LANL built environments and the quantity would represent a minor downstream contribution into the TA-55 watershed.

Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at LANL, are known to be present within the proposed site location. However, TA-55 does contain core and buffer Areas of Environmental Interest for the Mexican spotted owl (*Strix occidentalis lucida*), a federally

listed threatened species, and other special interest avian species may use the habitat for foraging or hunting. Prior to any construction activities, NNSA would consult with the U.S. Fish and Wildlife Service (USFWS), as appropriate, to discuss the potential impacts of a CPC on any threatened and endangered species. It is expected that a CPC would have minimal affect on the core and buffer area for the Mexican spotted owl as it is proposed for construction in an existing highly developed environment.

Construction

Construction requirements for the CPC are described in Section 3.4.1. A maximum of approximately 140 acres (Greenfield CPC) of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. Construction would take place within the TA-55 built environment. During site clearing activities, no special interest species would be killed or dislocated as no special interest species are known to inhabit the area. However, should LANL be selected for construction and operations of a CPC, then NNSA, prior to any habitat modifying activities, would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special interest species. Acreage temporarily modified from construction would be lost as potential foraging areas or hunting habitat for special interest avian species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

Operation

Operation requirements for the CPC are described in Section 3.4.1. A maximum estimated 110 acres (Greenfield CPC) of land would be required to operate the CPC. Depending upon the CPC approach selected, acreage permanently modified or lost as foraging or prey base habitat for species of special interest would vary, but would be less than approximately 110 acres. It is important to note that the impacts would be to highly developed areas. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations should have no adverse impacts to any special interest species population.

5.1.7.3 *CCE Alternative*

5.1.7.3.1 *CNC (CPC + CUC)*

Biological resource impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.7.2 as well as the impacts discussed below.

Terrestrial Resources

CUC Construction. As described in Section 3.5.1.1, approximately 50 acres of land would be disturbed during CUC construction. Construction would take place within the TA-55 built

environment. Wildlife and vegetation present are characteristic of species adapted to build environments with open settings, i.e., nonforested. Vegetation is comprised primarily of grasses, weeds, and plants used for landscaping. Wildlife is common to the region and consists of elk, deer, bob cat, mountain lion, bears, small mammals, lizards, and birds. Approximately 50 acres of vegetation and habitat would be affected during construction. During site clearing activities, highly mobile wildlife species such as some small mammals and birds would be able to relocate to adjacent less developed areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. For less mobile species (reptiles and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

CNC Operation. As described in Section 3.5.2, approximately 195 acres of land would be required to support CNC operations. It is important to note that the impacts would be within a previously and substantially developed location. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations would minimize the potential for any adverse effects to plant and animal communities (terrestrial resources) surrounding TA-55.

Wetlands

CUC Construction. Construction requirements for the CUC are described in Section 3.5.1.1. There would be no direct impacts to wetlands as there are no wetlands within the area proposed for the construction of the CPC or any of the associated construction staging and laydown areas. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid the indirect degradation of any adjacent wetland areas.

CNC Operation. There are no adverse impacts predicted to any adjacent wetland area from implementation of any of the CNC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations are not expected to adversely affect wetlands downstream of the TA-55 watershed.

Aquatic Resources

CUC Construction. Construction requirements for the CUC are described in Section 3.5.1.1. There are no perennial or seasonal aquatic habitats within the TA-55 location proposed for the CUC. Thus there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downstream and within the TA-55 watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNC Operation. Operation requirements for the CNC are described in Section 3.5.2. There would be no direct discharge of untreated operational effluent from CNC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other LANL built environments and the quantity would represent a minor downstream contribution into the TA-55 watershed.

Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at LANL, are known to be present within the proposed site location. However, TA-55 does contain core and buffer Areas of Environmental Interest for the Mexican spotted owl (*Strix occidentalis lucida*), a federally listed threatened species, and other special interest avian species may use the habitat for foraging or hunting. Prior to any construction activities, NNSA would consult with the USFWS, as appropriate, to discuss the potential impacts of a CUC on any threatened and endangered species. It is expected that a CUC would have minimal affect on the core and buffer area for the Mexican spotted owl as it is proposed for construction in an existing highly developed environment.

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1.1. Approximately 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CUC. Construction requirements for the CPC are described in Section 3.4.1. Construction would take place within the TA-55 built environment. During site clearing activities, no special interest species would be killed or dislocated as no special interest species are known to inhabit the area. However, should Los Alamos be selected for construction and operations of the CNC, then NNSA, prior to any habitat modifying activities, would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special interest species. Acreage temporarily modified from construction would be lost as potential foraging areas or hunting habitat for special interest avian species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

CNC Operation. Operation requirements for the CNC are described in Section 3.5.2. An estimated 195 acres of land would be required to operate the CNC. It is important to note that the impacts would be to highly developed areas. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, operations should not result in adverse impacts to any special interest species population.

5.1.7.3.2 CNPC (CPC + CUC + A/D/HE Center)

Biological resources impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.7.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. As described in Section 3.5.1.2, approximately 300 acres would be required for the A/D/HE Center. An area of 180 acres would be provided in the PIDAS for the weapons A/D facilities, and the associated weapons and plutonium component storage. Located outside the PIDAS area would be a buffer zone, non-nuclear facilities, HE fabrication, and administrative support facilities. This area would be approximately 120 acres.

Construction would take place within TA-16. Wildlife and vegetation present are characteristic of species adapted to build environments with open settings, i.e., nonforested. Vegetation is comprised primarily of grasses, weeds, and plants used for landscaping. Wildlife is common to the region and primarily small mammals, lizards, and birds. In addition to the impacts associated with the CPC and CUC, approximately 300 acres of low value vegetation and habitat would be affected during construction of the A/D/HE Center. During site clearing activities, highly mobile wildlife species such as some small mammals and birds would be able to relocate to adjacent less developed areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. For less mobile species (reptiles and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

Operation

CNPC. As described in Section 3.5.2, approximately 545 acres of land would be required to support CNPC operations. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CNPC operations would minimize the potential for any adverse effects to plant and animal communities (terrestrial resources) surrounding TA-16.

Wetlands

A/D/HE Center Construction. Construction requirements for the A/D/HE Center are described in Section 3.5.1.2. There would be no direct impacts to wetlands as there are no wetlands within the area proposed for the construction of the A/D/HE Center or any of the associated construction staging and laydown areas. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid the indirect degradation of any adjacent wetland areas.

CNPC Operation. There are no adverse impacts predicted to any adjacent wetland area from implementation of the CNPC alternative. There would be no direct untreated effluent discharges to the environment.

Aquatic Resources

A/D/HE Center Construction. Construction requirements for the A/D/HE Center are described in Section 3.5.1.2. There are no perennial or seasonal aquatic habitats within the TA-16 location proposed for the A/D/HE Center. Thus there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downstream and within the TA-16 watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNPC Operation. Operation requirements for the CNPC are described in Section 3.5.1. There would be no direct discharge of untreated operational effluent from CNPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other LANL built environments.

Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at LANL, are known to be present within the proposed site location. However, TA-16 does contain core and buffer Areas of Environmental Interest for the Mexican spotted owl (*Strix occidentalis lucida*), a federally listed threatened species, and other special interest avian species may use the habitat for foraging or hunting. Prior to any construction activities, NNSA would consult with the USFWS, as appropriate, to discuss the potential impacts of an A/D/HE Center on any threatened and endangered species. It is expected that an A/D/HE Center would have minimal affect on the core and buffer area for the Mexican spotted owl.

A/D/HE Center Construction. As described in Section 3.5.1.2, approximately 300 acres would be required for the A/D/HE Center at TA-16. An area of 180 acres would be provided in the PIDAS for the weapons assembly and disassembly facilities, and the associated weapons and plutonium component storage. Located outside the PIDAS area would be a buffer zone and non-nuclear facilities for HE fabrication, administrative support, and disposal of explosive materials. This area would be approximately 120 acres.

During site clearing activities, no special interest species would be killed or dislocated as no special interest species are known to inhabit the area. However, should LANL be selected for construction and operations of the CNPC, then NNSA, prior to any habitat modifying activities, would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special interest species. Acreage temporarily modified from construction would be lost as potential foraging areas or hunting habitat for special interest avian

species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

CNPC Operation. Operation requirements for the CNPC are described in Section 3.5.1. An estimated 545 acres of land would be required to operate the CNPC. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNPC operations should not adversely impact any special interest species population.

5.1.8 Cultural and Archaeological Resources

5.1.8.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in 3.2.1. No additional buildings or facilities would be built beyond those that NNSA has already decided to build, and no additional impacts to cultural and paleontological resources would occur at LANL beyond those of existing and future activities that are independent of this action.

As of 2005, cultural and paleontological surveys have been conducted on approximately 90 percent of the land within LANL boundaries with 86 percent having been intensively surveyed. The majority of these surveys emphasized American Indian cultural resources. Information on these resources was obtained from the LANL cultural resources database, which is organized primarily by site type. Although about 400 cultural and paleontological sites have been determined to be eligible for the National Register of Historic Places (NRHP), most of the remaining sites have yet to be formally assessed and are therefore assumed to be eligible until assessed (LANL 2005h).

5.1.8.2 *DCE Alternative*

As discussed in Section 5.1, the DCE Alternative at LANL includes the evaluation of three approaches, the Greenfield CPC, the Upgrade Alternative, and the 50/80 Alternative. Cultural and paleontological impacts from the construction and operation will be very similar regardless of the CPC approach selected.

5.1.8.2.1 Cultural Resources

Construction

As described in Section 3.4.1, the CPC would disturb an estimated 140 acres (Greenfield CPC) and 13 acres (Upgrade Alternative) of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace. For the 50/80 Alternative, the CMRR-NF would be constructed and expanded by approximately 9,000 square feet. The reference location for the CPC is at TA-55. Almost half of TA-55 has been disturbed through development of other facilities. All of TA-55 has been inventoried for cultural resources. Due to the high density of cultural resources at LANL, relative to other DOE sites under consideration, there is a high

probability that resources would be impacted during CPC construction anywhere on the LANL site, including TA-55.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by the construction of the CPC. Methods for identification could include field surveys, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the New Mexico Site Historic Preservation Office (SHPO) and in accordance with the *LANL Cultural Resource Overview and Data Inventory 1995* (LANL 1995). If previously unknown cultural resources, such as buried artifacts, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the New Mexico SHPO.

Operation

As described in Section 3.4.1, an estimated 110 acres (Greenfield CPC), 6.5 acres (Upgrade Alternative), and 2.5 acres (50/80 Alternative) of additional land would be required to operate the various CPC options at LANL. Operation of the CPC would have no impact on cultural resources.

5.1.8.2.2 Archaeological Resources

Construction

Only one archaeological resource has been reported within the TA-55 boundaries, and such resources are unlikely to be found due to the volcanic formations that comprise the area. Therefore, no archaeological resources would be impacted due to construction of the CPC.

Operation

Operation of the CPC would have no impact on paleontological resources.

5.1.8.3 CCE Alternative

5.1.8.3.1 CNC (CPC + CUC)

Cultural and paleontological resources impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.8.2 as well as the impacts discussed below.

Cultural Resources

CUC Construction. As described in Section 3.4.1, the CUC would disturb an estimated 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace. The reference location for the CUC is at TA-55. Almost half of TA-55 has

been disturbed through development of other facilities. All of TA-55 has been inventoried for cultural resources. Due to the high density of cultural resources at LANL, relative to other DOE sites under consideration, there is a high probability that resources would be impacted during CUC construction anywhere on the LANL site, including TA-55.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by the construction of the CUC. Methods for identification could include field surveys, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the New Mexico State Historic Preservation Office (SHPO) and in accordance with the *LANL Cultural Resource Overview and Data Inventory 1995* (LANL 1995). If previously unknown cultural resources, such as subsurface resources, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the New Mexico SHPO.

CNC Operation. As described in Section 3.5.2, an estimated 195 acres would be required to operate the CNC. Operation of the CNC would have no impact on cultural resources.

Archaeological Resources

CUC Construction. Only one archaeological resource has been reported within the TA-55 boundaries, and such resources are unlikely to be found due to the volcanic formations that comprise the area. Therefore, no archaeological resources would be impacted due to construction of the CUC. As discussed in Section 5.1.8.3.2, there is a higher probability that archaeological resources at TA-16 could be impacted if the CUC were sited at TA-16.

CNC Operation. As described in Section 3.5.2, operation of the CNC would require an estimated 195 acres. Operation of the CNC at would have no impact on archaeological resources.

5.1.8.3.2 CNPC (CPC + CUC + A/D/HE Center)

Cultural and archaeological resource impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.1.8.2, the CNPC impacts discussed above, and the A/D/HE Center impacts discussed below.

Cultural Resources

A/D/HE Center Construction. The A/D/HE Center construction would disturb an estimated 300 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace at TA-16. Approximately one-third of TA-16 has been disturbed through development of other facilities and HE R&D. Due to the high density of cultural resources at LANL, relative to other DOE sites under consideration, there is a high probability that resources would be impacted during A/D/HE Center construction anywhere on the LANL

site, including TA-16. The number of resources that would be disturbed is unknown, but would likely increase as the number of acres disturbed increases.

The Nake'muu site, an enclosed plaza pueblo, is located approximately 2 miles away from the proposed reference location for the A/D/HE Center. Unique architectural features of the Nake'muu are still visible, making it eligible for NRHP nomination. Previously, the New Mexico SHPO concurred in this determination in correspondence to the DOE dated February 21, 1989 (LANL 1995). This site is an irregular-shaped pueblo of possibly 50 rooms. The site has been described as the best-preserved ruin in this region. This site is unusual in that it is located at a high elevation, 7,175 feet, and is built on bedrock somewhat distant from agricultural resources as compared to other similar sites in the LANL area.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by the construction of the A/D/HE Center. Methods for identification could include field surveys, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the New Mexico SHPO and in accordance with the *LANL Cultural Resource Overview and Data Inventory 1995* (LANL 1995). If previously unknown cultural resources, such as buried artifacts, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the New Mexico SHPO.

CNPC Operation. As described in Section 3.5.1.2, the CNPC would require approximately 545 acres. Operation of the CNPC would be expected to have no impact on cultural resources.

Archaeological Resources

A/D/HE Center Construction. Only one archaeological resource has been reported within the LANL boundaries, and such resources are unlikely to be found due to the volcanic formations that comprise the area. Therefore, no archaeological resources would be impacted due to construction of the A/D/HE Center.

CNPC Operation. As described in Section 3.5.2, the CNPC would require approximately 545 acres. Operation of the CNPC at would have no impact on cultural resources.

5.1.9 Socioeconomics

This section analyzes the impacts to socioeconomic resources from the No Action Alternative, DCE Alternative, CCE Alternative, and the Capability-Based Alternative.

5.1.9.1 *No Action Alternative*

Under the No Action Alternative, there would be no major changes in the workforce currently at LANL. However, the 2006 Draft LANL SWEIS estimates that employment at LANL could

experience a minor rise with both increased pit production and increased remediation and D&D activities (LANL 2006a). If LANL’s employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011.

5.1.9.2 DCE Alternative

5.1.9.2.1 Greenfield CPC

Regional Economic Characteristics

Construction. Construction of the CPC would require a total of 2,650 worker-years of labor. During peak construction, about 770 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 816 indirect jobs would be created, for a total of 1,586 jobs. This represents less than 2 percent of the total ROI labor force. It is estimated that one-half of the direct and indirect jobs would be filled by current workers in the ROI.

Based on the ROI average earnings of \$30,900 for the construction industry, direct income would increase by \$23.8 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$49 million (\$23.8 million direct and \$25.2million indirect). Table 5.1.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Table 5.1.9-1 — Socioeconomic Impacts from Peak Construction – CPC

Socioeconomic Factor	CPC
Worker Years	2,650
Peak Workers	770
Indirect Jobs Created	816
Total Jobs Created	1,586
ROI Average Earning (direct)	\$30,900
Direct Income Increase	\$23,793,000
Indirect Income Increase	\$25,214,000
Total Impact to the ROI	\$49,007,000

Source: NNSA 2007.

Operation. Operation of a CPC would require a total of 1,780 workers.³ In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 1,887 indirect jobs would be created, for a total of approximately 3,667 jobs. This represents less than approximately 3 percent of the total ROI labor force. It is estimated that one-third of the direct and indirect jobs would be filled by workers migrating into the ROI.

³ LANL currently conducts plutonium operations, including R&D and limited pit production, with a workforce of approximately 610. Consequently, the projected workforce increase at LANL should be approximately 1,170, compared to 1,780 for other sites. However, if a CPC were located at Los Alamos, the existing workers at LANL would become part of a CPC mission. Consequently, for steady-state operations, this analysis includes these workers as part of the CPC operational workforce, and assesses income changes for this total workforce.

Based on the ROI average earnings of \$47,200 for the government services industry, direct income would increase by \$84 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$197.2 million (\$84 million direct and \$113.2 million indirect). Table 5.1.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC and the other facilities associated with the programmatic alternatives.

Table 5.1.9-2 — Socioeconomic Impacts from Operations: All Facilities/Alternatives

Socioeconomic Factor	CPC	CUC	CNC	AD/HE	CNPC
Workers	1,780	935	2,715	1,785	4,500
Indirect Jobs Created	1,887	991	2,878	1,892	4,770
Total Jobs Created	3,667	1,926	5,593	3,677	9,270
ROI Average Earning (direct)	\$47,200	\$47,200	\$47,200	\$47,200	\$47,200
Direct Income Increase	\$84,016,000	\$44,132,000	\$128,148,000	\$84,252,000	\$212,400,000
Indirect Income Increase	\$113,208,000	\$59,466	\$172,674,000	\$113,526,000	\$286,200,000
Total Impact to the ROI	\$197,224,000	\$103,598,000	\$300,822,000	\$197,778,000	\$498,600,000

Source: NNSA 2007.

Population and Housing

Construction. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (770 workers), a total of 1,155 new residents would be expected in the ROI. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.1.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Operation. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,170 new workers), approximately 1,170 new residents would be expected in the ROI, including workers and their families. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.1.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC.

Community Services

Construction. The small increase in the population would not put increased demand on community services. Comparable levels of service could be maintained with current staffing levels. Table 5.1.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Operation. The small increase in the population would not put increased demand on community services. Comparable levels of service could be maintained with current staffing levels. Table 5.1.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC.

5.1.9.2.2 Upgrade Alternative

Regional Economic Characteristics

Construction. Construction under the Upgrade Alternative would require a total of 1,100 worker-years of labor. During peak construction, 300 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 318 indirect jobs would be created, for a total of 618 jobs. This represents less than 1 percent of the total ROI labor force.

Based on the ROI average earnings of \$30,900 for the construction industry, direct income would increase by \$9.3 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$17.6 million (\$9.3 million direct and \$8.3 million indirect). Table 5.1.9-3 presents the impacts to socioeconomic resources from construction of facilities associated with the Upgrade Alternative.

Table 5.1.9-3 — Socioeconomic Impacts from Peak Construction – Upgrade Alternative

Socioeconomic Factor	CPC
Worker Years	1,100
Peak Workers	300
Indirect Jobs Created	318
Total Jobs Created	618
ROI Average Earning (direct)	\$30,900
Direct Income Increase	\$9,270,000
Indirect Income Increase	\$8,281,000
Total Impact to the ROI	\$17,551,000

Source: NNSA 2007.

Operation. Operations under the Upgrade Alternative would require 1,780 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 1,887 indirect jobs would be created, for a total of approximately 3,667 jobs.

Based on the ROI average earnings of \$47,200 for the government services industry, direct income would increase by \$84 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$197.2 million (\$84 million direct and \$113.2 million indirect).

Population and Housing

Construction. The influx of new workers would increase the ROI population and create new housing demand. A total of approximately 450 new residents would be expected in the ROI,

including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.1.9-3 presents the impacts to socioeconomic resources from construction of facilities associated with the Upgrade Alternative.

Operation. The influx of new workers would increase the ROI population and create new housing demand. A total of 1,170 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population.

Community Services

Construction. The small increase in the ROI population would not put increased demand on community services. Comparable levels of service could be maintained with current staffing levels. Table 5.1.9-3 presents the impacts to socioeconomic resources from construction of facilities associated with the Upgrade Alternative.

Operations. The small increase in the ROI population would not put increased demand on community services. Comparable services could be maintained with current staffing levels.

5.1.9.2.3 50/80 Alternative

Regional Economic Characteristics

Construction. Construction relating to the 50/80 Alternative would require a total of 430 worker-years of labor. During peak construction, 190 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 201 indirect jobs would be created, for a total of 391 jobs. This represents less than 0.3 percent of the total ROI labor force.

Based on the ROI average earnings of \$30,900 for the construction industry, direct income would increase by \$5.9 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$11 million (\$5.9 million direct and \$5.2 million indirect). Table 5.1.9-4 presents the impacts to socioeconomic resources from construction of facilities associated with the 50/80 Alternative.

Table 5.1.9-4 — Socioeconomic Impacts from Peak Construction – 50/80 Alternative

Socioeconomic Factor	CPC
Worker Years	430
Peak Workers	190
Indirect Jobs Created	201
Total Jobs Created	391
ROI Average Earning (direct)	\$30,900
Direct Income Increase	\$5,871,000
Indirect Income Increase	\$5,245,000
Total Impact to the ROI	\$11,116,000

Source: NNSA 2007.

Operation. Operation under the 50/80 Alternative would require 680 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 721 indirect jobs would be created, for a total of approximately 1,401 jobs. Based on the ROI average earnings of \$47,200 for the government services industry, direct income would increase by \$32.1 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$75.3 million (\$32.1 million direct and \$43.2 million indirect).

Population and Housing

Construction. The influx of new workers would increase the ROI population and create new housing demand. A total of approximately 285 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.1.9-4 presents the impacts to socioeconomic resources from construction of facilities associated with the 50/80 Alternative.

Operation. The influx of new workers would increase the ROI population and create new housing demand. A total of 680 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population.

Community Services

Construction. The small increase in the ROI population would not put increased demand on ROI community services. Comparable levels of service could be maintained with current staffing levels. Table 5.1.9-4 presents the impacts to socioeconomic resources from construction of facilities associated with the 50/80 Alternative.

Operation. The small increase in the ROI population would not put increased demand on community services. Comparable levels of service could be maintained with current staffing levels.

5.1.9.3 *CCE Alternative*

5.1.9.3.1 *CNC (CPC + CUC)*

Socioeconomic impacts from the construction and operation of the CNC would include the impacts discussed in Section 5.1.9.2 as well as the impacts discussed below.

Regional Economy Characteristics

CUC Construction. Construction of the CUC would require approximately 4,000 worker-years of labor. During peak construction, 1,300 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in

other supporting industries. It is estimated that approximately 1,378 indirect jobs would be created, for a total of 2,678 jobs. This represents approximately 2 percent of the total ROI labor force. Based on the ROI average earnings of \$30,900 for the construction industry, direct income would increase by \$40.2 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$76 million (\$40.1 million direct and \$35.9 million indirect). Table 5.1.9-5 presents the impacts to socioeconomic resources from construction of the CUC.

Table 5.1.9-5 — Socioeconomic Impacts from Peak Construction – CUC

Socioeconomic Factor	CUC
Worker Years	4,000
Peak Workers	1,300
Indirect Jobs Created	1,378
Total Jobs Created	2,678
ROI Average Earning (direct)	\$30,900
Direct Income Increase	\$40,170,000
Indirect Income Increase	\$35,886,000
Total Impact to the ROI	\$76,056,000

Source: NNSA 2007.

CUC and CNC Operation. Operation of the CUC would require 935 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 991 indirect jobs would be created, for a total of 1,926 jobs. Based on the ROI average earnings of \$47,200 for the government services industry, direct income would increase by \$44.1 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$103.6 million (\$44.1 million direct and \$59.5 million indirect). Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from the operation of the CPC and CUC individually.

Population and Housing

CUC Construction. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (1,300 workers), a total of 1,950 new residents would be expected in the ROI. This is an increase of approximately 2 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. The influx of new workers would increase the ROI population and create new housing demand. Table 5.1.9-5 presents the impacts to socioeconomic resources from construction of the CUC.

CUC and CNC Operation. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (935 new workers), approximately 935 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be

sufficient to absorb this increase in the ROI population. Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from operation of the CPC and CUC individually.

Community Services

CUC Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.1.9-5 presents the impacts to socioeconomic resources from construction of the CUC.

CNC Operation. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from operation of the CPC and CUC individually.

5.1.9.3.2 CNPC (CPC + CUC + A/D/HE Center)

Socioeconomic impacts from the construction and operation of a CNPC would include the CPC impacts discussed in Section 5.1.9.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Regional Economy Characteristics

A/D/HE Center Construction. Construction of the A/D/HE Center would require approximately 6,850 worker-years of labor. During peak construction, 3,820 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 4,049 indirect jobs would be created, for a total of 7,869 jobs. This represents approximately 5 percent of the total ROI labor force. Based on the ROI average earnings of \$30,900 for the construction industry, direct income would increase by \$118 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$223.5 million (\$118 million direct and \$105.5 million indirect). Table 5.1.9-6 presents the impacts to socioeconomic resources from construction of the AD/HE Center.

Table 5.1.9-6 — Socioeconomic Impacts from Peak Construction – A/D/HE Center

Socioeconomic Factor	AD/HE
Worker Years	6,850
Peak Workers	3,820
Indirect Jobs Created	4,049
Total Jobs Created	7,869
ROI Average Earning (direct)	\$30,900
Direct Income Increase	\$118,038,000
Indirect Income Increase	\$105,449,000
Total Impact to the ROI	\$223,487,000

Source: NNSA 2007.

A/D/HE Center and CNPC Operation. Operation of the A/D/HE Center would require 1,785 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 1,892 indirect jobs would be created, for a total of 3,677 jobs. Based on the ROI average earnings of \$47,200 for the government services industry, direct income would increase by \$84.3 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$197.8 million (\$84.3 million direct and \$113.5 million indirect). Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the operation of the A/D/HE Center individually.

Population and Housing

Construction. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (3,820 workers), a total of 5,730 new residents would be expected in the ROI. This is an increase of approximately 3.7 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.1.9-6 presents the impacts to socioeconomic resources from construction of the AD/HE Center.

A/D/HE Center and CNPC Operation. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,785 new workers), approximately 1,785 new residents would be expected in the ROI, including workers and their families. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the operation of the A/D/HE Center individually.

Community Services

A/D/HE Center Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.1.9-6 presents the impacts to socioeconomic resources from construction of the AD/HE Center.

A/D/HE Center and CNPC Operation. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.1.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the operation of the A/D/HE Center individually.

5.1.9.4 *Capability-Based Alternative*

LANL is presently reestablishing an interim pit fabrication capacity that could provide 50 pits annually. Under the Capability-Based Alternative, this effort would continue and would not

change. Employment at LANL is expected to continue to rise due to both increased pit production and increased remediation and D&D activities. In addition, work at LANL would likely increase beyond current operations in areas that cannot be easily identified at this time, but could be tied to expanding research efforts such as homeland security. Similar increases have been seen in recent years. LANL's employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011, which would be an increase of about 1,890 above the 2005 level (LANL 2006a).

5.1.9.5 *LANL Plutonium Phaseout*

If LANL is not selected as the site for the CPC or CNPC, NNSA would phaseout NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations would result in a loss of approximately 610 jobs, which would represent a decrease of 4.5 percent of the workforce at LANL (13,504). The loss of 610 direct jobs would result in the loss of approximately 650 indirect jobs. Thus, the total loss of jobs in the ROI would be 1,260, which would represent less than a 1 percent decrease in the ROI workforce of 147, 792. A less than 1 percent loss in ROI jobs would have no major effect on unemployment, housing, or community services.

5.1.10 **Environmental Justice**

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as being Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; or another non-White race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income.

Section 4.1.10 presents the existing environmental justice characteristics of the ROI, including census tracts for minority and low-income populations. Impacts for all of the alternatives do not differ significantly, as such; the analysis in this section discusses potential environmental justice impacts for all impacts.

In 2000, minority populations represented 57 percent of the total population within the census tracts containing LANL. In 2000, minorities were 24.9 percent of the population nationally and 75 percent of the population in New Mexico. The percentage of persons below the poverty level is 9.3 percent, which is comparable to the 2000 national average of 12.4 percent and the statewide figure of 18 percent.

Based on the analysis of impacts for resource areas, few high and adverse impacts from construction and operation activities at LANL are expected under any of the alternatives; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land uses, visual resources, noise, water, geology and soils, biological resources, cultural and archaeological resources. As shown in Section 5.1.11, Human Health and Safety, there are no large adverse impacts to any populations.

NNSA also analyzed the potential risk due to radiological exposure through subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. This special pathways receptors analysis is important to the environmental justice analysis because those consumption patterns reflect the traditional or cultural practices of minority populations in the area (LANL 2006a).

5.1.11 Health and Safety

5.1.11.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional impacts to health and safety beyond current and planned activities that are independent of this action. Based on the 2004 operational data, the total dose to the offsite MEI in 2004 was estimated at 1.68 mrem.

5.1.11.2 *DCE Alternative (Greenfield CPC, Upgrade, 50/80)*

Construction

No radiological risks would be incurred by members of the public from construction activities associated with the Greenfield CPC or the upgrade alternatives. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site, especially for the upgrade alternatives, where construction would occur in the immediate vicinity of PF-4. Workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from Bureau of Labor Statistics (BLS), U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including Integrated Safety Management (ISM) and the Voluntary Protection Program (VPP). Additionally, the small number of fatal accidents reported in the Computerized Accident/Incident Reporting System (CAIRS) makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CPC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown below in Table 5.1.11-1.

Table 5.1.11-1 — Injury, Illness, and Fatality Estimates for Construction of the CPC Alternatives, CUC, and A/D/HE Center at LANL

Injury, Illness, and Fatality Categories	Projects Under Consideration				
	Greenfield CPC	Upgrade	50/80	CUC	A/D/HE Center
Peak Annual Employment	770	300	190	1,300	3,820
Total Recordable Cases	73	28	18	112	329
Total Lost Workday Cases	35	14	9	54	159
Total Fatalities	0.2	0.1	<0.1	0.3	0.8
Project Duration (6 years)					
Total Recordable Cases	251	98	62	384	1,128
Total Lost Workday Cases	121	47	30	184	541
Total Fatalities	0.6	0.2	0.1	0.9	2.6

Source: NNSA 2007, BLS 2007.

No chemicals have been identified that would be a risk to members of the public from construction activities associated with the CPC. Construction workers would be protected from overexposure to hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals. Implementation of worker protection programs to construction activities would also decrease the potential for worker exposures by providing hazards identification and control measures for construction activities.

5.1.11.2.2 Operation

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public from routine operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an effective dose equivalent (EDE) in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61, Subpart H) limit exposure to the MEI) of the public from all air emissions to 10 mrem per year.

NNSA expects minimal public health impacts from the radiological consequences of CPC operations. Table 5.2.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental latent cancer fatalities (LCFs). To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Table 5.1.11-2 — Annual Radiological Impacts on the Public from CPC Alternatives, CNC, and CNPC Operations at LANL

Receptor	Projects Under Consideration				
	Greenfield CPC	Upgrade	50/80	CNC	CNPC
Population within 50 miles^a					
Collective dose (person-rem)	5.9×10^{-7}	5.9×10^{-7}	2.5×10^{-8}	0.376	0.379
% of natural background rad'n ^a	$< 1 \times 10^{-9}$	$< 1 \times 10^{-9}$	$< 1 \times 10^{-9}$	1.9×10^{-4}	1.9×10^{-4}
LCFs ^b	4×10^{-10}	4×10^{-10}	1×10^{-11}	2.3×10^{-4}	2.3×10^{-4}
Offsite MEI^c					
Dose (mrem)	3.6×10^{-9}	3.6×10^{-9}	3.0×10^{-9}	0.046	0.046
Percent of regulatory dose limit	3.6×10^{-10}	3.6×10^{-10}	3.0×10^{-10}	0.0046	0.0046
% of natural background rad'n ^a	$< 1 \times 10^{-9}$	$< 1 \times 10^{-9}$	$< 1 \times 10^{-9}$	1.3×10^{-2}	1.3×10^{-2}
Cancer fatality risk ^b	2.2×10^{-15}	2.2×10^{-15}	1.8×10^{-15}	2.8×10^{-8}	2.86×10^{-8}

^aThe average annual dose from background radiation at LANL is 360 mrem; the future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 would receive an annual dose of 198,760 person-rem from the background radiation. A “constant linear population growth” model was applied to estimate population increases.

^bBased on a cancer risk estimate of 0.0006 LCFs per rem or person-rem.

^cThe offsite MEI is assumed to reside at the site boundary, 1.2 miles from the CPC. An actual residence may not currently be present at this location.

As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both the EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be less than or equal to 3×10^{-15} per year, or about 1 chance in more than a trillion. The projected number of fatal cancers to the population within 50 miles would be less than or equal to 4×10^{-10} per year, or about 1 chance in 2.5 billion.

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, *Occupational Radiation Protection*, which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material “as low as reasonably achievable” (ALARA). The worker radiation dose projected in this SPEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose and internal dose, as required by 10 CFR Part 835.

Estimates of annual radiological doses to workers involved with CPC operations are independent of geographical location. These dose estimates are solely a function of:

- The number of radiological workers, as determined in the development of the CPC staffing estimate for each throughput alternative. The current estimates were developed by application of a factor to the total workers for each work group based on operating experience in plutonium facilities. Approximately 60 percent of total operating staff are estimated to be radiological workers.
- The working dose rate at the glovebox surface for each unit operation or workstation. These dose rates were calculated based on the maximum mass (plutonium, americium)

and form (metal, oxide) of material being handled. Standard “weapons grade” isotopic distribution, and americium content of 0.5 percent were assumed.

- The amount of time spent by direct operators/first line supervisors in the radiation area. This was determined from a time-motion estimate of direct “hands-in-gloves” labor required to perform each individual operation and the number of parts processed per year for a given pit production rate. Efficiency scaling factors were applied for various operations. For Foundry and Machining operations, this was assumed to be 50 percent; for Assembly and Post-Assembly & Testing, efficiencies were 90 percent.

As indicated above, the collective annual dose (mrem per year) received by individual operators is calculated based on the number of operators required for the various production rates, the time spent in the radiation area, and the associated dose rates for each operation. The collective exposures for support group workers were added to these numbers and were calculated using empirical data that implies that exposure for these workers can be estimated as a percentage of direct operator exposure (e.g., Analytical Laboratory Technician would receive approximately 25 percent of direct operator exposure). The average individual dose is calculated as the collective exposure divided by the estimated number of radiological workers for each throughput alternative.

The estimates of annual radiological doses to workers are provided in Table 5.1.11-3. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 mrem (10 CFR 835) and the DOE-recommended control level of 1,000 mrem (10 CFR 835). Operations in the CPC would result in an average individual worker dose of approximately 290 mrem annually. The total dose to workers associated with the CNC operations would be approximately 333 person-rem. Statistically, a total dose of 333 person-rem would result in 0.2 annual LCFs to the CNC workforce. The projected number of fatal cancers in the workforce from CPC annual operations would be 0.2, or 2 chances in 10 that the worker population would experience a fatal cancer per year of operations.

During normal (accident-free) operations, total facility staffing at the CPC would be approximately 1,780. The potential risk of occupational injuries and fatalities to workers operating the CPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown below in Table 5.1.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (WSRC 2002c).

Table 5.1.11-3 — Annual Radiological Impacts on CPC, CNC, and CNPC Workers at LANL from Operations

	Greenfield CPC	Upgrade	50/80	CNC	CNPC
Number of Radiological Workers	1,150	1,150	458	1,640	2,040
Individual Workers^a					
Average individual dose, mrem/yr ^b	290	290	380	210	189
Average worker cancer fatality risk ^c	2×10^{-4}	2×10^{-4}	2×10^{-4}	1.4×10^{-4}	1.3×10^{-4}
Worker Population					
Total dose (person-rem)	333	333	154	344	386
Cancer fatality risk ^c	0.20	0.20	0.09	0.21	0.23

^a The regulatory dose limit for an individual worker is 5,000 mrem/yr (10 CFR 835). However, the maximum annual dose to a worker would be kept below the DOE Control Level of 1,000 mrem/yr, as established in 10 CFR 835. Further, DOE recommends that facilities adopt a more limiting 500-mrem/yr Administrative Control Level. To reduce doses to levels that are as low as reasonably achievable, an effective dose reduction plan would be enforced.

^b Less than one third of all radiological workers would receive doses greater than, but no more than 90 percent above, the average worker dose.

^c Based on a cancer risk estimator of 0.0006 LCFs per rem or person-rem.

Source: Tetra Tech 2007.

Table 5.1.11-4 — Injury, Illness, and Fatality Annual Estimates for Normal Operations of the CPC, CNC, and CNPC at LANL

Injury, Illness, and Fatality Categories	Projects Under Consideration			
	Greenfield CPC and Upgrade	50/80	CNC	CNPC
Total Workers	1,780	680	2,715	4,500
Total Recordable Cases	77	29	117	195
Total Lost Workday Cases	40	15	61	101
Total Fatalities	0.07	0.02	0.11	0.18

Source: NNSA 2007, BLS 2007.

5.1.11.3 CCE Alternative

5.1.11.3.1 CNC (CPC + CUC)

Health and safety impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.1.11.2 as well as the impacts discussed below.

CUC Construction

No radiological risks would be incurred by members of the public from CUC construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CUC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CUC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.1.11-1.

CNC Operation

NNSA expects minimal public health impacts from the radiological consequences of CNC operations. Table 5.1.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Approximately 1,640 radiological workers would be required to conduct CNC operations. Operations in the CNC would result in an average individual worker dose of approximately 210 mrem annually. The total annual dose to workers associated with the CNC operations would be approximately 344 person-rem. Statistically, an annual dose of 344 person-rem would result in 0.21 LCFs to the CNC workforce.

During normal (accident-free) operations, total facility staffing would be approximately 2,715. The potential risk of occupational injuries and fatalities to workers operating the CNC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.1.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CNC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.1.11.3.2 CNPC (CPC + CUC + A/D/HE Center)

Health and safety impacts from the construction and operation of the CNC would include the CPC and CUC impacts discussed above, as well as the impacts discussed below.

A/D/HE Center Construction

No radiological risks would be incurred by members of the public from the A/D/HE Center construction activities. Construction workers could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the A/D/HE Center reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the A/D/HE Center would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.1.11-1.

CNPC Operation

DOE expects minimal public health impacts from the radiological consequences of CNC operations. Table 5.1.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Approximately 2,040 radiological workers would be required to conduct CNPC operations. Operations in the CNPC would result in an average individual worker dose of approximately 189 mrem annually. The total annual dose to workers associated with the CNPC operations would be approximately 386 person-rem. Statistically, an annual dose of 386 person-rem would result in 0.23 LCFs to the CNPC workforce.

During normal (accident-free) operations, total facility staffing would be approximately 4,500. The potential risk of occupational injuries and fatalities to workers operating the CNPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.1.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CNPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.1.11.4 *Capability-Based Alternative*

LANL is presently reestablishing an interim pit fabrication capacity that could provide 50 pits annually. Under the Capability-Based Alternative, this effort would continue and would not change. Worker dose from increased pit production at TA-55 would increase from 90 person-rem per year to 220 person-rem per year (LANL 2006a). Statistically, a dose of 220 person-rem would result in a LCF risk of 0.13, which would equate to 1 LCF for every 7.6 years of operation.

5.1.11.4 *LANL Plutonium Phaseout*

If LANL is not selected as the site for a CPC or CNC/CNPC, NNSA would phaseout NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential health impacts to LANL employees and the population surrounding LANL. Assuming that LANL would be producing up to 50 pits annually prior to phaseout, radiation doses to workers would be expected to decrease by approximately 220 person-rem.

If LANL were to produce 50 pits annually for the stockpile prior to phaseout, plutonium emissions would decrease by approximately 0.00084 curies. This would result in less radiation exposure to the 50-mile population surrounding LANL. Phasing out NNSA plutonium operations would reduce the dose to the 50-mile population by 0.20 person-rem.

5.1.12 *Facility Accidents*

This section presents the potential impacts on workers (both involved and non-involved) and the public due to potential accidents associated with the operation of the CPC, CUC, and A/D/HE Center at LANL. Additional details supporting the information presented here are provided in Appendix C.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.

- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. Using approved computer models, NNSA predicted the dispersion of released hazardous materials and their effects. However, prediction of potential health effects becomes increasingly difficult to quantify for workers as the distance between the accident location and the worker decreases because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident.

Emergency Preparedness— Each NNSA site has established an emergency management program. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts— NNSA estimated radiological impacts to three receptors: (1) the MEI at the LANL boundary; (2) the offsite population within 50 miles of LANL; and (3) a non-involved worker 3,281 feet from the accident location. DOE did not evaluate total dose from accidents to the involved workforce because this would depend upon the specific location of the facilities on each site, which is not an issue that will be decided as a result of this SPEIS. In any tiered, project-specific EIS, accident impacts to the involved workforce would be analyzed to evaluate alternative locations on the selected site.

5.1.12.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional accident risks beyond those associated with current and planned activities that are independent of this action. Potential accident scenarios for the No Action Alternative are addressed in detail in the LANL Draft SWEIS (LANL 2006a).

Under all alternatives analyzed in the LANL SWEIS, the facility accident with the highest radiological risk to the offsite population would be a lightning strike at the Radioassay and Nondestructive Testing Facility located in TA-54. If this accident were to occur, there could be six additional LCFs in the offsite population (LANL 2006a).

Under all alternatives, the individual facility accident with the highest estimated consequences to the MEI and noninvolved workers would be a fire at a waste storage dome in TA-54. If this accident were to occur, an LCF in a noninvolved worker located about 110 yards from the site of

the accident would be likely, and there would also be a 0.50 likelihood (1 chance in 2) of an LCF to the MEI, assumed to be present at the nearest site boundary for the duration of the accident release (LANL 2006a).

There is little difference among the alternatives for the maximum potential wildfire, seismic, or facility accident at LANL because actions under each alternative do not, for the most part, affect the location, frequency, scenario, or material at risk of the postulated accidents. Based on the analysis in the LANL SWEIS, if a seismic accident were to occur, there would be widespread damage at LANL and across the region resulting in a large number of fatalities and injuries unrelated to LANL operations. Facilities at LANL would be affected and the public and workers at the site would be exposed to increased risks from both radiological and chemical releases. In the event of such a seismic accident, the MEI would have an increased lifetime risk of an LCF of 0.55 (1 chance in 1.8) and an additional 22 LCFs could be expected in the population; a noninvolved worker 110 feet from certain failed buildings would likely develop an LCF. Taking into account the likelihood of occurrence, the annual risks from a seismic event are estimated to be 1 chance in 3,600 for an MEI, and zero (0.009) additional LCFs in the offsite population (LANL 2006a).

5.1.12.2 *Consolidated Plutonium Center*

5.1.12.2.1 **Radiological Accidents**

Greenfield CPC and Upgrade Alternative

The accident scenarios, material at risk, and source term for the CPC are shown below.

Accident Scenario	Material at Risk	Source Term
Beyond Evaluation Basis	16,929 kg Pu metal	4.23 kg Pu metal
Earthquake and Fire	35 kg Pu oxide	0.0021 kg Pu oxide
	24 kg Pu solution	0.048 kg Pu solution
Fire in a single building	7,685 kg Pu metal	1.92 kg Pu
Explosion in a feed casting furnace	4.5 kg molten Pu metal	2.25 kg Pu
Nuclear Criticality	See Appendix C	5×10^{17} fissions
Fire-induced release in the CRT Storage Room	600 kg Pu metal	0.15 kg Pu
Radioactive material spill	4.5 kg molten Pu metal	0.0045 kg Pu

Source: Tetra Tech 2007

Table 5.1.12–1 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CPC) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MELCOR Accident Consequence Code System (MACCS) computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. Table 5.1.12-2 shows the accident risks, obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented*

in the *Complex Transformation SPEIS* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CPC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

With respect to an earthquake, a comprehensive update to the LANL seismic hazards analysis was completed in 2007; the analysis presents estimated ground-shaking hazards and the ground motions that may result. The geological and geotechnical aspects of the study, along with a summary of the seismic setting, are incorporated in the description in Section 4.1.6.3. The new study indicates that the seismic hazard is higher than previously understood. One of the purposes of that seismic hazards analysis is to define the Design Basis Earthquake (DBE) ground motion parameters. That data would then be used to determine the design parameters that any facility at LANL would need to meet. The accident analyzed in this SPEIS is based on a beyond design basis earthquake, and assumes complete failure of structures, systems, and components, thereby resulting in the maximum possible radioisotope source term. This is a conservative approach. Higher seismic accelerations at the same annual frequency of exceedance would result in identical consequences for these facilities. Therefore, the larger seismic peak ground accelerations associated with the updated probabilistic seismic hazard analysis would not increase the consequence of this accident scenario.

Table 5.1.12-1 — CPC Radiological Accident Frequency and Consequences at LANL^a

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	87.5	0.105	44,200	26.5	1,420	1
Fire in a single building	1.0×10^{-4}	62.4	0.0749	27,600	16.6	2,200	1
Explosion in a feed casting furnace	1.0×10^{-2}	73.2	0.0878	32,400	19.4	2,580	1
Nuclear Criticality	1.0×10^{-2}	0.00014	8.40×10^{-8}	0.0372	2.23×10^{-5}	0.00278	1.67×10^{-6}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	4.88	0.00293	2,160	1.3	172	0.206
Radioactive material spill	1×10^{-2}	0.146	8.76×10^{-5}	64.8	0.0389	5.16	0.0031

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The results of the accident analysis indicate potential consequences that exceed NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The analyses in these cases are based on unmitigated releases of radioactive material in order to identify any differences among candidate sites for a CPC. Additional NEPA analyses would be conducted to identify specific mitigating features that would be incorporated in a CPC design to ensure compliance with exposure guidelines if NNSA were to decide to build a CPC at one of the candidate sites. These could include procedural and equipment safety features, HEPA filtration systems, and other design features to protect radioactive materials from release and to contain any material that might be released.⁴ Upon completion of these additional analyses, NNSA would prepare safety analysis documentation such as a safety analysis report to further ensure that exposure guidelines would not be exceeded. The results of the safety analysis report are incorporated into facility and equipment design and establish procedures to ensure public and worker safety. Once specific mitigation measures were incorporated into a CPC design and operating procedures, it is unlikely that the potential consequences would exceed the guidelines of 25 rem for a member of the public at the nearest site boundary for any of the site alternatives.

The accident with the highest potential consequences to the offsite population (see Table 5.1.12-1) is the beyond evaluation basis earthquake and fire. Approximately 26.5 LCFs in the offsite population could result from such an accident in the absence of mitigation measures. An offsite MEI would receive a dose of 87.5 rem. Statistically, this MEI would have a 0.052 chance of developing a LCF (i.e., about 1 chance in 19 of a LCF). This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.1.12-2), the accident with the highest risk is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately 9×10^{-4} , or approximately 1 in 1,000. For the population, the LCF risk would be 0.19, meaning that an LCF would statistically occur once every 5 years in the population.

Table 5.1.12-2 — Annual Cancer Risks for CPC at LANL

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	1.05×10^{-6}	2.65×10^{-4}	1×10^{-5}
Fire in a Single Building	7.49×10^{-6}	1.66×10^{-3}	1×10^{-4}
Explosion in a Feed Casting Furnace	8.78×10^{-4}	0.19	1×10^{-2}
Nuclear Criticality	8.40×10^{-10}	2.23×10^{-7}	1.67×10^8
Fire-induced Release in the CRT Storage Room	2.93×10^{-5}	1.3×10^{-2}	2.06×10^{-3}
Radioactive Material Spill	8.76×10^{-7}	3.89×10^{-4}	3.1×10^{-5}

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

⁴ For example, installing safety basis HEPA filters could reduce releases by orders of magnitude.

50/80 Alternative

Under the 50/80 Alternatives at Los Alamos, the Plutonium Facility, Building 4 (PF-4) at TA-55 would be upgraded to provide a capability to produce as many as 80 pits/year. The potential hazards and accidents postulated for a Greenfield CPC would be applicable to the upgraded PF-4. However, for three of the accidents (Beyond Evaluation Basis Earthquake and Fire, Fire in a single building, and the Fire-induced release in the CRT Storage Room), the material-at-risk for the 50/80 Alternative would be approximately two-thirds as large as for the Greenfield CPC. The potential consequences and risks from accidents for the 50/80 Alternative are presented in Tables 5.1.12-1a and 5.1.12-2a.

Table 5.1.12-1a — Radiological Accident Frequency and Consequences: 50/80 Alternative

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	58.6	0.07	29,614	17.8	951	1
Fire in a single building	1.0×10^{-4}	41.8	0.05	18,492	11.1	1,474	1
Explosion in a feed casting furnace	1.0×10^{-2}	73.2	0.0878	32,400	19.4	2,580	1
Nuclear Criticality	1.0×10^{-2}	0.00014	8.40×10^{-8}	0.0372	2.23×10^{-5}	0.00278	1.67×10^{-6}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	3.3	0.002	1,447	0.9	115	0.13
Radioactive material spill	1×10^{-2}	0.146	8.76×10^{-5}	64.8	0.0389	5.16	0.003

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.1.12-2a — Annual Cancer Risks for the 50/80 Alternative

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	7.0×10^{-7}	1.78×10^{-4}	1×10^{-5}
Fire in a Single Building	5.0×10^{-6}	1.1×10^{-3}	1×10^{-4}
Explosion in a Feed Casting Furnace	8.78×10^{-4}	0.19	1×10^{-2}
Nuclear Criticality	8.40×10^{-10}	2.23×10^{-7}	1.67×10^{-8}
Fire-induced Release in the CRT Storage Room	2.0×10^{-5}	9.0×10^{-3}	1.3×10^{-3}
Radioactive Material Spill	8.76×10^{-7}	3.89×10^{-4}	3.1×10^{-5}

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

5.1.12.2.2 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this analysis, Emergency Response Planning Guidelines (ERPG) values are used to develop hazard indices for chemical exposures.

ERPG DEFINITIONS	
<i>ERPG 1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.</i>	
<i>ERPG 2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.</i>	
<i>ERPG 3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.</i>	

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at the CPC. A chemical’s vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical’s hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Table 5.1.12–3 provides information on each chemical and the frequency and consequences of an accidental release under the Greenfield CPC and Upgrade Alternative. The source term shown represents the amount of the chemical that is accidentally released.

Table 5.1.12–3 — Greenfield CPC and Upgrade Alternative Chemical Accident Frequency and Consequences at LANL

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency (per year)
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary ^a (ppm)	
Nitric acid	10,500	6	0.85	4.5	8.76	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.05	10.4	10 ⁻⁴
Formic acid	1,500	10	0.215	0.54	1.06	10 ⁻⁴

^a Site boundary is at a distance of 1.2 miles.
Source: Tetra Tech 2007

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 3,281 feet from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.1.12-3 shows the consequences of the dominant loss of containment accident scenarios.

The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical’s release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

NNSA also estimated the impacts of the potential release of the most hazardous chemicals that would be used under the TA-55 Upgrade Alternative. Table 5.1.12-4 provides information on each chemical and the frequency and consequences of an accidental release. The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical’s release. As the distance to the ERPG-2 concentration increases, the potential number of people onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would also be expected to increase.

Table 5.1.12-4 — 50/80 Alternative Chemical Accident Consequences at LANL

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency (per year)
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary ^a (ppm)	
Nitric acid	3,420	6	0.5	1.46	2.85	10 ⁻⁴
Hydrofluoric acid	340	20	0.4	3.1	6.42	10 ⁻⁴
Hydrochloric acid	384	20	2.1	118	264	10 ⁻⁴

^a Site boundary is at a distance of 1.2 miles.
Source: Tetra Tech 2007

None of the chemicals released in an accident would exceed ERPG-2 limits offsite. Concentrations at the location of a non-involved worker at a distance of 3,281 feet from a hydrochloric acid release would exceed ERPG-2 limits.

5.1.12.2.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the individual decreases because the individual exposure cannot be adequately established with respect to the presence of shielding and other protective features. Noninvolved workers may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury. For the TA-55 Upgrade Alternative, the number of workers required for operations is estimated to be 630 (including security guards). Each process facility within the upgraded facility would have attached safe haven structures designed in accordance with a number of life safety, fire protection, and safeguards and security requirements

5.1.12.3 Consolidated Uranium Center

5.1.12.3.1 Radiological Accidents

The accident scenarios, material at risk, and source term for the CUC are shown below:

Operation	Accident	Source Term	Notes/Assumptions
EU Metal Fabrication	Major fire	EU = 17.9 kg (sum of metal and chips) DU = 452 kg (sum of metal and chips) 2 kg EU	Release height = ground level Release duration = 1 hour
Assembly	Explosion	(sum of metal and chips) 0.04 kg DU (sum of metal and chips)	Release height = 7.6 m Release duration = 1 hour
EU Warehouse	Fire	EU = 22.6 kg DU = 20.1 kg U-233 = 0.0066 kg Th = 0.13 kg (the above all represent the sum of metals, oxides, and combustibles)	Release height = 4 m Release duration = 1 hour
HEUMF	Design-basis fires	Pu = 1.0×10^{-6} kg Np-237 = 1.6×10^{-5} kg EU = 2.58 kg DU = 0.55 kg	Release height = 11.3 m Release duration = 1 hour
EU Operations	Aircraft crash	37.8 kg EU (includes metals, chips, oxides, and aqueous and organic solutions)	Release height = "roof level" Release duration = 15 min

Source: Tetra Tech 2007

Table 5.1.12–5 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CUC) and a hypothetical non-involved worker, as well as the accident risks (Table 5.1.12-6), obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CUC. Thus, in the event that any other accident that was not evaluated were to occur, its impacts on workers and the public would be expected to be within the range of the impacts for accidents that were evaluated.

Table 5.1.12-5 — CUC Radiological Accident Frequency and Consequences at LANL

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.213	1.28 x 10 ⁻⁴	94.5	5.67 x 10 ⁻²	7.53	4.52 x 10 ⁻³
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.0209	1.25 x 10 ⁻⁵	9.3	5.58 x 10 ⁻³	0.612	3.67 x 10 ⁻⁴
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.249	1.49 x 10 ⁻⁴	110	6.6 x 10 ⁻²	8.33	5.0 x 10 ⁻³
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.0267	1.6 x 10 ⁻⁵	12	7.2 x 10 ⁻³	0.637	3.82 x 10 ⁻⁴
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.132	7.92 x 10 ⁻⁵	75.5	4.53 x 10 ⁻²	0.8	4.8 x 10 ⁻⁴

^a CUC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.1.12-6 — Annual Cancer Risks for CUC at Los Alamos, TA-55

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	1.28 x 10 ⁻⁸	5.67 x 10 ⁻⁶	4.52 x 10 ⁻⁷
Explosion	1.25 x 10 ⁻⁹	5.58 x 10 ⁻⁷	3.67 x 10 ⁻⁸
Fire in EU Warehouse	1.49 x 10 ⁻⁸	6.6 x 10 ⁻⁶	5.0 x 10 ⁻⁷
Design-basis fires for HEU Storage	1.6 x 10 ⁻⁷	7.2 x 10 ⁻⁵	3.82 x 10 ⁻⁶
Aircraft crash	7.92 x 10 ⁻⁹	4.53 x 10 ⁻⁶	4.8 x 10 ⁻⁸

^a CUC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Tables 5.1.12-5 and 5.1.12-7) is the fire in the EU warehouse. Depending upon whether the CUC were located at TA-55 or TA-16, approximately 0.04-0.06 LCFs in the offsite population could result from such an accident in the absence of mitigation measures. An offsite MEI would receive a maximum dose of 0.926 rem. Statistically, this MEI would have an LCF risk of approximately 6x10⁻⁴, or approximately 1 chance in about 2,000 of an LCF. This accident has a probability of occurring approximately once every 10,000 years.

When probabilities are taken into account (see Tables 5.1.12-6 and 5.1.12-8), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 6x10⁻⁷, or less than one in a million. For the population, the LCF risk would be 7.2 x 10⁻⁵, meaning that an LCF would statistically occur once every 13,888 years in the population.

Table 5.1.12-7 — Potential Accident Consequences – CUC at Los Alamos, TA16^a

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
EU Metal Fabrication	0.798	4.79 x 10 ⁻⁴	60.3	3.62 x 10 ⁻²	7.53	4.52 x 10 ⁻⁷
Assembly	0.0768	4.61 x 10 ⁻⁵	5.95	3.57 x 10 ⁻³	0.612	3.67 x 10 ⁻⁸
EU Warehouse	0.926	5.56 x 10 ⁻⁴	70.6	4.24 x 10 ⁻²	8.33	5.0 x 10 ⁻⁷
HEUMF	0.0961	5.77 x 10 ⁻⁵	7.7	4.62 x 10 ⁻³	0.637	3.82 x 10 ⁻⁶
EU Operations	0.158	9.48 x 10 ⁻⁵	68.2	4.09 x 10 ⁻²	0.8	4.8 x 10 ⁻⁸

^a LANL Option 2 Uranium Operations would be at TA16. At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.1.12-8 — Annual Cancer Risks for CUC at LANL, TA-16

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	4.79 x 10 ⁻⁸	3.62 x 10 ⁻⁶	0.00452
Explosion	4.61 x 10 ⁻⁹	3.57 x 10 ⁻⁷	0.000367
Fire in EU Warehouse	5.56 x 10 ⁻⁸	4.24 x 10 ⁻⁶	0.005
Design-basis fires for HEU Storage	5.77 x 10 ⁻⁷	4.62 x 10 ⁻⁵	0.000382
Aircraft crash	9.48 x 10 ⁻⁹	4.09 x 10 ⁻⁶	0.00048

^a LANL Option 2 Uranium Operations would be at TA16. At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

5.1.12.3.2 Hazardous Chemicals Impacts

A CUC would store and use a variety of hazardous chemicals. The quantities of chemicals would vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public. NNSA estimated the impacts of the potential release of the most hazardous chemical used at a CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative

modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.1.12-9 shows the consequences of the dominant loss of containment accident scenario.

Table 5.1.12-9 — Consequences and Frequency of CUC Chemical Accidents, Los Alamos

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.85	4.5	8.76	10 ⁻⁴

^a Site boundary is at a distance of 1.2 miles.
Source: Tetra Tech 2007

5.1.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the individual decreases because the worker exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident.

Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.1.12.4 Assembly/Disassembly/High Explosives Center

5.1.12.4.1 Radiological Accidents

The accident scenarios and representative source terms for the A/D/HE Center are shown below:

Scenario	Representative Source Terms	
	Pu Release (Ci)	Tritium Release (Ci)
Scenario 1: Explosive Driven Plutonium and Tritium Dispersal from an Internal Event	400	3.0 × 10 ⁵
Scenario 2: Tritium Reservoir Failure from an Internal Event	0	2.0 × 10 ⁵
Scenario 3: Pit Breach from an Internal Event	1.8 × 10 ⁻⁵	0
Scenario 4: Multiple Tritium Reservoir Failure from an External Event or Natural Phenomena	0	4.0 × 10 ⁷
Scenario 5: Fire Driven Dispersal Involving Stored Pits from an External Event or Natural Phenomena	50	0
Scenario 6: Plutonium and Tritium Dispersal from an External Event or Natural Phenomena	1.2 × 10 ⁻²	3.0 × 10 ⁵

Source: Tetra Tech 2007

Tables 5.1.12-10 and 5.1.12-11 show the consequences and risks of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the A/D/HE Center) and a hypothetical non-involved worker. The dose shown in the tables are

calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table were selected from a wide spectrum of accidents described in the *Topical Report – Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the A/D/HE Center. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts for accidents that were evaluated.

Table 5.1.12-10 — A/D/HE Center Radiological Accident Consequences at LANL

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	73.8	0.0886	5,580	3.35	696	0.835
Scenario 2	0.0529	3.17x10 ⁻⁵	4	2.4x10 ⁻³	0.499	2.99x10 ⁻⁴
Scenario 3	4.42x10 ⁻⁶	2.65x10 ⁻⁹	0.000334	2.00x10 ⁻⁷	4.17x10 ⁻⁵	2.50x10 ⁻⁸
Scenario 4	1.31	7.86x10 ⁻⁴	545	0.327	7.94	4.76x10 ⁻³
Scenario 5	1.37	8.22x10 ⁻⁴	570	0.342	8.3	4.98x10 ⁻³
Scenario 6	0.0102	6.12x10 ⁻⁶	4.23	2.5x10 ⁻³	0.0615	3.69x10 ⁻⁵

^a At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.1.12-11 — Annual Cancer Risks for A/D/HE Center Accidents at LANL

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Individual Noninvolved Worker ^c
Scenario 1	8.86x10 ⁻⁶	3.35x10 ⁻⁴	8.35x10 ⁻⁵
Scenario 2	3.17x10 ⁻⁷	2.4x10 ⁻⁴	2.99x10 ⁻⁶
Scenario 3	2.65x10 ⁻¹¹	2.00x10 ⁻⁹	2.50x10 ⁻¹⁰
Scenario 4	7.86x10 ⁻¹⁰	3.27x10 ⁻⁷	4.76x10 ⁻⁹
Scenario 5	8.22x10 ⁻⁸	3.42x10 ⁻⁵	4.98x10 ⁻⁷
Scenario 6	6.12x10 ⁻⁸	2.54x10 ⁻⁵	3.69x10 ⁻⁷

^a At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The results of the accident analysis indicate potential consequences that exceed NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The analyses in these cases are based on unmitigated releases of radioactive material in order to identify any differences among candidate sites for an A/D/HE Center. Additional NEPA analyses would be conducted to identify specific mitigating features that would be incorporated in an A/D/HE Center design to ensure compliance with exposure guidelines if NNSA were to decide to build an A/D/HE Center at one of the candidate sites. These could include procedural and equipment

safety features, HEPA filtration systems, and other design features to protect radioactive materials from release and to contain any material that might be released.⁵ Upon completion of these additional analyses, NNSA would prepare safety analysis documentation such as a safety analysis report to further ensure that exposure guidelines would not be exceeded. The results of the safety analysis report are incorporated into facility and equipment design and establish procedures to ensure public and worker safety. Once specific mitigation measures were incorporated into an A/D/HE Center design and operating procedures, it is unlikely that the potential consequences would exceed the guidelines of 25 rem for a member of the public at the nearest site boundary for any of the site alternatives.

The accident with the highest potential consequences to the offsite population (see Table 5.1.12-10) is Scenario 1, the explosive driven plutonium and tritium dispersal from an internal event. Approximately 3 LCFs in the offsite population could result from such an accident in the absence of mitigation measures. An offsite MEI would receive a dose of 73.8 rem. Statistically, this MEI would have a 0.04 chance of developing a LCF (i.e., about 1 chance in 23 of an LCF). The overall likelihood of this scenario occurring is less than 1×10^{-4} per year.

When probabilities are taken into account (see Table 5.1.12-11), the explosive driven plutonium and tritium dispersal from an internal event also has the highest overall risk. For this accident, the LCF risk to the MEI would be approximately 9×10^{-6} , or approximately 1 in 100,000. For the population, the LCF risk would be 3.35×10^{-4} , meaning that an LCF would statistically occur once every 3,000 years in the population.

5.1.12.4.2 Hazardous Chemicals Impacts

NNSA has identified chlorine as the hazardous chemical dominating the risk from non-radiological releases for an A/D/HE Center (DOE 1996). Chlorine is the only chemical with the potential for significant adverse offsite consequences. Since chlorine is not carcinogenic, the consequences of exposure to chlorine (primarily acute effects) differ from the consequences of exposure to radionuclides (potential latent cancers). This difference precludes a direct comparison between the risk and consequences associated with hazardous chemical releases and radionuclide releases.

Scenario 7 involves a chlorine release. A release of chlorine to the environment due to an earthquake is an unlikely event. Should an earthquake occur with sufficient magnitude to damage a facility that uses chlorine, it could release the contents from as many as four chlorine cylinders. The magnitude of this release could be as high as 408 kilograms (900 pounds) (Pantex 1996a).

Workers in the vicinity of a chlorine release could be exposed to chlorine concentrations in excess of EPRG3 and threshold levels. No long-term adverse health effects are expected for workers who promptly evacuate the area. For any persons incapable of evacuating the area of the chlorine plume, no serious or irreversible health impacts are expected from EPRG1 or EPRG2 exposures since the exposure duration is less than 1 hour. Persons incapable of evacuating an area with EPRG3 concentrations may experience adverse health impacts depending upon the

⁵ For example, installing safety basis HEPA filters could reduce releases by orders of magnitude.

actual chlorine concentrations encountered and the exposure duration. Chronic lung disease, electrocardiographic changes, and death have occurred in humans exposed to high concentrations of chlorine as a consequence of industrial accidents (Calabrese 1991). Table 5.1.12-12 depicts the potential impacts of conservative modeling of a chlorine release over the period of 1-hour with culated down-wind concentrations.

Table 5.1.12–12 — A/D/HE Center Chemical Accident Frequency and Consequences

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Scenario 7- Chlorine Release	408.23	3	2.8	17.4	32.5	10 ⁻⁴

^a Site boundary is at a distance of 0.5 miles from the A/D/HE Center.
 Source: Tetra Tech 2007

5.1.12.4.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the individual decreases because the worker exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.1.12.5 LANL Plutonium Phaseout

If LANL is not selected as the site for a CPC or CNC/CNPC, NNSA would phaseout NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in the potential accident impacts to LANL employees and the population surrounding LANL. For a site-wide seismic event, the dose from TA-55 to a non-involved worker at 110 yards could be reduced by approximately 2,700 rem. This would reduce the likelihood to less than 1 that this non-involved worker would contract a fatal cancer during their lifetime from this accident. For the population surrounding LANL, a site-wide seismic event affecting TA-55 could produce a population dose of 14,000 person-rem (approximately 9 LCFs) and a MEI dose of 150 rem (a LCF risk of 0.17). Phaseout of all plutonium operations from TA-55 would reduce these consequences to zero.

Risks from chemical accidents would also be reduced. For example, phasing out the plutonium operations would eliminate the risks from a chlorine gas release. Based on the current LANL operations, there is 1 chance in 15 that a worker within approximately 200 yards of the Plutonium Facility would receive exposure in excess of limits.

5.1.13 Transportation

5.1.13.1 *No Action Alternative*

Under the No Action Alternative, there would be no change in the transportation activities at LANL, and impacts would remain unchanged from the baseline presented in Section 4.1.12. Radiological transportation under the No Action Alternative for LANL would include transport of pits from Pantex to LANL, recycle of enriched uranium parts to and from Y-12, return of re-assembled pits to Pantex, shipment of TRU waste to Waste Isolation Pilot Plant (WIPP) (near Carlsbad, New Mexico), and SNM transfers between LANL and other sites, including LLNL and SRS. Low-level waste (LLW) would be disposed of onsite at LANL. The number of pits processed per year would be limited to approximately 50. Section 5.10.1 presents the impacts of the No Action Alternative impacts associated with transportation.

Because there would be no change from the baseline in operations employment under the No Action Alternative, there would be no change in traffic in the vicinity of LANL.

5.1.13.2 *DCE Alternative (Greenfield CPC, Upgrade, 50/80 Alternative)*

5.1.13.2.1 Construction

Construction for a CPC, the Upgrade Alternative, or the 50/80 Alternative would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small (a maximum of 2 percent based on employment increases) compared to the average daily traffic levels reported in Section 4.1.12 and would be temporary.

5.1.13.2.2 Operation

Radiological transportation impacts are presented in Section 5.10 for all the action alternatives. The addition of a maximum of 1,170 new direct employees (Greenfield CPC) would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.1.12.

5.1.13.3 *CCE Alternative*

5.1.13.3.1 CNC (CPC + CUC)

Construction

CUC. Construction of a CUC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.1.12 and would be temporary.

Operation

CNC. Radiological transportation for a CNC is assessed in Section 5.10. The addition of approximately 2,105 new direct employees for a CUC (1,170 for CPC and 935 for CUC) would represent an increase in ROI employment of less than 2 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.1.12.

5.1.13.4 *CNPC (CPC + CUC + A/D/HE Center)*

Construction

A/D/HE Center. Construction of an A/D/HE Center would result in increased traffic due to commuting construction workers and deliveries of construction materials. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small (approximately 5 percent based on employment increases) and temporary compared to average daily traffic levels reported in Section 4.1.12.

Operation

CNPC. If the A/D/HE Center were located at LANL as part of a CNPC, the annual radiological transportation impacts associated with the pit production alternatives and the impacts associated with a CUC would not occur, with the exception of TRU waste transportation described for the pit production alternatives. There would be a one-time transport of SNM from Y-12 and Pantex to the CNPC, as described in Section 5.10. The addition of approximately 3,890 new direct employees for a CNPC (1,170 for CPC, 935 for CPC, and 1,785 for A/D/HE Center) would represent an increase in ROI employment of approximately 2.5 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.1.12.

5.1.13.5 *Phaseout of NNSA Category I/II SNM Missions from LANL*

If NNSA's Category I/II SNM missions were eliminated at LANL, all of its Category I/II SNM inventories would be transferred to other DOE or NNSA sites. The environmental impacts of this transportation are addressed in Section 5.10.

5.1.14 **Waste Management**

5.1.14.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at LANL would continue as required to support the missions described in Section 3.2.1. There would be no additional impacts to waste management resources beyond current and planned activities that are independent of this action. Table 5.1.14-1 shows annual waste generation volumes from LANL

operations for the years 1999 – 2004 to facilitate comparisons of the additional alternatives presented.

Table 5.1.14-1 — Annual Routine Waste Generation from LANL Operations

Waste Type	Units	1999	2000	2001	2002	2003	2004	2005
LLW	yd ³ /year	2,190	5,530	3,400	9,560	7,640	19,400	7,080
Mixed LLW	yd ³ /year	30	780	80	30	50	50	90
Transuranic Waste	yd ³ /year	190	160	150	160	530	50	100
Mixed Transuranic Waste	yd ³ /year	110	120	60	110	210	30	130
Chemical Waste	100lbs/year	34,000	61,000	60,800	3,820	1,520	2,460	4,340

Source: LANL 2006a.

5.1.14.2 DCE Alternative (Greenfield CPC, Upgrade, 50/80)

5.1.14.2.1 Construction Impacts of Greenfield CPC, Upgrade, 50/80 Alternatives

Construction of a new CPC, or upgrading existing facilities, could generate TRU, LLW, hazardous waste and non-hazardous waste. Table 5.1.14-2 summarizes the expected construction wastes.

Table 5.1.14-2 — Construction Waste Generation from CPC Alternatives

Construction Waste Type	Greenfield CPC	Upgrade	50/80
TRU Waste (yd ³)	0	200	0
LLW (yd ³)	0	200	0
Hazardous Waste (yd ³)	6.5	4 ^a	4
Non-hazardous Solid Waste (yd ³)	9,800	578 (tons)	9,750
Non-hazardous Liquid waste (yd ³)	50,700	7,800 ^a	7,800

Source: NNSA 2007.

^a Levels not expected to be significantly above levels for the 50/80 Alternative.

Construction associated with the 50/80 Alternative and the Greenfield CPC Alternative, at LANL, would not be expected to generate any TRU or LLW. Small quantities of hazardous waste would be generated from the construction associated with the Greenfield CPC, the Upgrade, and 50/80 Alternatives. Although these quantities approach the amount currently generated by LANL, they are a fraction of what LANL generated only a few years ago. Accordingly, the capacity to collect these wastes, accumulate them at four existing storage facilities (with two additional already planned) for offsite disposal at a commercial facility, presently exists.

Construction of a Greenfield CPC at LANL would generate 9,810 cubic yards of non-hazardous solid waste. Construction of the 50/80 Alternative at LANL would be expected to generate 9,750 cubic yards of non-hazardous waste. Construction of the Upgrade Alternative, at LANL would be expected to generate 578 tons of non-hazardous solid waste. Previously, solid waste and construction waste generated at LANL was disposed at the Los Alamos County Landfill, located within LANL boundaries, and operated by Los Alamos County. This landfill is now closed. Solid waste includes paper, cardboard, plastic, glass, office supplies and furniture, food waste, brush, and debris. Through an aggressive waste minimization and recycling program, the amount of solid waste at LANL requiring disposal has been greatly reduced. In 2004, 6,380 tons of solid waste were generated at LANL, of which 4,240 tons were recycled (LANL 2004p). The

County currently operates a new transfer station, which would transport that waste to other solid waste landfills within the state. The Upgrade and the 50/80 Alternatives are not expected to generate substantial quantities of non-hazardous solid waste in relation to what the transfer station can accommodate.

Construction activities associated with the Greenfield CPC, Upgrade, and 50/80 Alternatives are expected to generate non-hazardous liquid wastes. The Greenfield Alternative would be expected to generate 58,000 cubic yards, and the 50/80 Alternative would be expected to generate 7,800 cubic yards. The Upgrade Alternative, at LANL would not be expected to generate liquid, non-hazardous waste significantly above the 50/80 Alternative levels.. This waste would be processed at the TA-46 Sanitary Wastewater System Plant. Treated liquid effluent from the Sanitary Wastewater System Plant is pumped to storage tanks near the TA-3 Power Plant before being discharged to Sandia Canyon through a permitted outfall. The effluent reclamation facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation and has sufficient capacity to handle expected volumes. Sanitary sludge from the Sanitary Wastewater System Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as New Mexico Special Waste at a permitted landfill (LANL 2006a).

A concrete batch plant would operate at the CPC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CPC construction is completed.

A retention pond would be constructed to manage stormwater runoff from the entire CPC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

5.1.14.2.2 Operation of Greenfield CPC, Upgrade, 50/80 Alternatives

Normal operation under a Greenfield CPC, Upgrade, and 50/80 Alternatives would generate TRU waste, mixed TRU waste, LLW, mixed LLW (MLLW), hazardous waste, and non-hazardous waste. Table 5.1.14-3 summarizes the annual volumes of waste expected to be generated by normal operations.

Table 5.1.14-3 — Operational Waste Generation from CPC Alternatives

Annual Operating Waste Type (yd ³)	Greenfield CPC	Upgrade	50/80
TRU Solid (including Mixed TRU) (yd ³)	850	850	575 ¹
Mixed TRU Solid Waste (yd ³)(included in TRU solid)	310	310	2.6
TRU Liquid waste (yd ³)			6.5
Low Level Liquid Waste (yd ³)	0	0	19.5
LLW Solid (yd ³)	3,500	3,500	1,850
Mixed Low Level Solid Waste (yd ³)	3.6	3.6	65
Mixed Low Level Liquid Waste (yd ³)	0.4	0.4	0
Hazardous Solid (tons)	3.6	3.6	265
Hazardous Waste liquid (tons)	0.5	0.5	2.6
Nonhazardous Solid (yd ³)	7,400	7,400	700
Nonhazardous Liquid (gal)	69,500	69,500	16,000

NNSA 2007.

¹Includes 75 cubic yards/yr over a 10-year period to replace gloveboxes in PF-4

Operation of a Greenfield CPC would generate 850 cubic yards of TRU waste, and operation of the Upgrade Alternative would also generate 850 cubic yards of TRU waste. The 50/80 Alternative would generate a slightly smaller 575 cubic yards of TRU waste. Some portions of this TRU waste would be mixed TRU waste for the Greenfield Alternative (a little more than a third) and for the 50/80 Alternative (a little more than ten percent). This waste would be packaged in accordance with the WIPP Waste Acceptance Criteria (WAC), placed in TRUPACT-II shipping containers, and shipped to WIPP. This would be done within a new CPC or at the Solid Waste Management Facility in TA-54 for the Upgrade and 50/80 Alternatives. The liquid portions would be solidified.

Operation of the Greenfield CPC and the Upgrade Alternative would each generate 3,500 cubic yards of LLW. This amount of LLW that would be generated by the Greenfield CPC or the Upgrade Alternative would be from one-third to one-half the amount of LLW routinely generated at LANL. This waste would be processed at the newly constructed CPC, Greenfield or Upgrade Alternative facility, or at the Solid Waste Management Facility in TA-54 and disposed of on-site at TA-54 Area G. Operation of the 50/80 Alternative would generate an estimated 1,850 cubic yards of LLW (reduced size and throughput), or a little more than half the amount of LLW generated by the Greenfield CPC and Upgrade Alternative. This LLW would be handled in a similar manner.

Small quantities of hazardous solid waste would be generated from the operation of a Greenfield CPC or the Upgrade Alternative. The 50/80 Alternative, relying on older, less efficient facilities, would generate substantially more (265 tons) hazardous waste. All of these amounts are small in comparison to the total amount of hazardous waste generated by LANL routine operations. The capacity to collect these wastes, accumulate them at four existing storage facilities (with two additional already planned) for shipment offsite and disposal at a commercial facility, presently exists, and would have little impact on routine hazardous waste operations at LANL.

Operation of a Greenfield CPC or the Upgrade Alternative would each generate 7,400 cubic yards of non-hazardous solid waste. The 50/80 Alternative is expected to generate 700 cubic yards of non-hazardous waste. The County currently operates a new transfer station, which provides all of the services that are available to residents and businesses at the existing landfill.

The transfer station has the capacity to handle these volumes of waste on a regular basis.

Operation of the Greenfield CPC or the Upgrade Alternative is expected to generate just under 70,000 cubic yards of non-hazardous liquid waste. The 50/80 Alternative is expected to generate approximately 16,000 cubic yards of non-hazardous waste. This waste would be processed at the TA-46 Sanitary Wastewater System Plant. Treated liquid effluent from the Sanitary Wastewater System Plant is pumped to storage tanks near the TA-3 Power Plant before being discharged to Sandia Canyon through a permitted outfall. The effluent reclamation facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation. Sanitary sludge from the Sanitary Wastewater System Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as New Mexico Special Waste at a permitted landfill (LANL 2006a).

5.1.14.2 CCE Alternative

Waste management impacts from the construction and operation of the CNC would include the impacts of a Greenfield CPC discussed in Section 5.1.14.2, as well as the impacts of a CUC discussed below.

5.1.14.2.1 CNC (CPC + CUC)

Construction

CUC. Construction of a CNC would entail construction of a Greenfield CPC, already discussed in Section 5.1.14.2.1, above, and construction of a CUC, discussed in this section. Construction of a CUC would generate LLW, hazardous waste, and solid non-hazardous sanitary waste. Table 5.1.14-4 summarizes the total volume of waste which will be generated over the entire construction period for the CUC.

Table 5.1.14-4 — Total Waste Generation from Construction of the CUC

Waste Category	Quantity
Low-level solid (yd ³)	70
Mixed Low-level solid (yd ³)	0
Hazardous (tons)	6
Nonhazardous (Sanitary) (tons)	1,000

NNSA 2007.

Construction associated with a CUC would generate 70 cubic yards of LLW. This amount of LLW is a small percentage of the amount of LLW routinely generated at LANL. This waste would result from the installation of equipment and processes and would be processed at the Solid Waste Management Facility in TA-54 and disposed of on-site at TA-54 Area G.

Small quantities of hazardous waste would be generated from the construction of a CUC. This 6 tons of hazardous waste generated over the entire construction period could easily be handled by the existing infrastructure at LANL. These wastes would be collected, accumulated at any of the four existing storage facilities (with two additional already planned) for offsite disposal at a commercial facility.

Construction of a CUC would generate 1,000 tons of non-hazardous solid waste. Solid waste

includes paper, cardboard, plastic, glass, office supplies and furniture, food waste, brush, and debris. To the extent possible, metals would be removed from this waste and recycled. The County currently operates a new transfer station, which would transport that waste to other commercially available solid waste landfills within the state.

A concrete batch plant would operate at the CNC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CNC construction is completed. A retention pond would be constructed to manage stormwater runoff from the entire CNC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

Operation

CNC. Operation of a CNC would entail operation of a Greenfield CPC, already discussed in Section 5.1.14.2.1, above, in addition to the operation of a CUC, discussed in this section. Operation of the CUC would generate LLW, and both solid and liquid sanitary waste. Table 5.1.14-5 summarizes the total volume of waste which will be generated by the operation of the CNC, at LANL.

Operation of a CNC would generate 850 cubic yards of TRU waste and 310 cubic yards of mixed TRU waste. This waste would be collected and then packaged in accordance with the WIPP WAC, placed in TRUPACT-II shipping containers, and shipped to WIPP.

Operation of a CNC would generate 3,515 gallons of liquid LLW and 3,616.4 gallons of mixed liquid LLW. These wastes would be solidified, processed, and packaged for disposal at the CUC or at the Solid Waste Management Facility in TA-54 and then disposed of on-site at TA-54 Area G. The mixed LLW could require additional treatment prior to solidification and disposal. In addition, operation of the CNC would generate 11,632 cubic yards of solid LLW and 72 cubic yards of mixed LLW. This waste would also be processed and packaged for disposal at the CPC and then disposed of on-site at TA-54 Area G. The mixed solid LLW could require additional treatment prior to disposal.

Table 5.1.14-5 — Annual Waste Generation for CNC Operation

Waste Generated	CPC	CUC	CNC
TRU Solid Waste (yd ³)	850	0	850
TRU liquid waste (yd ³)	6.5		6.5
Low Level Liquid Waste (gal)	0	3,515	3,515
Low Level Solid Waste (yd ³)	3,500	8,100	11,600
Mixed Low Level Liquid Waste (gal)	0.4	3,616	3,616.4
Mixed Low Level Solid Waste (yd ³)	2.3	70	72.3
Mixed TRU Solid Waste (yd ³)	310	0	310
Hazardous waste solid (tons)	3.7	15	18.7
Hazardous waste liquid (tons)	0.52	0	0.52
Non-Hazardous Solid Waste (yd ³)	7,400	7,500	14,900
Non-Hazardous Liquid Waste (gal)	69,500	50,000	119,500

Source: NNSA 2007.

mall quantities of liquid hazardous waste and an estimated 18.7 cubic yards of solid hazardous waste would be generated by the operation of a CNC. The capacity to collect these wastes, accumulate them at four existing storage facilities (with two additional already planned) for offsite disposal at a commercial facility, presently exists and is sufficient to handle these volumes of hazardous waste.

Operation of a CNC would generate 14,900 cubic yards of non-hazardous solid waste. The County currently operates a new transfer station, which would transport that waste to other commercially available solid waste landfills within the state. Sufficient capacity exists to handle this amount of non-hazardous solid waste on a regular basis.

Operation of a CNC is expected to generate 119,500 gallons of non-hazardous liquid waste. This waste would be processed at the TA-46 Sanitary Wastewater System Plant. Treated liquid effluent from the Sanitary Wastewater System Plant is pumped to storage tanks near the TA-3 Power Plant before being discharged to Sandia Canyon through a permitted outfall. The effluent reclamation facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation. Sanitary sludge from the Sanitary Wastewater System Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as New Mexico Special Waste at a permitted landfill (LANL 2006a).

5.1.14.2.2 CNPC (CPC + CUC + A/D/HE Center)

Waste management impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.1.14.2, the CUC impacts, discussed above, and the impacts of an A/D/HE Center, the waste impacts of which are discussed below.

Construction

A/D/HE Center. The additional construction of an A/D/HE Center would generate LLW, and non-hazardous waste. Table 5.1.14-6 summarizes the total volume of waste to be generated over the 6 years construction period for an A/D/HE Center.

Table 5.1.14-6 — A/D/HE Center Construction Waste

Waste Generated	A/D/HE Center
TRU Solid Waste (yd ³)	0
Low Level Solid Waste (yd ³)	9,900
Mixed TRU Solid Waste (yd ³)	0
Hazardous waste (tons)	0
Non-Hazardous Solid Waste (tons)	7,100
Non-Hazardous Liquid Waste (gallons)	40,000

Source: NNSA 2007.

Construction of an A/D/HE Center is expected to generate 9,900 cubic yards of solid LLW. This waste would be processed, and packaged for disposal at the new facility or at the Solid Waste Management Facility in TA-54 and then disposed of on-site at TA-54 Area G.

Construction of an A/D/HE Center would generate 7,100 cubic yards of non-hazardous solid waste. A concrete batch plant would operate at the CNPC site during the construction phase.

The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CNPC construction is completed. A retention pond would be constructed to manage stormwater runoff from the entire CNPC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

5.1.14.4.2 CNPC Operations Impacts

Normal operation of a CNPC would generate TRU waste, LLW, MLLW, hazardous waste, and sanitary waste. Table 5.1.14-7 summarizes the estimated waste generation rates for the operation of the CNPC at LANL.

Table 5.1.14-7 — Annual CNPC Operations Waste Generation

Waste Generated	CPC	CUC	A/D/HE Center	CNPC
TRU Solid Waste (yd ³)	850	0	0	850
Low Level Liquid Waste (gal)		3,515	5,410	8,925
Low Level Solid Waste (yd ³)	3,500	8,100	40	11,640
Mixed Low Level Liquid Waste (gal)	0.4	3,616	6	3,622.4
Mixed Low Level Solid Waste (yd ³)	2.3	70	0	72.3
Mixed TRU Solid Waste (yd ³)	310	0	0	310
Hazardous waste solid (yd ³)	3.7	15	1,350	1,368.7
Hazardous waste liquid (gal)	0.5	0	8,850	8,850.5
Non-Hazardous Solid Waste (yd ³)	7,400	7,500	15,000	29,900
Non-Hazardous Liquid Waste (gal)	69,500	50,000	46,000	165,500

Source: NNSA 2007

Operation of a CNPC would generate 850 cubic yards of TRU waste and 310 cubic yards of mixed TRU waste. This waste would be collected and then packaged in accordance with the WIPP WAC, placed in TRUPACT-II shipping containers, and shipped to WIPP. Sufficient storage space to accumulate shipment quantities would exist in the CNPC.

Operation of a CNPC would generate 8,925 gallons of liquid LLW and 3,622.4 gallons of mixed liquid LLW. These wastes would be solidified, processed, and packaged for disposal at the waste processing portion of the new CNPC facility, or at the Solid Waste Management Facility in TA-54, and then disposed of on-site at TA-54 Area G. The mixed LLW could require additional treatment prior to solidification and disposal. The CNPC will have the necessary RCRA permit to allow for such treatment. In addition, operation of a CNPC would generate 11,640 cubic yards of solid LLW and 72.3 cubic yards of mixed LLW. This waste would also be processed and packaged for disposal, on-site, at TA-54 Area G. The mixed solid LLW could require additional treatment prior to disposal. This would be done at the new CNPC as it will have a RCRA permitted mixed waste treatment facility.

An estimated 1,368.6 cubic yards of solid hazardous waste and an estimated 8,850.5 gallons of liquid hazardous waste would be generated by the operation of a CNPC. The capacity to collect these wastes, accumulate them at four existing storage facilities (with two additional already planned), to solidify the liquid waste, and to ship these wastes offsite for treatment and disposal at a commercial facility, presently exists and is sufficient to handle these volumes of hazardous waste.

Operation of a CNPC at LANL would generate 29,900 cubic yards of non-hazardous solid waste. The County currently operates a new transfer station, which would transport that waste to other solid waste landfills within the state. Sufficient capacity exists to handle this volume of waste on a regular basis.

Operation of a CNPC is expected to generate 165,500 cubic yards of non-hazardous liquid waste. This waste would be processed at the TA-46 Sanitary Wastewater System Plant. Treated liquid effluent from the Sanitary Wastewater System Plant is pumped to storage tanks near the TA-3 Power Plant before being discharged to Sandia Canyon through a permitted outfall. The effluent reclamation facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation. Sanitary sludge from the Sanitary Wastewater System Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as New Mexico Special Waste at a permitted landfill (LANL 2006a).

5.1.14.5 *Capability-Based Alternative*

LANL is presently reestablishing an interim pit fabrication capacity that could provide up to 50 pits annually. Under the Capability-Based Alternative, this effort would continue and would not change. As a result of increased pit production, larger quantities of some radioactive wastes would be generated. Increased pit production is projected to annually result in about 240 cubic yards of additional contact-handled transuranic waste (LANL 2006a).

5.1.14.6 *Plutonium Phase out*

If LANL is not selected as the site for a CPC or CNC/CNPC, NNSA would phaseout NNSA plutonium operations and remove Category I/II SNM from LANL by approximately 2022. Phasing out the plutonium operations from TA-55 would result in a decrease in waste generated at LANL. Assuming that LANL would be producing 50 certifiable pits annually prior to phase out, wastes would be expected to decrease by the following amounts after interim pit production ends:

- LLW would decrease by 1,400 cubic yards annually (from 13,000 cubic yards to 11,600 cubic yards, a decrease of approximately 11 percent);
- MLLW would decrease by 20 cubic yards annually (from 140 cubic yards to 120 cubic yards, a decrease of approximately 14 percent); and
- TRU would decrease by 690 cubic yards annually (from 860 cubic yards to 170 cubic yards, a decrease of approximately 80 percent).

5.2 LAWRENCE LIVERMORE NATIONAL LABORATORY

There are no Programmatic Alternatives for LLNL. Relevant project specific analyses for LLNL are discussed in Sections 5.12 through 5.17.

5.3 NEVADA TEST SITE

This section discusses the potential environmental impacts associated with the following programmatic alternatives at NTS:

- **No Action Alternative:** under the No Action Alternative, NNSA would continue operations to support national security requirements using the nuclear weapons complex as it exists today. NTS would continue to perform its existing missions as described in Section 3.2.3 and no additional impacts would occur beyond those of existing and future activities that NNSA has already decided to perform.
- **DCE Alternative:** this alternative includes a CPC.
- **CCE Alternative:** this alternative includes two options: (1) a Consolidated Nuclear Production Center (CNPC), which would consist of a CPC, a Consolidated Uranium Center (CUC), and an A/D/HE Center; and (2) Consolidated Nuclear Centers (CNC), which would be a CPC and a CUC, with the A/D/HE Center at Pantex. In general, the CCE facilities would produce additive construction impacts because construction activities would occur sequentially as follows: CUC, 2011-2016; CPC, 2017-2022; A/D/HE, 2020-2025).
- **Capability-Based Alternative:** under this alternative, no additional changes would be required at NTS. As such, the No Action Alternative is the same as the Capability-Based Alternative at NTS.

The environmental impacts are presented below for each of the following environmental resource areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, and waste management.

5.3.1 Land Use

This section presents a discussion of the environmental impacts associated with the No Action Alternative, the DCE Alternative, and the CCE Alternative. Table 5.3.1-1 describes the potential effects on land use from construction and operation of facilities under the DCE and CCE Alternatives.

Table 5.3.1-1 — Potential Effects on Land Use at the Proposed Sites

CPC Alternatives			
	Construction (acres)	Operation (acres)	
		110 ^a	
Greenfield Alternative	140	PIDAS	Non-PIDAS
			40
Upgrade Alternative	13	6.5 (All within PIDAS)	
50/80 Alternative	6.5	2.5 (All within PIDAS)	
CUC			
Construction (acres)	50		
Operation (acres)	Total Area: 35 ^b		
	PIDAS	Non-PIDAS	
	15	20	

Table 5.3.1-1 — Potential Effects on Land Use at the Proposed Sites (continued)

A/D/HE CENTER ^d		
Construction (acres)	300	
Operation (acres)	Total Area: 300 ^e	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120
CNC		
Operation (acres)	Total Area: 195 ^f	
	PIDAS	Non-PIDAS
	Total: 55 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	Total: 140 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50
CNPC		
Operation (acres)	Total Area: 545 ^g	
	PIDAS	Non-PIDAS
	Total: 235 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	Total: 310 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100

^a Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^b At Y-12, a UPF would be constructed (see Section 3.4.2).

^c Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^d At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

^e Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^f Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

^g Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

5.3.1.1 *No Action Alternative*

Most of NTS is currently unused or provides buffer zones for ongoing programs and projects, while about 7-10 percent (60,000 – 86,500 acres) of the site has been disturbed. Existing land use at NTS is discussed in Section 4.3.1.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at NTS beyond those of existing and future activities that are independent of this action.

Primary facilities that support the NTS national security missions include the U1a Facility (where high explosives are detonated in the presence of aging nuclear materials to test their dynamic properties), the Big Explosives Experimental Facility (BEEF) (used for hydrodynamic testing of high explosives), the Devise Assembly Facility (DAF) (originally built for high-explosive and nuclear explosive assembly operations, and now being used for other operations including criticality experiments), and Joint Actinide Shock Physics Experimental Research (JASPER) Facility (which uses high explosives in research and development experiments using special nuclear material), and the Hazardous Materials (HAZMAT) Spill Center (used for hazardous materials testing and training). Facilities that support the Waste Management Program include the Area 5 Radioactive Waste Management Complex, and the Area 3 Radioactive Waste Management Site.

5.3.1.2 DCE Alternative (Greenfield CPC)

5.3.1.2.1 Construction

As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. There would be four separate nuclear buildings: Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D. These buildings would be surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS) and a buffer area. The area outside the PIDAS would have a number of smaller support facilities, a Waste Staging/Transuranic (TRU) Packaging Building, roads and parking areas, and a runoff retention area. In addition to these structures, a construction laydown area and a concrete batch plant would be used for the construction phase only. Upon construction completion, they would be removed and the area could be returned to its original state.

All buildings would be either one or two stories. The site would require two HVAC exhaust stacks; the tallest, standing 100 feet, would be located inside the PIDAS. Facility exhausts would be HEPA-filtered prior to discharge through the stacks.

The reference location for a CPC at NTS is within Area 6. The northern quarter of the area is designated as the Nuclear Test Zone, the south central portion is categorized as the Defense Industrial Zone, and the remaining area is designated as the Reserved Zone. The reference location would be located on land designated as a Defense Industrial Zone within Area 6.

An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the CPC. The land required for the proposed CPC construction would represent less than 0.02 percent of NTS's total land area of 880,000 acres. The post-construction developed area would be approximately 110 acres. Table 5.3.1-1 summarizes land use requirements for each alternative.

Although there would be a change in land use, the proposed CPC is compatible and consistent with land use plans and the current use designation (Defense Industrial Zone) for this area. No impacts to NTS land use plans or policies are expected.

5.3.1.2.2 Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the concrete batch plant upon construction completion. The land required for the proposed CPC operations would represent 0.01 percent of NTS's total land area of 880,000 acres.

Although there would be a change in land use, the proposed CPC is compatible and consistent with land use plans and the current land use designation, Defense Industrial Zone, for this area. No impacts to NTS land use plans or policies are expected.

5.3.1.3 *CCE Alternative*

5.3.1.3.1 **CNC (CPC + CUC)**

Land use impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.3.1.2 as well as the CUC impacts discussed below.

CUC. As described in Section 3.5.1.1, a CUC would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside of it. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state.

The CUC reference location at NTS is within Area 6. The northern quarter of the area is designated as the Nuclear Test Zone, the south central portion is categorized as the Defense Industrial Zone, and the remaining area is designated as the Reserved Zone. The reference location would be located on land designated as a Defense Industrial Zone within Area 6.

An estimated 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CUC. The land required for CUC construction would represent 0.01 percent of NTS's total land area of 880,000 acres. The reference location has adequate space to accommodate the total facilities footprint.

Once constructed, the area required to support a CUC would be approximately 35 acres. Although there would be a change in land use, a CUC is compatible and consistent with land use plans and the current use designation (Defense Industrial Zone) for this area. No impacts to NTS land use plans or policies are expected.

Operation

CNC. As described in Section 3.5.2, an estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNC. Of this, approximately 55 acres would be located within a PIDAS. The administrative support buildings, and non-nuclear component production would consist of a 90-acre area outside the PIDAS. A 50-acre buffer zone would also be located outside the PIDAS. The land required for the proposed CNC operations would represent 0.02 percent of NTS's total land area of 880,000 acres. Although there would be a change in land use, a CNC is compatible and consistent with land use plans and the current use designation for this area. No impacts to NTS land use plans or policies are expected.

5.3.1.3.2 **CNPC (CPC + CUC + A/D/HE)**

Land use impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.1.2, the CUC impacts discussed in Section 5.3.1.3, and the A/D/HE impacts discussed below.

Construction

A/D/HE Center. At NTS, an A/D/HE Center would make use of the existing capabilities at the Device Assembly Facility (DAF) and other NTS facilities such that construction requirements would be reduced compared to the generic A/D/HE Center as described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 additional acres would be required for the construction of an A/D/HE Center. The existing DAF would form the cornerstone of this Center at NTS. All plant facilities located within the material access area either occupy existing buildings inside the DAF or would be located in hardened new construction connected to the DAF. There is 1.2 acres of space available in the DAF. All plant facilities located within the limited area at the plant site would be new construction.

The DAF is located in an area designated as a Defense Industrial Zone. The land required for A/D/HE construction would represent 0.02 percent of NTS's total land area of 880,000 acres. Although there would be a change in land use, the proposed A/D/HE is compatible and consistent with land use plans and the current land use designation for this area. No impacts to NTS land use plans or policies are expected.

Operation

CNPC. As described in Section 3.5.1.2, an estimated 445 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNPC at NTS. The land required for CNPC operations would represent 0.05 percent of NTS's total land area of 880,000 acres. Although there would be a change in land use, a CNPC is compatible and consistent with land use plans and the current land use designation for this area.

5.3.2 Visual Resources

5.3.2.1 *No Action Alternative*

Existing visual resources are discussed in Section 4.3.2. The region surrounding NTS ranges from unpopulated to sparsely populated desert and rural land. Lands within NTS have a BLM Visual Resource Management rating of Class II or III. Developed areas within the site are consistent with a Visual Resource Management Class IV rating in which management activities dominate the view and are the focus of viewer attention. Existing visual resources are discussed in Section 4.3.2.

Under the No Action Alternative, there would be no impact on visual resources at NTS since no new facilities would be built.

5.3.2.2 *DCE Alternative (CPC)*

5.3.2.2.1 Construction

As described in Section 3.4.3, a CPC would consist of multiple aboveground facilities. Activities related to the construction of new buildings required for a CPC would result in a

change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. Except for the buildings themselves, these changes would be temporary and would not be noticeable beyond the NTS boundary, which would be more than 10 miles away. Site visitors and employees observing CPC construction would find these activities similar to the past construction activities of other developed areas on the NTS.

5.3.2.2.2 Operation

The CPC facilities, which would include one- and two-story buildings, storage tanks, and two HVAC exhaust stacks, would change the appearance of the reference location in Area 6. However, this change would be consistent with the currently developed areas of Area 6. Thus, CPC's placement in the Defense Industrial Zone within Area 6 boundaries would be consistent with the current Class IV BLM Visual Resources Management rating of developed areas within Area 6. As noted above, a CPC and its supporting structures would not be visible beyond the NTS boundary. Views of the building, tanks, and exhaust stacks would be limited to visitors or employees using the NTS road network.

5.3.2.3 CCE Alternative

5.3.2.3.1 CNC (CPC + CUC)

Visual Resources impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.2.2 as well as the impacts discussed below.

Construction

CUC. Construction activities for a CUC are described in Section 3.5.2. Activities related to the construction of new buildings required for a CUC would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. Except for the buildings themselves, these changes would be temporary and, because of its interior location on the NTS site, would not be noticeable beyond the NTS boundary. Site visitors and employees observing CUC construction would find these activities similar to the past construction activities of other developed areas on the NTS.

Operation

CNC. As described in Section 3.5.2, a CNC would include one- and two-story buildings that would change the appearance of the reference location. The placement in the Defense Industrial Zone with Area 6 boundaries would be consistent with the current Class IV BLM Visual Resources Management rating of developed areas within Area 6. A CNC would not be visible beyond the NTS boundary. Views of the building, tanks, and exhaust stacks would be limited to visitors or employees using the NTS road network. However, this change would be consistent with the currently developed areas of NTS.

5.3.2.3.2 CNPC (CPC + CUC + A/D/HE)

Visual Resources impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.2.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 acres would be required for construction. The existing DAF would form the cornerstone of an A/D/HE Center at NTS, along with the underground complex of tunnels at U1a, the Big Explosive Experimental Facility (BEEF), the Explosives Ordnance Disposal Unit, existing NTS site infrastructure, and the support areas of Mercury, the Control Point and Area 6 Construction.

Activities related to the construction of new buildings required for an A/D/HE Center would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. Except for the buildings themselves, these changes would be temporary and, based on the interior location within the NTS site, would not be noticeable beyond the NTS boundary.

Operation

CNPC. As described in Section 3.5.2, a CNPC would include one- and two-story buildings that would change the appearance of the reference location. The DAF is in the Defense Industrial Zone and would be consistent with the current Class IV BLM Visual Resources Management. The CNPC would not be visible beyond the NTS boundary. Views of the building, tanks, and exhaust stacks would be limited to visitors or employees using the NTS road network. Only the cooling tower would exceed the height of the forest vegetation. However, this change would be consistent with the currently developed areas of NTS.

5.3.3 Site Infrastructure

The analysis of site infrastructure focuses on the ability of the site to provide the electrical power needed to support the programmatic alternatives. The ability of the site to provide the water requirements is addressed in the water resource section (Section 5.3.5). Other infrastructure demands, such as fuels or industrial gases, are not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS

5.3.3.1 *No Action Alternative*

An extensive network of existing infrastructure provides services to NTS activities and facilities as shown in Table 4.3.3-1. Electrical usage is below current site capacity. The annual maximum production capacity of site potable supply wells is approximately 2.1 billion gallons per year while the sustainable site capacity is estimated to be 1.36 billion gallons per year (DOE 2002).

Baseline requirements are discussed in Section 4.3.3. Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3

5.3.3.2 DCE Alternative (CPC)

5.3.3.2.1 Construction

Construction requirements for a CPC are described in Section 3.4.1. The projected demand on electrical resources is shown in Table 5.3.3-1.

Table 5.3.3-1 — Electrical Requirements: Construction of CPC, CUC, and A/D/HE Center

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity^a	176,844	45
Available site capacity^a	75,476	18
No Action Alternative		
Total site requirement	101,377	27
Percent of site capacity	57%	60%
CPC		
CPC requirement	13,000	3.3
Percent of site capacity	7%	7%
Percent of available capacity	17.3%	18%
CUC		
CUC requirement	11,000	2.5
Percent of site capacity	6.2%	5.5%
Percent of available capacity	14.6%	13.8%
A/D/HE		
A/D/HE requirement	55,000	12.7
Percent of site capacity	31%	28.2%
Percent of available capacity	73.3%	70.5%

Source: NNSA 2007.

^a Not limited due to offsite procurement.

The existing electrical infrastructure at NTS would be adequate to support annual construction requirements for the proposed plant sizes for the projected 6-year construction period.

5.3.3.2.2 Operation

Operation requirements for a CPC are described in Section 3.4.1. The estimated annual site electrical infrastructure requirements are presented in Table 5.3.3-2. Electrical energy requirements would be within the site's available capacity.

Table 5.3.3–2 — Electrical Requirements: Operation of CPC, CUC, CNC, A/D/HE Center, and CNPC at NTS

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity ^a	176,844	45
Available site capacity ^a	75,476	18
No Action Alternative		
Total site requirement	101,377	27
Percent of site capacity	57%	60%
CPC		
CPC requirement	48,000	11
Percent of site capacity	27%	24%
Percent of available capacity	64%	61%
CUC		
CUC requirement	168,000	18.4
Percent of site capacity	95%	41%
Percent of available capacity	224%	102%
CNC (CPC + CUC)		
CNC requirement	216,000	29.4
Percent of site capacity	122%	65%
Percent of available capacity	288%	163%
A/D/HE		
A/D/HE requirement	52,000	11.9
Percent of site capacity	29.4%	26%
Percent of available capacity	69.3%	66%
CNPC (CPC + CUC + A/D/HE)		
CNPC requirement	268,000	41.3
Percent of site capacity	151%	91.7%
Percent of available capacity	357%	229%

^a Not limited due to offsite procurement.
 Source: NNSA 2007.

5.3.3.3 *CCE Alternative*

5.3.3.3.1 **CNC (CPC + CUC)**

Site Infrastructure impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.3.3.2 as well as the impacts discussed below.

Construction

CUC. A CUC would primarily be made up of a new structure to contain a nuclear facility composed of the UPF and HEU storage (described in Sections 3.4.2 and 3.5.1.1). As shown in Table 5.3.3-1, the existing electrical infrastructure at NTS would be adequate to support annual construction requirements for a CUC.

Operation

CNC. The core operations of a CNC would be made up of the CPC and CUC operations described in Sections 3.4.2 and 3.5.1.1. The estimated annual site infrastructure requirements for

operation of a CNC are presented in Table 5.3.3-2. Because electrical energy requirements would exceed available site electrical energy capacity, to support a CNC, NTS would have to procure additional power.

5.3.3.3.2 CNPC (CPC + CUC + A/D/HE)

Site electrical infrastructure impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.3.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF and other existing NTS facilities such that construction requirements would be reduced compared to a generic A/D/HE Center described in Sections 3.5.1.2 and 3.5.1.2.1. The existing electrical infrastructure at NTS would be adequate to support annual construction requirements for an A/D/HE Center for the projected 6-year construction period. The estimated site infrastructure requirements for construction of an A/D/HE Center are shown in Table 5.3.3-1.

Operation

CNPC. The core operations of a full CNPC are discussed in Section 3.5.1. The estimated annual site electrical infrastructure requirements for operation of a CNPC are presented in Table 5.3.3-2. Because electrical energy requirements would exceed available site electrical energy capacity, to support a CNPC, NTS would have to procure additional power.

5.3.4 Air Quality and Noise

5.3.4.1 *No Action Alternative*

NTS is located in the Nevada Intrastate Air Quality Control region (AQCR) 147. The region is classified as an attainment area for all six criteria pollutants under the NAAQS. No emission limits for any criteria air pollutants or HAPS were exceeded (NTS 2007). Measured concentration of non-radiological criteria pollutants are below regulatory requirements (NTS 2007). For data reported for 2006, the estimated annual dose to the public from radiological emissions from current and past NTS activities is well below the 10 millirem per year dose limit (NTS 2007). Existing air quality at NTS is discussed in Section 4.3.4.1.

During periods of activity, local sound levels at NTS could vary from loud (70 dbA) to deafening (160 dbA) depending on the distance between the noise source and receptor (NTS 2006a). A description of the existing activities that produce noise at NTS is in Section 4.3.4.2. Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. There would be no additional impacts to air quality and noise beyond current and planned activities.

5.3.4.2 *DCE Alternative (Greenfield CPC)*

5.3.4.2.1 **Air Quality**

Construction

Non-radiological Impacts. Construction of new structures would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, particulate matter, total suspended particulates, and carbon monoxide. The calculation of emissions from construction equipment is based on factors provided in the EPA document AP-42, “Compilation of Air Pollutant Emission Factors” (EPA 1995). For highway vehicles (worker commuting vehicles and delivery vehicles), factors were obtained from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA 2002).

Fugitive dust generated during the clearing, grading, and other earth moving operations depends on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 2.69 metric tons per hectare (1.20 tons per acre) per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. Facility construction would necessitate a concrete batch plant at the building site. Particulate matter, consisting primarily of cement dust, would be the only regulated pollutant emitted in the concrete mixing process.

The estimated maximum annual pollutant emissions resulting from construction activities are presented in Table 5.3.4–1. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities are too small to result in violations of the National Ambient Air Quality Standards (NAAQS) beyond the NTS site boundary (DOE 2003d).

Table 5.3.4–1 — Estimated Peak Non-radiological Air Emissions for CPC—Construction

Pollutant	Estimated Annual Emission Rate (metric tons/yr)
	CPC
Carbon monoxide	409.6
Carbon dioxide	7,084.2
Nitrogen dioxide	177.7
Sulfur dioxide	11.6
Volatile organic compounds	28.7
PM ₁₀	686
Total Suspended Particulates	915

Source: NNSA 2007

Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

Non-radiological Impacts. Pit manufacturing activities would result in the release of criteria and toxic pollutants into the surrounding air. The primary volume contributors are nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Carbon dioxide would be used as a cleaning agent and helium would be used for leak testing operations. Hydrogen and nitrogen dioxide are reaction products from aqueous purification operations (pyrochemical purification would produce lower amounts of hydrogen and nitrogen dioxide). The chemicals used for dye-penetrant testing of welds are assumed to be volatilized and released to the atmosphere. Organic solvents used for cleaning and chemicals used in the Analytical Laboratory for various analyses would not be expected to contribute any appreciable quantities of any other chemicals to the annual non-radioactive air emissions. As shown in Table 5.3.4-2, air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon dioxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates (WSRC 2002e). If NTS is selected for a CPC, a prevention of significant deterioration (PSD) increment analysis would be performed under a project-specific tiered EIS to determine whether the pit manufacturing activities would cause a significant pollutant emission increase.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because NTS is located in an attainment area for all criteria pollutants. Therefore, although the CPC would emit criteria pollutants, a conformity review is not necessary.

Table 5.3.4-2 — Annual Non-radiological Air Emissions for the CPC – Operations

Chemical Released	Quantity Released (kg/yr)
	200 ppy
Carbon dioxide	1,843,600
Carbon monoxide	8,580
Nitrogen dioxide	42,803.2
PM ₁₀	1,042.8
Sulfur dioxide	2,626.8
Total suspended particulates	2,820.4
Volatile organic compounds	2,626.8

Source: NNSA 2007.

The maximum concentrations (microgram per cubic meter) at the NTS site boundary that would be associated with the release of pollutants were modeled and are presented in Table 5.3.4-3. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. For almost all the pollutants for which data were available, the incremental addition would be less than 1 percent of the most stringent standard or guideline. Since estimated

emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative.

Table 5.3.4-3 — Criteria Pollutant Concentrations for CPC—Operations

Pollutant	Averaging Time	Most Stringent Standard ^a ($\mu\text{g}/\text{m}^3$)	Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)	
			Baseline ^d	CPC- 200ppy
Carbon monoxide	8-hr (elevations < 5,000 ft amsl)	13,079 ^b	2,995	2.68
	8-hour (elevations \geq 5,000 ft above msl)	8,985 ^b	No Data	No Data
	1-hr	52,318 ^c	3,597	3.82
Nitrogen dioxide	Annual	130.8 ^c	No Data	1.5
Lead	Quarterly	1.96 ^c	No Data	No Data
Ozone	1-hr	307.4 ^c	No Data	No Data
Sulfur dioxide	Annual	104.6 ^c	No Data	0.09
	24-hr	477.4 ^c	20.5	0.46
	3-hr	1,700 ^c	85.5	1.06
PM ₁₀	Annual	65.4 ^c	No Data	0.037
	24-hr	196.2 ^c	102.4	0.18

PM₁₀ = particulate matter less than or equal to 10 microns in aerodynamic diameter.

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic PM₁₀ mean standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

^b State standard.

^c Federal standard (NAAQS).

^d Highest measured concentration at NTS.

Source: NNSA 2007.

Radiological Impacts. Radioactive air emissions from pit manufacturing activities would involve plutonium, americium, and enriched uranium. The pit manufacturing activities would be performed within gloveboxes or vaults for radiological containment; and include plutonium recovery using aqueous or pyrochemical processes, foundry, machining, assembly, post assembly operations, inspection and certification, waste handling, and preparing the final product (pits) for shipment. Analytical operations would normally be conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. Sample transfers would occur using a vacuum tube transfer system from the Feed Preparation and Manufacturing Facilities to the Analytical Support Facility. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before being released to the air via a 100-ft tall stack. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of entrained particles from the exhaust air.

NNSA estimated routine radionuclide air emissions (see Table 5.3.4-4). Total radionuclide emissions at NTS would increase by less than 0.0001 percent. To ensure that total emissions are not underestimated, NNSA's method for estimating emissions was conservative. Therefore, actual emissions from pit manufacturing operations would be smaller.

Table 5.3.4-4 — Annual Radiological Air Emissions for CPC at NTS—Operations

Isotope	Annual Emissions (Ci/yr)	
	Baseline ^{a,b}	200 ppy
Americium-241	4.7×10^{-2}	3.12×10^{-7}
Plutonium-239		1.02×10^{-5}
Plutonium-240		2.66×10^{-6}
Plutonium-241		1.96×10^{-4}
Total Plutonium	2.9×10^{-1}	2.1×10^{-4}
Uranium-234		5.02×10^{-9}
Uranium-235		1.58×10^{-10}
Uranium-236		2.56×10^{-11}
Uranium-238		1.42×10^{-12}
Total Uranium	NA	–
Tritium	170	–
Total	170.3	2.09×10^{-4}

^aThe No Action Alternative is represented by the baseline.

^b Onsite emissions only.

NA = not available.

Source: NNSA 2007.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding NTS. As shown in Table 5.3.4-5, the expected annual radiation dose to the offsite MEI would be much lower than the limit of 10 mrem per year set by both EPA (40 CFR Part 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the processing facilities resulting from radiological air emissions are presented in Section 5.3.11.

Table 5.3.4-5 — Annual Doses Due to Radiological Air Emissions from CPC Operations at NTS

Receptor	CPC- 200 ppy
Offsite MEI ^a (mrem/yr)	2.14×10^{-9}
Population within 50 miles (person-rem per year) ^a	3.66×10^{-8}

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.3.4-3 and using the CAP88 computer code. Based on a projected future population (year 2030) of 60,138 persons residing within 50 miles of NTS location. The offsite MEI is assumed to reside at the site boundary 13.7 miles from the release.

Source: Tetra Tech 2007.

5.3.4.2.2 Noise

Construction

Construction of new buildings at Area 6 would involve the movement of workers and construction equipment and would result in some temporary increase in noise levels near the area. Sources associated with construction at Area 6 would not include loud intermittent sources such as blasting. Although noise levels in construction areas could be as high as 110 dBA, these high local noise levels would not extend far beyond the boundaries of the construction site. Table 5.3.4-6 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55-85 dBA. The *Environmental Impact Data Book* (Golden et al. 1980) suggests that noise levels higher than 80-

85 dBA are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing wildlife outside a 400-foot radius of the construction site. Given the distance to the site boundary (more than 10 miles), there would be no change in noise impacts on the public as a result of construction activities, except for a small increase in traffic noise levels from construction employees and material shipments.

Table 5.3.4-6 — Peak and Attenuated Noise Levels from Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Operation

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations at the new buildings would be expected to be similar to those from existing operations at Area 6. There would be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (more than 10 miles), noise emissions from equipment would not likely disturb the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. But these noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur onsite and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with the operation of these facilities would likely increase traffic noise levels along roads used to access the site.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.3.4.3 *CCE Alternative*

5.3.4.3.1 **CNC (CPC + CUC)**

Air quality and noise impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.4.2 as well as the impacts discussed below for the CUC.

5.3.4.3.1.1 **Air Quality**

Construction

CUC Non-radiological Impacts. Construction impacts would be similar to the construction impacts for a CPC (discussed above), as both facilities are similarly sized (approximately 650,000 square feet of floorspace) and have the same construction durations (6 years). As such, the non-radiological emissions presented in Table 5.3.4–1 would bound CUC emissions. Actual construction emissions of a CUC are expected to be less, since conservative emission factors and other assumptions were used to model the CPC construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the NTS site boundary, as the maximum baseline concentrations are more than 30 percent below the most stringent standard or guideline.

CUC Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

CUC and CNC Non-radiological Impacts. CUC (and CNC) activities would result in the release of criteria and toxic pollutants into the surrounding air. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates. The estimated emission rates for non-radiological pollutants were derived from existing Y-12 operations. The non-radiological pollutants were modeled to determine the incremental concentrations from the CUC to the NTS baseline. The results are presented in Table 5.3.4–7. Because the estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. The CUC contribution to non-radiological emissions would not cause any standard

or guideline to be exceeded. Organic solvents used for cleaning and chemicals used in the Analytical Laboratory for various analyses would not be expected to contribute any appreciable quantities of any other chemicals to the annual non-radioactive air emissions.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because NTS is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

Table 5.3.4-7 — Criteria Pollutant Concentrations at NTS Boundary for CUC and CNC Operations

Pollutant	Averaging Time	Most Stringent Standard ^a ($\mu\text{g}/\text{m}^3$)	Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)		
			Baseline ^d	CUC	CNC
Carbon monoxide	8-hr (elevations < 5,000 ft amsl)	13,079 ^b	2,995	0.2	2.78
	8-hour (elevations \geq 5,000 ft amsl)	8,985 ^b	NA	No Data	No Data
	1-hr	52,318 ^c	3,597	No Data	3.66
Nitrogen dioxide	Annual	130.8 ^c	No Data	0.9	2.18
Sulfur dioxide	Annual	104.6 ^c	No Data	2.1	2.16
	24-hr	477.4 ^c	20.5	52.4	52.8
	3-hr	1,700 ^c	85.5	17.5	18.5
PM ₁₀	Annual	65.4 ^c	No Data	0.02	0.05
	24-hr	196.2 ^c	102.4	0.2	0.4
Lead	Quarterly	1.96 ^c	No Data	No Data	No Data
Ozone	1-hr	307.4 ^c	No Data	No Data	No Data

NA – Not Applicable

PM₁₀ = particulate matter less than or equal to 10 microns in aerodynamic diameter.

^aThe more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic PM₁₀ mean standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

^bState standard.

^cFederal standard (NAAQS).

^d Highest measured concentration at NTS.

Source: NNSA 2007.

CUC and CNC Radiological Impacts. A CUC would release radiological contaminants, primarily uranium, into the atmosphere during operations. The current design of the CUC nuclear facility calls for appropriately sized filtered HVAC systems. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from existing EU facilities at Y-12, and are likely to be less due to the incorporation of newer technology into the facility design. However, because detailed design information does not yet exist, these reductions cannot be quantified. As a result, for purposes of this SPEIS, the radiological airborne emissions from a CUC are conservatively estimated from existing operations at Y-12. An estimated 0.10 curies (2.17 kilograms) of uranium was released into the atmosphere in 2004 as a result of Y-12 activities (DOE 2005a). After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding NTS, and NTS workers. The CAP88 code is a Gaussian plume dispersion model used to demonstrate compliance with the radionuclide NESHAP (40 CFR Part 61). Specific parameters, including meteorological data, source characteristics, and population

data, were used to estimate the radiological doses. NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding NTS. As shown in Table 5.3.4-8, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of a CUC resulting from radiological air emissions are presented in Section 5.3.11.

Table 5.3.4-8 — Annual Doses^a Due to Radiological Air Emissions from CUC and CNC Operations at NTS

Receptor	CUC	CNC
Offsite MEI ^a (mrem/yr)	4.06×10 ⁻³	4.06×10 ⁻³
Population within 50 miles (person-rem per year) ^a	1.3×10 ⁻²	1.3×10 ⁻²

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.3.4-3 and using the CAP88 computer code. Based on a projected future population (year 2030) of 60,138 persons residing within 50 miles of NTS location. The offsite MEI is assumed to reside at the site boundary 13.7 miles from the release.
Source: Tetra Tech 2007.

5.3.4.3.1.2 Noise

Construction

CUC. Anticipated noise impacts from the construction of a CUC would be similar to those described for the CPC in Section 5.3.4.2.

Operation

CUC and CNC. Anticipated noise impacts from the operation of a CNC would be similar to those described for the CPC in Section 5.3.4.2.

5.3.4.3.2 CNPC (CPC + CUC + A/D/HE Center)

Air Quality and Noise impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.4.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

5.3.4.3.2.1 Air Quality

Construction

A/D/HE Center Non-radiological Impacts. Non-radiological impacts of an A/D/HE Center construction are expected to be similar to the impacts described above for a CPC and CUC. However, due to the potential to disturb approximately 200 acres of land during construction, modeling was performed to determine if PM₁₀ emissions (which were considered to be the most likely criteria pollutant to exceed regulatory limits) at the site boundary would exceed regulatory limits. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and

area disturbed. Fugitive emissions were estimated based on the EPA emission factor of 1.20 tons per acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent.

The estimated maximum annual PM₁₀ emissions resulting from construction activities are presented in Table 5.3.4–9. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts. The results represent a conservative estimate if PM₁₀ emissions at the site boundary. As shown, these results show that concentrations would remain approximately 90 percent below any regulatory limits.

Table 5.3.4–9 — A/D/HE Center Construction-- PM₁₀ Impacts

Parameter	Guideline or limit ($\mu\text{g}/\text{m}^3$)	Concentration at Site Boundary ($\mu\text{g}/\text{m}^3$)
Particulate Matter emitted: 1,620 tons/year		
Annual	50	5.67
24-hour	150	13.3

Source: Janke 2007.

A/D/HE Center Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

A/D/HE Center and CNPC Non-radiological Impacts. A CNPC would release non-radiological contaminants into the atmosphere during operations. The CPC and CUC non-radiological emissions are discussed in Sections 5.3.4.2.1 and 5.3.4.3.1 respectively, and are not repeated here. The total non-radiological air impacts of a CNPC would be additive of a CPC, CUC, and an A/D/HE Center (which is discussed in this section). During normal operations, an A/D/HE Center would release the non-radionuclides to the air in the quantities indicated in Table 5.3.4-10. These emissions would be incremental to the NTS baseline.

Table 5.3.4-10 — Annual Non-radiological Air Emissions, A/D/HE Center—Operations

NAAQS emissions (tons/year)	Emissions
Oxides of Nitrogen (tons/year)	91
Carbon Monoxide (tons/year)	31
Volatile Organic Compounds (tons/year)	31
Particulate Matter (tons/year)	18
Sulfur Dioxide (tons/year)	5
Hazardous Air Pollutants and Effluents (tons/yr)	22

Source: NNSA 2007.

The maximum concentrations (micrograms per cubic meter) at the NTS site boundary that would be associated with the release of criteria pollutants are presented in Table 5.3.4-11. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. Because the estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative.

Table 5.3.4-11 — Criteria Pollutant Concentrations at NTS for CNPC—Operations

Pollutant	Averaging Time	Most Stringent Standard ^a ($\mu\text{g}/\text{m}^3$)	Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)		
			Baseline ^d	A/D/HE Center	CNPC
Carbon monoxide	8-hr (elevations < 5,000 ft amsl)	13,079 ^b	2,995	0.12	3.0
	8-hour (elevations \geq 5,000 ft above msl)	8,985 ^b	NA	No Data	NA
	1-hr	52,318 ^c	3,597	1.88	5.6
Nitrogen dioxide	Annual	130.8 ^c	No Data	0.35	2.5
Sulfur dioxide	Annual	104.6 ^c	No Data	0.02	2.2
	24-hr	477.4 ^c	20.5	0.05	52.8
	3-hr	1,700 ^c	85.5	0.2	18.7
PM ₁₀	Annual	65.4 ^c	No Data	0.07	0.1
	24-hr	196.2 ^c	102.4	0.16	0.6
Lead	Quarterly	1.96 ^c	No Data	No Data	No Data
Ozone	1-hr	307.4 ^c	No Data	No Data	No Data

PM₁₀ = particulate matter less than or equal to 10 microns in aerodynamic diameter.

^a The more stringent of the Federal and state standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic PM₁₀ mean standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

^b State standard.

^c Federal standard (NAAQS).

^d Highest measured concentration at NTS.

Source: NNSA 2007.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because NTS is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

A/D/HE Center and CNPC Radiological Impacts. A CNPC would release radiological contaminants into the atmosphere during operations. The CPC and CUC radiological emissions are discussed in sections 5.3.4.2.1 and 5.34.3.1 respectively, and are not repeated here. The total radiological air impacts of a CNPC would be additive of a CPC, CUC, and an A/D/HE Center (which is discussed in this section).

During normal operations, an A/D/HE Center would release the radionuclides to the air in the quantities indicated in Table 5.3.4-12.

Table 5.3.4-12 — Annual Radiological Air Emissions for A/D/HE Center Operations

Radionuclide	Emission (Ci)
Tritium (Ci)	1.41×10^{-2}
Total Uranium (Ci)	7.50×10^{-5}
Total Other Actinides (Ci)	2.17×10^{-15}

Source: NNSA 2007.

After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding NTS, and NTS workers. NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding NTS. As shown in Table 5.3.4-12, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of an A/D/HE Center resulting from radiological air emissions are presented in Section 5.3.11.

Table 5.3.4-13 — Annual Doses Due to Radiological Air Emissions from A/D/HE Center Operations at NTS

Receptor	A/D/HE	CNPC
Offsite MEI ^a (mrem/yr)	3.12×10^{-5}	4.09×10^{-3}
Population within 50 miles (person-rem per year) ^a	9.79×10^{-5}	1.3×10^{-2}

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.3.4-3 and using the CAP88 computer code. Based on a projected future population (year 2030) of 60,138 persons residing within 50 miles of NTS location. The offsite MEI is assumed to reside at the site boundary 13.7 miles from the release.

Source: Tetra Tech 2007.

5.3.4.3.2.2 Noise

Construction

A/D/HE Center. Anticipated noise impacts from the construction of a CNPC would be similar to those described for a CPC in Section 5.3.4.2.

Operation

A/D/HE Center and CNPC. Anticipated noise impacts from the operation of a CNPC would be similar to those described for the CPC in Section 5.3.4.2.

5.3.5 Water Resources

Environmental impacts associated with the proposed alternatives at NTS could affect groundwater resources. No impacts to surface water are expected. At NTS, groundwater resources would be used to meet all construction and operations water requirements.

5.3.5.1 No Action Alternative

There are no perennial streams or other naturally occurring surface waterbodies at NTS. Three principal groundwater sub-basins have been identified within the NTS region. The history of nuclear testing at NTS has contaminated groundwater in some areas. Data for 2005 indicate that groundwater at offsite locations has not been significantly impacted by nuclear testing. Results from nine NTS water supply wells and one water monitoring well continue to indicate that nuclear testing has not impacted the NTS potable water supply network. Current and planned activities would continue as required with an expected demand for water of 634 million gallons per year. Water resources are discussed in Section 4.3.5.

Table 5.3.5–1 and 5.3.5-2 summarizes existing surface water and groundwater resources at NTS, the total NTS water resource requirements for each alternative, and the potential changes to water resources at NTS resulting from the proposed alternatives.

Table 5.3.5–1 — Potential Changes to Water Resources from the Construction of the CPC, CUC and A/D/HE Center at NTS

Proposed Alternatives	Water Availability and Use
Annual Maximum Production Capacity (gal/yr)	2,100,000,000
Sustainable site capacity (gal/yr)	1,360,000,000
No Action Alternative	
Water Requirement (gal/yr)	634,000,000
Percent of Available Site Capacity	46.6%
CPC	
Water Requirement (gal)	20,900,000
Percent of Sustainable Site Capacity	1.5%
CUC	
Water Requirement (gal)	5,200,000
Percent of Sustainable Site Capacity	0.4%
A/D/HE Center	
Water Requirement (gal)	2,022,000
Percent of Sustainable Site Capacity	0.2%

Source: NNSA 2007.

Table 5.3.5–2 — Potential Changes to Water Resources from the Operation of the CPC, CUC and A/D/HE Center at NTS

Proposed Alternatives	Water Availability and Use
Annual Maximum Production Capacity (gal/yr)	2,100,000,000
Sustainable site capacity (gal/yr)	1,360,000,000
No Action Alternative	
Water Requirement (gal)	634,000,000
Percent of Sustainable Site Capacity	46.6%
CPC	
Water Requirement (gal)	88,500,000
Percent of Sustainable Site Capacity	6.5%
Total Water Requirement/Within Sustainable Capacity?	722,500,000/Yes

Table 5.3.5–2 — Potential Changes to Water Resources from the Operation of the CPC, CUC and A/D/HE Center at NTS (continued)

Proposed Alternatives	Water Availability and Use
CUC	
Water Requirement (gal)	105,000,000
Percent of Sustainable Site Capacity	7.8%
Total Water Requirement/Within Sustainable Capacity?	739,000,000/Yes
CNC (CPC + CUC)	
Water Requirement (gal)	193,500,000
Percent of Sustainable Site Capacity	14.2%
Total Water Requirement/Within Sustainable Capacity?	827,500,000/Yes
A/D/HE Center	
Water Requirement (gal)	130,000,000
Percent of Sustainable Site Capacity	9.5%
Total Water Requirement/Within Sustainable Capacity?	764,000,000/Yes
CNPC (CPC + CUC + A/D/HE Center)	
Water Requirement (gal)	323,500,000
Percent of Sustainable Site Capacity	23.7%
Total Water Requirement/Within Sustainable Capacity?	957,500,00/Yes

Source: NNSA 2007.

5.3.5.1.1 Surface Water

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts to water resources would occur at NTS.

5.3.5.1.2 Groundwater

There would be no additional impacts on groundwater availability or quality beyond current and planned activities. Current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3.

5.3.5.2 DCE Alternative (Greenfield CPC)

5.3.5.2.1 Surface Water

Construction

Construction requirements for a CPC are described in Section 3.4.1. Surface water would not be used to support the construction of a CPC at NTS as groundwater is the source of water at NTS. There are no natural surface waterbodies in the vicinity that are a viable source of water. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Although runoff from the vicinity of the site drains toward Frenchman Lake, which has standing water during the winter months, surface drainages in the vicinity and onsite in general are ephemeral, and runoff infiltration is rapid on alluvium. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. NTS would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at NTS is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

A rise in the surface elevation of any standing water on playas creates a potential flood hazard. Therefore, safeguards would be constructed as necessary for the proposed CPC buildings and would be sited in accordance with applicable regulatory requirements and DOE orders, including Executive Order 11988, Floodplain Management.

Operation

Operation requirements for a CPC are described in Section 3.4.1. No impacts on surface water resources are expected as a result of CPC operations at NTS. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds according to permit requirements. No industrial or other regulated discharges to surface waters are anticipated.

A CPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive-contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CPC liquid process waste facilities for the plutonium purification process.

5.3.5.2.2 Groundwater

Construction

Construction requirements for a CPC are described in Section 3.4.1. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing

activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.3.5–1. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require a total of 20,900,000 gallons of groundwater mainly to support CPC construction. It is expected that construction should take approximately 6 years. The yearly peak in water use would be approximately 3.5 million gallons. The total site water requirements including these quantities would be well within the sustainable site capacity of 1.36 billion gallons. It is anticipated that this water would be derived from NTS’s groundwater distribution system via a temporary service connection or trucked to the point-of-use, especially during the early stages of construction.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

Operation

Operation requirements for a CPC are described in Section 3.4.1. Activities at NTS under the CPC Alternative would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. A summary of water usage by category and total is listed in Table 5.3.5–2. The CPC operations would require 6.5 percent of the sustainable site water capacity. No sanitary or industrial effluent would be directly discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected.

Routine chemical additives would be added to the domestic water to control bacteria, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.3.5.3 *CCE Alternative*

5.3.5.3.1 *CNC (CPC + CUC)*

Water resources impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.3.5.2 as well as the impacts discussed below.

Surface Water

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1. Surface water would not be used to support the construction of a CUC at NTS as groundwater is the source of water at NTS. There are no natural surface waterbodies in the vicinity that are a viable source of water. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Although runoff from the vicinity of the site drains toward Frenchman Lake, which has standing water during the winter months, surface drainages in the vicinity and onsite in general are ephemeral, and runoff infiltration is rapid on alluvium. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. NTS would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at NTS is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

A rise in the surface elevation of any standing water on playas creates a potential flood hazard. Therefore, safeguards would be constructed as necessary for CUC buildings and would be sited in accordance with applicable regulatory requirements and DOE orders, including Executive Order 11988, Floodplain Management.

CNC Operation. Operation requirements for a CNC are described in Section 3.5.1. No impacts on surface water resources are expected as a result of CNC operations at NTS. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds. No industrial or other regulated discharges to surface waters are anticipated.

A CNC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures.

Groundwater

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.3.5-1. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require a total of 5.2 million gallons of groundwater mainly to support CUC construction. The

maximum additional water requirement for a CPC is less than 1 percent of NTS's sustainable site capacity. It is anticipated that this water would be derived from NTS's groundwater distribution system via a temporary service connection or trucked to the point-of-use, especially during the early stages of construction.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNC Operation. CUC operations would require 7.8 percent of the sustainable site water capacity. Operation requirements for a CNC are described in Section 3.5.1. Activities at NTS under the CNC Alternative would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. A summary of water usage by category and total is listed in Table 5.3.5-2. CNC operations would require 14.2 percent of the sustainable site water capacity. No sanitary or industrial effluent would be directly discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected.

Routine chemical additives would be added to the domestic water to control bacteria, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.3.5.3.2 CNPC (CPC + CUC + A/D/HE Center)

Water resource impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.5.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Surface Water

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would use the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 acres would be required for the construction of the A/D/HE Center. The existing DAF would form the cornerstone of an A/D/HE Center at NTS. All plant facilities located within the material access area either occupy existing buildings inside the DAF or would be located in hardened new construction connected to the DAF.

Surface water would not be used to support the construction of an A/D/HE Center at NTS as groundwater is the source of water at NTS. There are no natural surface waterbodies in the vicinity that are a viable source of water. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction liquid wastes would be generated. Liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Although runoff from the vicinity of the site drains toward Frenchman Lake, which has standing water during the winter months, surface drainages in the vicinity and onsite in general are ephemeral, and runoff infiltration is rapid on alluvium. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. NTS would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the reference location at NTS is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

A rise in the surface elevation of any standing water on playas creates a potential flood hazard. Therefore, safeguards would be constructed as necessary for CUC buildings and would be sited in accordance with applicable regulatory requirements and DOE orders, including Executive Order 11988, Floodplain Management.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. No impacts on surface water resources are expected as a result of CNPC operations at NTS. No surface water would be used to support facility activities and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of facility operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. The sanitary wastewater would be treated, monitored, and discharged into sewage lagoons and ponds. No industrial or other regulated discharges to surface waters are anticipated.

A CNPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. .

Groundwater

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center described in Section 3.5.1.2 and 3.5.1.2.1.

Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. A summary of water usage by category and total is listed in Table 5.3.5–1. The proposed use of portable toilets by construction personnel would greatly reduce water use over

that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require a total of approximately 2 million gallons of groundwater mainly to support A/D/HE Center construction. The maximum additional water requirement for A/D/HE Center construction would be less than 1 percent of NTS's sustainable site capacity.

There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. A/D/HE Center operations would require approximately 130 million gallons of water annually, which would be 9.5 percent of the sustainable site water capacity. When coupled with a CPC and CUC, a CNPC would use 323.5 million gallons of groundwater annually to support operations. CNPC operations would require 23.7 percent of the sustainable site water capacity. No sanitary or industrial effluent would be directly discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected.

Routine chemical additives would be added to the domestic water to control bacteria, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.3.6 Geology and Soils

5.3.6.1 *No Action Alternative*

Soils at NTS are considered acceptable for standard construction techniques. There is no prime farmland at NTS. Past testing at NTS (underground, atmospheric, safety, and nuclear rocket and related tests) has resulted in the displacement and contamination of soils at NTS. The areas of contamination have been delineated, air monitoring and radiological surveying continue for key indicator parameters and an extensive research and development project has evaluated alternative methods for remediating the soils for possible future land use. Existing geology and soils resources are discussed in Section 4.3.6.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on geology and soils would occur at NTS beyond those of existing and future activities that are independent of this action.

5.3.6.2 DCE Alternative (Greenfield CPC)

5.3.6.2.1 Construction

As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the CPC.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in southern Nevada. In addition to CPC construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER Program and in accordance with appropriate requirements and agreements. Construction of a CPC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion. As discussed in Section 4.3.5, faults located in the vicinity of NTS have the potential for earthquakes.

As discussed in Section 4.3.6, NTS is located in a region with relatively high seismicity. Ground shaking associated with postulated earthquakes is possible and supported by the historical record for the region. Further, minor to moderate earthquakes have occurred within the site within the last decade. Modified Mercalli Intensity VII ground shaking would be expected to affect primarily the integrity of inadequately designed or non-reinforced structures, but damage to properly or specially designed facilities would not be expected. Nevertheless, three potentially active fault systems intersect the site and, thus, should be considered capable.¹ The closest capable fault (Cane Spring) is located about 3 miles southeast of DAF. The potential for other large scale geologic hazards to affect Area 6 facilities is generally low. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines. Thus, site geologic conditions would not likely affect the facilities.

5.3.6.2.2 Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. The operation of a CPC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the

¹ A *capable fault* is a fault which has exhibited movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.

public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.3.6.3 *CCE Alternative*

5.3.6.3.1 **CNC (CPC + CUC)**

Geologic and soil resource impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.6.2 as well as the impacts discussed below.

Construction

CUC. As described in Section 3.5.1.1, a CUC would consist of multiple aboveground facilities. An estimated 50 acres of land, which includes a construction laydown area and temporary parking would be needed for construction. Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state. Once constructed, a CUC would require approximately 35 acres of land.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in southern Nevada. In addition to CUC construction, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; therefore the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's Environmental Restoration Program and in accordance with appropriate requirements and agreements. Construction of a CUC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

The CUC reference location is in a region that has been seismically active within the last few thousand to tens of thousands of years. Earthquakes on the faults in the area and larger earthquakes on the farther faults would result in ground motion at the CUC site. Ground shaking affects primarily the integrity of inadequately designed or non-reinforced structures, but does not damage or only slightly damages properly or specially designed facilities.

Operation

CNC. As described in Section 3.5.2, an estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNC. The land required for CNC operations would represent less than 0.02 percent of NTS's total land area of 880,000 acres.

The operation of a CNC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear

facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.3.6.3.2 CNPC (CPC + CUC + A/D/HE Center)

Geologic and soil resource impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.3.6.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. At NTS, an A/D/HE Center would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to the generic A/D/HE Center as described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 acres would be required for the construction of the A/D/HE Center. The DAF is located in an area designated as a Defense Industrial Zone. The land required for the proposed A/D/HE Center construction would represent 0.02 percent of NTS's total land area of 880,000 acres.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities, but these resources are abundant in southern Nevada. In addition to A/D/HE Center construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small; the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER Program and in accordance with appropriate requirements and agreements. Construction of the A/D/HE Center would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

The A/D/HE Center representative site is located in a region that has been seismically active within the last few thousand to tens of thousands of years. Earthquakes on the faults in the area and larger earthquakes on the farther faults would result in ground motion at the A/D/HE Center site. Ground shaking affects primarily the integrity of inadequately designed or non-reinforced structures, but does not damage or only slightly damages properly or specially designed facilities.

Operation

CNPC. As described in Section 3.5.1, an estimated 445 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CNPC. The land required for the proposed CNPC operations would represent 0.05 percent of NTS's total land area of 880,000 acres.

The operation of the CNPC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed

in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.3.7 Biological Resources

5.3.7.1 *No Action Alternative*

The only federally-threatened species found at NTS is the Mojave Desert population of the desert tortoise (NTS 2007). Existing biological resources are discussed in Section 4.3.7.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. No additional impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered (T&E) species would occur at NTS beyond those of existing and future activities that are independent of this action.

5.3.7.2 *DCE Alternative (Greenfield CPC)*

5.3.7.2.1 Terrestrial Resources

Construction

Construction requirements are described in Section 3.4.1. The area identified for construction of a CPC consists primarily of white bursage (*Ambrosia dumosa*) and creosote bush (*Larrea tridentata*) or saltbush and white bursage shrubland vegetation (Skougard 2002) that supports a limited diversity of wildlife. An estimated 140 acres of land would be required to construct a CPC. During site-clearing activities, highly mobile wildlife species or wildlife species with large home ranges (such as deer and birds) would be able to relocate to adjacent undeveloped areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. Species relocation may result in additional pressure to lands already at or near carrying capacity. The impacts could include overgrazing (in the case of herbivores), stress, and over-wintering mortality. For less mobile species (reptiles, amphibians, and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

Operation

As described in Section 3.4.1, an estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. In addition to the areas to be disturbed, there would be a decrease in quality of the habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. The adjacent habitat also would experience a loss of quality from the reduction in size, segmentation of the habitat, and restriction on mobility for some species (Kelly and Rotenberry 1993).

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations would minimize the potential for any adverse affects to plant and animal communities (terrestrial resources) in the surrounding environment.

5.3.7.2.2 Wetlands

Construction

Construction requirements for a CPC are described in Section 3.4.1. Of the known 24 springs and seeps found at NTS, most of which support wetland vegetation, none are located on the proposed CPC site. Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid any degradation to wetlands in the area.

Operation

Operation requirements for a CPC are described in Section 3.4.1. There are no adverse impacts predicted to wetlands from operation of the CPC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CPC operations are not expected to adversely affect any wetlands.

5.3.7.2.3 Aquatic Resources

Construction

Construction requirements for a CPC are described in Section 3.4.1. There are no perennial or seasonal aquatic habitats within the proposed CPC location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

Operation

Operation requirements for a CPC are described in Section 3.4.1. There would be no direct discharge of untreated operational effluent from CPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff water would be similar to runoff from other NTS built environments and the quantity would represent a very minor contribution to the watershed.

5.3.7.2.4 Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at NTS, are known to be present within the proposed site location. As discussed in section 4.3.7.4, the only federally-threatened species found at NTS is the Mojave Desert population of the desert tortoise (*Gopherus agassizii*) (NTS 2007). The desert tortoise inhabits the southern one-third of the NTS at fairly low estimated densities. The abundance of tortoises at NTS is low to very low compared to other areas within the range of this species. NTS contains less than 1 percent of the total desert tortoise habitat of the Mojave Desert population (DOE 2002). A cumulative total of 265.70 acres of tortoise habitat on the NTS has been disturbed since the desert tortoise was listed as threatened in 1992 (NTS 2005).

Construction

Construction requirements for a CPC are described in Section 3.4.1. Approximately 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. This represents much less than 1 percent of the undeveloped area at NTS. Prior to any habitat modifying activities, the DOE would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special-interest species. Acreage temporarily modified from construction would be lost as potential habitat, foraging areas, or hunting habitat for special interest avian, mammalian, and reptile species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

Operation

Operation requirements for a CPC are described in Section 3.4.1. An estimated 110 acres of land would be required to operate a CPC. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations should not impact any special-interest species population.

5.3.7.3 CCE Alternative

5.3.7.3.1 CNC (CPC + CUC)

Biological resource impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.7.2 as well as the impacts discussed below.

Terrestrial Resources

CUC Construction. As described in Section 3.5.1.1, approximately 50 acres of land would be modified during CUC construction. Once constructed, approximately 35 acres would be needed to support CUC operations. The area identified for construction of the CUC consists primarily of white bursage (*Ambrosia dumosa*) and creosote bush (*Larrea tridentata*) or saltbush and white bursage shrubland vegetation (Skougard 2002) that supports a limited diversity of wildlife. An estimated 140 acres of land would be required to construct the CUC. During site-clearing activities, highly mobile wildlife species or wildlife species with large home ranges (such as deer and birds) would be able to relocate to adjacent undeveloped areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. Species relocation may result in additional pressure to lands already at or near carrying capacity. The impacts could include overgrazing (in the case of herbivores), stress, and over-wintering mortality. For less mobile species (reptiles, amphibians, and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

CNC Operation. As described in Section 3.5.2, an estimated 195 acres of land would be modified or lost. Of this, approximately 80 acres would be located within a PIDAS. The land required for CNC operations would represent less than 0.02 percent of NTS's total land area of 880,000 acres. In addition to the areas to be disturbed, there would be a decrease in quality of the habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. The adjacent habitat also would experience a loss of quality from the reduction in size, segmentation of the habitat, and restriction on mobility for some species (Kelly and Rotenberry 1993).

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production and uranium operations, CNC operations would minimize the potential for any adverse effects to plant and animal communities (terrestrial resources) in the surrounding environment.

Wetlands

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1.1. Of the known 24 springs and seeps found at NTS, most of which support wetland vegetation, none are located on the proposed CUC site. Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid any degradation to wetlands in the area.

CNC Operation. Operation requirements for a CNC are described in Section 3.5.2. There are no adverse impacts predicted to wetlands from operation of a CNC. There would be no direct

untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations are not expected to adversely affect any wetlands.

Aquatic Resources

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1.1. There are no perennial or seasonal aquatic habitats within the proposed CUC location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNC Operation. Operation requirements for a CNC are described in Section 3.5.2. There would be no direct discharge of untreated operational effluent from CNC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff water would be similar to runoff from other NTS built environments and the quantity would represent a very minor contribution to the watershed.

Threatened and Endangered Species

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1.1. Approximately 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CUC. Prior to any habitat modifying activities, the DOE would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special-interest species. Acreage temporarily modified from construction would be lost as potential habitat, foraging areas, or hunting habitat for special interest avian, mammalian, and reptile species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

CNC Operation. Operation requirements for a CNC are described in Section 3.5.2. An estimate 195 acres of land would be required to operate a CNC. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations should not impact any special-interest species population.

5.3.7.3.2 CNPC (CPC + CUC + A/D/HE Center)

Biological resources impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.3.7.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Terrestrial Resources

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center as described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 acres would be required for the construction of the A/D/HE Center. The existing DAF would form the cornerstone of an A/D/HE Center at NTS. All plant facilities located within the material access area either occupy existing buildings inside the DAF or would be located in hardened new construction connected to the DAF.

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNPC operations would minimize the potential for any adverse affects to plant and animal communities (terrestrial resources) in the surrounding environment.

CNPC Operation. As described in Section 3.5.1, an estimated 445 acres of land would be required to support CNC operations, which would represent 0.05 percent of NTS's total land area of 880,000 acres. In addition to the areas to be disturbed, there would be a decrease in quality of the habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. The adjacent habitat also would experience a loss of quality from the reduction in size, segmentation of the habitat, and restriction on mobility for some species (Kelly and Rotenberry 1993).

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNPC operations would minimize the potential for any adverse affects to plant and animal communities (terrestrial resources) in the surrounding environment.

Wetlands

A/D/HE Center Construction. Construction of the A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to the generic A/D/HE Center. Approximately 200 acres would be required for the construction of the A/D/HE Center.

Of the known 24 springs and seeps found at NTS, most of which support wetland vegetation, none are located on the proposed A/D/HE Center site. Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid any degradation to wetlands in the area.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. There are no adverse impacts predicted to wetlands from operation of the CPC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to

administrative procedures, along with facility design and engineering controls, CNPC operations are not expected to adversely affect any wetlands.

Aquatic Resources

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center. Approximately 200 acres would be required for the construction of an A/D/HE Center.

There are no perennial or seasonal aquatic habitats within the proposed A/D/HE Center location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. There would be no direct discharge of untreated operational effluent from CNC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff water would be similar to runoff from other NTS built environments and the quantity would represent a very minor contribution to the watershed.

Threatened and Endangered Species

A/D/HE Center Construction. Construction requirements for an A/D/HE Center are described in Section 3.5.1.2. Approximately 200 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct an A/D/HE Center. Prior to any habitat modifying activities, the DOE would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special-interest species. Acreage temporarily modified from construction would be lost as potential habitat, foraging areas, or hunting habitat for special interest avian, mammalian, and reptile species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. An estimate 445 acres of land would be required to operate a CNPC. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, operations should not impact to any special-interest species population.

5.3.8 Cultural and Archaeological Resources

5.3.8.1 *No Action Alternative*

Prehistoric sites found at NTS include habitation sites (DOE 2002l). Historic sites found at NTS include mines and prospects, trash dumps, settlements, campsites, ranches and homesteads, developed springs, roads, trails, and nuclear weapon development sites. Three ethnic groups were identified as having prehistoric and historic ties to NTS: Western Shoshone, Southern Paiute, and Owens Valley Shoshone Paiute. Existing cultural and archaeological resources are discussed in Section 4.3.8.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts to cultural and archaeological resources would occur at NTS beyond those of existing and future activities that are independent of this action.

5.3.8.2 *DCE Alternative (Greenfield CPC)*

5.3.8.2.1 Cultural Resources

Construction

CPC. As described in Section 3.4.1, a CPC would disturb an estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace. The CPC reference location at NTS has not been inventoried for cultural resources, thus the presence of resources that would be impacted during construction of a CPC is currently unknown. This is true of many areas within NTS. However, an unrelated survey conducted in Area 6 indicated a low density of cultural resources in that area, relative to other areas at NTS and the other DOE sites under consideration. Thus, there is a low probability that resources would be impacted during CPC construction at the reference location. Probabilities for other areas on NTS would depend on the locations; some areas exhibit a high density of cultural resources. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

Because the exact location of a CPC at NTS is not yet determined, cultural resources arising from infrastructure construction (such as water, sewer, gas, electricity, access roads) are not analyzed here. They will be analyzed in the site-specific EIS. However, like the facility itself, the greater the number of acres disturbed, the greater the possibility for impacts to cultural resources.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by the construction of a CPC. Methods for identification could include field survey, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts.

Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the Nevada SHPO and in accordance with the *Cultural Resources Management Plan for the Nevada Test Site* (DOE 1999d). If previously unknown cultural resources, such as subsurface resources, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by DOE in consultation with the Nevada SHPO.

Operation

CPC. As described in Section 3.4.1, an estimated 110 acres of land would be required to operate a CPC. Operation of a CPC at would have no impact on cultural resources.

5.3.8.2.2 Archaeological Resources

Construction

CPC. As described in Section 3.4.1, a CPC would disturb an estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace.

No known fossil localities have been recorded on NTS and no fossils were located during the construction of the DAF (DOE 2002k). However, the Quaternary deposits that make up Frenchman Flat and Area 6 could contain archaeological materials. Thus, there is a possibility that archaeological resources would be impacted due to construction of the CPC or the associated infrastructure at the reference location. This is also true for any other area on NTS. The probability for impacts to archaeological resources would increase with an increase in the number of acres disturbed.

Archaeological resources would be included in the scope of any cultural resource inventories conducted prior to the beginning of construction. If previously unknown archaeological resources are discovered during construction, activities in the area of the discovery would stop, and the discovery would be treated appropriately, as determined by DOE.

Operation

CPC. As described in Section 3.4.1, an estimated 110 acres of land would be required to operate the CPC. Operation of the CPC at would have no impact on archaeological resources.

5.3.8.3 CCE Alternative

5.3.8.3.1 CNC (CPC + CUC)

Cultural and archaeological resources impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.8.2 as well as the impacts discussed below.

Cultural Resources

CUC Construction. As described in Section 3.5.1.1, a CUC would disturb an estimated 50 acres of land during construction. The CUC reference location at NTS has not been inventoried for cultural resources, thus the presence of resources that would be impacted during construction of the CUC is currently unknown. This is true of many areas within NTS. However, an unrelated survey conducted in Area 6 indicated a low density of cultural resources in that area, relative to other areas at NTS and the other DOE sites under consideration. Thus, there is a low possibility that resources would be impacted during CUC construction at the reference location. Probabilities for other areas on NTS would depend on the locations; some areas exhibit a high density of cultural resources. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

Because the exact location of a CUC at NTS is not yet determined, cultural resources arising from infrastructure construction (such as water, sewer, gas, electricity, access roads) are not analyzed here. They will be analyzed in the site-specific EIS. However, like the facility itself, the greater the number of acres disturbed, the greater the possibility for impacts to cultural resources.

CNC Operation. As described in Section 3.5.2, an estimated 195 acres would be required to operate a CNC. Operation of a CNC would have no impact on cultural resources.

Archaeological Resources

CUC Construction. As described in Section 3.5.1.1, a CUC would disturb an estimated 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace. No known fossil localities have been recorded on NTS and no fossils were located during the construction of the DAF (DOE 2002k). However, the Quaternary deposits that make up Frenchman Flat and Area 6 could contain archaeological materials. Thus, there is a probability that archaeological resources would be impacted due to construction of the CPC or the associated infrastructure at the reference location. This is also true for any other area on NTS. The probability for impacts to archaeological resources would increase with an increase in the number of acres disturbed.

Archaeological resources would be included in the scope of any cultural resource inventories conducted prior to the beginning of construction. If previously unknown archaeological resources are discovered during construction, activities in the area of the discovery would stop, and the discovery would be treated appropriately, as determined by DOE.

CNC Operation. As described in Section 3.5.2, a CNC would require an estimated 195 acres. Operation of a CNC at would have no impact on archaeological resources.

5.3.8.3.2 CNPC (CPC + CUC + A/D/HE Center)

Cultural and archaeological resource impacts from the construction and operation of the full CNPC would include the CNC impacts discussed above, and the A/D/HE Center impacts discussed below.

Cultural Resources

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center. Approximately 200 acres would be required for the construction of an A/D/HE Center.

The presence of resources that would be impacted during construction of the A/D/HE Center is currently unknown. This is true of many areas within NTS. However, an unrelated survey conducted in Area 6 indicated a low density of cultural resources in that area, relative to other areas at NTS and the other sites under consideration. Thus, there is a low probability that resources would be impacted during A/D/HE Center construction at the reference location. Probabilities for other areas on NTS would depend on the locations; some areas exhibit a high density of cultural resources. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

CNPC Operation. As described in Section 3.5.1.2, a CNPC would require an estimated 445 acres. Operation of a CNPC would have no impact on cultural resources.

Archaeological Resources

A/D/HE Center Construction. Construction of an A/D/HE Center at NTS would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to a generic A/D/HE Center as described in Section 3.5.1.2 and 3.5.1.2.1. Approximately 200 acres would be required for the construction of an A/D/HE Center.

No known fossil localities have been recorded on NTS and no fossils were located during the construction of the DAF (DOE 2002k). However, the Quaternary deposits that make up Frenchman Flat and Area 6 could contain archaeological materials. Thus, there is a possibility that archaeological resources would be impacted due to construction of an A/D/HE Center or the associated infrastructure at the reference location. This is also true for any other area on NTS. The probability for impacts to archaeological resources would increase with an increase in the number of acres disturbed.

Archaeological resources would be included in the scope of any cultural resource inventories conducted prior to the beginning of construction. If previously unknown archaeological resources are discovered during construction, activities in the area of the discovery would stop, and the discovery would be treated appropriately, as determined by NNSA.

CNPC Operation. As described in Section 3.5.1.2, the CNPC would require an estimated 445 acres. Operation of the CNPC would have no impact on archaeological resources.

5.3.9 Socioeconomic Resources

This section analyzes the impacts to socioeconomic resources from the No Action Alternative, DCE Alternative, and the CCE Alternative.

5.3.9.1 *No Action Alternative*

The NTS ROI consists of Nye and Clark Counties. The current level of NTS employment is expected to continue. Existing socioeconomic characteristics for the ROI are described in Section 4.3.9.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. There would be no additional impacts to socioeconomic resources beyond current and planned activities that are independent of this action.

5.3.9.2 *DCE Alternative (Greenfield CPC)*

5.3.9.2.1 Regional Economic Characteristics

Construction

Construction of a CPC would require 2,900 worker-years of labor. During peak construction, about 850 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 826 indirect jobs would be created, for a total of 1,676 jobs. This represents less than 1 percent of the total ROI labor force.

ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by a maximum of \$38.2 million annually at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$66.6 million (\$38.2 million direct and \$28.4 million indirect). Table 5.3.9-1 presents the impacts to socioeconomic resources from construction of the CPC. Impacts from the construction of the CPC on population, housing, and community services characteristics within the ROI are presented in sections 5.3.9.2.2 and 5.3.9.2.3.

Table 5.3.9-1 — Socioeconomic Impacts from CPC Construction

Socioeconomic Factor	CPC
Worker Years	2,900
Peak Workers	850
Indirect Jobs Created	826
Total Jobs Created	1,676
ROI Average Earning	\$44,900
Direct Income Increase	\$38,165,000
Indirect Income Increase	\$28,456,000
Total Impact to the ROI	\$66,621,000

Source: NNSA 2007.

Operation

Operation of a CPC would require 1,780 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,481 indirect jobs would be created, for a total of 3,261 jobs. This represents less than 1 percent of the total ROI labor force.

ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$87.6 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$135.1 million (\$87.6 million direct and \$47.5 million indirect). Table 5.3.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC.

5.3.9.2.2 Population and Housing

Construction

An influx of new workers would increase the ROI population and could create a new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (850 workers), a total of 1,275 new residents would be expected in the ROI. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Operation

The influx of new workers would increase the ROI population and could create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,780 new workers), 1,780 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC.

5.3.9.2.3 Community Services

Construction

There would be no impact to ROI community services because the increase would be less than 1 percent over the current population.

Operation

There would be no impact to ROI community services because the increase would be less than 1 percent over the current population.

Table 5.3.9-2 — Socioeconomic Impacts from Operations

Socioeconomic Factor	CPC	CUC	CNC	AD/HE	CNPC
Peak Workers	1,780	935	2,715	1,785	4,500
Indirect Jobs Created	1,481	1,713	1,704	3,270	2,824
Total Jobs Created	3,261	2,648	4,419	5,055	7,324
ROI Average Earning	\$49,200	\$49,200	\$49,200	\$49,200	\$49,200
Direct Income Increase	\$87,576,000	\$46,002,000	\$133,578,000	\$87,822,000	\$221,400,000
Indirect Income Increase	\$47,519,000	\$24,961,000	\$72,479,000	\$47,652,000	\$120,132,000
Total Impact to the ROI	\$135,095,000	\$70,963,000	\$206,057,000	\$135,474,000	\$341,532,000

Source: NNSA 2007.

Note: Construction of the UPF at Y-12 requires 900 peak workers. Construction of the CUC at NTS requires 1,300 peak workers

5.3.9.3 CCE Alternative

5.3.9.3.1 CNC (CPC + CUC)

Socioeconomic impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.9.2 as well as the impacts discussed below.

Regional Economy Characteristics

CUC Construction. Construction of the CUC would require 4,000 worker-years of labor. During peak construction, 1,300 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 2,563 indirect jobs would be created, for a total of 3,863 jobs. It is estimated that many of the direct jobs would be filled by workers migrating into the ROI, at least temporarily during the construction period.

Income within the ROI would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by \$58.4 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$101.9 million (\$58.4 million direct and \$43.5 million indirect). Table 5.3.9-3 presents the impacts to socioeconomic resources from construction of the CUC.

Table 5.3.9-3 — Socioeconomic Impacts from CUC Construction

Socioeconomic Factor	CUC
Worker Years	4,000
Peak Workers	1,300
Indirect Jobs Created	2,563
Total Jobs Created	3,863
ROI Average Earning	\$44,900
Direct Income Increase	\$58,370,000
Indirect Income Increase	\$43,521,000
Total Impact to the ROI	\$101,891,000

Source: NNSA 2007.

CNC Operation. Operation of the CNC would require 2,715 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,704 indirect jobs would be created, for a total of 4,419 jobs. It is estimated that most of the direct jobs would likely be filled by current workers in the ROI. In addition, this ROI labor force would be sufficient to fill any indirect jobs generated.

The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$133.6 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$206.1million (\$133.6 million direct and \$72.5 million indirect). Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from individual operation of the CPC and CUC.

Population and Housing

CUC Construction. The influx of new workers would increase the ROI population and could create new housing demand. For the peak year of construction (1,300 new workers), 1,950 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-3 presents the impacts to socioeconomic resources from construction of the CUC.

CNC Operation. The influx of new workers would increase the ROI population and could create new housing demand. For operations (935 new workers), 935 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from individual operation of the CPC and CUC.

Community Services

CUC Construction. Table 5.3.9-3 presents the impacts to socioeconomic resources from construction of the CUC. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing.

CNC Operation. There would be no impact to ROI community services because the increase would be less than 1 percent over the current population. Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNC as well as from individual operation of the CPC and CUC.

5.3.9.3.2 CNPC (CPC + CUC + A/D/HE Center)

Socioeconomic impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.3.9.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Regional Economy Characteristics

A/D/HE Center Construction. At NTS, the A/D/HE Center would make use of the existing capabilities at the DAF such that construction requirements would be reduced compared to the generic A/D/HE Center. Construction of the A/D/HE Center would require 915 worker-years of labor. During peak construction, 525 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,035 indirect jobs would be created, for a total of 1,560 jobs. It is estimated that many of the direct jobs would be filled by workers migrating into the ROI, at least temporarily during the construction period.

Income within the ROI would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by \$23.6 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$41.2 million (\$23.6 million direct and \$17.6 million indirect). Table 5.3.9-4 presents the impacts to socioeconomic resources from construction of the A/D/HE Center.

Table 5.3.9-4 — Socioeconomic Impacts from A/D/HE Center Construction

Socioeconomic Factor	AD/HE
Worker Years	915
Peak Workers	525
Indirect Jobs Created	1,035
Total Jobs Created	1,560
ROI Average Earning	\$44,900
Direct Income Increase	\$23,573,000
Indirect Income Increase	\$17,576,000
Total Impact to the ROI	\$41,149,000

Source: NNSA 2007.

CNPC Operation. Operation of the CNPC would require 4,500 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 2,824 indirect jobs would be created, for a total of 7,324 jobs. It is estimated that most of the direct jobs would likely be filled by current workers in the ROI. In addition, this ROI labor force would be sufficient to fill any indirect jobs generated.

The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$221.4 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$341.5 million (\$221.4 million direct and \$120.1 million indirect). Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the individual operation of the A/D/HE Center.

Population and Housing

A/D/HE Center Construction. The influx of new workers would increase the ROI population and could create new housing demand. For the peak year of construction (525 new workers), 788 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-4 presents the impacts to socioeconomic resources from construction of the AD/HE Center.

CNPC Operation. The influx of new workers would increase the ROI population and could create new housing demand. For operations (4,500 new workers), 4,500 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the individual operation of the AD/HE Center.

Community Services

A/D/HE Center Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.3.9-4 presents the impacts to socioeconomic resources from construction of the A/D/HE Center.

CNPC Operation. The increase in population would not increase demand on local community services. Table 5.3.9-2 presents the impacts to socioeconomic resources from operation of the CNPC as well as from the individual operation of the A/D/HE Center.

5.3.10 Environmental Justice

Under Executive Order 12898, NNSA is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as being Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; or another non-White race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income.

Section 4.3.10 presents the existing environmental justice characteristics of the ROI, including census tracts for minority and low-income populations. Impacts for all of the alternatives do not differ significantly, as such; the analysis in this section discusses potential environmental justice impacts for all impacts.

In 2000, approximately 1,408,250 people lived within the census tracts containing NTS. Minorities comprise 39.1 percent of this population. In 2000, minorities comprised 30.9 percent of the population nationally and 34.8 percent of the population in Nevada. The percentage of persons below the poverty level at the time of the 2000 Census was 13.7 percent, which is higher than the 2000 national average of 12.4 percent and the statewide figure of 10.5 percent.

Based on the analysis of impacts for resource areas, few high and adverse impacts from construction and operation activities at NTS are expected under any of the alternatives; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land uses, visual resources, noise, water, geology and soils, biological resources, socioeconomic resources, cultural and archaeological resources. As shown in Section 5.3.11, there are no large adverse impacts to any populations.

5.3.11 Health and Safety

5.3.11.1 *No Action Alternative*

Based on 2006 operational data, NTS caused a MEI dose of 0.2 millirem per year. This dose is less than 1 percent of the DOE public dose limit for all pathways and is significantly below the EPA maximum permissible exposure limit to the public of 10 millirem per year. Existing health and safety at NTS is discussed in Section 4.3.11.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. There would be no additional impacts to health and safety beyond current and planned activities that are independent of this action.

5.3.11.2 *DCE Alternative (Greenfield CPC)*

5.3.11.2.1 Construction

No radiological risks would be incurred by members of the public from construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CPC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including Integrated Safety Management (ISM) and the Voluntary Protection Program (VPP). Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CPC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for construction activities. These values are shown below in Table 5.3.11-1.

No chemicals have been identified that would be a risk to members of the public from construction activities associated with the CPC. Construction workers would be protected from overexposure to hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals. Implementation of worker protection programs to construction activities would also decrease the potential for worker exposures by providing hazards identification and control measures for construction activities.

Table 5.3.11-1 — Injury, Illness, and Fatality Estimates for Construction of the CPC, CUC, and A/D/HE Center at NTS

Injury, Illness, and Fatality Categories	Projects Under Consideration		
	CPC	CUC	A/D/HE Center
Peak Annual Employment	850	1,300	525
Total Recordable Cases	81	112	50
Total Lost Workday Cases	38	54	25
Total Fatalities	0.2	0.3	0.1
Project Duration (6 years for CPC and CUC, 2 years for A/D/HE Center)			
Total Recordable Cases	276	384	100
Total Lost Workday Cases	143	184	50
Total Fatalities	0.7	0.9	0.2

Source: NNSA 2007, BLS 2002b.

5.3.11.2.2 Operation

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public from routine operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an effective dose equivalent (EDE) in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61, Subpart H) limit exposure to the MEI) of the public from all air emissions to 10 mrem per year.

NNSA expects minimal public health impacts from the radiological consequences of CPC operations. Public radiation doses would likely occur from airborne releases only (Section

5.3.3). Table 5.3.11–2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be less than or equal to 1×10^{-15} per year, or less than 1 in more than a billion. The projected number of fatal cancers to the population within 50 miles would be less than or equal to 2×10^{-11} per year, or about 1 in 20 billion.

Table 5.3.11-2 — Annual Radiological Impacts on the Public from CPC, CNC, and CNPC Operations at NTS

Receptor	Projects Under Consideration		
	CPC	CNC	CNPC
Population within 50 miles			
Collective dose (person-rem)	2.7×10^{-8}	1.3×10^{-2}	1.3×10^{-2}
Percent of natural background radiation ^a	1.2×10^{-12}	5.9×10^{-7}	5.9×10^{-7}
LCFs ^b	2×10^{-11}	7.80×10^{-6}	7.80×10^{-6}
Offsite MEI			
Dose (mrem)	1.6×10^{-9}	4.06×10^{-3}	4.09×10^{-3}
Percent of regulatory dose limit	1.6×10^{-10}	4.06×10^{-4}	4.06×10^{-4}
Percent of natural background radiation ^a	7.3×10^{-14}	1.8×10^{-7}	1.8×10^{-7}
Cancer fatality risk ^b	1×10^{-15}	2.44×10^{-9}	2.47×10^{-9}

^aThe average annual dose from background radiation at NTS is 314 mrem ; the 69,501 people living within 50 mi of NTS in the year 2043 would receive an annual dose of 21,823 person-rem from the background radiation..

^bBased on a cancer risk estimate of 0.0006 LCFs per rem or person-rem.

^cThe offsite MEI is assumed to reside at the site boundary, 103,680 feet south from the CPC. An actual residence may not currently be present at this location.

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, *Occupational Radiation Protection*, which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The worker radiation dose projected in this SPEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose and internal dose, as required by 10 CFR Part 835.

Estimates of annual radiological doses to workers involved with CPC operations are independent of geographical location. These dose estimates are solely a function of:

- The number of radiological workers, as determined in the development of the CPC staffing estimate for each throughput alternative. The current estimates were developed by application of a factor to the total workers for each work group based on operating experience in plutonium facilities. Approximately 60 percent of total operating staff are estimated to be radiological workers.
- The working dose rate at the glovebox surface for each unit operation or workstation. These dose rates were calculated based on the maximum mass (plutonium, americium) and form (metal, oxide) of material being handled. Standard “weapons grade” isotopic

distribution, and americium content of 0.5 percent were assumed.

- The amount of time spent by direct operators/first line supervisors in the radiation area. This was determined from a time-motion estimate of direct “hands-in-gloves” labor required to perform each individual operation and the number of parts processed per year for a given pit production rate. Efficiency scaling factors were applied for various operations. For Foundry and Machining operations, this was assumed to be 50 percent; for Assembly and Post-Assembly & Testing, efficiencies were 90 percent.

As indicated above, the collective annual dose (mrem per year) received by individual direct operators is calculated based on the number of operators required for the various production rates, the time spent in the radiation area, and the associated dose rates for each operation. The collective exposures for support group workers were added to these numbers and were calculated using empirical data that implies that exposure for these workers can be estimated as a percentage of direct operator exposure (e.g., Analytical Laboratory Technician approximately 25 percent of direct operator exposure). The average individual dose is calculated as the collective exposure divided by the estimated number of radiological workers for each throughput alternative.

The estimates of annual radiological doses to workers are provided in Table 5.3.11-3. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 mrem (10 CFR 835) and the DOE-recommended control level of 1,000 mrem (10 CFR 835). Operations in the CPC would result in an average individual worker dose of 290 mrem annually. The total dose to workers associated with the CPC operations would be 333 person-rem. Statistically, a total dose of 333 person-rem would result in 0.2 annual LCFs to the CPC workforce. The projected number of fatal cancers in the workforce from CPC annual operations would be 0.2 (or 2 chances in 10 that the worker population would experience a fatal cancer per year of operations).

Table 5.3.11-3 — Annual Radiological Impacts on CPC, CNC, and CNPC Workers at NTS from Operations

	CPC	CNC	CNPC
Number of Radiological Workers	1,150	1,640	2,040
Individual Workers^a			
Average individual dose, mrem/yr ^b	290	210	189
Average worker cancer fatality risk ^c	2×10^{-4}	1.4×10^{-4}	1.3×10^{-4}
Worker Population			
Collective dose (person-rem)	333	344	386
Cancer fatality risk ^c	0.20	0.21	0.23

^aThe regulatory dose limit for an individual worker is 5,000 mrem/yr (10 CFR 835). However, the maximum annual dose to a worker would be kept below the DOE Control Level of 1,000 mrem/yr, as established in 10 CFR 835. Further, DOE recommends that facilities adopt a more limiting 500-mrem/yr Administrative Control Level. To reduce doses to levels that are as low as reasonably achievable, an effective dose reduction plan would be enforced.

^bLess than one third of all radiological workers would receive doses greater than, but no more than 90 percent above, the average worker dose.

^cBased on a cancer risk estimator of 0.0006 LCFs per rem or person-rem.

During normal (accident-free) operations, total facility staffing at a CPC would be 1,780. The potential risk of occupational injuries and fatalities to workers operating the CPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown below in Table 5.3.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (WSRC 2002c).

Table 5.3.11-4 — Injury, Illness, and Fatality Annual Estimates for Normal Operations of the CPC, CNC, and CNPC at NTS

Injury, Illness, and Fatality Categories	Projects Under Consideration		
	CPC	CNC	CNPC
Total Workers	1,780	2,715	4,500
Total Recordable Cases	77	117	195
Total Lost Workday Cases	40	61	101
Total Fatalities	0.07	0.11	0.18

Source: NNSA 2007, BLS 2002b.

5.3.11.3 CCE Alternative

5.3.11.3.1 CNC (CPC + CUC)

Health and safety impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.3.11.2 as well as the impacts discussed below.

CUC Construction

No radiological risks would be incurred by members of the public from CUC construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CUC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CUC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.3.11-1.

CNC Operation

NNSA expects minimal public health impacts from the radiological consequences of CNC operations. Public radiation doses would likely occur from airborne releases only (Section 5.3.4). Table 5.3.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

The estimates of annual radiological doses to workers are provided in Table 5.3.11-3. As shown in the table, 1,640 radiological workers would be required to conduct CNC operations. Operations in the CNC would result in an average individual worker dose of 210 mrem annually. The total annual dose to workers associated with the CNC operations would be 344 person-rem. Statistically, an annual dose of 344 person-rem would result in 0.21 LCFs to the CNC workforce.

During normal (accident-free) operations, total facility staffing would be 2,715. The potential risk of occupational injuries and fatalities to workers operating the CNC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.3.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CNC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.3.11.3.2 CNPC (CPC + CUC + A/D/HE Center)

Health and safety impacts from the construction and operation of the CNPC would include the CNC impacts discussed above, as well as the A/D/HE Center impacts discussed below.

A/D/HE Center Construction

No radiological risks would be incurred by members of the public from the A/D/HE Center construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the A/D/HE Center would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for construction activities. These values are shown in Table 5.3.11-1.

Operation

NNSA expects minimal public health impacts from the radiological consequences of CNPC operations. Table 5.3.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

The estimates of annual radiological doses to workers are provided in Table 5.3.11-3. As shown in the table, 2,040 radiological workers would be required to conduct CNPC operations. Operations in the CNPC would result in an average individual worker dose of 189 mrem annually. The total annual dose to workers associated with the CNPC operations would be 386 person-rem. Statistically, an annual dose of 386 person-rem would result in 0.23 LCFs to the CNPC workforce.

During normal (accident-free) operations, total facility staffing would be approximately 4,500. The potential risk of occupational injuries and fatalities to workers operating the CNPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.3.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CNPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.3.12 Facility Accidents

This section presents the potential impacts on workers (both involved and non-involved) and the public due to potential accidents associated with the operation of the CPC, CUC, and A/D/HE Center at NTS. Additional details supporting the information presented here are provided in Appendix C.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, DOE predicted the dispersion of released hazardous materials and their effects. However, prediction of potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident.

Emergency Preparedness— Each NNSA site has established an emergency management program. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts— NNSA estimated radiological impacts to three receptors: (1) the MEI at the NTS boundary; (2) the offsite population within 50 miles of NTS; and (3) a non-involved worker 3,281 feet from the accident location. NNSA did not evaluate total dose from accidents to the involved workforce because this would depend upon the specific location of the facilities on each site, which is not an issue that will be decided as a result of this SPEIS. In any tiered, project-specific EIS, accident impacts to the involved workforce would be analyzed to evaluate alternative locations on the selected site.

5.3.12.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. There would be no additional accident risks beyond those associated with current and planned activities. Potential accident scenarios for the No Action Alternative are addressed in detail in the NTS SWEIS (DOE 1996b) and Supplement Analysis (DOE 2002i).

The NTS SWEIS (DOE 1996b) and the Supplement Analysis for the NTS SWEIS (DOE 20021) provide a baseline for accidents related to the No Action Alternative at NTS. Based on the analyses in those documents, the maximum reasonably foreseeable accident at the NTS would be a non-nuclear explosion involving high explosives in a storage bunker, which has a probability of occurrence of 1 in 10,000,000. The following consequences are estimated if such an accident occurs: MEI dose of 34 rem, which would result in a 0.02 probability of an LCF; population dose of 5,800 to 110,000 person-rem, which would result in 3-55 LCFs (DOE 1996b).

5.3.12.2 *Consolidated Plutonium Center*

5.3.12.2.1 **Radiological Accidents**

Table 5.3.12–1 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CPC) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. Table 5.3.12-2 shows the accident risks, obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CPC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.3.12-1 — CPC Radiological Accident Frequency and Consequences at NTS

Accident	Frequency	Maximally Exposed Offsite Individual ^a		Offsite Population ^{a,b}		Noninvolved Worker ^{a,c}	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	1.99	0.00119	788	0.473	1,770	1
Fire in a single building	1.0×10^{-4}	0.918	0.000551	354	0.212	984	1
Explosion in a feed casting furnace	1.0×10^{-2}	1.08	0.000648	414	0.248	1,150	1
Nuclear Criticality	1.0×10^{-2}	1.89×10^{-6}	1.13×10^{-9}	0.000309	1.85×10^{-7}	0.00124	7.44×10^{-7}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	0.0717	0.000043	27.6	0.0166	76.8	0.0922
Radioactive material spill	1×10^{-2}	0.00215	1.29×10^{-6}	0.829	0.000497	2.31	0.00139

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.3.12-2 — Annual Cancer Risks for CPC - NTS

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	1.19×10^{-8}	4.73×10^{-6}	1×10^{-5}
Fire in a Single Building	5.51×10^{-8}	2.12×10^{-5}	1×10^{-4}
Explosion in a Feed Casting Furnace	6.48×10^{-6}	2.48×10^{-3}	1×10^{-2}
Nuclear Criticality	1.13×10^{-11}	1.85×10^{-9}	7.44×10^{-9}
Fire-induced Release in the CRT Storage Room	4.3×10^{-7}	1.66×10^{-4}	9.22×10^{-4}
Radioactive Material Spill	1.29×10^{-8}	4.97×10^{-6}	1.39×10^{-5}

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.3.12-1) is the beyond evaluation basis earthquake and fire. Approximately 0.47 LCFs in the offsite population could result from such an accident in the absence of mitigation measures. An offsite MEI would receive a dose of approximately 2 rem. Statistically, the MEI would have a 0.001 chance of developing a LCF (i.e., about 1 chance in 1,000 of an LCF). This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.3.12-2), the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 6×10^{-6} , or approximately 1 in 150,000. For the population, the LCF risk would be approximately 2×10^{-3} , meaning that an LCF would statistically occur once every 400 years in the population.

5.3.12.2.2 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this analysis, Emergency Response Planning Guidelines (ERPG) values are used to develop hazard indices for chemical exposures.

DOE estimated the impacts of the potential release of the most hazardous chemicals used at the CPC. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Table 5.3.12-3 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released.

ERPG DEFINITIONS

ERPG 1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG 2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG 3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.3.12-3 shows these consequences.

The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.3.12-3 — CPC Chemical Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.86	4.55	<0.1	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.05	<0.1	10 ⁻⁴
Formic acid	1,500	10	0.215	0.54	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7 miles west.
 Source: Tetra Tech 2007

5.3.12.2.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.3.12.3 Consolidated Uranium Center

5.3.12.3.1 Radiological Accidents

Table 5.3.12-4 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CUC) and a hypothetical non-involved worker, as well as the accident risks (Table 5.3.12-5), obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CUC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.3.12-4 — CUC Radiological Accident Frequency, Consequences, and Risks at NTS

Accident	Frequency (per year)	Maximally Exposed Offsite Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.00314	1.88 x 10 ⁻⁶	1.21	0.000726	3.36	0.00202
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.000309	1.85x10 ⁻⁷	0.119	0.0000714	0.252	0.000151
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.00366	2.20x10 ⁻⁶	1.41	0.000846	3.63	0.00218
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.000398	2.39x10 ⁻⁷	0.155	0.000093	0.243	0.000146
Aircraft crash ^d	10 ⁻⁴ – 10 ⁻⁶	0.0071	4.26x10 ⁻⁶	2.28	0.00137	2.13	0.00128

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

^d NTS has controlled airspace over approximately 8000 square miles. Aircraft accidents are extremely unlikely and, therefore, are usually excluded from further analysis at the NTS. This accident is included as a comparison to other CUC sites.

Source: Tetra Tech 2007

Table 5.3.12-5 — Annual Cancer Risks for CUC at NTS

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	1.88 x 10 ⁻¹⁰	7.26 x 10 ⁻⁸	2.02 x 10 ⁻⁷
Explosion	1.85 x 10 ⁻¹¹	7.14 x 10 ⁻⁹	1.51 x 10 ⁻⁸
Fire in EU Warehouse	2.20 x 10 ⁻¹⁰	8.46 x 10 ⁻⁸	2.18 x 10 ⁻⁷
Design-basis fires for HEU Storage	2.39 x 10 ⁻⁹	9.3 x 10 ⁻⁷	1.46 x 10 ⁻⁶
Aircraft crash	4.26 x 10 ⁻¹⁰	1.37 x 10 ⁻⁷	1.28 x 10 ⁻⁷

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release. Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.3.12-4) is the fire in the EU warehouse. Approximately 0.0008 LCFs in the offsite population could result from such an accident in the absence of mitigation measures. An offsite MEI would receive a maximum dose of 0.0037 rem. Statistically, the LCF risk to the MEI would be approximately 2x10⁻⁶, or about 1 in half a million. This accident has a probability of occurring approximately once every 10,000 years.

When probabilities are taken into account (see Table 5.3.12-5), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 2x10⁻⁹, or about 1 in half a billion. For the population, the LCF risk would be approximately 9x10⁻⁷, or about 1 in a million.

5.3.12.3.2 Hazardous Chemicals Impacts

The CUC facility would store and use a variety of hazardous chemicals. The quantities of chemicals would vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor

accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public. DOE estimated the impacts of the potential release of the most hazardous chemical used at the CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.3.12-6 shows the consequences of the dominant loss of containment accident scenario.

Table 5.3.12-6 — CUC Chemical Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.86	4.55	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7 miles.
 Source: Tetra Tech 2007

5.3.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.3.12.4 Assembly/Disassembly/High Explosives Center

5.3.12.4.1 Radiological Accidents

The accident scenarios and representative source terms for the A/D/HE Center are shown below:

Scenario	Representative Source Terms	
	Pu Release (Ci)	Tritium Release (Ci)
Scenario 1: Explosive Driven Plutonium and Tritium Dispersal from an Internal Event	400	3.0×10^5
Scenario 2: Tritium Reservoir Failure from an Internal Event	0	2.0×10^5
Scenario 3: Pit Breach from an Internal Event	1.8×10^{-5}	0
Scenario 4: Multiple Tritium Reservoir Failure from an External Event or Natural Phenomena	0	4.0×10^7
Scenario 5: Fire Driven Dispersal Involving Stored Pits from an External Event or Natural Phenomena	50	0
Scenario 6: Plutonium and Tritium Dispersal from an External Event or Natural Phenomena	1.2×10^{-2}	3.0×10^5

Source: Tetra Tech 2007

Tables 5.3.12–7 and 5.3.12-8 show the consequences and risks of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the A/D/HE Center) and a hypothetical non-involved worker. The dose shown in the tables is calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the A/D/HE Center. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.3.12-7 — A/D/HE Center Radiological Accident Consequences at NTS

Accident	Maximally Exposed Offsite Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	0.29	0.000174	112	0.0672	311	0.373
Scenario 2	0.000208	1.25×10^{-7}	0.08	0.000048	0.223	0.000134
Scenario 3	1.74×10^{-8}	1.04×10^{-11}	6.70×10^{-6}	4.02×10^{-9}	1.86×10^{-5}	1.12×10^{-8}
Scenario 4	0.043	2.58E-05	17.7	0.0106	26.3	0.0316
Scenario 5	0.045	0.000027	18.5	0.0111	27.5	0.033
Scenario 6	0.000333	2.00×10^{-7}	0.137	8.22×10^{-5}	0.204	0.000122

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) approximately 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.3.12-8 — Annual Cancer Risks for A/D/HE Center Accidents at NTS

	Maximally Exposed Offsite Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Accident	Latent Cancer Fatalities	Latent Cancer Fatalities	Latent Cancer Fatalities
Scenario 1	1.74x10 ⁻⁸	6.72x10 ⁻⁶	3.73x10 ⁻⁵
Scenario 2	1.25x10 ⁻⁹	4.8x10 ⁻⁷	1.34x10 ⁻⁶
Scenario 3	1.04x10 ⁻¹³	4.02x10 ⁻¹¹	1.12x10 ⁻¹⁰
Scenario 4	2.58x10 ⁻¹¹	1.06x10 ⁻⁸	3.16x10 ⁻⁸
Scenario 5	2.7x10 ⁻⁹	1.11x10 ⁻⁶	3.3x10 ⁻⁶
Scenario 6	2.00x10 ⁻⁹	8.22x10 ⁻⁷	1.22x10 ⁻⁶

^a At site boundary, approximately 13.7 miles from release.

^b Based on a projected future population (year 2030) approximately 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The results of the accident analysis indicate that potential consequences would not exceed the NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The accident with the highest consequences to the offsite population (see Table 5.3.12-7) is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 0.06 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 0.29 rem. Statistically, this MEI would have a 2×10^{-4} chance of developing a LCF (i.e., about 1 chance in 57,000 of an LCF). The overall likelihood of this scenario occurring is less than 1×10^{-4} per year.

When probabilities are taken into account (see Table 5.3.12-8), the accident with the highest overall risk is also the explosive driven plutonium and tritium dispersal from an internal event. For this accident, the LCF risk to the MEI would be approximately 2×10^{-8} , or less than 1 chance in a million. For the population, the LCF risk would be approximately 7×10^{-6} , or approximately one chance in 150,000.

5.3.12.4.2 Hazardous Chemicals Impacts

DOE estimated the impacts of the potential release of the most hazardous chemical used at the A/D/HE Center. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the release of the chemical. Table 5.3.12-9 provides information on the chemical and the frequency and consequence of an accidental release. The source term shown represents the amount of the chemical that is accidentally released. The American Industrial Hygiene Association defines ERPG-2 as the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. Chlorine released in the accident would not exceed ERPG-2 limits offsite.

Table 5.3.12-9 — A/D/HE Center Chemical Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Chlorine	408.23	3	2.7	17	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7 miles.

Source: Tetra Tech 2007

5.3.12.4.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.3.13 Transportation

5.3.13.1 No Action Alternative

Baseline transportation characteristics would remain unchanged. Under the No Action Alternative, there would be no change in the transportation activities at NTS, and impacts would remain unchanged from the baseline presented in Section 4.3.12.

5.3.13.2 DCE Alternative (Greenfield CPC)

5.3.13.2.1 Construction

Construction of the CPC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.3.12 and would be temporary.

5.3.13.2.2 Operation

Radiological transportation for the CPC is presented in Section 5.10. The addition of new employees for the CPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.3.12.

5.3.13.3 *CCE Alternative*

5.3.13.3.1 **CNC (CPC + CUC)**

Construction

CUC. Construction of the CUC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.3.12 and would be temporary.

Operation

CNC. Radiological transportation for the CNC is presented in Section 5.10. The addition of new employees for the CUC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.3.12.

5.3.13.3.2 **CNPC (CPC + CUC + A/D/HE Center)**

Construction

A/D/HE Center. Construction of the A/D/HE Center would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.3.12 and would be temporary.

Operation

CNPC. If the A/D/HE Center were located at NTS as part of a CNPC, there would be a one-time transport of SNM from Y-12 and Pantex to the CNPC, as described in Section 5.10. There would also be new employees. The addition of new employees for the CNPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.3.12.

5.3.14 **Waste Management**

5.3.14.1 *No Action Alternative*

In 2001 NTS generated 4.86 cubic yards of hazardous waste and 4,550 cubic yards of sanitary waste. In 2005, the Area 5 RWMS received shipments containing 48,169 cubic yards of low level waste (LLW) for disposal. The Area 3 RWMS received shipments containing 12,576 cubic yards of LLW. A total of 1,055 cubic yards of LLW disposed of in 2005 was generated onsite.

In 2005, a total of 38,228 pounds of hazardous wastes were received at the HWSU for temporary storage and 27,172 pounds were shipped offsite from the HWSU. A total of 27,140 pounds of hazardous wastes were shipped offsite. No hazardous wastes storage limits were exceeded. Approximately 2.1 tons/day of nonhazardous waste were disposed of at the Area 23 landfill, well below permit limits (NTS 2006a). Baseline waste amounts are discussed in Section 4.3.13.

Under the No Action Alternative, current and planned activities at NTS would continue as required to support the missions described in Section 3.2.3. There would be no additional impacts to waste management resources beyond current and planned activities that are independent of this action. Table 5.3.14-1 gives a summary of the major waste categories currently being generated at NTS.

Table 5.3.14-1 — Waste Volumes Generated at the NTS

Waste Type	1996	1997	1998	1999	2000	2001	2005
Transuranic (yd ³)	0	0	0	0	0	0	0
Low Level Waste (yd ³)	0	0	0	7.1	0.46	0	1,055
Mixed LLW (yd ³)	0	0	0	0	0	0	0
Hazardous ^a (tons)	46	11	50.2	14	24.5	4.86	NA
Non-Hazardous Sanitary ^b (tons)	4,550	2,280	6,460	7,460	5,080	4,550	NA

^a Includes state-regulated waste. Hazardous waste reported in metric tons.

^b From DOE 2002o (1996 data) and DOE's Central Internet Database. Sanitary waste reported in metric tons.

Source: DOE 2002o.

5.3.14.2 DCE Alternative (Greenfield CPC)

5.3.14.2.1 Construction

Construction of a CPC would generate hazardous waste and both liquid and solid non-hazardous waste. Table 5.3.14-2 summarizes the total volume of waste expected to be generated over the 6 years of construction activity for the CPC at NTS. CPC construction activities would increase routine waste generation at NTS for hazardous waste and both liquid and solid non-hazardous waste over more recent waste generation volumes, but well below historic levels.

Table 5.3.14-2 — CPC Construction Wastes at NTS

Waste Type	CPC
TRU Waste (yd ³)	0
LLW (yd ³)	0
Hazardous Waste (tons)	7.0
Nonhazardous Solid Waste (yd ³)	10,900
Nonhazardous Liquid Waste (gallons)	56,000

Source: NNSA 2007.

Hazardous wastes generated from the construction of a CPC would be sent offsite for treatment and disposal at a commercial facility. Commercial treatment is readily available and currently used to treat most NTS hazardous wastes.

Nonhazardous wastes are currently disposed of in three onsite landfills. The disposal location would be determined by the specific characteristics of the construction waste. Existing and planned disposal sites at NTS have more than adequate capacity to handle all CPC construction

waste. Sanitary wastewater generated during CPC construction would be disposed either by a septic system or by a lagoon system. Portable sanitary units would be used during the construction phase until the permanent wastewater system would be available.

A retention pond would be constructed to manage storm water runoff from a CPC, including the construction laydown area and concrete batch plant. The basin would be sized to limit storm water discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land. A concrete batch plant would operate at a CPC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CPC construction is completed.

5.3.14.2.2 Operation

Normal operation of a CPC would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.3.14–3 summarizes the estimated waste generation rates for the operation of a CPC.

Table 5.3.14–3 — CPC Annual Operational Wastes at NTS

Waste Category	CPC
TRU Solid Waste (Including Mixed TRU)(yd ³)	950
Mixed TRU Solid Waste (included in TRU, above)(yd ³)	340
Low Level Solid Waste (yd ³)	3,900
Mixed Low Level Solid Waste (yd ³)	2.5
Mixed Low Level Liquid Waste (yd ³)	0.4
Hazardous waste solid (tons)	4.0
Hazardous waste liquid (tons)	0.6
Non-Hazardous Solid Waste (yd ³)	8,100
Non-Hazardous Liquid Waste (gal)	75,000

Source: NNSA 2007.

NTS does not routinely generate TRU waste but manages about 21,200 cubic feet of legacy waste that was transferred to NTS from offsite generators pending disposal at WIPP. DOE expects to complete disposition of all of this stored TRU waste at NTS prior to construction and operation of a CPC. TRU waste generated from a CPC would include gloves, filters, and other operations/maintenance waste from gloveboxes. Americium process waste would be solidified and packaged as TRU waste. About 36 percent of the TRU waste would be mixed waste. The waste would be transferred from the CPC to the Waste Staging/TRU Packaging Building, which would be located outside the PIDAS. The Waste Staging/TRU Packaging Building would be a RCRA-permitted facility with the ability to treat mixed TRU waste and would include a staging area with capacity for the storage of approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transportation to WIPP.

NTS routinely generates little LLW but manages large volumes of LLW in its role as a national disposal site for other facilities within the DOE complex. LLW from CPC operations would

include job control waste, failed equipment, and other general operations and maintenance waste. Liquid LLW resulting from CPC operations would be solidified prior to leaving the facility. LLW generated at the CPC would be transferred from CPC to an existing facility in Area 5, the Radioactive Waste Management Site (RWMS). Here, the LLW would undergo characterization and certification prior to disposal in either Area 3 and Area 5, at NTS. The capacity of these two LLW disposal facilities, at 3,923,888 cubic yards, could readily accommodate the projected LLW volume from CPC operations, as well as other planned volumes.

CPC operations would generate small amounts of hazardous waste and mixed LLW. These wastes include lead acid batteries, lubricating oils/fluids, rags, and absorbents. The projected hazardous waste volumes from CPC operations would substantially increase the annual volumes routinely managed by NTS. The waste would be sent to the Hazardous Waste Storage Unit at Area 5 and then shipped offsite to a commercial facility for treatment and disposal. Commercial treatment is readily available and currently used to treat most NTS hazardous wastes. The impacts of managing this waste at NTS would be minimal.

NTS does not routinely generate mixed LLW but manages substantial volumes in its role as one of two national disposal sites for the DOE complex. MLLW generated from CPC operations would be managed in accordance with the NTS Site Treatment Plan. The mixed LLW would be transferred to the Area 5 RWMS for characterization and identification of appropriate treatment. Once treated, the waste would be disposed onsite. The annual mixed LLW volume from CPC operations represents only a fraction of the disposal capacity 466,577 cubic yards and of the anticipated permit limit of 78,477 cubic yards for the Pit 3 disposal unit in Area 5. The impacts of managing this waste at NTS would be minimal.

Sanitary waste from CPC operations would be disposed of at the onsite landfill in Area 23. The CPC waste would substantially increase the annual routine waste volume from current NTS operations, but is a small fraction of the available capacity of 824,022 cubic yards in Area 23. Sanitary wastewater generated during CPC operations would be disposed of either by a septic system or by a lagoon system. The impacts of managing this non-hazardous sanitary waste at NTS would be minimal.

CPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process. The waste would then be classified and handled according to the appropriate categories described above.

5.3.14.3 CCE Alternative

5.3.14.3.1 CNC (CPC + CUC)

Construction

CUC. Construction of a CNC would entail construction of a CPC, already discussed in Section 5.3.13.2.1, above and construction of a CUC, discussed in this section. Construction of a CUC would generate LLW, hazardous waste and solid non-hazardous waste. Table 5.3.14-4 summarizes the total volume of waste expected to be generated over the 6 years of construction activity for the CUC at NTS.

Table 5.3.14-4 — CUC Construction Wastes at NTS

Waste Category	Quantity
Low-level Solid (yd ³)	70
Mixed Low-level Solid (yd ³)	0
Hazardous (tons)	6
Nonhazardous (Sanitary) (tons)	1,000

Source: NNSA 2007.

NTS routinely generates little LLW but manages large volumes of LLW in its role as a national disposal site for the DOE complex. LLW from CUC construction would result from installation of process waste capturing mechanisms, and other such process line installation activities. There would not be any liquid LLW resulting from actual CUC facility construction activities. LLW generated from CUC construction activities would be transferred from the CUC construction site to the Area 5 RWMS for characterization and certification prior to disposal at the RWMSs in Area 3 and Area 5. The capacity of these RWMSs could readily accommodate the projected LLW volume from CUC construction.

Nonhazardous wastes are currently disposed in three onsite landfills. The disposal location would be determined by the specific characteristics of the construction waste. To the extent possible, metals would be removed from this waste and recycled. Existing and planned disposal sites at NTS have more than adequate capacity to handle all CUC construction waste.

Hazardous wastes generated from the construction of a CUC would be sent offsite for treatment and disposal at a commercial facility. Commercial treatment is readily available and currently used to treat most NTS hazardous wastes.

Sanitary wastewater generated during CUC construction would be disposed either by a septic system or by a lagoon system. Portable sanitary units would be used during the construction phase until the permanent wastewater system became available. A retention pond would be constructed to manage storm water runoff from the entire CUC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at a CUC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CUC construction is completed.

Operation

CNC. Normal operation of a CNC would generate TRU waste, LLW, MLLW, hazardous waste, and sanitary waste. Table 5.3.14-5 summarizes the estimated waste generation rates for the operation of the CPC.

NTS does not routinely generate TRU waste but manages about 21,200 cubic feet of legacy waste that was transferred to NTS from offsite generators pending disposal at WIPP. DOE expects to complete disposition of all of this stored non-classified TRU waste at NTS prior to the timeframe of CNC construction and operations. TRU waste generated from the CNC includes gloves, filters, and other operations/maintenance waste from gloveboxes. Americium process waste would be solidified and packaged as TRU waste. About 36 percent of the TRU waste would be mixed waste. The waste would be transferred from the CNC to the Waste Staging/TRU Packaging Building, which would be located outside the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transportation to WIPP.

NTS routinely generates little LLW but manages large volumes of LLW in its role as a national disposal site for the DOE complex. LLW from CNC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CNC operations would be solidified prior to leaving the facility. The annual LLW generation for a CNC would be transferred from CNC to the Area 5 RWMS for characterization and certification prior to disposal at the RWMS in Area 3 and Area 5. The capacity of these RWMS could readily accommodate the projected LLW volume from CNC operations.

Table 5.3.14-5 — Annual CNC Operational Waste at NTS

	CPC	CUC	CNC
TRU Solid Waste (including Mixed TRU)(yd ³)	950	0	950
Mixed TRU Solid Waste (included in TRU, above) (yd ³)	340	0	340
Low Level Solid Waste (yd ³)	3,900	8,100	12,000
Low Level Liquid Waste (gal)	0	3,515	3,515
Mixed Low Level Solid Waste (yd ³)	2.5	70	72.5
Mixed Low Level Liquid Waste (yd ³)`	0.4	3,616	3,616.4
Hazardous waste solid (tons)	4.0	15	19
Hazardous waste liquid (tons)	0.6	0	0.6
Non-Hazardous Solid Waste (yd ³)	8,100	7,500	15,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	125,000

Source: NNSA 2007.

NTS does not routinely generate TRU waste but manages about 21,200 cubic feet of legacy waste that was transferred to NTS from offsite generators pending disposal at WIPP. DOE expects to complete disposition of all of this stored TRU waste at NTS prior to construction and

operation of a CNC. TRU waste generated from a CNC would include gloves, filters, and other operations/maintenance waste from gloveboxes. Americium process waste would be solidified and packaged as TRU waste. Since this process of the CNC is the same as for the CPC, about 36 percent of the TRU waste would be mixed waste. The waste would be transferred from the CNC to the Waste Staging/TRU Packaging Building, which would be located outside the PIDAS. The Waste Staging/TRU Packaging Building would be a RCRA-permitted facility with the ability to treat mixed TRU waste and would include a staging area with capacity for the storage of approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transportation to WIPP.

CNC operations would generate three times the amount of LLW of a CPC and small amounts of hazardous waste and MLLW. These wastes would include lead acid batteries, lubricating oils/fluids, rags, and absorbents. NTS has more than enough capacity to handle the projected annual generation of 12,000 cubic yards of LLW. The projected hazardous waste volumes from CNC operations would substantially increase the annual volumes routinely managed by NTS. The hazardous waste would be sent to the Hazardous Waste Storage Unit, at Area 5, for accumulation of transport quantities, packaged, and then shipped offsite to a commercial facility for treatment and disposal. Commercial treatment is readily available and currently used to treat most NTS hazardous wastes. The infrastructure to collect, package, and transport these quantities of hazardous waste already exist at NTS and the impacts of managing this waste category, at NTS, would be minimal.

Solid sanitary waste from CNC operations would be disposed of at the onsite landfill in Area 23. The CNC waste would substantially increase the annual routine waste volume from current NTS operations, but is a small fraction of the available capacity of 824,022 cubic yards in Area 23. In the event this landfill proves insufficient, there would be no impediments to creating another at NTS. Sanitary wastewater generated during CNC operations would be disposed either by a septic system or by a lagoon system. The impacts of managing this waste at NTS would be minimal. CNC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process.

5.3.14.4 *CNPC (CPC + CUC + A/D/HE CENTER)*

Waste management impacts from the construction and operation of a full CNPC would include CPC impacts discussed in Section 5.3.13.2, CUC impacts discussed above, and an A/D/HE Center. The expected waste impacts are discussed below.

5.3.14.4.1 Construction

A/D/HE Center

Construction of a CNPC would entail the construction of the CPC and CUC, discussed above, and the construction of an A/D/HE Center, discussed in this section. At NTS, an A/D/HE Center would utilize the existing DAF for disassembly operations and therefore incur less waste generation, for some waste categories, than at some of the other sites for construction related activities. The additional construction of an A/D/HE Center, at NTS, would generate LLW, and non-hazardous waste. Table 5.3.14-6 summarizes the total volume of waste to be generated over the 6 years construction period for a proposed A/D/HE Center at NTS.

Table 5.3.14-6 — A/D/HE Center Construction Waste at NTS

	A/D/HE Center
TRU Solid Waste (yd ³)	0
Low Level Solid Waste (yd ³)	9,000
Mixed TRU Solid Waste (yd ³)	0
Hazardous waste (tons)	0
Non-Hazardous Solid Waste (yd ³)	6,400
Non-hazardous Liquid Waste (gal)	40,000

Source: NNSA 2007.

A/D/HE Center construction activities would substantially increase routine LLW and Non-hazardous waste generation at NTS, with the generation of 9,000 cubic yards of LLW and 6,400 cubic yards of non-hazardous solid waste. NTS routinely generates little LLW but manages large volumes of LLW in its role as a national disposal site for the DOE complex. LLW from A/D/HE Center construction would result from installation of process waste capturing mechanisms, and other such process line installation activities. There would not be any liquid LLW resulting from A/D/HE Center construction activities. LLW generated from construction activities would be transferred from the A/D/HE Center construction site to the Area 5 RWMS for characterization and certification prior to disposal at the RWMSs in Area 3 and Area 5. The capacity of these RWMS disposal areas could readily accommodate the projected LLW volume from construction.

Nonhazardous wastes are currently disposed in three onsite landfills. The disposal location would be determined by the specific characteristics of the construction waste. Existing and planned disposal sites at NTS have more than adequate capacity to handle all A/D/HE Center construction waste. A retention pond would be constructed to manage storm water runoff from the entire A/D/HE Center site including the construction laydown area and concrete batch plant. The basin would be sized to limit storm water discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at the A/D/HE Center site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once A/D/HE Center construction is completed.

5.3.14.4.2 Operation

CNPC

Normal operation of a CNPC would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.3.14-7 summarizes the estimated waste generation rates for the operation of a CNPC at NTS.

Table 5.3.14-7 — Annual CNPC Operational Wastes at NTS

	CPC	CUC	A/D/HE Center	CNPC
TRU Solid Waste(including mixed TRU)(yd ³)	950	0	0	950
Mixed TRU Solid Waste(included in TRU, above (yd ³)	340	0	0	340
Low Level Solid Waste (yd ³)	3,900	8,100	40	12,640
Low Level Liquid Waste (gal)	0	3,515	5,410	8,925
Mixed Low Level Solid Waste (yd ³)	2.5	70	0	782.5
Mixed Low Level LiquidWaste (gal)	0.4	3,616	6	3,622.4
Hazardous waste solid (tons)	4.0	15	.9	19.9
Hazardous waste liquid (tons)	0.6	0	5.9	6.5
Non-Hazardous Solid Waste (yd ³)	8,100	7,500	12,000	27,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	46,000	171,000

Source: NNSA 2007.

NTS does not routinely generate TRU waste but manages about 21,200 cubic yards of legacy waste that was transferred to NTS from offsite generators pending disposal at WIPP. DOE expects to complete disposition of all of this stored TRU waste at NTS prior to the timeframe of CNPC construction and operations. TRU waste generated from a CNPC would include gloves, filters, and other operations/maintenance waste from gloveboxes. Americium process waste would be solidified and packaged as TRU waste. About 36 percent of the TRU waste would be mixed waste. The waste would be transferred from a CNPC to the Waste Staging/TRU Packaging Building, which would be located outside the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transportation to WIPP.

NTS routinely generates little LLW but manages large volumes of LLW in its role as a national disposal site for the DOE complex. LLW from CNPC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CNPC operations would be solidified prior to leaving the facility. The annual LLW generation for a CNPC would be transferred from a CNPC to the Area 5 RWMS for characterization and certification prior to disposal at the RWMS in Area 3 and Area 5. The capacity of these RWMS could readily accommodate the projected LLW volume from CNPC operations.

CNPC operations would generate small amounts of hazardous waste and mixed LLW. These wastes include lead acid batteries, lubricating oils/fluids, rags, and absorbents. The projected hazardous waste volumes from CNPC operations would substantially increase the annual

volumes routinely managed by NTS. The waste would be sent to the Hazardous Waste Storage Unit at Area 5 and then shipped offsite to a commercial facility for treatment and disposal. Commercial treatment is readily available and currently used to treat most NTS hazardous wastes. The impacts of managing this waste at NTS would be minimal.

Sanitary waste from CNPC operations would be disposed at the onsite landfill in Area 23. The CNPC waste would substantially increase the annual routine waste volume from current NTS operations, but is a small fraction of the available capacity of 824,022 cubic yards in Area 23. Sanitary wastewater generated during CNPC operations would be disposed either by a septic system or by a lagoon system. The impacts of managing this waste at NTS would be minimal.

CNPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process.

5.4 TONOPAH TEST RANGE

There are no Programmatic Alternatives for Tonopah Test Range (TTR). The project-specific analysis for TTR is discussed in Section 5.15.

5.5 PANTEX

This section discusses the potential environmental impacts associated with the following programmatic alternatives at Pantex:

- **No Action Alternative:** under the No Action Alternative, NNSA would continue operations to support national security requirements using the nuclear weapons complex as it exists today. Pantex would continue to perform its existing missions as described in Section 3.2.5.
- **DCE Alternative:** this alternative includes a CPC.
- **CCE Alternative:** by definition, adding a CPC and Consolidated Uranium Center (CUC) at Pantex would create a full CNPC because there is an existing A/D/HE mission at Pantex. In general, construction impacts would be additive because construction activities would occur in series as follows: CUC, 2011-2016; and CPC, 2017-2022).
- **Capability-Based Alternative:** under this alternative, production activities at Pantex would be reduced to support stockpile requirements below the Moscow Treaty requirements.

The environmental impacts are presented below for each of the following environmental resource areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, and waste management.

5.5.1 Land Use

This section presents a discussion of the environmental impacts associated with the No Action Alternative, the DCE Alternative, and the CCE Alternative. Table 5.5.1-1 describes the potential effects on land use from construction and operation of facilities under the DCE and CCE Alternatives.

Table 5.5.1-1 — Potential Effects on Land Use at the Proposed Sites

CPC Alternatives				
	Construction (acres)		Operation (acres)	
	Greenfield Alternative	140		110 ^a
		PIDAS	Non-PIDAS	
		40	70	
Upgrade Alternative	13		6.5 (All within PIDAS)	
50/80 Alternative	6.5		2.5 (All within PIDAS)	
CUC				
Construction (acres)	50			
Operation (acres)	Total Area: 35 ^b			
	PIDAS		Non-PIDAS	
	15		20	
A/D/HE CENTER ^d				
Construction (acres)	300			
Operation (acres)	Total Area: 300 ^e			
	PIDAS		Non-PIDAS	
	Weapons A/D/Pu Storage: 180		Administrative and High Explosives Area: 120	

Table 5.5.1-1 — Potential Effects on Land Use at the Proposed Sites (continued)

CNC		
	Total Area: 195 ^f	
	PIDAS	Non-PIDAS
Operation (acres)	Total: 55	Total: 140
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50
CNPC		
	Total Area: 545 ^g	
	PIDAS	Non-PIDAS
Operation (acres)	Total: 235	Total: 310
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100

^a Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^b At Y-12, a UPF would be constructed (see Section 3.4.2).

^c Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^d At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

^e Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^f Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

^g Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

5.5.1.1 No Action Alternative

Under the No Action Alternative, current and planned activities at Pantex would continue on the 15,977 acre site, as required to support the missions described in Section 3.2.5. No additional buildings or facilities would be built beyond current and planned, but not built, and no additional impacts on land use would occur at Pantex beyond those of existing and future activities that are independent of this action. Existing land use at Pantex is discussed in Section 4.3.1.

Table 5.5.1-2 presents a summary of the facilities at Pantex associated with the No Action Alternative.

Table 5.5.1-2 – Summary of Pantex No Action Alternative Facilities^a

Mission	Approximate Number of Buildings	Example Facilities	Approximate Area (ft ²)	Year Built (average)	Remaining Life (average years)
A/D QA Testing, and Maintenance and Modification	94	A/D Bays, A/D Cells, Production Support Laboratories, Tool and Component Warehousing, Weapon Staging Magazines	908,000	1966	31
HE R&D	124	HE Machining Bays, HE Pressing Bays, HE Formulation, HE Synthesis, Firing Sites, Production Support Laboratories, HE Storage Magazines	498,000	1955	15
Facility Operations	141	Maintenance and Craft Shops, Security, Medical, Fire Department, ES&H, Support Laboratories, Offices	814,800	1977	22

Table 5.5.1-2 – Summary of Pantex No Action Alternative Facilities^a

Mission	Approximate Number of Buildings	Example Facilities	Approximate Area (ft²)	Year Built (average)	Remaining Life (average years)
Pit Storage	22 ^b	Magazines, Vaults, Staging Facilities	74,200	1949	34

^a Table excludes tanks, chemical storage, ramps (concrete floor enclosed walkways between buildings), guard towers, utility structures (e.g., pump houses), and miscellaneous structures (e.g., bust stop hut).

^b Represents 18 Modified Richmond Magazines and Buildings 12-44 (Cell 8), 12-55, 12-58, and 12-116. Note 12-26 and 12-42 pit vaults and Steel Arch Construction (SAC) magazines are listed as Component Warehousing and Weapon Staging Magazines, respectively.

ES&H – Environment, Safety, and Health

HE – High Explosive(s)

A/D – Assembly and Disassembly

QA – Quality Assurance

R&D – Research and Development

5.5.1.2 DCE Alternative (Greenfield CPC)

5.5.1.2.1 Construction

As described in Section 3.4.1, a CPC would have multiple aboveground facilities. A construction laydown area and a concrete batch plant would be built for the construction phase only. Upon construction completion, they would be removed and the area could be returned to its original state. All new buildings would be either one or two stories. The site would require two HVAC exhaust stacks; the tallest, standing 100 feet, would be located inside the PIDAS. Facility exhausts would be HEPA-filtered prior to discharge through the stacks. The CPC reference location at Pantex is located north of Zone 11 and south of Zone 4 West and Zone 4 East. The land was cultivated until 1993 and replanted with native grasses in 1996. This tract of land is surrounded on all sides by a similar land use, open space. It is now considered a low maintenance area within the Protected Area boundaries.

An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. The land required for the proposed CPC construction would represent approximately 0.9 percent of Pantex’s total land area of 15,977 acres. The post-construction developed area would be approximately 110 acres.

5.5.1.2.2 Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the concrete batch plant upon construction completion. The land required for the proposed CPC operations would represent approximately 0.7 percent of Pantex’s total land area of 15,977 acres. Although there would be a change in land use, a CPC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to Pantex land use plans or policies are expected.

5.5.1.3 *CCE Alternative*

5.5.1.3.1 **CNPC (CPC + CUC + existing A/D/HE Center)**

A CNPC located at Pantex would not require the construction of the A/D/HE Center, as Pantex currently performs these missions in existing facilities. As such, a CNPC at Pantex would entail the construction of a CPC and a CUC. Land use impacts from the construction and operation of the CNPC would include the CPC impacts discussed in Section 5.5.1.2 as well as the impacts for the CUC discussed below.

Construction

CUC. As described in Section 3.5.1.1, a CUC would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. The land required for CUC construction would represent approximately 0.3 percent of Pantex's total land area of 15,977 acres. The reference location has adequate space to accommodate the total facilities footprint. The CUC reference location at Pantex is located north of Zone 11 and south of Zone 4 West and Zone 4 East.

Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state. The post-construction developed area would be approximately 35 acres. All buildings would be either one or two stories. Although there would be a change in land use, a CUC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to Pantex land use plans or policies are expected.

Operation

CNPC. As described in Section 3.5, an estimated 195 acres of additional land would be required for buildings, walkways, building access, parking, and buffer space to add both a CPC and CUC to Pantex to comprise a full CNPC. The total additional land required for the CNPC operations (195 acres) would represent approximately 1.2 percent of Pantex's total land area of 15,977 acres. Although there would be a change in land use, a CNPC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to Pantex land use plans or policies are expected.

5.5.1.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at Pantex. Reduced operations would not change land use at Pantex.

5.5.2 Visual Resources

5.5.2.1 *No Action Alternative*

The Pantex Plant is located on the Llano Estacado portion of the Great Plains at an elevation of approximately 3,500 feet. The topography at the Pantex Plant is relatively flat and characterized by rolling grassy plains and numerous natural playa basins. The developed areas at Pantex Plant are consistent with a Visual Resource Management Class IV designation. The remainder of Pantex is consistent with a Visual Resource Management rating of Class III or IV.

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to visual resources beyond current and planned activities that are independent of this action. Existing visual resources are discussed in Section 4.5.2.

5.5.2.2 *DCE Alternative (Greenfield CPC)*

5.5.2.2.1 Construction

As described in Section 3.4.1, activities related to the construction of new buildings required for a CPC would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. The reference location is obstructed from offsite view by existing buildings and infrastructure. However, dust and construction equipment mobilization may be visible to the general public. Members of the public, as well as onsite employees and visitors, observing CPC construction would find these activities temporary and similar to the past construction activities of other developed areas on the Pantex site. Thus, impacts on visual resources during construction would be minimal.

5.5.2.2.2 Operation

A CPC, which would include one- and two-story buildings, storage tanks, and two HVAC exhaust stacks, would change the appearance of the reference location. Located in the midst of the industrial complex, the facility would be visible to onsite employees and visitors, but not to the general public. The offsite view of CPC buildings would be obstructed by existing buildings and infrastructure. This change would be consistent with the currently developed areas of the Pantex site. Thus, new construction would not change the current Class IV BLM Visual Resource Management rating of developed areas within Pantex boundaries.

5.5.2.3 *CCE Alternative*

5.5.2.3.1 CNPC (CPC + CUC + existing A/D/HE Center)

A CNPC located at Pantex would not require the construction of the A/D/HE Center, as Pantex currently performs these missions in existing facilities. As such, the CNPC at Pantex would

entail the construction of a CPC and the CUC. Visual impacts from the construction and operation of the CNPC would include the CPC impacts discussed in Section 5.5.2.2 as well as the impacts of the CUC discussed below.

Construction

CUC. As described in Section 3.5.1.1, activities related to the construction of new buildings required for the CUC would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. The reference location is obstructed from offsite view by existing buildings and infrastructure. However, dust and construction equipment mobilization may be visible to the general public. Members of the public, as well as onsite employees and visitors, observing CUC construction would find these activities temporary and similar to the past construction activities of other developed areas on the Pantex site. Thus, impacts on visual resources during construction would be minimal.

Operation

CNPC. As described in Section 3.5.1, a CNPC would include one- and two-story buildings that would change the appearance of the reference location. The offsite view of CNPC buildings would be obstructed by existing buildings and infrastructure. This change would be consistent with the currently developed areas of the Pantex site. Thus, new construction would not change the current Class IV BLM Visual Resource Management rating of developed areas within Pantex boundaries.

5.5.2.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on visual resources would occur at Pantex. Reduced operations would not change visual resource impacts at Pantex.

5.5.3 *Site Infrastructure*

The analysis of site infrastructure focuses on the ability of the site to provide the electrical power needed to support the programmatic alternatives. The ability of the site to provide the water requirements is addressed in the water resource section (Section 5.5.5). Other infrastructure demands, such as fuels or industrial gases, are not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS.

5.5.3.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to site infrastructure beyond current and planned activities that are independent of this action. Baseline characteristics are described in Section 4.5.3. Pantex is expected to continue

using about 81,850 MWh per year of electricity, well below the available site capacity.

5.5.3.2 *DCE Alternative (Greenfield CPC)*

5.5.3.2.1 **Construction**

Construction requirements for a CPC are described in Section 3.4.1. For a CPC, the projected demands on electrical infrastructure resources associated with construction activities are shown in Table 5.5.3-1. The existing electrical infrastructure at Pantex would be sufficient to support annual construction requirements for the projected 6-year construction period.

5.5.3.2.2 **Operation**

The estimated electrical infrastructure requirements for the operation of a CPC are shown in Table 5.5.3-2. Electrical energy requirements would be approximately 24 percent of the site capacity. The peak electrical load would be approximately 23 percent of the site capacity.

5.5.3.3 *CCE Alternative*

5.5.3.3.1 **CNC (CPC + CUC)**

Implementation of the CNC Alternative at Pantex would create a CNPC because of the existing A/D/HE mission at Pantex (see Section 5.5.3.3.2).

Table 5.5.3-1 — Electrical Infrastructure Requirements for CPC and CUC Construction

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity ^a	201,480	47.5
Available site capacity ^a	119,630	33.9
No Action Alternative		
Total site requirement	81,850	13.6
Percent of site capacity	41%	29%
CPC		
CPC requirement	13,000	3.3
Percent of site capacity	6.5%	7%
Percent of available capacity	10.8%	10%
CUC		
CUC requirement	11,000	2.5
Percent of site capacity	5.5%	5.3%
Percent of available capacity	9.2%	7.4%

^a Not limited due to offsite procurement.

Source: NNSA 2007.

Table 5.5.3-2 — Electrical Infrastructure Requirements for CPC and CUC Operation

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity ^a	201,480	47.5
Available site capacity ^a	119,630	33.9
No Action Alternative		
Total site requirement	81,850	13.6
Percent of site capacity	41%	29%
CPC		
CPC requirement	48,000	11
Percent of site capacity	24%	23%
Percent of available capacity	40%	32%
CUC		
CUC requirement	168,000	18.4
Percent of site capacity	83%	39%
Percent of available capacity	140%	54%
CNPC (CPC + CUC + existing A/D/HE)		
CNPC requirement	297,850	44
Percent of site capacity	148%	93%
Percent of available capacity	247%	130%

^a Not limited due to offsite procurement.
 Source: NNSA 2007.

5.5.3.3.2 CNPC (CPC + CUC + A/D/HE Center)

Site electrical infrastructure impacts from the construction and operation of a CNPC would include the CPC impacts discussed in Section 5.5.3.2 as well as the impacts discussed below.

Construction

CUC. Construction requirements for a CUC are described in Section 3.5.1.1. The projected demand on electrical infrastructure resources associated with construction activities for the CUC is shown in Table 5.5.3-1. The existing electrical infrastructure at Pantex would be sufficient to support annual construction requirements for the projected 6-year construction period.

Operation

CNPC. The estimated annual electrical infrastructure requirements for the operation of a CUC would exceed the available capacity. To support a CUC (and, thus a CNPC), Pantex would need to procure additional power.

5.5.3.4 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to infrastructure, electrical use would be reduced from 81,850 MWhr/year to approximately 61,000 MWhr/year. Because there is currently adequate electrical capacity at the site, this reduction would not have any major impact on operations.

5.5.4 Air Quality and Noise

5.5.4.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to air quality and noise beyond current and planned activities that are independent of this action. The Pantex Plant is located within the Amarillo-Lubbock Intrastate AQCR. The Amarillo-Lubbock Intrastate AQCR is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and PM₁₀) (40 CFR 81.344). Pantex is in compliance with all NAAQs. Existing air quality and noise resources are discussed in Section 4.5.4.

5.5.4.2 *DCE Alternative (Greenfield CPC)*

5.5.4.2.1 Air Quality

Construction

Construction of new structures would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, PM₁₀, total suspended particulates, and carbon monoxide. The calculation of emissions from construction equipment was based on emission factors provided in the EPA document AP-42, "Compilation of Air Pollutant Emission Factors" (EPA 1995). For highway vehicles (worker commuting vehicles and delivery vehicles) emission factors were obtained from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA 2002).

Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 1.20 tons per acre/month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. Facility construction would necessitate a concrete batch plant at the building site. Particulate matter, consisting primarily of cement dust, would be the only regulated pollutant emitted in the concrete mixing process. Emission factors for the concrete batch plant were obtained from AP-42 (EPA 1995).

The estimated maximum annual pollutant emissions resulting from construction activities are

presented in Table 5.5.4–1. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities would be too small to result in violations of the National Ambient Air Quality Standards (NAAQS) beyond the Pantex site boundary (DOE 2003d). A site-specific EIS, if required, would address this issue, and any potential need for mitigation, in greater detail.

**Table 5.5.4-1 — Estimated Peak Non-radiological Air Emissions for the CPC—
 Construction**

Pollutant	Estimated Annual Emission Rate (metric tons/yr)
	CPC
Carbon monoxide	409.6
Carbon dioxide	7,084.2
Nitrogen dioxide	177.7
Sulfur dioxide	11.6
Volatile organic compounds	28.7
PM ₁₀	686
Total Suspended Particulates	915

Source: NNSA 2007

Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

Non-radiological Impacts. Pit manufacturing activities would result in the release of criteria and toxic pollutants into the surrounding air. The primary volume contributors are nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Carbon dioxide would be used as a cleaning agent and helium would be used for leak testing operations. Hydrogen and nitrogen dioxide are reaction products from aqueous purification operations (pyrochemical purification would produce lower amounts of hydrogen and nitrogen dioxide). Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates (WSRC 2002e). The estimated emission rates (kg/yr) for non-radiological pollutants emitted are presented in Table 5.5.4–2. These emissions would be incremental to the Pantex baseline. If Pantex is selected as the preferred site, a prevention of significant deterioration (PSD) increment analysis would be performed to determine whether the pit manufacturing activities would cause a significant pollutant emission increase.

Table 5.5.4-2 — Annual Non-radiological Air Emissions for the CPC—Operations

Chemical Released	Quantity Released (kg/yr)
	200 ppy
Carbon dioxide	1,843,600
Carbon monoxide	8,580
Nitrogen dioxide	42,803.2
PM ₁₀	1,042.8
Sulfur dioxide	2,626.8
Total suspended particulates	2,820.4
Volatile organic compounds	2,626.8

Source: NNSA 2007.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on *Clean Air Act* Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because Pantex is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

The maximum concentrations ($\mu\text{g}/\text{m}^3$) at the Pantex site boundary that would be associated with the release of criteria pollutants were modeled and are presented in Table 5.5.4-3. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. The incremental concentration increases would be small and ambient concentrations would remain well below all ambient air quality standards. Since estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative.

Table 5.5.4-3 — Criteria Pollutant Concentrations at Pantex for CPC—Operations

Pollutant	Averaging Period	Most Stringent Standard or Guideline ^a ($\mu\text{g}/\text{m}^3$)	Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$) ^b	
			Baseline ^b	CPC 200 ppy
Carbon monoxide	8-hour	10,000	161	5.1
	1-hour	40,000	924	7.3
Nitrogen dioxide	Annual	100	0.90	2.2
Sulfur dioxide	Annual	80	<0.01	0.18
	24-hour	365	<0.01	0.90
	3-hour	1,300	<0.01	1.9
PM ₁₀	Annual	50	8.73	0.07
	24-hour	150	88.5	0.35
Total Suspended Particulates	3-hour	200	NA	0.19
	1-hour	400	NA	0.97

NA = not available.

^a The more stringent of the Federal and state standards will be presented if both exist for the averaging period.

^bNo non-radiological air monitoring has been conducted at the Pantex Plant since November 2003, when the requirement by the Texas Commission on Environmental Quality (TCEQ) was eliminated (Pantex 2006). Data in this table is the best available data available related to NAAQS.

Source: NNSA 2007.

Radiological Impacts. Radioactive air emissions from pit manufacturing activities would involve plutonium, americium, and enriched uranium. Analytical operations would normally be

conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before being released to the air via a 100-foot tall stack. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of entrained particles from the exhaust air. NNSA estimated routine radionuclide air emissions (see Table 5.5.4-4).

Table 5.5.4-4 — Annual Radiological Air Emissions for the CPC at Pantex—Operations

Isotope	Baseline ^{a,b} (Ci/yr)	CPC—200 ppy Annual Emissions (Ci/yr)
Americium-241	ND	3.12×10^{-7}
Plutonium-239	ND	1.02×10^{-5}
Plutonium-240	ND	2.66×10^{-6}
Plutonium-241	ND	1.96×10^{-4}
Uranium-234	ND	5.02×10^{-9}
Uranium-235	ND	1.58×10^{-10}
Uranium-236	ND	2.56×10^{-11}
Uranium-238	ND	1.42×10^{-12}
Total Uranium	7.34×10^{-10}	
Tritium	5.53×10^{-5}	—
All Other	1.76×10^{-12}	—
Total	5.53×10^{-5}	2.09×10^{-4}

ND = No Data for individual radionuclides.

^a Based on calendar year 2005 data.

^b The No Action Alternative is represented by the baseline.

Source: NNSA 2007.

Total radionuclide emissions at Pantex would be much less than 1 curie of any radionuclide. To ensure that total emissions are not underestimated, DOE’s method for estimating emissions was conservative. Therefore, actual emissions from pit manufacturing operations would be smaller.

DOE estimated the radiation doses to the offsite MEI and the offsite population surrounding Pantex. As shown in Table 5.5.4-5, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne radioactivity releases. The maximum estimated dose to the offsite population within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the processing facilities resulting from radiological air emissions are presented in Section 5.5.11.

Table 5.5.4-5 — Annual Doses Due to Radiological Air Emissions from CPC Operations at Pantex

Receptor	CPC-200 ppy Annual Dose
Offsite MEI ^a (mrem/yr)	2.36×10^{-8}
Population within 50 miles (person-rem per year) ^a	1.7×10^{-7}

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.5.4-4 and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary.
Source: Tetra Tech 2007.

5.5.4.2.2 Noise

Construction

Construction of new buildings would involve the movement of workers and construction equipment and would result in some temporary increase in noise levels near the area. Noise sources associated with construction would not include loud impulsive sources such as blasting. Although noise levels in construction areas could be as high as 110 dBA, these high local noise levels would not extend far beyond the boundaries of the construction site. Table 5.5.4-6 presents the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55-85 dBA. The *Environmental Impact Data Book* (Golden et al. 1980) suggests that noise levels higher than 80-85 dBA are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing wildlife outside a 400-foot radius of the construction site. Given the distance to the site boundary (more than 2 miles) there would be no change in noise impacts on the public as a result of construction activities, except for a small increase in traffic noise levels from construction employees and material shipments.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Table 5.5.4-6 — Peak and Attenuated Noise Levels Expected from Operation of Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980.

Operation

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations at the new buildings would be expected to be similar to those from

existing operations. There would be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (more than 2 miles) noise emissions from equipment would not likely disturb the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. But these noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur onsite and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with the operation of these facilities would likely increase traffic noise levels along roads used to access the site.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.5.4.3 *CCE Alternative*

5.5.4.3.1 **CNC (CPC + CUC)**

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.4.3.2).

5.5.4.3.2 **CNPC (CPC + CUC + A/D/HE)**

Air quality and noise impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.5.4.2 as well as the impacts discussed below.

5.5.4.3.2.1 **Air Quality**

Construction

CUC Non-radiological Impacts. Construction impacts would be similar to the construction impacts for a CPC (discussed above), as both facilities are similarly sized (approximately 650,000 square feet of floorspace) and have the same construction durations (6 years). As such, the non-radiological emissions presented in Table 5.5.4–1 would be representative of a CUC. Actual construction emissions of a CUC are expected to be less, since conservative emission factors and other assumptions were used to model the CPC construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Pantex site boundary (Janke 2007).

CUC Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities.

Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

CUC and CNPC Non-radiological Impacts. CUC activities would result in the release of criteria and toxic pollutants into the surrounding air. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates. The estimated emission rates for non-radiological pollutants were derived from existing Y-12 operations. The non-radiological pollutants were modeled to determine the incremental concentrations from a CUC to the Pantex baseline. The results are presented in Table 5.5.4–7. The PM-10 concentration has the potential to exceed the annual standard. However, because estimated emissions are maximum potential emissions, and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. A site-specific EIS, if required, would address this issue, and the potential need for mitigation, in greater detail.

Since estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. CUC contribution to non-radiological emissions would not cause any standard or guideline to be exceeded. Organic solvents used for cleaning and chemicals used in the Analytical Laboratory for various analyses would not be expected to contribute any appreciable quantities of any other chemicals to the annual non-radioactive air emissions. As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because Pantex is located in an attainment area for all criteria pollutants. Thus, while each alternative would emit criteria pollutants, a conformity review is not necessary.

Table 5.5.4-7 — Criteria Pollutant Concentrations, CUC and CNPC: Operations

Pollutant	Averaging Period	Most Stringent Standard or Guideline ^a (µg/m ³)	Maximum Incremental Concentration (µg/m ³) ^b		
			Baseline ^b	CUC	CNPC
Carbon monoxide	8-hour	10,000	161	0.2	5.3
	1-hour	40,000	924	No Data	7.3
Nitrogen dioxide	Annual	100	0.90	0.9	3.1
Sulfur dioxide	Annual	80	<0.01	2.1	2.3
	24-hour	365	<0.01	52.4	53.3
	3-hour	1,300	<0.01	17.5	19.4
PM ₁₀	Annual	50	8.73	52.4	53.1
	24-hour	150	88.5	17.5	17.8
Total Suspended Particulates	3-hour	200	NA	No Data	0.19
	1-hour	400	NA	No Data	0.97

NA = not available.

^a The more stringent of the Federal and state standards will be presented if both exist for the averaging period.

^b No non-radiological air monitoring has been conducted at the Pantex Plant since November 2003, when the requirement by the Texas Commission on Environmental Quality (TCEQ) was eliminated (Pantex 2006). Data in this table is the best available data available related to NAAQS.

Source: NNSA 2007.

CUC and CNPC Radiological Impacts. A CUC would release radiological contaminants, primarily uranium, into the atmosphere during operations. The current design of a CUC nuclear facility calls for appropriately sized filtered HVAC systems. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from existing EU facilities at Y-12, and are likely to be less due to the incorporation of newer technology into the facility design. However, because detailed design information does not yet exist, these reductions cannot be quantified. As a result, for purposes of this SPEIS, the radiological airborne emissions from a CUC are conservatively estimated from existing operations at Y-12. An estimated 0.10 Curies (2.17 kg) of uranium was released into the atmosphere in 2004 as a result of Y-12 activities (DOE 2005a). After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding Pantex, and Pantex workers. The CAP88 code is a Gaussian plume dispersion model used to demonstrate compliance with the radionuclide NESHAP (40 CFR Part 61). Specific parameters, including meteorological data, source characteristics, and population data, were used to estimate the radiological doses.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding Pantex. As presented in Table 5.5.4-8, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of a CUC resulting from radiological air emissions are presented in Section 5.5.11.

Table 5.5.4-8 — Annual Doses^a Due to Radiological Air Emissions from CUC and CNPC Operations at Pantex

Receptor	CUC	CNC
Offsite MEI ^a (mrem/yr)	0.019	0.019
Population within 50 miles (person-rem per year)	0.138	0.138

^aMEI and population dose estimates for the CUC and CNC operations were calculated using the uranium emission rates from the Y-12 ASER and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary. Source: NNSA 2007.

5.5.4.3.2.2 Noise

Construction

CUC. Anticipated noise impacts from the construction of a CUC would be similar to those described for the CPC in Section 5.5.4.2.

Operation

CUC and CNPC. Anticipated noise impacts from the operation of a CNC would be similar to those described for the CPC in Section 5.5.4.2.

5.5.4.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue

as required to support smaller stockpile requirements. With respect to air quality, Pantex is located within the Amarillo-Lubbock Intrastate Air Quality Control Region (AQCR), which is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and PM₁₀) (40 CFR 81.344). Reduced operations would reduce the emissions from the steam plant boilers, the explosives-burning operation, and emissions from onsite vehicles. With respect to radiological emissions, because the maximum radiation levels are extremely small (less than three percent of the allowable standard), further reductions would be inconsequential.

5.5.5 Water Resources

5.5.5.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to water resources beyond current and planned activities that are independent of this action. Pantex is expected to continue using about 130 million gallons of water per year, which is drawn from the Ogallala Aquifer. Existing water resources are discussed in Section 4.5.5.

5.5.5.2 *DCE Alternative (Greenfield CPC)*

5.5.5.2.1 Surface Water

Construction

Construction requirements for a CPC are described in Section 3.4.1. Surface water would not be used to support the construction of the construction of a CPC as groundwater is the source of water at Pantex. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction, it is estimated that one-third of the liquid wastes generated would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. Water runoff from construction would be handled according to Pantex's Texas Pollutant Discharge Elimination System (TPDES) permit for stormwater involving construction activities.

Stormwater runoff from construction areas could potentially impact downstream surface water quality, although runoff would likely be collected in retention ponds. In addition, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. Pantex would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the CPC reference location is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

Floodplains at the Pantex site have been delineated. The CPC reference location at Pantex is not

within the 100- or 500-year floodplains, or the Standard Project Flood boundaries. Therefore, no impacts to floodplains would be anticipated, nor would project facilities be expected to be impacted by flooding.

Operation

Operation requirements for a CPC are described in Section 3.4.1. No impacts on surface water resources would be expected as a result of CPC operations at Pantex. No surface water would be used to support facility activities, and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. Pantex's current NPDES permit may require modification and approval concerning the increase in wastewater discharges. The sanitary wastewater would be treated in the Waste Water Treatment Facility (WWTF) and disposed of via land application for the irrigation of crops in cooperation with the Texas Tech University Research Farm. No industrial or other TPDES-regulated discharges to surface waters are anticipated.

A CPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CPC liquid-process waste facilities for the plutonium purification process.

5.5.5.2.2 Groundwater

Construction

Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. The proposed use of portable toilets by construction personnel would greatly reduce water over that normally required by construction activities. In addition, water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require a total of approximately 20.9 million gallons to support CPC construction (see Table 5.5.5.-1). It is expected that construction should take approximately 6 years. Assuming an equal usage over that timeframe, it is estimated that 3.5 million gallons would be needed for CPC construction annually. This would increase current water use by approximately 2.6 percent compared to the No Action Alternative and would be within Pantex's water capacity of approximately 422.7 million gallons. It is anticipated that this water would be derived from Pantex's groundwater distribution system via a temporary service connection or trucked to the point-of-use, especially during the early stages of construction.

There would be no onsite discharge of wastewater to the surface or subsurface, and appropriate

spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

Table 5.5.5-1 — Potential Changes to Water Resources from the Construction of the CPC and CUC at Pantex

Proposed Alternatives	Water Availability and Use
No Action Alternative	
Water source	Ground (Ogallala Aquifer)
Water Requirement (gal)	130,000,000
CPC	
Water Requirement (gal)	20,900,000
Percent Change from No Action Alternative	16%
CUC	
Water Requirement (gal)	5,200,000
Percent Change from No Action Alternative	4%

Source: NNSA 2007.

Operation

Activities at Pantex for a CPC would use groundwater primarily to meet the potable and sanitary needs of facility personnel and for cooling tower water makeup. A summary of water needed is presented in Table 5.5.5-2. The percent change in water consumption from the No Action Alternative is approximately 68 percent. The Pantex wellfield has a water capacity of approximately 422.7 million gallons per year. For comparison, in 2001, the City of Amarillo withdrew 6.93 billion gallons of water from the Amarillo City wellfield. Pantex, governed by the Panhandle Groundwater Conservation District No. 3, does not limit the quantity of water pumped from the aquifer. However, depletion of the Ogallala Aquifer is a regional concern. The Texas portion of the Ogallala Aquifer contained approximately 146.7 trillion gallons of water in 1990. The Texas Water Development Board estimated that the net depletion rate of the Ogallala Aquifer is predicted to average about 1.2 trillion gallons per year from 1990 to 2000. Approximately 70 percent of water use on the Texas High Plains is attributed to agriculture (Guru and Horne 2000). Pantex’s total contribution to the depletion of the Ogallala Aquifer from operation of a CPC would be much less than 1 percent of the estimated annual total depletion.

Table 5.5.5-2 — Potential Changes to Water Resources from Operation of the CPC and CUC at Pantex

Proposed Alternatives	Water Availability and Use
No Action Alternative	
Water source	Ground (Ogallala Aquifer)
Water Requirement (gal)	130,000,000
CPC	
Water Requirement (gal)	88,500,000
Percent Change from No Action Alternative	68%
CUC	
Water Requirement (gal)	105,000,000
Percent Change from No Action Alternative	80.8%
CNPC (CPC + CUC at Pantex)	
Water Requirement (gal)	193,500,000
Percent Change from No Action Alternative	149%

Source: NNSA 2007

No sanitary or industrial effluent would be discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these chemicals is standard and no adverse impacts would be expected.

5.5.5.3 CCE Alternative

5.5.5.3.1 CNC (CPC + CUC)

Implementation of a CNC Alternative at Pantex would create a CNPC because of the existing A/D/HE mission at Pantex (see Section 5.5.5.3.2)

5.5.5.3.2 CNPC (CPC + CUC + A/D/HE)

Site infrastructure impacts from the construction and operation of a CNPC would include the CPC impacts discussed in Section 5.5.5.2 as well as the impacts discussed below.

Surface Water

CUC Construction. Construction requirements for a CUC are described in Section 3.5.1.1. Surface water would not be used to support construction of a CUC as groundwater is the source of water at Pantex. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. Because plans include use of portable toilets, onsite discharge of sanitary wastewater would be minimized.

During construction, it is estimated that one-third of the liquid wastes generated would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities.

Water runoff from construction would be handled according to Pantex's TPDES permit for stormwater involving construction activities.

Stormwater runoff from construction areas could potentially impact downstream surface water quality, although runoff would likely be collected in retention ponds. In addition, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. Pantex would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. However, the CUC reference location is not located near any surface water; therefore, no impacts to surface water from potential construction-related spills would be expected.

Floodplains at the Pantex site have been delineated. The CUC reference location at Pantex is not within the 100- or 500-year floodplains, or the Standard Project Flood boundaries. Therefore, no impacts to floodplains would be anticipated, nor would project facilities be expected to be impacted by flooding.

CNPC Operation. Operation requirements for a CNPC are described in Section 3.5.1. No impacts on surface water resources would be expected as a result of CNPC operations at Pantex. No surface water would be used to support facility activities, and there would be no discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated as a result of operations stemming from use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. Pantex's current NPDES permit may require modification and approval concerning the increase in wastewater discharges. The sanitary wastewater would be treated in the WTTF and disposed of via land application for the irrigation of crops in cooperation with the Texas Tech University Research Farm. No industrial or other TPDES-regulated discharges to surface waters are anticipated.

A CNPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CNPC liquid-process waste facilities for the plutonium purification process.

Groundwater

CUC Construction. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. The proposed use of portable toilets by construction personnel would greatly reduce water over that normally required by construction activities. In addition, water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require a total of approximately 5,200,000 gallons to support CUC

construction. It is expected that construction should take approximately 6 years. Assuming an equal usage over that timeframe, it is estimated that approximately 866,667 gallons would be needed annually for CUC construction. This would increase current water use by less than 1 percent compared to the No Action Alternative and would be within Pantex's water capacity of approximately 422.7 million gallons. It is anticipated that this water would be derived from Pantex's groundwater distribution system via a temporary service connection or trucked to the point-of-use, especially during the early stages of construction.

There would be no onsite discharge of wastewater to the surface or subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNPC Operation. A CUC would require approximately 105 million gallons/year for operation. The percent change in water consumption from the No Action Alternative would be approximately 80.8 percent for a CUC. For a CNPC, groundwater would be used primarily to meet the potable and sanitary needs of facility personnel and for cooling tower water makeup. A summary of water need by category and total is presented in Table 5.5.5-2. Including the 130 million gallons/year for the existing A/D/HE operations, a CNPC would require approximately 323.5 million gallons/year of water. The Pantex wellfield has a water capacity of approximately 422.7 million gallons year. For comparison, in 2001, the City of Amarillo withdrew 6.93 billion gallons of water from the Amarillo City wellfield. Pantex, governed by the Panhandle Groundwater Conservation District No. 3, does not limit the quantity of water pumped from the aquifer. However, depletion of the Ogallala Aquifer is a regional concern. The Texas portion of the Ogallala Aquifer contained approximately 146.7 trillion gallons of water in 1990. The Texas Water Development Board estimated that the net depletion rate of the Ogallala Aquifer is predicted to average about 1.2 trillion gallons per year from 1990 to 2000. Approximately 70 percent of water use on the Texas High Plains is attributed to agriculture (Guru and Horne 2000). Pantex's total contribution to the depletion of the Ogallala Aquifer from operation of the CNPC would be less than 1 percent of the estimated annual total depletion. No sanitary or industrial effluent would be discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected.

Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these chemicals is standard and no adverse impacts would be expected.

5.5.5.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to water resources, the reduction in use from 130 million gallons per year to 97.5 million gallons per year would continue to be well within Pantex's water capacity of approximately 422.7 million gallons per year. While this would reduce the burden on the Ogallala Aquifer, Pantex operations account for much less than 1 percent of the total depletion of this aquifer.

5.5.6 Geology and Soils

5.5.6.1 No Action Alternative

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to the Pullman and Randall soil series, or other geological and soil resources, beyond current and planned activities that are independent of this action. Existing geology and soils are discussed in Section 4.5.6.

5.5.6.2 DCE Alternative (Greenfield CPC)

5.5.6.2.1 Construction

As described in Section 3.4.1, a CPC would have multiple aboveground facilities. There would be four separate nuclear buildings: Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D. An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. The land required for CPC construction would represent approximately 0.9 percent of Pantex's total land area of 15,977 acres. The post-construction developed area would be approximately 110 acres.

The CPC reference location at Pantex is located north of Zone 11 and south of Zone 4 West and Zone 4 East. The land was cultivated until 1993 and replanted with native grasses in 1996. This tract of land is surrounded on all sides by a similar land use, open space.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at Pantex, but these resources are abundant in the Amarillo area. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small, the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's ER Program and in accordance with appropriate requirements and agreements. Construction of a CPC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

Faults located in the vicinity of Pantex have little potential for earthquakes. Ground shaking affecting primarily the integrity of inadequately designed or non-reinforced structures might occur, but shaking capable of damaging property or specially designed or upgraded facilities is not expected. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines. Thus, site geologic conditions would not likely affect the facilities

5.5.6.2.2 Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the Concrete Batch Plant upon construction completion. The land required for CPC operations would represent approximately 0.7 percent of Pantex's total land area of 15,977 acres. The operation of a CPC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.5.6.3 CCE Alternative

5.5.6.3.1 CNC (CPC + CUC)

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.6.3.2).

5.5.6.3.2 CNPC (CPC + CUC + existing A/D/HE Center)

Geologic and soil impacts from the construction and operation of a CNPC would include the CPC impacts discussed in Section 5.5.6.2 as well as the impacts discussed below.

Construction

CUC. As described in Section 3.5.1.1, a CUC would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. The CUC reference location at Pantex is located north of Zone 11 and south of Zone 4 West and Zone 4 East. The land was cultivated until 1993 and replanted with native grasses in 1996. An estimated 50 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CUC.

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at Pantex, but these resources are abundant in the Amarillo area. In addition to new facility construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. The land area to be disturbed is relatively small, the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's Environmental Restoration Program and in accordance with appropriate requirements and agreements. Construction of a CUC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

Faults located in the vicinity of Pantex have little potential for earthquakes. Ground shaking affecting primarily the integrity of inadequately designed or non-reinforced structures might occur, but shaking capable of damaging property or specially designed or upgraded facilities is not expected.

Operation

CNPC. An estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to add both a CPC and CUC to Pantex to comprise a full CNPC. The operation of a CNPC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.5.6.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to geology and soils, reduced operations would have no impact.

5.5.7 *Biological Resources*

5.5.7.1 *No Action Alternative*

At least 13 species of mammals were recorded at the Pantex Plant in 2005 during routine activities such as bird surveys, nuisance animal actions, and incidental observations. There are six playas on DOE-owned or leased land at Pantex: Playas 1, 2, and 3 are on the main Pantex Site; Playas 4 and 5 are on land leased from Texas Tech University; and Pantex Lake is on a separate parcel of DOE-owned property, approximately 2.5 miles northeast of the main portion of the Pantex Plant. There are no federally designated Wild and Scenic Rivers onsite. The Pantex Plant provides habitat for several species protected by Federal and state endangered species. The current status of threatened and endangered (T&E) species known to appear on, or in the vicinity of the Pantex Plant is shown in Table 4.5.7-1. Five special status species have been observed at the Pantex Plant.

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to biological resources beyond current and planned activities that are independent of this action. Existing biological resources are discussed in Section 4.5.7.

5.5.7.2 DCE Alternative (Greenfield CPC)

5.5.7.2.1 Terrestrial Resources

Construction

Construction activities for a CPC are described in Section 3.4.1. The area identified for construction of a CPC is classified as a previously cultivated area that has been replanted with native grasses. This tract of land is surrounded by similar land use on all sides, which is wide-open space. The land was last cultivated in 1993 and was planted to native short grasses in 1996 (Robbins 2002). The current state of the altered shortgrass prairie is reflective of conditions of the Southern High Plains of Texas that contain relatively little native undisturbed grassland. Land in the Texas Panhandle is generally used for agricultural purposes and does not support extensive populations of endemic shortgrass prairie wildlife. The remaining undisturbed playas are “islands” of wildlife habitat, allowing the continued existence of many species. The 2002 revision of the *Integrated Plan for Playa Management at Pantex Plant* (BWXT 2002b) calls for adaptive management for species diversity that is consistent with the shortgrass prairie ecosystem of the Southern High Plains. Cultivation, intensive grazing, and invasion of honey mesquite (*Prosopis glandulosa*) have changed species diversity and supporting habitat. Consequently, the importance of managed shortgrass prairie has increased for wildlife and plant species. Thus, preservation and management of remaining grassland is an important goal for biotic community protection. This management issue takes on special significance because few federally managed public lands occur on the Southern High Plains, an important part of the Central Flyway for migratory birds.

Approximately 140 acres of primarily shortgrass prairie and habitat would be cleared or modified during CPC construction. During site-clearing activities, highly mobile wildlife species, such as some mammals and birds, would be able to relocate to adjacent, less developed areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. For less mobile species (reptiles and small mammals), direct mortality could occur on a very small scale during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

Operation

Operation requirements for a CPC are described in Section 3.4.1. Approximately 110 acres of primarily shortgrass prairie and habitat would be cleared or modified for CPC operation. In addition to the areas to be disturbed, there could be impacts to wildlife in habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. Further loss of shortgrass prairie habitat on the site is of regional and local concern due to fragmentation of habitat. However, adverse impacts to wildlife due to the loss of grassland in Zone 11 would be negligible.

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations would minimize the potential for any adverse affects to plant and animal communities (terrestrial resources) in the surrounding environment.

5.5.7.2.2 Wetlands

Construction

The two nearest wetlands to the CPC reference location are Playa 1 and Playa 2. Measuring from the center of the CPC site, the center of Playa 1 is approximately 3,860 feet northeast and the center of Playa 2 is approximately 5,200 feet west (Robbins 2002). There would be no direct impacts to wetlands as there are no wetlands within the area proposed for construction of a CPC or any of the associated construction staging and laydown areas. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid the indirect degradation of Playas 1 and 2.

Operation

There would be no adverse impacts predicted to wetlands from operation of a CPC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CPC operations are not expected to adversely affect Playa 1, Playa 2, or other wetlands.

5.5.7.2.3 Aquatic Resources

Construction

There are no perennial or seasonal aquatic habitats within the CPC reference location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downslope and within the Pantex watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

Operation

There would be no direct discharge of untreated operational effluent from CPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas is not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other Pantex built environments and the quantity would represent a very minor contribution to the watershed.

5.5.7.2.4 Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they

authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at Pantex, are known to be present within the proposed site location. Prior to any construction activities, NNSA would consult with the U.S. Fish and Wildlife Service (USFWS), as appropriate, to discuss the potential impacts of a CPC on any threatened and endangered species.

Construction

Table 4.5.7-1 identifies those Federal- and state-threatened and endangered listed species and other special interest species that occur or may occur within Carson County and Pantex. The CPC would disturb approximately 140 acres of restored shortgrass vegetation and habitat would be cleared or modified during CPC construction. Acreage temporarily modified from construction would be lost as potential habitat, foraging areas, or hunting habitat for special interest avian, mammalian, and reptile species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

Operation

Approximately 110 acres of land would be permanently modified or lost as habitat, foraging areas, or as a prey base for species of special interest. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations should not impact any special-interest species population. The USFWS has told Pantex that construction within Zones 11 and 12 would not have adverse impacts on threatened and endangered species. The contractor would be advised to move any Texas horned lizards encountered and to notify the Pantex Regulatory Compliance Department should any bird nests be discovered.

5.5.7.3 *CCE Alternative*

5.5.7.3.1 *CNC (CPC + CUC)*

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.7.3.2).

5.5.7.3.2 *CNPC (CPC + CUC + existing A/D/HE)*

Biological resource impacts from the construction and operation of a CNPC would include the CPC impacts discussed in Section 5.5.7.2 as well as the impacts discussed below.

Construction

CUC. Approximately 50 acres of primarily shortgrass prairie and habitat would be cleared or

modified during CUC construction. Impacts for terrestrial resources, wetlands, aquatic resources, and threatened and endangered species would be similar to those described for construction of a CPC in Section 5.5.7.2.

Operation

CNPC. An estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to add both a CPC and CUC to Pantex to comprise a full CNPC. Impacts for terrestrial resources, wetlands, aquatic resources, and threatened and endangered species would be similar to those described for operations of a CPC in Section 5.5.7.2.

5.5.7.4 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to biological resources, reduced operations would have no impact.

5.5.8 Cultural and Archaeological Resources

5.5.8.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no expected impacts to the 69 identified cultural and archaeological resources beyond current and planned activities that are independent of this action. Current cultural and archaeological resources are discussed in Section 4.5.8.

5.5.8.2 *DCE Alternative (Greenfield CPC)*

5.5.8.2.1 Construction

Under this alternative, approximately 140 acres of land would be disturbed during construction of a CPC. As discussed in section 4.5, systematic archaeological inventories at Pantex have included approximately half of the facility acreage with the other half of the site consisting mainly of industrial areas, playa wetlands, or uplands between playas with very low probability of site occurrence. The probability of impacting cultural and archeological resources would depend on the location, because some areas (near playas or in developed areas) can exhibit a higher density of cultural resources. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by the construction of a CPC. Methods for identification could include field survey, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be

conducted in consultation with the Texas SHPO and in accordance with the Cultural Resource Management Plan. If previously unknown cultural resources, such as subsurface resources, are discovered during construction, activities in the area of the discovery would stop, and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the Texas SHPO.

5.5.8.2.2 Operation

Operation of a CPC would have no impact on cultural and archeological resources.

5.5.8.3 CCE Alternative

5.5.8.3.1 CNC (CPC + CUC)

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.8.3.2).

5.5.8.3.1 CNPC (CPC + CUC + existing A/D/HE)

Cultural and archaeological impacts from the construction and operation of the CNPC would include the CPC impacts discussed in Section 5.5.8.2 as well as the impacts discussed below.

Construction

CUC. Construction activities for a CUC are discussed in Section 3.5.1.1. Approximately 50 acres of land would be disturbed during construction. Impacts cultural and archaeological resources would be similar to those described for construction of a CPC in Section 5.5.8.2.

Operation

CNPC. Operation of a CNPC would have no impact on cultural and archaeological resources.

5.5.8.4 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to cultural resources, reduced operations would have no impact.

5.5.9 Socioeconomics

This section analyzes the impacts to socioeconomic resources from the No Action Alternative, DCE Alternative, CCE Alternative, and Capability-Based Alternative.

5.5.9.1 No Action Alternative

Under the No Action Alternative, Pantex would be expected to continue employing approximately 3,800 employees in order to maintain current and planned activities as required to support the missions described in Section 3.2.5. There would be no additional impacts to

socioeconomic resources beyond current and planned activities that are independent of this action. Existing socioeconomic characteristics are discussed in Section 4.5.9.

5.5.9.2 DCE Alternative (Greenfield CPC)

5.5.9.2.1 Regional Economic Characteristics

Construction

Construction of the CPC would require 2,900 worker-years of labor. During peak construction, 850 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 677 indirect jobs would be created, for a total of 1,527 jobs. This represents approximately 1.5 percent of the total ROI labor force.

Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by \$38.2 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$63.7 million (\$38.2 million direct and \$25.5 million indirect). Table 5.5.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Table 5.5.9-1 — Socioeconomic Impacts from CPC Construction

Socioeconomic Factor	CPC
Worker Years	2,900
Peak Workers	850
Indirect Jobs Created	677
Total Jobs Created	1,527
ROI Average Earning	\$44,900
Direct Income Increase	\$38,165,000
Indirect Income Increase	\$25,563,000
Total Impact to the ROI	\$63,728,000

Source: NNSA 2007, BEA 2007.

Operation

Operation of a CPC would require 1,780 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,707 indirect jobs would be created, for a total of approximately 3,487 jobs. The ROI income would increase by approximately 1 percent as a result of the new jobs created.

Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$87.6 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$136 million (\$87.6 million direct and \$48.4 million indirect). Table 5.5.9-2 illustrates the impacts to socioeconomic resources from operation of CPC and other programmatic facilities.

5.5.9.2.2 Population and Housing

Construction

The influx of new workers would increase the ROI population and could create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (850 new workers), 1,275 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.5.9-1 presents the impacts to socioeconomic resources from construction of a CPC.

Table 5.5.9-2 — Socioeconomic Impacts for All Alternatives- Operations

Socioeconomic Resource	CPC	CUC	CNC	A/D/HE	CNPC
Peak Workers	1,780	935	NA	NA	2,715
Indirect Jobs Created	1,707	897	NA	NA	2,604
Total Jobs Created	3,487	1,832	NA	NA	5,319
ROI Average Earning (direct)	49,200	49,200	NA	NA	49,200
Direct Income Increase	\$87,576,000	\$46,002,000	NA	NA	\$133,578,000
Indirect Income Increase	\$48,403,000	\$25,425,000	NA	NA	\$73,828,000
Total Impact to the ROI	\$135,979,000	\$71,427,000	NA	NA	\$207,406,000

Note: There are no numbers under the CNC alternative because if the CNC is constructed then the CNPC would be located at Pantex. There are no numbers under the A/D/HE alternative because this mission already exists at Pantex and no new impacts are anticipated. The numbers under the CNPC alternative reflect the changes to socioeconomic resources from addition of the CPC and CUC.

Source: NNSA 2007, BEA 2007.

Operation

The influx of new workers would increase the ROI population and could create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,780 new workers), 1,780 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.5.9-2 illustrates the impacts to socioeconomic resources from operation of a CPC.

5.5.9.2.3 Community Services

Construction

The increase in population would put an increased demand on local community services. Because the population would increase by less than 1 percent, comparable levels of service could be maintained without increased staffing. Table 5.5.9-1 presents the impacts to socioeconomic resources from construction of a CPC.

Operation

The increase in population would not increase demand on local community services. Because the population would increase by less than 1 percent, comparable levels of service could be maintained without increased staffing. Table 5.5.9-2 illustrates the impacts to socioeconomic resources from operation of a CPC.

5.5.9.3 CCE Alternative

5.5.9.3.1 CNC (CPC + CUC)

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.9.3.2).

5.5.9.3.2 CNPC (CPC + CUC + A/D/HE)

Socioeconomic impacts from the construction and operation of a full CNPC at Pantex (which operates the existing A/D/HE mission) would include the CPC impacts discussed above and the CUC impacts discussed below.

Regional Economy Characteristics

CUC Construction. Construction of a CUC would require 4,000 worker-years of labor. During peak construction, 1,300 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,036 indirect jobs would be created, for a total of 2,336 jobs. This represents less than 2 percent of the total ROI labor force.

Income within the ROI would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by \$58.4 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$97.5 million (\$58.4 million direct and \$39.1 million indirect).

Table 5.5.9-3 presents the impacts to socioeconomic resources from construction of a CUC.

Table 5.5.9-3 — Socioeconomic Impacts from CUC Construction

Socioeconomic Factor	CUC
Worker Years	4,000
Peak Workers	1,300
Indirect Jobs Created	1,036
Total Jobs Created	2,336
ROI Average Earning (direct)	\$44,900
Direct Income Increase	\$58,370,000
Indirect Income Increase	\$39,096,000
Total Impact to the ROI	\$97,466,000

Source: NNSA 2007, BEA 2007.

CNPC Operation. Operation of a CNPC at Pantex would require 2,715 new workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 2,604 indirect jobs would be created, for a total of 5,319 jobs. It is estimated that most of the direct jobs would likely be filled by current workers in the ROI. In addition, this ROI labor force would be sufficient to fill any indirect jobs generated.

The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$133 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$207 million (\$133 million direct and \$74million indirect). Table 5.5.9-2 presents the impacts to socioeconomic resources from operation of a CNPC.

Population and Housing

CUC Construction. The influx of new workers would increase the ROI population and could create new housing demand. For the peak year of construction (1,300 new workers), 1,950 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.5.9-3 presents the impacts to socioeconomic resources from construction of a CUC.

CNPC Operation. The influx of new workers would increase the ROI population and could create new housing demand. For operations (2,715 new workers), 2,175 new residents would be expected in the ROI, including workers and their families. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.5.9-2 presents the impacts to socioeconomic resources from operation of a CNPC.

Community Services

CUC Construction. The minor increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.5.9-3 presents the impacts to socioeconomic resources from construction of a CUC.

CNPC Operation. The minor increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.5.9-2 presents the impacts to socioeconomic resources from operation of a CNPC.

5.5.9.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to socioeconomics, reduced

operations would reduce the workforce from 1,644 to 1,230. This workforce, which currently represents approximately 1.3 percent of area employment, would fall to 1.2 percent. This change would not have a major impact on the socioeconomics of the region.

5.5.10 Environmental Justice

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as being Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; or another non-White race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income.

Section 4.5.10 presents the existing environmental justice characteristics of the ROI, including census tracts for minority and low-income populations. Impacts for all of the alternatives do not differ significantly, as such; the analysis in this section discusses potential environmental justice impacts for all impacts.

In 2000, minority populations comprised 30.1 percent of the ROI population surrounding Pantex. In 2000, minorities comprised 30.9 percent of the population nationally and 47.6 percent of the population in Texas. The percentage of persons within the ROI below the poverty level at the time of the 2000 Census was 13 percent, which is higher than the 2000 national average of 12.4 percent but lower than the statewide figure of 15.4 percent.

Based on the analysis of impacts for resource areas, few high and adverse impacts from construction and operation activities at Pantex are expected under any of the alternatives; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land uses, visual resources, noise, water, geology and soils, biological resources, socioeconomic resources, cultural and archaeological resources. As shown in Section 5.5.11, there are no large adverse impacts to any populations.

5.5.11 Health and Safety

5.5.11.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to health and safety beyond current and planned activities that are independent of this action. It is expected that Pantex would emit a dose to the MEI of 4.28×10^{-9} mrem per year. This is significantly below the EPA maximum permissible exposure limit to the public. Existing health and safety at Pantex is discussed in Section 4.5.11.

5.5.11.2 DCE Alternative (Greenfield CPC)

5.5.11.2.1 Construction

No radiological risks would be incurred by members of the public from construction activities. Construction workers could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CPC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid. The potential risk of occupational injuries and fatalities to workers constructing the CPC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are presented in Table 5.5.11-1.

Table 5.5.11-1 — Injury, Illness, and Fatality Estimates for Construction of a CPC and CUC at Pantex

Injury, Illness, and Fatality Categories	CPC	CUC
Peak Annual Employment	850	1,300
Total Recordable Cases	81	112
Total Lost Workday Cases	38	54
Total Fatalities	0.2	0.3
Project Duration (6 years)		
Total Recordable Cases	276	384
Total Lost Workday Cases	143	184
Total Fatalities	0.7	0.9

Source: NNSA 2007

No chemicals have been identified that would be a risk to members of the public from construction activities associated with a CPC. Construction workers would be protected from overexposure to hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals. Implementation of worker protection programs to construction activities would also decrease the potential for worker exposures by providing hazards identification and control measures for construction activities.

5.5.11.2.2 Operation

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public

from routine DOE operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an EDE in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61, Subpart H) limit exposure to the MEI of the public from all air emissions to 10 mrem per year.

NNSA expects minimal public health impacts from the radiological consequences of CPC operations. Table 5.5.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Table 5.5.11-2 — Annual Radiological Impacts on the Public from the CPC and CNPC Operations at Pantex

Receptor	CPC	CNC/CNPC ¹
Population within 50 mi		
Collective dose (person-rem)	1.2×10^{-7}	0.138
Percent of natural background radiation ^a	8.5×10^{-13}	9.7×10^{-7}
LCFs ^b	7.2×10^{-11}	8.3×10^{-5}
Offsite MEI		
Dose (mrem)	1.7×10^{-8}	0.019
Percent of regulatory dose limit	1.7×10^{-9}	0.0019
Percent of natural background radiation ^a	5.1×10^{-11}	5.6×10^{-5}
Cancer fatality risk ^b	1×10^{-14}	1.1×10^{-8}

^aThe average annual dose from background radiation at Pantex is 335 mrem; based on a projected future population (year 2030) of approximately 386,000 persons residing within 50 miles of Pantex location.

^bBased on a cancer risk estimate of 0.0006 LCFs per rem or person-rem.

^cThe offsite MEI is assumed to reside at the site boundary at distance of approximately 2.2 miles. An actual residence may not currently be present at this location. Source: Tetra Tech 2007.

As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be approximately 1×10^{-8} per year (i.e., about 1 chance in 100 million). The projected number of fatal cancers to the population within 50 miles would be less than or equal to 7×10^{-11} per year (i.e., about 1 chance in 14 billion).

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, *Occupational Radiation Protection*, which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE/NNSA has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The worker radiation dose projected in this SPEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose and internal dose, as required by 10 CFR Part 835.

¹ By definition, a CNC Alternative at Pantex would create a CNPC because of the existing A/D/HE mission at Pantex.

Estimates of annual radiological doses to workers involved with CPC operations are independent of geographical location. These dose estimates are solely a function of:

- The number of radiological workers, as determined in the development of a CPC staffing estimate for each throughput alternative. The current estimates were developed by application of a factor to the total workers for each work group based on operating experience in plutonium facilities. Approximately 60 percent of total operating staff are estimated to be radiological workers.
- The working dose rate at the glovebox surface for each unit operation or workstation. These dose rates were calculated based on the maximum mass (plutonium, americium) and form (metal, oxide) of material being handled. Standard “weapons grade” isotopic distribution, and americium content of 0.5 percent were assumed.
- The amount of time spent by direct operators/first line supervisors in the radiation area. This was determined from a time-motion estimate of direct “hands-in-gloves” labor required to perform each individual operation and the number of parts processed per year for a given pit production rate. Efficiency scaling factors were applied for various operations. For Foundry and Machining operations, this was assumed to be 50 percent; for Assembly and Post-Assembly & Testing, efficiencies were 90 percent.

As indicated above, the collective annual dose (mrem per year) received by individual direct operators is calculated based on the number of operators required for the various production rates, the time spent in the radiation area, and the associated dose rates for each operation. The collective exposures for support group workers were added to these numbers and were calculated using empirical data that implies that exposure for these workers can be estimated as a percentage of direct operator exposure (e.g., Analytical Laboratory Technician ~25 percent of direct operator exposure). The average individual dose is calculated as the collective exposure divided by the estimated number of radiological workers for each throughput alternative.

The estimates of annual radiological doses to workers are provided in Table 5.5.11-3. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 mrem (10 CFR 835) and the DOE-recommended control level of 1,000 mrem (10 CFR 835). Operations in a CPC would result in an average individual worker dose of approximately 290 mrem annually. The total dose to workers associated with the CPC operations would be approximately 333 person-rem. Statistically, a total dose of 333 person-rem would result in 0.2 annual LCFs to a CPC workforce. The projected number of fatal cancers in the workforce from CPC annual operations would be 0.2 (or 2 chances in 10 that the worker population would experience a fatal cancer per year of operations).

Table 5.5.11-3 — Annual Radiological Impacts on CPC and CNPC Workers at Pantex from Operations

	CPC	CNC/CNPC ²
Number of Radiological Workers	1,150	2,040
Average individual dose, mrem/yr ^b	290	189
Average worker cancer fatality risk ^c	2×10^{-4}	1.3×10^{-4}
Collective dose (person-rem)	333	386
Cancer fatality risk ^c	0.20	0.23

^a The regulatory dose limit for an individual worker is 5,000 mrem/yr (10 CFR 835). However, the maximum annual dose to a worker would be kept below the DOE Control Level of 1,000 mrem/yr, as established in 10 CFR 835. Further, DOE recommends that facilities adopt a more limiting 500-mrem/yr Administrative Control Level (DOE 1999e). To reduce doses to levels that are as low as reasonably achievable, an effective dose reduction plan would be enforced.

^b Less than one third of all radiological workers would receive doses greater than, but no more than 90 percent above, the average worker dose.

^c Based on a cancer risk estimator of 0.0006 LCFs per rem or person-rem.

Source: Tetra Tech 2007.

During normal (accident-free) operations, total facility staffing at a CPC would be approximately 1,780. The potential risk of occupational injuries and fatalities to workers operating a CPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are presented in Table 5.5.11-4.

Table 5.5.11-4 — Injury, Illness, and Fatality Annual Estimates for Normal Operations of the CPC, CNC, and CNPC at Pantex

Injury, Illness, and Fatality Categories	CPC	CNC/CNPC ³
Total Workers	1,780	4,500
Total Recordable Cases	77	195
Total Lost Workday Cases	40	101
Total Fatalities	0.07	0.18

Source: Tetra Tech 2007, BLS 2002b

No chemical-related health impacts are associated with normal (accident-free) operations of a CPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (WSRC 2002c).

5.5.11.3 CCE Alternative

5.5.11.3.1 CNC (CPC + CUC)

By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex (see Section 5.5.11.3.2).

² By definition, a CNC Alternative at Pantex would create a CNPC because of the existing A/D/HE mission at Pantex.

³ By definition, a CNC Alternative at Pantex would amount to a CNPC, because of the existing A/D/HE mission at Pantex.

5.5.11.3.2 CNPC (CPC + CUC + A/D/HE)

Because Pantex operates the existing A/D/HE mission, a CNPC would include the CPC impacts discussed in Section 5.5.11.3.1 as well as the CUC impacts discussed below.

Construction

CUC. No radiological risks would be incurred by members of the public from CUC construction activities. Construction workers could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CUC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents at Pantex makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the A/D/HE Center would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.5.11-1.

Operation

CNPC. DOE expects minimal public health impacts from the radiological consequences of CNPC operations. Table 5.5.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table. The estimates of annual radiological doses to workers are provided in Table 5.5.11-3. As shown in the table, approximately 2,040 radiological workers would be required to conduct CNPC operations. Operations in the CNPC would result in an average individual worker dose of approximately 189 mrem annually. The total annual dose to workers associated with CNPC operations would be approximately 386 person-rem. Statistically, an annual dose of 386 person-rem would result in 0.23 LCFs to a CNPC workforce.

During normal (accident-free) operations, total facility staffing would be approximately 4,500. The potential risk of occupational injuries and fatalities to workers operating the CNPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.5.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of a

CNPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.5.11.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to health and safety, reduced operations would reduce the number of workers involved in radiological operations from approximately 334 to 250. This would reduce the total worker dose from 44.1 person-rem to 33 person-rem. Statistically, the number of LCFs would be reduced from 2.6×10^{-2} to 2.0×10^{-2} , which would be an inconsequential change. Impacts to the surrounding population would also be inconsequential.

5.5.12 **Facility Accidents**

This section presents the potential impacts on workers (both involved and non-involved) and the public due to potential accidents associated with the operation of the CPC, CUC, and A/D/HE Center at Pantex. Additional details supporting the information presented here are provided in Appendix C.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers,

members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, DOE predicted the dispersion of released hazardous materials and their effects. However, prediction of potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases because the individual worker exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident.

Emergency Preparedness— Each NNSA site has established an emergency management program. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts— NNSA estimated radiological impacts to three receptors: (1) the MEI at the Pantex boundary; (2) the offsite population within 50 miles of Pantex; and (3) a non-involved worker 3,281 feet from the accident location. NNSA did not evaluate total dose from accidents to the involved workforce because this would depend upon the specific location of the facilities on each site, which is not an issue that will be decided as a result of this SPEIS. In any tiered, project-specific EIS, accident impacts to the involved workforce would be analyzed to evaluate alternative locations on the selected site.

5.5.12.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional accident risks beyond those associated with current and planned activities that are independent of this action. Potential accident scenarios for the No Action Alternative are addressed in Section 5.5.12.4.

5.5.12.2 *Consolidated Plutonium Center*

5.5.12.2.1 **Radiological Accidents**

Table 5.5.12-1 and 5.5.12-2 present the frequencies, consequences, and risks of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CPC) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem. If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012.

Table 5.5.12-1 — CPC Radiological Accident Frequency and Consequences-- Pantex

Accident	Maximally Exposed Offsite Individual ^a			Offsite Population ^{a,b}		Noninvolved Worker ^{a,c}	
	Frequency	Dose (rem)	Latent Cancer Fatalities ^d	Dose (Person-rem)	Latent Cancer Fatalities ^e	Dose (rem)	Latent Cancer Fatalities ^d
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	23.1	0.0277	9,840	5.9	1,550	1
Fire in a single building	1.0×10^{-4}	11.4	0.00684	4,610	2.77	988	1
Explosion in a feed casting furnace	1.0×10^{-2}	13.3	0.00798	5,400	3.24	1,160	1
Nuclear Criticality	1.0×10^{-2}	3.17×10^{-5}	1.90×10^{-8}	0.00446	2.68×10^{-6}	0.00126	7.56×10^{-7}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	0.888	0.000533	360	0.216	77.2	0.0926
Radioactive material spill	1×10^{-2}	0.0266	0.000016	10.8	0.00648	2.32	0.00139

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.5.12-2 — Annual Cancer Risks for CPC-- Pantex

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^{a,b}	Noninvolved Worker ^{a,c}
Beyond Evaluation Basis Earthquake with Fire	2.77×10^{-7}	5.9×10^{-5}	1×10^{-5}
Fire in a Single Building	6.84×10^{-7}	2.77×10^{-4}	1×10^{-4}
Explosion in a Feed Casting Furnace	7.98×10^{-5}	3.24×10^{-2}	1×10^{-2}
Nuclear Criticality	1.90×10^{-10}	2.68×10^{-8}	7.56×10^{-9}
Fire-induced Release in the CRT Storage Room	5.33×10^{-6}	2.16×10^{-3}	9.26×10^{-4}
Radioactive Material Spill	1.6×10^{-7}	6.48×10^{-5}	1.39×10^{-5}

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CPC. In the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

The accident with the highest potential consequences to the offsite population (see Table 5.5.12-

1) is the beyond evaluation basis earthquake and fire in the absence of mitigation measures. Approximately 5.9 LCFs in the offsite population could result from such an accident. An offsite MEI would receive a dose of 23.1 rem. Statistically, the MEI would have a 0.01 chance of developing a LCF (i.e., about 1 chance in 100 of an LCF). This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.5.12-2), the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be approximately 8×10^{-5} , or approximately one in 10,000. For the population, the LCF risk would be 3×10^{-2} , meaning that an LCF would statistically occur once every 31 years in the population.

5.5.12.2.2 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. For this analysis, ERPG values are used to develop hazard indices for chemical exposures. ERPG definitions are provided below.

ERPG DEFINITIONS

ERPG 1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG 2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG 3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at the CPC. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Table 5.5.12-3 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released.

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 3,281 feet from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.5.12-3 shows the consequences of the dominant accident scenarios.

The distance from the release point to the point where the ERPG-2 concentration is reached in

relation to the site boundary reflects the consequence of the chemical’s release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.5.12-3 — CPC Chemical Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.85	4.49	0.48	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.1	0.55	10 ⁻⁴
Formic acid	1,500	10	0.22	0.56	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles east.

Source: Tetra Tech 2007

5.5.12.2.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.5.12.3 Consolidated Uranium Center

5.5.12.3.1 Radiological Accidents

Table 5.5.12-4 presents the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CUC) and a hypothetical non-involved worker, as well as the accident risks (Table 5.5.12-5), obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CUC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.5.12-4 — CUC Radiological Accident Frequency and Consequences at Pantex

Accident	Frequency (per year)	Maximally Exposed Offsite Individual ^a		Offsite Population ^{a,b}		Noninvolved Worker ^{a,c}	
		Dose (rem)	Latent Cancer Fatalities ^c	Dose (Person-rem)	Latent Cancer Fatalities ^c	Dose (rem)	Latent Cancer Fatalities ^d
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.0388	0.0000233	15.8	0.00948	3.38	0.00203
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.00383	2.30x10 ⁻⁶	1.56	0.000936	0.283	0.00017
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.0454	0.0000272	18.4	0.011	3.77	0.00226
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.00494	2.96x10 ⁻⁶	2.01	0.00121	0.303	0.000182
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.0719	0.0000431	26.4	0.0158	2.68	0.00161

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.5.12-5 — Annual Cancer Risks for CUC at Pantex

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^{a,b}	Noninvolved Worker ^{a,c}
Major fire	2.33 x 10 ⁻⁹	9.48 x 10 ⁻⁷	2.03 x 10 ⁻⁷
Explosion	2.30x10 ⁻¹⁰	9.36 x 10 ⁻⁸	1.7 x 10 ⁻⁸
Fire in EU Warehouse	2.72 x 10 ⁻⁹	1.1 x 10 ⁻⁶	2.26 x 10 ⁻⁷
Design-basis fires for HEU Storage	2.96x10 ⁻⁸	1.21 x 10 ⁻⁵	1.82 x 10 ⁻⁶
Aircraft crash	4.31 x 10 ⁻⁹	1.58 x 10 ⁻⁶	1.61 x 10 ⁻⁷

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.5.12-4) is the aircraft crash into the EU facilities. Approximately 0.0158 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a maximum dose of 0.07 rem. Statistically, this MEI would have a 0.00004 chance of developing a LCF, or about 1 in 25,000. This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.5.12-5), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be approximately 3x10⁻⁸, or approximately 1 in 33 million. For the population, the LCF risk would be 1x10⁻⁵, or approximately 1 in 100,000.

5.5.12.3.2 Hazardous Chemicals Impacts

A CUC would store and use a variety of hazardous chemicals. The quantities of chemicals would vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or

estimated the impacts of the potential release of the most hazardous chemical used at the CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.5.12-6 shows the consequences of the dominant loss of containment accident scenario.

Table 5.5.12-6 — CUC Chemical Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.85	4.49	0.48	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles.
Source: Tetra Tech 2007

5.5.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.5.12.4 Assembly/Disassembly/High Explosives

Accidents associated with the A/D/HE Center, which are included under the No Action Alternative, are presented in Tables 5.5.12-7 through 5.5.12-9 below.

Table 5.5.12-7 — Potential Consequences of A/D/HE Accidents at Pantex

Accident	Maximally Exposed Offsite Individual ^a		Offsite Population ^{a,b}		Noninvolved Worker ^{a,c}	
	Dose (rem)	Latent Cancer Fatalities ^c	Dose (Person-rem)	Latent Cancer Fatalities ^d	Dose (rem)	Latent Cancer Fatalities ^c
Scenario 1	3.59	0.00215	1,460	0.876	312	0.374
Scenario 2	0.00257	1.54x10 ⁻⁶	1.04	0.000624	0.224	0.000134
Scenario 3	2.15x10 ⁻⁷	1.29x10 ⁻¹⁰	8.73x10 ⁻⁵	5.24x10 ⁻⁸	1.87x10 ⁻⁵	1.12x10 ⁻⁸
Scenario 4	0.453	0.000272	208	0.125	25.2	0.0302
Scenario 5	0.474	0.000284	218	0.131	26.3	0.0316
Scenario 6	0.00352	2.11x10 ⁻⁶	1.61	0.000966	0.195	0.000117

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.5.12-8 — Annual Cancer Risks for A/D/HE Accidents at Pantex

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^{a,b}	Noninvolved Worker ^{a,c}
Scenario 1	2.15x10 ⁻⁷	8.76x10 ⁻⁵	3.74x10 ⁻⁵
Scenario 2	1.54x10 ⁻⁸	6.24x10 ⁻⁶	1.34x10 ⁻⁶
Scenario 3	1.29x10 ⁻¹²	5.24x10 ⁻¹⁰	1.12x10 ⁻¹⁰
Scenario 4	2.72x10 ⁻¹⁰	1.25x10 ⁻⁷	3.02x10 ⁻⁸
Scenario 5	2.84x10 ⁻⁸	1.31x10 ⁻⁵	3.16x10 ⁻⁶
Scenario 6	2.11x10 ⁻⁸	9.66x10 ⁻⁶	1.17x10 ⁻⁶

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.5.12-7) is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 0.876 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a dose of 3.6 rem. Statistically, this MEI would have a 0.002 chance of developing a LCF (i.e., about 1 chance in 460 of an LCF). The overall likelihood of this scenario occurring is less than 1x10⁻⁴ per year.

When probabilities are taken into account (see Table 5.5.12-8), the accident with the highest overall risk is also the explosive driven plutonium and tritium dispersal from an internal event. For this accident, the LCF risk to the MEI would be 2x10⁻⁷, or approximately 1 in 5 million. For the population, the LCF risk would be approximately 9x10⁻⁵, or approximately 1 in 10,000.

For chemical accidents, NNSA estimated the impacts of the potential release of the most hazardous chemical used at the A/D/HE Center. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the release of the chemical. Table 5.5.12-9 provides information on the chemical and the frequency and consequence of an accidental release. The source term shown represents the amount of the

chemical that is accidentally released. The American Industrial Hygiene Association defines ERPG-2 as the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical’s release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. Chlorine released in the accident would not exceed ERPG-2 limits offsite.

Table 5.5.12-9 — Chlorine Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2 ^a		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Chlorine	408.23	3	2.8	17.5	1.8	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles east.
Source: Tetra Tech 2007

5.5.12.5 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to accidents, potential consequences would be virtually unaffected, as consequences are related to the *types* of operations which are conducted, including the material-at-risk, which would not change. The probability that a particular accident would occur would also be relatively unchanged, as most probabilities are small (less than once every 100-1,000,000 years), which means that accidents are largely a function of the operation being conducted, rather than the number of times the operation is conducted. Nonetheless, it is acknowledged that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

5.5.13 **Transportation**

5.5.13.1 *No Action Alternative*

Under the No Action Alternative, there would be no change in the transportation activities at Pantex, and impacts would remain unchanged from the baseline presented in Section 4.5.12.

5.5.13.2 *DCE Alternative (Greenfield CPC)*

Construction

Construction of a CPC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels and would be temporary.

Operation

If a CPC were sited at Pantex there would be no significant transportation of plutonium within the nuclear weapons complex. Radiological transportation for the CPC would include the recycle of enriched uranium parts to Y-12, return of enriched uranium parts to Pantex, and shipment of TRU waste to WIPP. LLW would be disposed of at NTS. The addition of CPC employees would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.5.12.

5.5.13.3 CCE Alternative

5.5.13.3.1 CNPC (CPC + CUC)

Construction

CUC. Construction of the CUC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels and would be temporary.

Operation

CNPC. If a CUC were located at Pantex as part of a CNPC, only the impacts of transporting TRU waste and LLW for the CPC would occur. There would be a one-time transport of SNM from Y-12 to the CNPC, as described in Section 5.10. The addition of new employees for a CNPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic levels.

5.5.13.4 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to local transportation, a reduction in employees from 1,644 to 1,230 would not be noticed on area roads. Reduced operations would not affect the transportation of pits, as this transportation would be the same under both the No Action Alternative and the Capability-Based Alternative. Regarding the radiological transportation of secondaries and cases between Y-12 and Pantex, reduced operation would reduce these transportation requirements by approximately 50 percent compared to the No Action Alternative. As discussed in Section 5.10, the annual transportation impacts for secondaries and cases, for both incident-free transportation and potential accidents, would be small (less than 1 death related to non-radiological impacts and less than 1 LCF for radiological impacts).

5.5.14 Waste Management

5.5.14.1 *No Action Alternative*

The types of wastes generated at Pantex Plant include hazardous wastes, regulated under RCRA, universal waste, non-hazardous wastes, wastes regulated under TSCA, LLW, MLLW, and sanitary waste.

Under the No Action Alternative, current and planned activities at Pantex would continue as required to support the missions described in Section 3.2.5. There would be no additional impacts to waste management resources beyond current and planned activities. Table 5.5.14-1 presents annual waste generation volumes from Pantex Operations.

Table 5.5.14-1 — Annual Waste Volumes Generated at Pantex

Waste Type	1993	2003	2004	2005
TRU (yd ³)	0	0	0	0
Low-Level Waste (yd ³)	375.4	75.8	95.6	96.8
Mixed LLW (yd ³)	49	0.8	3.3	1.8
Hazardous Waste (yd ³)	483.8	8,798.9	337.6	711
Universal Waste ^a (yd ³)	-	31.9	24	30.7
TSCA Waste (yd ³)	147.7	542.9	1,481.8	2,036.1
Non-hazardous Waste (yd ³)	14,237	14,208.3	6,050	6,374.5
Sanitary Waste (yd ³)	800.5	988.8	1,061	944.9

^a In 2001, Pantex began managing some hazardous Waste under the Universal Waste Rules.
Source: Pantex 2006.

Previously, DOE has made decisions on the various waste types in a series of RODs that have been issued under the Waste Management PEIS (DOE 1997). With respect to wastes that could be affected by this SPEIS, the initial transuranic (TRU) waste ROD was issued on January 20, 1998 (63 FR 3629) with several subsequent amendments; and the low-level radioactive waste and mixed low-level radioactive waste ROD was issued on February 18, 2000 (65 FR 10061). The TRU waste ROD states that DOE will develop and operate mobile and fixed facilities to characterize and prepare TRU waste for disposal at WIPP. Pantex does not generate TRU waste. Each DOE site that has or will generate TRU waste will, as needed, prepare and store its TRU waste onsite until the waste is shipped to WIPP. The ROD for low-level waste (LLW) and mixed LLW (MLLW) states that, for the management of LLW, minimal treatment will be performed at all sites and disposal will continue, to the extent practicable, onsite at Idaho National Laboratory (INL), LANL, ORR, and SRS. In addition, the Hanford Site and NTS will be available to all DOE sites for LLW disposal. Mixed LLW will be treated at the Hanford Site, INL, ORR, and SRS and disposed of at the Hanford Site and the NTS.

It is current DOE policy to treat, store and dispose of low level and low level radioactive mixed waste at the site where the waste is generated, if practical; or at another DOE facility (DOE Order 435.1, DOE Manual 435.1-1). If DOE capabilities are not practical or cost-effective, exemptions to this policy may be approved to allow use of non-DOE facilities. The RODs under the Waste Management PEIS designate NTS and Hanford as the regional disposal facilities for DOE sites to send LLW or MLLW where it is not practical to treat, store or dispose of those wastes on-site. For purposes of analysis in this SPEIS, NTS is used as a representative site for

LLW or MLLW disposal because it is the current site in use for this purpose. Over the life of the program, LLW or MLLW may be disposed of on the site where it is generated or, in compliance with DOE Order 435.1, at NTS, Hanford, other DOE sites, or at licensed commercial disposal facilities. DOE/NNSA also routinely ship LLW to off-site commercial LLW disposal facilities.

The DOE MLLW disposal facility at NTS is permitted by the State of Nevada through December 2010 and NNSA may not be able to ship MLLW to NTS after that. LLW and MLLW cannot currently be shipped to Hanford until the new Tank Waste and Solid Waste EIS are completed and RODs are in place. Hanford may be available for disposal of MLLW before the MLLW disposal facility at NTS closes. EM disposal facilities at Hanford are not scheduled to operate beyond the completion of the cleanup mission at Hanford, which would be in about 40 years. Commercial disposal facilities, such as Clive, UT, or a new facility in Texas may be available to dispose of LLW and MLLW. The analysis of disposition of LLW or MLLW at NTS in this SPEIS approximates the impacts that would be expected to occur at NTS, Hanford, other possible DOE sites or the available commercial sites. Appropriate NEPA review would be conducted where necessary to address changes in the options available to DOE/NNSA for disposition of these wastes.

5.5.14.2 DCE Alternative (Greenfield CPC)

5.5.14.2.1 Construction

Construction of CPC would generate hazardous waste, and both solid and liquid sanitary waste. Table 5.5.14-2 summarizes the total volume of waste expected to be generated over the 6 years of construction activity for a CPC.

Table 5.5.14-2 — Waste Generation from CPC Construction at Pantex

Waste Type	CPC
TRU Waste, solid (yd ³)	0
LLW (yd ³)	0
Hazardous Waste (tons)	7.0
Nonhazardous Solid (yd ³)	10,900
Nonhazardous Liquid (gallons)	56,000

Source: NNSA 2007.

CPC construction would increase Pantex’s 2005 routine hazardous waste generation by less than one percent. The hazardous waste would be sent offsite for treatment and disposal at a commercial facility. Commercial treatment is readily available and is the normal method currently used to treat Pantex’s hazardous waste. The onsite Hazardous Waste Treatment and Processing Facility (HWTPF) may also be used to treat hazardous waste generated from CPC construction activities.

Solid non-hazardous waste generated from CPC construction activities would result in a 70 percent increase over the 2005 level for Pantex. Although a large increase, this volume of non-hazardous waste would present no issues at Pantex, as substantial capacity is available for the disposal of this material. The waste would be disposed of onsite, in the Construction Debris Landfill or at offsite facilities, such as the City of Amarillo Landfill. These disposal facilities, or their replacements, are expected to have adequate capacity to handle the projected amount of

waste. To the extent practicable, metal and other recyclable materials would be removed from this waste stream prior to its disposal.

Sanitary wastewater generated during CPC construction would be treated in the onsite Waste Water Treatment Facility (WWTF). DOE recently completed upgrades to this facility sufficient to satisfy the increased treatment requirements of the CPC as well as other planned program requirements at Pantex.

A retention pond would be constructed to manage stormwater runoff from the entire CPC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acres per 40 acres of developed land.

A concrete batch plant would operate at the CPC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CPC construction is completed.

5.5.14.2.2 Operation

Normal operation of a CPC would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.5.14-3 summarizes the estimated waste generation rates for a CPC.

Table 5.5.14-3 — CPC Annual Operational Waste Generation at Pantex

Waste Type	CPC
TRU Solid Waste (including Mixed TRU)(yd ³)	950
Mixed TRU Solid Waste (included in TRU, above)(yd ³)	340
Low Level Solid Waste (yd ³)	3,900
Mixed Low Level Solid Waste (yd ³)	2.5
Mixed Low Level Liquid Waste (yd ³)	0.4
Hazardous waste solid (tons)	4.0
Hazardous waste liquid (tons)	0.6
Non-Hazardous Solid Waste (yd ³)	8,100
Non-Hazardous Liquid Waste (gal)	75,000

Source: NNSA 2007.

Normal operations at Pantex do not generate TRU waste. While there are procedures to manage TRU, there is presently no TRU waste management infrastructure at Pantex. CPC operations would generate about 1,290 cubic yards of TRU waste annually (950 TYRU plus 340 Mixed TRU). TRU waste generated from plutonium pit manufacturing would include gloves, filters, and other operations/maintenance waste from gloveboxes. About 26 percent of the TRU waste would be mixed waste. The TRU and mixed TRU waste would be transferred from the CPC process buildings to the Waste Staging/TRU Packaging Building, which would be located outside of the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). This capacity is more than sufficient to allow for the packaging of this waste according to the WIPP Waste Acceptance Criteria and one to two months of accumulation prior to shipment to WIPP. A drum-loading area equipped with overhead bridge cranes would load the

waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transport to WIPP.

CPC operations would generate small amounts of hazardous waste and mixed LLW. These wastes include lead acid batteries, lubricating oils/fluids, rags, and sorbents. The projected hazardous waste volumes from CPC operations represent about 2-4 percent of the annual routine hazardous waste volumes presently managed by Pantex. Commercial treatment is readily available and currently used to treat most Pantex hazardous wastes.

LLW generation from the operation of a CPC would be a small percentage of the 2005 Pantex LLW generation volume. The LLW would be packaged according to DOE, NRC, and DOT requirements, and transferred to NTS for disposal. LLW from CPC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CPC operations would be solidified prior to leaving the facility. This waste could also be disposed of at a commercial LLW disposal facility.

Pantex's current mixed LLW generation level is small. The majority of the mixed LLW is presently transferred offsite to commercial facilities for treatment and disposal. CPC operations would increase the annual generation of mixed LLW generation by 20-48 percent over current amounts. The waste would be managed in accordance with the Pantex Site Treatment Plan. The mixed LLW would be managed onsite at the HWTPF or shipped offsite to commercial facilities. The impact to the capacity of these onsite or commercial facilities would be small.

Non-hazardous waste from CPC operations includes sanitary solid waste and wastewater. Volumes of this waste generated by the operation of a CPC would be about 27 percent greater than the amount generated by Pantex in 2005. This sanitary solid waste would be disposed of at offsite facilities, such as the City of Amarillo Landfill. Some waste may be suitable for disposal onsite in the Construction Debris Landfill. Sanitary wastewater from a CPC would be treated in the onsite WWTF. DOE recently completed upgrades to this facility to provide flexibility to increase the treatment volume. There would be adequate capacity to manage the sanitary wastewater from CPC operations.

CPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process.

5.5.14.3 *CCE Alternative*

Since the A/D/HE Center already exists at Pantex, the addition of a CNC at Pantex would create a CNPC. The impacts of this alternative are discussed above in Section 5.5.13.4, and there is no need to present them here.

5.5.14.3.1 CNPC (CPC + CUC + A/D/HE Center)

Waste management impacts from the construction of a CPC and CUC would be the same as for a CNPC, since Pantex already is operating an A/D/HE Center.

Construction

CUC. For Pantex, construction of a CNPC would entail only the construction of a CPC, already discussed in Section 5.5.14.2.1 and a CUC, discussed in this Section, since an A/D/HE Center already exists. Table 5.5.14-4 describes the wastes expected to be generated by the construction of a CPC and CUC at Pantex.

Table 5.5.14-4 — Waste Generation from CUC Construction at Pantex

Waste Category	CPC	CUC	CNPC
TRU Solid Waste (yd ³)	0	0	0
Low Level Solid Waste (yd ³)	0	70	70
Mixed TRU Solid Waste (yd ³)	0	0	0
Hazardous waste (tons)	7.0	6	13
Non-Hazardous Solid Waste (tons)	10,900	1,000	11,900

Source: NNSA 2007.

Construction of a CUC would generate LLW, hazardous waste, and both solid and liquid sanitary waste. CUC construction would increase Pantex’s annual routine hazardous waste generation by less than 3 percent. The hazardous waste would be sent offsite for treatment and disposal at a commercial facility. Commercial treatment is readily available and currently used to treat Pantex’s hazardous waste. The onsite HWTPF may also be used to treat hazardous waste generated from CUC construction activities.

Hazardous waste generated through the construction of a CUC at Pantex would be a small percentage of the amount of hazardous waste generated by Pantex in 2005. This waste would be managed according to RCRA requirements and shipped off-site for treatment and disposal at a commercial facility. LLW volume from the construction of a CUC would be about 72 percent of the LLW generated by Pantex in 2005. The LLW would be packaged and transferred to NTS for disposal.

Solid non-hazardous waste from CUC construction activities would result in a 70 percent increase over the 2005 volume. The waste would be disposed of onsite in the Construction Debris Landfill or at offsite facilities, such as the City of Amarillo Landfill. These disposal facilities, or their replacements, are expected to have more than adequate capacity to handle the projected amount of waste. Sanitary wastewater generated during CUC construction would be treated in the onsite WWTF. DOE recently completed upgrades to this facility sufficient to satisfy the increased treatment requirements of a CUC. A retention pond would be constructed to manage stormwater runoff from the entire CUC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acres per 40 acres of developed land. A concrete batch plant would operate at the CUC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities.

Operation

CNPC. Normal operation of a CNPC at Pantex would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.5.14-5 summarizes the estimated waste generation rates for the CNPC. It should be noted that the A/D/HE Center operational waste generation rates do not appear on this table since these wastes are presently being generated at Pantex and are therefore attributable to the no action alternative. Pantex current waste generation rates are described in Table 4.5.13.

Table 5.5.14-5 — Annual Wastes Generated by the Operation of Facilities at Pantex

Waste Type	Projects Under Consideration		
	CPC	CUC	CNPC (CPC + CUC + existing A/D/HE)
TRU Solid Waste (including Mixed TRU)(yd ³)	950	0	950
Mixed TRU Solid Waste (included in TRU, above) (yd ³)	340	0	340
Low Level Solid Waste (yd ³)	3,900	8,100	12,000
Low Level Liquid Waste (gal)	0	3,515	3,515
Mixed Low Level Solid Waste (yd ³)	2.5	70	72.5
Mixed Low Level Liquid Waste (yd ³)	0.4	3,616	3,616.4
Hazardous waste solid (tons)	4.0	15	19
Hazardous waste liquid (tons)	0.6	0	0.6
Non-Hazardous Solid Waste (yd ³)	8,100	7,500	15,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	125,000

Source: NNSA 2007.

Normal operations at Pantex do not generate TRU waste. While there are procedures to manage TRU, there is presently no TRU waste management infrastructure at Pantex. CNPC operations would result in the generation of about 950 cubic yards of TRU waste, annually. TRU waste generated from plutonium pit manufacturing would include gloves, filters, and other operations/maintenance waste from gloveboxes. About 36 percent of the TRU waste would be mixed waste. The TRU and mixed TRU waste would be transferred from the CNPC process buildings to the Waste Staging/TRU Packaging Building, which would be located outside of the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 977 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transport to WIPP.

CNPC operations would generate small amounts of hazardous waste and mixed LLW. These wastes include lead acid batteries, lubricating oils/fluids, rags, and sorbents. The projected hazardous waste volumes from CNPC operations represent about 2-4 percent of the annual hazardous waste volumes presently managed by Pantex. Commercial treatment is readily available and currently used to treat most Pantex hazardous wastes.

LLW generation for a CNPC would substantially increase the current Pantex LLW generation volumes. The LLW would be packaged at a waste management portion of a new CNPC, in accordance with DOE, NRC, and DOT requirements, and transferred to NTS for disposal. Due

to the large increase in routine LLW generation, additional storage capacity would be needed to manage the waste until it can be accumulated into shipment quantities and shipped offsite for disposal. LLW from CNPC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CNPC operations would be solidified prior to leaving the facility.

Pantex's current mixed LLW generation level is small. The majority of this mixed LLW is presently transferred offsite to commercial facilities for treatment and disposal. CNPC operations would drastically increase the annual routine mixed LLW generation at Pantex. The waste would be managed in accordance with the Pantex Site Treatment Plan, and similar to the small quantities presently being generated, shipped offsite to commercial facilities. Since the CNPC would contain a RCRA-permitted mixed waste treatment facility, this would pose no issues to the normal Pantex operations. The impact from managing this increased mixed LLW waste stream would be small.

Non-hazardous waste from CNPC operations would include sanitary solid waste and paper, debris, and general office waste. Sanitary solid wastes would be disposed of at offsite facilities, such as the City of Amarillo Landfill. Some waste may be suitable for disposal onsite in the Construction Debris Landfill. Annual non-hazardous waste volumes would increase by a factor of 4 – 5 relative to current Pantex operations. This increase could accelerate the rate at which DOE consumed the available onsite capacity and require more off-site, commercial treatment and disposal.

Sanitary wastewater from the CNPC would be treated in the onsite WWTF. DOE recently completed upgrades to this facility to provide flexibility to increase the treatment volume. There would be adequate capacity to manage the sanitary wastewater from CNPC operations. CNPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process.

5.5.14.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Pantex would continue as required to support smaller stockpile requirements. With respect to waste management, reduced operations would reduce wastes generated as shown in Table 5.5.14-6.

Table 5.5.14-6 — Annual Wastes Generated by Pantex for the No Action Alternative and the Capability-Based Alternative at Pantex

Waste Category	No Action	Capability-Based Alternative
Low-level Waste (yd ³)	96.8	73
Mixed Low-level Waste (yd ³)	1.8	1.4
Hazardous Waste (yd ³)	711	530
Nonhazardous Waste (yd ³)	6,375	4,800

Source: NNSA 2007.

Because Pantex has adequate facilities to manage the wastes under the No Action Alternative (what Pantex is doing today), neither alternative would present major impacts to waste management, as the Capability-Based Alternative generates less waste than the No Action Alternative. Reductions in LLW generation would reduce the transportation of LLW to NTS. As discussed in Section 5.10, these impacts are small (less than 1 death related to non-radiological impacts and less than 1 LCF for radiological impacts) under the No Action Alternative.

5.5.15 Impacts Associated with Closing and D&D of Pantex Facilities

If a CNPC were to be constructed at a site other than Pantex, Pantex would close. As a part of estimating the overall environmental impacts associated with such an action, this section discusses, in general terms, what would be necessary for the closure and remediation of the Pantex Plant, and what these activities might entail.

In May 1994, the Pantex Plant was listed on the National Priorities List (NPL) as a Superfund Site. This action required complete site characterization and the development of a remediation plan. The remediation plan was completed in July 2003. This plan, prepared by BWXT Pantex, with oversight by the EPA and the Texas Commission on Environmental Quality, entails a reduction of building usage to only what is actually being used (thereby reducing the usable footprint) and a comprehensive clean-up of the rest of the site. The plan has four major strategies: 1) accelerate soil clean-up, 2) accelerate clean-up of the perched aquifer, 3) continued monitoring of the Ogallala Aquifer, and 4) reduction of operating footprint and clean-up of entire site areas.

It is estimated that these actions would require a total expenditure of \$131 million through 2114. The plan calls for the operations footprint reduction to occur by 2008. Pantex is presently finalizing remediation plans for the accelerated soil clean-up from previously identified Solid Waste Management Units. A pump and treat system will be utilized to remove contaminants from the perched aquifer, directed by a predictive groundwater modeling program to direct and prioritize activities. In addition to the above mentioned remediation, clean-up of the Ogallala Aquifer will be required, once final characterization has been completed. It has been estimated by the Innovative Treatment Remediation Demonstration (ITRD) Program that restoration of the Ogallala Aquifer would be a 30 year project costing an estimated \$30 million. This would entail the drilling of up to 50 monitoring/injection/extraction/treatment wells.

All of the remediation actions detailed above have been committed to by DOE/NNSA and BWXT Pantex (the current operating contractor at the site), and would be done regardless of

alternatives being considered by the Complex Transformation SPEIS. Accordingly, these remediation actions, for purposes of this analysis, are considered part of the No Action Alternative and not a part of the proposed actions. Although the Pantex Plant covers approximately 16,000 acres (about 25 square miles), the majority of Plant operations are conducted on about 2,500 acres. Pantex has about 640 buildings covering almost 3 million square feet of floor space, 55 miles of paved roads, 60 miles of fences, and 17,000 pieces of Plant equipment. There are nine miles of steam/condensate lines, 17 miles of natural gas lines, 30 miles of main line water piping, 33 miles of electrical distribution lines and five water production wells (see Section 4.5).

Once these remediation activities which NNSA/DOE has already committed to have been completed, the Pantex Plant will be left with approximately 400 buildings, comprising approximately 1,875,000 square feet, with which to conduct ongoing operations. It is this footprint which if decisions were to be made to close the Pantex Plant that would be attributable to that decision. Although many of these buildings, especially the administrative and office complexes could be of use to DOE and/or others, for purposes of this analysis, it is assumed that the entire site would be razed and the waste from this activity managed in accordance with all applicable requirements. It is further assumed that the roads, electric supply system, water supply system, and natural gas supply system would remain intact as a potential asset for future use of the property. The closing and decontamination and decommissioning (D&D) of these facilities would be expected to entail the impacts detailed in Table 5.5.15-1. It should be noted that this analysis is not a rigorous engineering assessment intended to serve as the basis of decision-making or serve as a cost analysis. It was constructed only to give the reader some idea of the magnitude of the effort associated with the closure and D&D of this facility.

Table 5.5.15-1 — Impacts from Closure and D&D of the Pantex Plant

Activity	Quantity	
Total floorspace ft ²		
Admin	10% x 1,875,000	187,500
Industrial	90% x 1,875,000	1,687,500
TOTAL		1,875,000
No of bldgs		
Admin	10 % x 400	40
Industrial	90 % x 400	360
TOTAL		400
Non-Hazardous Solid Waste (yds ³)		
Admin bldgs	4 yds ³ x 40	160
Industrial bldgs	2 yds ³ x 360	720
TOTAL		880
Concrete/bock/brick (yds ³)		
Admin bldgs	187,500 ft ² x .064 yds ³ / ft ²	12,000
Industrial bldgs	1,687,500 ft ² x .09 yds ³ / ft ²	151,875
TOTAL		163,865
Steel and scrap iron (tons)		
Steam pipe	17.8lb/ft x 47,520 / 2,000	423
Rebar		20
Misc		20
Scrap equip		120
TOTAL		583
Soil excavation (yds ³)	360 bldg x 20% x 200 yds ³ / bldg	14,400

Table 5.5.15-1 — Impacts from Closure and D&D of the Pantex Plant

Activity	Quantity	
LLW generated (yds ³)		
Concrete	2% x 151,875	3,036
Soil	1% x 14,400	144
Equip		50
TOTAL		3,230
TRU generated (yds ³)		0
Mixed LLW (yds ³)		20
Hazardous waste (yds ³)		
from rubble	2% x 151,875	3,036
from soils	2% x 14,440	288
unused storage		100
TOTAL		3,424
Asbestos waste (yds ³)	400 bldg x 4 yds ³ /bldg	1,600
Employment		
Admin bldgs	5 persons/bldg x 40	200
Industrial bldgs	8 persons/bldg x 360	2,880
TOTAL		3,080
Peak employment		4,000
Total worker hours	2,000 x 4yrs x 3,080	24,640,000
Time required (yrs)		4
Asbestos waste (yds ³)	400 bldg x 4 yds ³ /bldg	1,600
Water requirements (gal/yr)		
Workers	2gal x 200 days x 3,080 workers	1,232,000
construction	1000 gal/hr x 11 hrs x 100 days	1,100,000
TOTAL		2,332,000

Source: NNSA 2007.

Once the buildings are vacated, all reusable fixtures, doors copper pipe, copper wire, equipment, office furniture etc. would be removed inspected for radioactivity or the presence of hazardous wastes and sold. The buildings would then be cleaned of all remaining loose items. It is expected that this would result in the generation of 880 cubic yards of non hazardous solid waste. This waste would be disposed of, on-site, as Class 2 non-hazardous waste, as defined by Title 30 of the Texas Administrative Code. Once this has been completed, all buildings and structures would be demolished. This would involve hand cutting, detonations, and large earthmoving equipment.

As detailed in Table 5.5.15-1, above, an estimated 12,000 cubic yards of concrete/block/brick rubble would be generated from the administration buildings (not expected to be contaminated) and 151, 875 cubic yards generated from the razing of the industrial buildings and structures. All of this material would undergo analysis for the presence of radioactive material and hazardous waste contamination. Contaminated quantities would be removed and handled according to their classification. It is assumed that 2 percent of this waste originating from the industrial facilities would be contaminated with radioactive materials and be considered LLW. Another 2 percent of this waste originating from the industrial buildings would be assumed to be contaminated with hazardous waste and be handled accordingly. This would leave approximately 157,800 cubic yards of concrete, brick, block, rebar and rubble, which would likely be disposed of on-site as Class 2 non-hazardous waste, as defined by Title 30 of the Texas

Administrative Code.

An estimated 14,400 cubic yards of soil would be removed from around and under the industrial buildings and structures. This soil would be tested for the presence of radioactive materials and for hazardous wastes. Soil found not to be contaminated with these materials would be mounded and stored, to be used as grade material and fill once the buildings were removed and the surrounding areas cleaned up. These mounds would be covered with vegetation or tarps to minimize erosion. The D&D of this soil would be expected to generate about 288 cubic yards of LLW. An additional 3,036 cubic yards of LLW would be expected to be generated from the concrete, brick, and block, along with 50 cubic yards of LLW from contaminated equipment. The 3,230 cubic feet of LLW, which amounts to about thirty-five times the annual LLW generation rate for Pantex would be packaged for transport, taken to NTS and disposed of at NTS. In addition it is expected that 20 cubic yards of mixed LLW would be generated. This waste would be packaged for transport and transported to NTS for treatment and disposal.

Approximately 3,424 cubic yards of hazardous waste would be expected to be generated from the demolition process. About 100 cubic yards of hazardous waste would come from unused chemicals and “empty drums”, bottles, etc. left in buildings. The hazardous waste would be packaged and transported to a commercial facility for treatment and disposal. From 2003 – 2005, Pantex generated an average of 3,282 cubic yards of hazardous waste. It is estimated that 1,600 cubic yards of asbestos waste would be generated. This waste would be removed from buildings (prior to demolition) packaged and shipped off-site, in accordance with TSCA requirements and then disposed of at a TSCA certified disposal facility.

5.6 SANDIA NATIONAL LABORATORIES/NEW MEXICO

There are no Programmatic Alternatives for SNL/NM. Relevant project specific analyses for SNL/NM are discussed in Sections 5.12 through 5.17.

5.7 WHITE SANDS MISSILE RANGE

There are no Programmatic Alternatives for WSMR. Project specific analysis for WSMR is discussed in Section 5.15.

5.8 SAVANNAH RIVER SITE

This section discusses the potential environmental impacts associated with the following programmatic alternatives at SRS:

- **No Action Alternative:** under the No Action Alternative, NNSA would continue operations to support national security requirements using the nuclear weapons complex as it exists today. SRS would continue to perform its existing missions as described in Section 3.2.8. In addition, construction of the Mixed Oxide Fuel (MOX) Facility was started in August, 2007, and is expected to begin operation in 2016. Construction of the Pit Disassembly and Conversion Facility (PDCF) is scheduled to start in 2010, and begin operation in 2019.
- **DCE Alternative:** this alternative includes a CPC, which could be either a “Greenfield” facility or a facility that uses the mixed-oxide (MOX) fuel fabrication facility and the pit disassembly and conversion facility (PDCF) infrastructure. Operations would be the same for either the Greenfield facility or MOX/PDCF option.
- **CCE Alternative:** this alternative includes two options: (1) a Consolidated Nuclear Production Center (CNPC), which would consist of a CPC, a Consolidated Uranium Center (CUC), and an A/D/HE Center; and (2) Consolidated Nuclear Centers (CNC), which would be a CPC and a CUC, with the A/D/HE Center at Pantex. In general, the CCE facilities would produce additive construction impacts because construction activities would occur sequentially as follows: CUC, 2011-2016; CPC, 2017-2022; A/D/HE Center, 2020-2025).
- **Capability-Based Alternative:** under this alternative, tritium activities at SRS would be reduced to support stockpile requirements below the Moscow Treaty requirements.

The environmental impacts are presented below for each of the following environmental resource areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, and waste management.

5.8.1 Land Use

This section presents a discussion of the potential impacts to land associated with the No Action Alternative, the DCE Alternative, and the CCE Alternative. Table 5.8.1-1 describes the potential effects on land use from construction and operation of facilities under the DCE and CCE Alternatives.

Table 5.8.1-1 — Potential Effects on Land Use at the Proposed Sites

CPC Alternatives		
	Construction (acres)	Operation (acres)
Greenfield Alternative	140	110 ^a
		PIDAS
	40	70
Upgrade Alternative	13	6.5 (All within PIDAS)
50/80 Alternative	6.5	2.5 (All within PIDAS)
CUC		
Construction (acres)	50	
Operation (acres)	Total Area: 35 ^b	
	PIDAS	Non-PIDAS
	15	20
A/D/HE CENTER ^d		
Construction (acres)	300	
Operation (acres)	Total Area: 300 ^e	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120
CNC		
	Total Area: 195 ^f	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 55	Total: 140
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50
CNPC		
	Total Area: 545 ^g	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 235	Total: 310
	<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100

^a Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^b At Y-12, a UPF would be constructed (see Section 3.4.2).

^c Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^d At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

^e Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^f Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

^g Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

5.8.1.1 No Action Alternative

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at SRS beyond those of existing and future activities that are independent of this action. Planned construction includes the MOX/ PDCF facilities. Construction of the MOX facility began in August 2007, and construction of the PDCF is scheduled to begin in 2010. Together these two facilities will disturb 77 acres in the F-Area. Existing land resources is discussed in Section 4.8.1.

Table 5.8.1-2 identifies the major facilities at SRS for the No Action Alternative.

Table 5.8.1-2 — Savannah River Site No Action Alternative Facilities

<p>Administrative facilities Area A</p> <p>Area B</p>	<p>Provides office space, training areas, and records storage. Houses Savannah River National Lab</p> <p>Provides office space, training areas, and records storage. Over the last ten years most admin. functions have been transferred to B Area, with A Area and M Area undergoing some closure activities</p>
<p>Heavy water reprocessing D Area</p>	<p>Now closed, had facilities for supporting heavy water coolant/moderator for the reactors, heavy water purification facilities, an analytical laboratory, and a power plant</p>
<p>Non-nuclear facilities N Area</p> <p>T Area</p>	<p>Central Shops, containing construction and craft facilities and the primary facilities for storage of construction material</p> <p>Also known as TNX-Area, used to contain facilities that tested equipment and developed new designs</p>
<p>Nuclear/radiological facilities M Area</p>	<p>Fuel/Target Fabrication facilities housed the metallurgical/foundry operations for fabricating fuel and target elements for the SRS reactors. This area is undergoing closure activities</p>
<p>Reactors C, K, L, P, and R Areas</p>	<p>Housed the C, K, L, P, and R reactors. These reactors were used for nuclear production, are permanently shut down and are being evaluated for D & D. Fuel storage basins at the L reactor contain spent nuclear fuel. Portions of the K reactor have been converted to the K Area Material Storage Facility. Decontamination capability has been installed in the C Area.</p>
<p>Processing facilities H Area</p> <p>F Area</p>	<p>Process, stabilize, separate, and recover nuclear materials. Includes the Tritium Extraction Facility, Tritium Loading, Unloading, and Surveillance Facility, Effluent Treatment Facility, High Level Tanks.</p> <p>Chemical Separation Facility (now closed). Houses high level tanks, Mixed Oxide Fuel Fabrication Facility (under construction), Pit Disassembly and Conversion Facility (proposed), Waste Solidification Facility (proposed)</p>
<p>Waste Management facilities G Area</p> <p>E Area</p> <p>S Area</p> <p>Z Area</p>	<p>Storage and disposal of radioactive waste</p> <p>Storage and disposal of radioactive waste; LLW Disposal Facilities (2) TRU Waste Storage Facilities</p> <p>Defense Waste Processing Facility, Salt Waste Processing Facility (under construction)</p> <p>Saltstone Production Facility, Saltstone Disposal Facility, Salt Waste Processing Facility (under construction)</p>

5.8.1.2 DCE Alternative (CPC)

5.8.1.2.1 Construction

As described in Section 3.4.1, a CPC would have multiple aboveground facilities. There would be four separate nuclear buildings: Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D. These buildings would be surrounded by a PIDAS with a 300-foot wide buffer area outside the PIDAS. The area outside the PIDAS and buffer area would consist of a number of smaller support facilities, a Waste Staging/TRU Packaging Building, roads and parking areas, and a runoff retention area. In addition to these structures, a construction laydown area and a concrete batch plant would be built for the construction phase only. Upon construction completion, they would be removed and the area could be returned to its original state.

All buildings would be either one or two stories. The site would require two HVAC exhaust stacks; the tallest, standing 100 feet, would be located inside the PIDAS. Facility exhausts would be HEPA-filtered prior to discharge through the stacks.

The CPC reference location at SRS is immediately south of Road C near Burma Road. The site is flat and located on a topographic divide so surface drainage is both west toward Upper Three Runs and east toward Fourmile Branch streams. The reference location would be located on land categorized as Site Industrial.

An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the CPC. The land required for the proposed CPC construction would represent 0.07 percent of SRS's total land area of 198,400 acres. Use of the MOX/PDCF facilities would reduce the land disturbance by approximately 10 percent. The reference location has adequate space to accommodate the total CPC footprint. The post-construction developed area would be approximately 110 acres.

Although there would be a change in land use, a CPC is compatible and consistent with land use plans and the current land use designation (Site Industrial) for this area. No impacts to SRS land use plans or policies are expected.

5.8.1.2.2 Operation

An estimated 110 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC. The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the concrete batch plant upon construction completion. The land required for CPC operations would represent 0.06 percent of SRS's total land area of 310 square miles.

Although there would be a change in land use, a CPC is compatible and consistent with land use plans and the current land use designation (Site Industrial) for this area. No impacts to SRS land use plans or policies are expected.

5.8.1.3 CCE Alternative

5.8.1.3.1 CNC (CPC + CUC)

Land Use impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.1.2 as well as the impacts for the CUC discussed below.

Construction

CUC. As described in Section 3.5.2, a CUC would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state. Once constructed, operations at a CUC would require approximately 35 acres. All buildings would be either one or two stories.

The CUC reference location at SRS is immediately south of Road C near Burma Road. The site is flat and located on a topographic divide so surface drainage is both west toward Upper Three Runs and east toward Fourmile Branch streams. The reference location would be located on land categorized as Site Industrial. The land required for CUC construction would represent 0.02 percent of SRS's total land area of 310 square miles. The reference location has adequate space to accommodate the total facilities footprint. Although there would be a change in land use, a CUC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to SRS land use plans or policies are expected.

Operation

CNC. As described in Section 3.5.2, an estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNC. Of this, approximately 55 acres would be located within a PIDAS. The land required for CNC operations would represent approximately 0.1 percent of SRS's total land area of 310 square miles. Although there would be a change in land use, a CNC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to SRS land use plans or policies are expected.

5.8.1.3.2 CNPC (CPC + CUC + A/D/HE Center)

Land use impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.1.2, the CUC impacts discussed in Section 5.8.1.3, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. As described in Section 3.5, an Assembly/Disassembly/High Explosives (A/D/HE) Center would consist of a nuclear facility within the PIDAS and high explosives

facilities and non-nuclear support facilities outside the PIDAS. Approximately 300 acres would be required for an A/D/HE Center. Approximately 180 acres would be protected within a PIDAS.

The A/D/HE Center reference location at SRS is immediately south of Road C near Burma Road. The site is flat and located on a topographic divide so surface drainage is both west toward Upper Three Runs and east toward Fourmile Branch streams. The reference location would be located on land categorized as Site Industrial. The land required for A/D/HE Center construction would represent approximately 0.1 percent of SRS's total land area of 310 square miles. The reference location has adequate space to accommodate the total facilities footprint. Although there would be a change in land use, an A/D/HE Center is compatible and consistent with land use plans and the current land use designation for this area. No impacts to SRS land use plans or policies are expected.

Operation

CNPC. An estimated 545 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNPC. Of this, approximately 235 acres would be located within a PIDAS. The land required for CNPC operations would represent approximately 0.2 percent of SRS's total land area of 310 square miles. Although there would be a change in land use, a CNPC is compatible and consistent with land use plans and the current land use designation for this area. No impacts to SRS land use plans or policies are expected.

5.8.1.4 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at SRS. Reduced operations would not change land use at SRS

5.8.2 Visual Resources

5.8.2.1 No Action Alternative

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. No additional impacts to visual resources would occur beyond current and planned activities that are independent of this action. Construction of the MOX/PDCF facilities will temporarily change the visual appearance of the F-Area. Since this is an already developed site and the two buildings will be of a similar type to those there now, there will not be a change in the visual classification. Existing visual resources is discussed in Section 4.8.2.

5.8.2.2 *DCE Alternative (CPC)*

5.8.2.2.1 **Construction**

Activities related to the construction of new buildings required for a CPC would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. These changes would be temporary and, because of its interior location on the SRS site, would not be noticeable beyond the SRS boundary (approximately 6.7 miles away). Site visitors and employees observing CPC construction would find these activities similar to the past construction activities of other developed areas on the SRS. Thus, impacts on visual resources during construction would be minimal.

Cranes used during construction of a CPC could create short-term visual impacts, but would not be out of character for an industrial site such as SRS. The construction lay-down areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. After construction of the facilities are complete, cranes and temporary construction office trailers would be removed, and construction lay-down areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel.

5.8.2.2.2 **Operation**

A CPC, which would include one- and two-story buildings, storage tanks, and two HVAC exhaust stacks, would change the appearance of the reference location. Views of the buildings, tanks, and exhaust stacks by visitors or employees using the SRS road network (Road C and Burma Road) would be limited by the forest vegetation and rolling terrain surrounding the location. Only the exhaust stacks would exceed the height of the forest vegetation. However, this change would be consistent with the currently developed areas of SRS.

5.8.2.3 *CCE Alternative*

5.8.2.3.1 **CNC (CPC + CUC)**

Visual resources impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.2.2 as well as the impacts discussed below.

Construction

CUC. Activities related to the construction of new buildings required for a CUC would be similar to a CPC described in Section 5.8.2.2.1. There would be a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. These changes would be temporary and, because of its interior location on the SRS site, would not be noticeable beyond the SRS boundary. Site visitors and employees observing CUC construction would find these activities similar to the past construction activities of other developed areas on the SRS. Thus, impacts on visual resources during construction would be minimal.

Operation

CNC. A CNC would encompass approximately 195 acres of buildings, walkways, parking, and buffer space. Structures would include one- and two-story industrial facilities, cooling towers, and water tanks that would change the appearance of the reference location. Views of the buildings, tanks, and exhaust stacks by visitors or employees using the SRS road network would be limited by the forest vegetation and rolling terrain surrounding the location. Any changes would be consistent with the currently developed areas of SRS.

5.8.2.3.2 CNPC (CPC + CUC + A/D/HE Center)

Visual resources impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.2.2, the CUC impacts discussed in Section 5.8.2.3.1, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. Activities related to the construction of new buildings required for an A/D/HE Center would be similar in nature to a CPC and CUC. Any changes would be temporary and, because of its interior location on the SRS site, would not be noticeable beyond the SRS boundary. Site visitors and employees observing A/D/HE Center construction would find these activities similar to the past construction activities of other developed areas on the SRS. Thus, impacts on visual resources during construction would be minimal.

Operation

CNPC. A CNPC would be a large complex of industrial facilities, parking lots, and a buffer zone encompassing approximately 545 acres. Because of the reference site's interior location on the SRS site, a CNPC would not be noticeable beyond the SRS boundary. Views of the complex by visitors or employees using the SRS road network would be limited by the forest vegetation and rolling terrain surrounding the location. Any changes would be consistent with the currently developed areas of SRS.

5.8.2.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on visual resources would occur at SRS.

5.8.3 Site Infrastructure

The analysis of site infrastructure focuses on the ability of the site to provide the electrical power needed to support the programmatic alternatives. The ability of the site to provide the water requirements is addressed in the water resource section (Section 5.8.5). Other infrastructure demands, such as fuels or industrial gases, are not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS.

5.8.3.1 No Action Alternative

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to the site electrical infrastructure beyond current and planned activities (MOX/PDCF facilities) that are independent of this action. SRS currently uses about 370,000 MWh per year of electricity. Additional site infrastructure information is discussed in Section 4.8.2.

5.8.3.2 DCE Alternative (Greenfield CPC)

5.8.3.2.1 Construction

The projected demand on the site electrical infrastructure resources associated with construction activities for a CPC are shown in Table 5.8.3-1.

Table 5.8.3-1 — Electrical Infrastructure Requirements for Construction of CPC, CUC, and the A/D/HE Center at SRS

Proposed Alternatives	Electrical	
	Energy	Peak Load
	(MWh/yr)	(MWe)
Site capacity	4,400,000	330
Available site capacity	4,030,000	260
No Action Alternative		
Total site requirement	370,000	70
Percent of site capacity	8%	21%
CPC		
Total site requirement	13,000	3.0
Percent of site capacity	<1%	1%
Percent of available capacity	<1%	1.2%
CUC		
Total site requirement	11,000	2.5
Percent of site capacity	<1%	<1%
Percent of available capacity	<1%	1%
A/D/HE Center		
Total site requirement	55,000	12.7
Percent of site capacity	1.2%	3.8%
Percent of available capacity	1.4%	4.9%

^a Not limited due to offsite procurement.

NA = not applicable.

Source: NNSA 2007.

The existing electrical infrastructure at SRS would be adequate to support annual construction requirements for a CPC (Greenfield or use of MOX/PDCF) for the projected 6-year construction period.

5.8.3.2.2 Operation

The estimated annual site electrical infrastructure requirements for a CPC are presented in Table 5.8.3-2. There would be negligible impacts to site infrastructure.

Table 5.8.3-2 — Electrical Infrastructure Requirements for Operations of the CPC, CUC, A/D/HE Center, CNC, and the CNPC at SRS

Proposed Alternatives	Electrical	
	Energy	Peak Load
	(MWh/yr)	(MWe)
Site capacity	4,400,000	330
Available site capacity	4,030,000	260
No Action Alternative		
Total site requirement	370,000	70
Percent of site capacity	8%	21%
CPC		
Total site requirement	48,000	11
Percent of site capacity	1.1%	3.3%
Percent of available capacity	1%	4.2%
CUC		
Total site requirement	168,000	18.4
Percent of site capacity	3.8%	5.6%
Percent of available capacity	4.1%	7.1%
A/D/HE Center		
Total site requirement	52,000	11.9
Percent of site capacity	1.2%	3.6%
Percent of available capacity	1.3%	4.6%
CNPC (CPC + CUC + A/D/HE Center)		
Total site requirement	268,000	41.3
Percent of site capacity	6.1%	12.4%
Percent of available capacity	6.6%	15.9%

Source: NNSA 2007.

5.8.3.3 CCE Alternative

5.8.3.3.1 CNC (CPC + CUC)

Site electrical infrastructure impacts from the construction of a CUC and operation of a CNC would include the CPC impacts discussed in Section 5.8.3.2 as well as the impacts discussed below.

Construction

CUC. A CUC would require additional infrastructure demands during the construction phase. During construction, these facilities would require a peak electrical demand of approximately 2.5 MWe, which is approximately 1 percent of the current electrical usage at SRS and less than 1 percent of available capacity. The existing electrical infrastructure at SRS would be adequate to support annual construction requirements for a CUC for the projected 6-year construction period. Infrastructure requirements for construction would have a negligible impact on current site infrastructure resources. The estimated electrical infrastructure requirements for construction of a CUC are presented in Table 5.8.3-1.

Operation

CNC. During operations, a CNC would require approximately 15 percent of the current available electrical capacity at SRS. The core operations of a CNC would be similar to the CPC and CUC operations described in Sections 3.4.2 and 3.5.1.1. The estimated annual site electrical infrastructure requirements for operation of a CNC are presented in Table 5.8.3-2. There would be negligible impacts to site infrastructure.

5.8.3.3.2 CNPC (CPC + CUC + A/D/HE Center)

Site electrical infrastructure impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.3.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. The existing electrical infrastructure at SRS would be adequate to support annual construction requirements for an A/D/HE Center for the projected 5-year construction period. Infrastructure requirements for construction would have a negligible impact on current site infrastructure resources. The estimated site electrical infrastructure requirements for construction of an A/D/HE Center are presented in Table 5.8.3-1.

Operation

CNPC. During operations, a CNPC would require less than 20 percent of the current available electrical capacity at SRS. The estimated annual site electrical infrastructure requirements for operation of a CNPC are presented in Table 5.8.3-2. There would be negligible impacts to the site electrical infrastructure.

5.8.3.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to infrastructure, electrical use at the tritium facilities would be reduced from 27,500 MWhr per year to 22,500 MWhr per year. Because there is currently adequate electrical capacity at the site, this reduction would not have any major impact on operations.

5.8.4 Air Quality and Noise

5.8.4.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. The SRS is located in the Augusta-Aiken Interstate AQCR. All areas within this region are classified as achieving attainment with the NAAQS (40 CFR 50). There would be no additional impacts to air quality and noise beyond temporary fugitive dust emissions, and traffic and construction noise resulting from construction of the MOX/PDCF facilities. Operation of these facilities is not expected to diminish the existing level of air quality, impact existing permits, or exceed any established air release limits. SRS is presently in compliance with all NAAQs. Existing air quality and noise resources is discussed in Section 4.8.4.

5.8.4.2 *DCE Alternative (CPC)*

5.8.4.2.1 Air Quality

Construction

Non-radiological Impacts. Construction of new structures would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, PM₁₀, total suspended particulates, and carbon monoxide. The calculation of emissions from construction equipment was based on factors provided in the EPA document AP-42, “Compilation of Air Pollutant Emission Factors” (EPA 1995). For highway vehicles (worker commuting vehicles and delivery vehicle) emission factors were obtained from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA 2002).

Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 1.20 tons/acres per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. Facility construction would necessitate a concrete batch plant at the building site. Particulate matter, consisting primarily of cement dust, would be the only regulated pollutant emitted in the concrete mixing process. Emission factors for the concrete batch plant were obtained from AP-42 (EPA 1995).

The estimated maximum annual pollutant emissions resulting from construction activities are presented in Table 5.8.4–1. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts. The temporary increases in pollutant emissions due to construction activities would be too small to result in violations of the National Ambient Air

Quality Standards (NAAQS) beyond the SRS site boundary (DOE 2003d). A site-specific EIS, if required, would address this issue, and any potential need for mitigation, in greater detail.

Table 5.8.4–1 — Estimated Peak Non-radiological Air Emissions for the CPC—Construction

Pollutant	Estimated Annual Emission Rate (metric tons/yr)
	CPC
Carbon monoxide	409.6
Carbon dioxide	7,084.2
Nitrogen dioxide	177.7
Sulfur dioxide	11.6
Volatile organic compounds	28.7
PM ₁₀	686
Total Suspended Particulates	915

Source: NNSA 2007.

Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

Non-radiological Impacts. Pit manufacturing activities would result in the release of criteria and toxic pollutants into the surrounding air. The primary volume contributors are nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Carbon dioxide would be used as a cleaning agent and helium would be used for leak testing operations. Hydrogen and nitrogen dioxide are reaction products from aqueous purification operations (pyrochemical purification would produce lower amounts of hydrogen and nitrogen dioxide). The chemicals used for dye-penetrant testing of welds are assumed to be volatilized and released to the atmosphere. Organic solvents used for cleaning and chemicals used in the Analytical Laboratory for various analyses would not be expected to contribute any appreciable quantities of any other chemicals to the annual non-radioactive air emissions. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates (WSRC 2002e). The estimated emission rates (kg/yr) for non-radiological pollutants emitted are presented in Table 5.8.4–2. These emissions would be incremental to the SRS baseline. If SRS is selected as the preferred site, a prevention of significant deterioration (PSD) increment analysis would be performed to determine whether the pit manufacturing activities would cause a significant pollutant emission increase.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because SRS is located in an attainment area for all criteria pollutants. Therefore,

although each alternative would emit criteria pollutants, a conformity review is not necessary. The maximum concentrations ($\mu\text{g}/\text{m}^3$) at the SRS site boundary that would be associated with the release of criteria pollutants were modeled and are presented in Table 5.8.4-3.

Table 5.8.4-2 — Annual Non-radiological Air Emissions for the CPC—Operations

Chemical Released	Quantity Released (kg/yr)
	200 ppy
Carbon dioxide	1,843,600
Carbon monoxide	8,580
Nitrogen dioxide	42,803.2
PM ₁₀	1,042.8
Sulfur dioxide	2,626.8
Total suspended particulates	2,820.4
Volatile organic compounds	2,626.8

Source: NNSA 2007.

Table 5.8.4-3 — Criteria Pollutant Concentrations at SRS Boundary for CPC—Operations

Pollutant	Averaging Times	Most Stringent Standard or Guideline ^a ($\mu\text{g}/\text{m}^3$)	Background Ambient Air Concentration	CPC—200 ppy Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)
Carbon Monoxide	8-hour ⁽¹⁾	10	No Data	2.58
	1-hour ⁽¹⁾	40	No Data	3.66
Lead	Quarterly Average	1.5	0.001	No Data
Nitrogen Dioxide	Annual	100	7.9	1.28
Particulate Matter (PM ₁₀)	Annual ⁽²⁾	50	17.6	0.0356
	24-hour ⁽¹⁾	150	36	0.18
Particulate Matter (PM _{2.5})	Annual ⁽³⁾	15	13.5	No Data
	24-hour ⁽⁴⁾	65	32.1	No Data
Ozone	8-hour ⁽⁵⁾	0.08 ppm	0.069 ppm	No Data
	1-hour ⁽⁶⁾	0.12 ppm	0.082 ppm	No Data
Sulfur Oxides	Annual	80	4.5	0.06296
	24-hour ⁽¹⁾	365	18.3	0.454
	3-hour ⁽¹⁾	1300	34.0	0.992
Total Suspended Particulates	Annual Geometric Mean	75	38.2	0.05

Source: SCDHEC 2005; Janke 2007.

¹ Not to be exceeded more than once per year.

² To attain this standard, the 3-year average of the weighted annual mean PM₁₀ concentration within an area must not exceed 50 $\mu\text{g}/\text{m}^3$.

³ To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations must not exceed 15.0 $\mu\text{g}/\text{m}^3$.

⁴ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations must not exceed 65 $\mu\text{g}/\text{m}^3$.

⁵ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations must not exceed 0.08 ppm.

⁶ (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1; (b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone non-attainment Early Action Compact (EAC) Areas.

These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. Because the estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative.

Radiological Impacts. Radioactive air emissions from pit manufacturing activities would involve plutonium, americium, and enriched uranium. The pit manufacturing activities would be performed within gloveboxes or vaults for radiological containment; and include plutonium recovery using aqueous or pyrochemical processes, foundry, machining, assembly, post assembly operations, inspection and certification, waste handling, and preparing the final product (pits) for shipment. Analytical operations would normally be conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before being released to the air via a 100-foot tall stack. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of entrained particles from the exhaust air.

NNSA estimated routine radionuclide air emissions (see Table 5.8.4-4). Releases would be small. Total radionuclide emissions at SRS would increase by less than 1 percent. To ensure that total emissions are not underestimated, NNSA’s method for estimating emissions was conservative. Therefore, actual emissions from pit manufacturing operations would be smaller.

Table 5.8.4-4 — Annual Radiological Air Emissions for the CPC at SRS—Operations

Isotope	Baseline ^a (Ci/yr)	Annual Emissions (Ci/yr)
Americium-241	2.67×10^{-4}	3.12×10^{-7}
Plutonium-239	2.20×10^{-3}	1.02×10^{-5}
Plutonium-240	8.51×10^{-7}	2.66×10^{-6}
Plutonium-241	6.70×10^{-6}	1.96×10^{-4}
Uranium-234	3.26×10^{-4}	5.02×10^{-9}
Uranium-235	1.10×10^{-5}	1.58×10^{-10}
Uranium-236	7.17×10^{-10}	2.56×10^{-11}
Uranium-238	4.12×10^{-4}	1.42×10^{-12}
Tritium	4.74×10^4	—
Krypton-85	6.47×10^4	—
All other	3.06×10^{-1}	—
Total	1.12×10^5	2.09×10^{-4}

^a Based on calendar year 2001 data. The No Action Alternative is represented by the baseline.
 Source: NNSA 2007.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding SRS. As shown in Table 5.8.4-5, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the processing facilities resulting from radiological air emissions are presented in Section 5.8.11.

Table 5.8.4-5 — Annual Doses Due to Radiological Air Emissions from CPC Operations at SRS

Receptor	CPC-200 ppy
Offsite MEI ^a (mrem/yr)	1.06×10^{-7}
Population within 50 miles (person-rem per year) ^a	5.9×10^{-7}

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.8.4-4 and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary.
Source: Tetra Tech 2007.

5.8.4.2.2 Noise

Construction

Construction of new buildings would involve the movement of workers and construction equipment and would result in some temporary increase in noise levels near the area. Noise sources associated with construction would not include loud impulsive sources such as blasting. Although noise levels in construction areas could be as high as 110 dBA, these high local noise levels would not extend far beyond the boundaries of the construction site. Table 5.8.4-6 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55-85 dBA. The *Environmental Impact Data Book* (Golden et al. 1980) suggests that noise levels higher than 80-85 dBA are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing wildlife outside a 400-foot radius of the construction site. Given the distance to the site boundary (approximately 6.7 miles) there would be no change in noise impacts on the public as a result of construction activities, except for a small increase in traffic noise levels from construction employees and material shipments.

Table 5.8.4-6 — Peak Noise Levels Expected from Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Operation

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations at the new buildings would be expected to be similar to those from existing operations. There would be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (approximately 6.7 miles) noise emissions from equipment would not likely disturb the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. But these noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur onsite and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with the operation of these facilities would likely produce increases in traffic noise levels along roads used to access the site.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.8.4.3 CCE Alternative

5.8.4.3.1 CNC (CPC + CUC)

Air Quality and Noise impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.4.2 as well as the impacts discussed below for the CUC.

5.8.4.3.1.1 Air Quality

Construction

CUC Non-radiological Impacts. Construction impacts would be similar to the construction impacts for a CPC (discussed above), as both facilities are similarly sized (approximately 650,000 square feet of floorspace) and have the same construction durations (6 years). As such, the non-radiological emissions presented in Table 5.8.4–1 would be representative of a CUC. Actual construction emissions of a CUC are expected to be less, since conservative emission factors and other assumptions were used to model CPC construction activities and tend to overestimate impacts.

CUC Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities.

Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Table 5.8.4-7 — Criteria Pollutant Concentrations at SRS for CUC and CNC—Operations

Pollutant	Averaging Times	Most Stringent Standard or Guideline ($\mu\text{g}/\text{m}^3$)	Background Ambient Air Concentration ($\mu\text{g}/\text{m}^3$)	CUC Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)	CNC Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)
Carbon Monoxide	8-hour ⁽¹⁾	10	No Data	0.2	2.78
	1-hour ⁽¹⁾	40	No Data	No Data	3.66
Lead	Quarterly Average	1.5	0.001	No Data	No Data
Nitrogen Dioxide	Annual	100	7.9	0.9	2.18
Particulate Matter (PM ₁₀)	Annual ⁽²⁾	50	17.6	52.4	52.4
	24-hour ⁽¹⁾	150	36	17.5	17.7
Particulate Matter (PM _{2.5})	Annual ⁽³⁾	15	13.5	0.02	0.02
	24-hour ⁽⁴⁾	65	32.1	0.2	0.2
Ozone	8-hour ⁽⁵⁾	0.08 ppm	0.069 ppm	No Data	No Data
	1-hour ⁽⁶⁾	0.12 ppm	0.082 ppm	No Data	No Data
Sulfur Oxides	Annual	80	4.5	2.1	2.16
	24-hour ⁽¹⁾	365	18.3	52.4	52.8
	3-hour ⁽¹⁾	1300	34.0	17.5	18.5
Total Suspended Particulates	Annual Geometric Mean	75	38.2	0.05 ⁽⁷⁾	0.1

Source: SCDHEC 2005; Janke 2007.

¹ Not to be exceeded more than once per year.

² To attain this standard, the 3-year average of the weighted annual mean PM₁₀ concentration at each monitor within an area must not exceed 50 $\mu\text{g}/\text{m}^3$.

³ To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu\text{g}/\text{m}^3$.

⁴ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 $\mu\text{g}/\text{m}^3$.

⁵ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

⁶ (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1 , as determined by appendix H.

(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone non-attainment Early Action Compact (EAC) Areas.

⁷ No data exists for TSP for the CUC. TSP concentrations estimated based on CPC data.

Operation

CUC and CNC Non-radiological Impacts. CUC activities would result in the release of criteria and toxic pollutants into the surrounding air. Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, and sulfur dioxide. The estimated emission rates for non-radiological pollutants were derived from existing Y-12 operations. The non-radiological pollutants were modeled to determine the incremental concentrations from a CUC to the SRS baseline. The results are presented in Table 5.8.4-7. Because the estimated emissions are maximum potential emissions

and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. CUC contribution to non-radiological emissions should not cause any standard or guideline to be exceeded. As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because SRS is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

CUC and CNC Radiological Impacts. A CUC would release radiological contaminants, primarily uranium, into the atmosphere during operations. The current design of a CUC nuclear facility calls for appropriately sized filtered HVAC systems. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from existing EU facilities at Y-12, and are likely to be less due to the incorporation of newer technology into the facility design. However, because detailed design information does not yet exist, these reductions cannot be quantified. As a result, for purposes of this SPEIS, the radiological airborne emissions from a CUC are conservatively estimated from existing operations at Y-12. An estimated 0.10 Curies (2.17 kg) of uranium was released into the atmosphere in 2004 as a result of Y-12 activities (DOE 2005a). After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding SRS, and SRS workers. The CAP88 code is a Gaussian plume dispersion model used to demonstrate compliance with the radionuclide NESHAP (40 CFR Part 61). Specific parameters, including meteorological data, source characteristics, and population data, were used to estimate the radiological doses.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding SRS. As shown in Table 5.8.4-8, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of a CUC resulting from radiological air emissions are presented in Section 5.8.11.

Table 5.8.4-8 — Annual Doses^a Due to Radiological Air Emissions from CUC and CNC Operations at SRS

Receptor	CUC	CNC
Offsite MEI ^a (mrem/yr)	3.36×10 ⁻³	3.36×10 ⁻³
Population within 50 miles (person-rem per year)	0.426	0.426

^a MEI and population dose estimates for the CUC and CNC operations were calculated using the uranium emission rates from the Y-12 ASER and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary
 Source: Tetra Tech 2007.

5.8.4.3.1.2 Noise

Construction

CUC. Anticipated noise impacts from the construction of a CUC are similar to those described for a CPC in Section 5.8.4.2.

Operation

CUC and CNC. Anticipated noise impacts from the operation of a CNC are similar to those described for a CPC in Section 5.8.4.2.

5.8.4.3.2 CNPC (CPC + CUC + A/D/HE Center)

Air quality and noise impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.4.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

5.8.4.3.2.1 Air Quality

Construction

A/D/HE Center Non-radiological Impacts. Non-radiological impacts of A/D/HE Center construction are expected to be similar to the impacts described above for a CPC and CUC. However, due to the potential to disturb approximately 300 acres of land during construction, modeling was performed to determine if PM₁₀ emissions (which were considered to be the most likely criteria pollutant to exceed regulatory limits) at the site boundary would exceed regulatory limits. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. Fugitive emissions were estimated based on the EPA emission factor of 1.20 tons/acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. The estimated maximum annual PM₁₀ emissions resulting from construction activities are presented in Table 5.8.4–8a. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts.

Table 5.8.4-8a — A/D/HE Center Construction — PM₁₀ Impacts

Parameter	Guideline or limit (µg/m ³)	Concentration at Site Boundary (µg/m ³)
Particulate Matter emitted: 1,620 tons/year		
Annual	50	0.15
24-hour	150	41.2

Source: Janke 2007.

The results presented above represent a conservative estimate if PM₁₀ emissions at the site boundary. As shown, concentrations would remain well below any regulatory limits.

A/D/HE Center Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, NNSA would survey potentially

affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

A/D/HE Center and CNPC Non-radiological Impacts. A CNPC would release non-radiological contaminants into the atmosphere during operations. CPC and CUC non-radiological emissions are discussed in sections 5.8.4.2.1 and 5.8.4.3.1 respectively, and are not repeated here. The total non-radiological air impacts of a CNPC would be additive of a CPC, CUC, and an A/D/HE Center (which is discussed in this section). During normal operations, an A/D/HE Center would release the non-radionuclides to the air in the quantities indicated in Table 5.8.4-9. These emissions would be incremental to the SRS baseline.

Table 5.8.4-9 — Annual Non-radiological Air Emissions, A/D/HE Center—Operations

NAAQS emissions (tons/year)	
Oxides of Nitrogen	91
Carbon Monoxide	31
Volatile Organic Compounds	31
Particulate Matter	18
Sulfur Dioxide	5
Hazardous Air Pollutants and Effluents	22

Source: NNSA 2007.

The maximum concentrations ($\mu\text{g}/\text{m}^3$) at the SRS site boundary that would be associated with the release of criteria pollutants presented in Table 5.8.4-10. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. There would be a potential to exceed the annual standards for PM-10 and PM-2.5. However, because the estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative. A site-specific EIS, if required, would address this issue, and the potential need for mitigation, in greater detail.

As part of its evaluation of the impact of air emissions, DOE consulted the Guidance on CAA Conformity requirements (DOE 2000a). DOE determined that the General Conformity rule does not apply because SRS is located in an attainment area for all criteria pollutants. Therefore, although each alternative would emit criteria pollutants, a conformity review is not necessary.

Table 5.8.4-10 — Criteria Pollutant Concentrations at the SRS Site Boundary for the CNPC—Operations

Pollutant	Averaging Times	Most Stringent Standard or Guideline (µg/m ³)	Background Ambient Air Concentration (µg/m ³)	A/D/HE Center Maximum Incremental Concentration (µg/m ³)	CNPC Maximum Incremental Concentration (µg/m ³)
Carbon Monoxide	8-hour ⁽¹⁾	10	No Data	1.91	4.69
	1-hour ⁽¹⁾	40	No Data	5.8	9.46
Lead	Quarterly Average	1.5	0.001		
Nitrogen Dioxide	Annual	100	7.9	0.01	2.19
Particulate Matter (PM ₁₀)	Annual ⁽²⁾	50	17.6	0.0019	52.4
	24-hour ⁽¹⁾	150	36	0.5	18.2
Particulate Matter (PM _{2.5})	Annual ⁽³⁾	15	13.5	0.0019	52.4
	24-hour ⁽⁴⁾	65	32.1	0.5	18.2
Ozone	8-hour ⁽⁵⁾	0.08 ppm	0.069 ppm	No Data	No Data
	1-hour ⁽⁶⁾	0.12 ppm	0.082 ppm	No Data	No Data
Sulfur Oxides	Annual	80	4.5	0.005	2.16
	24-hour ⁽¹⁾	365	18.3	0.14	52.94
	3-hour ⁽¹⁾	1300	34.0	0.62	19.1
Total Suspended Particulates	Annual Geometric Mean	75	38.2	0.0024	0.1

Source: SCDHEC 2005; Janke 2007.

¹ Not to be exceeded more than once per year.

² To attain this standard, the 3-year average of the weighted annual mean PM₁₀ concentration at each monitor within an area must not exceed 50 µg/m³.

³ To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m³.

⁴ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 µg/m³.

⁵ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

⁶ (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1, as determined by appendix H.

(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone non-attainment Early Action Compact (EAC) Areas.

A/D/HE Center and CNPC Radiological Impacts. A CNPC would release radiological contaminants into the atmosphere during operations. CPC and CUC radiological emissions are discussed in sections 5.8.4.2.1 and 5.8.4.3.1 respectively, and are not repeated here. The total radiological air impacts of a CNPC would be additive of a CPC, CUC, and an A/D/HE Center (which is discussed in this section).

During normal operations, an A/D/HE Center would release the radionuclides to the air in the quantities indicated in Table 5.8.4-11.

Table 5.8.4-11 — Annual Radiological Air Emissions for A/D/HE Center Operations

Radionuclide	Emissions (Ci)
Tritium (Ci)	1.41×10^{-2}
Total Uranium (Ci)	7.50×10^{-5}
Total Other Actinides (Ci)	2.17×10^{-15}

Source: NNSA 2007.

After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the MEI, the populations surrounding SRS, and SRS workers. NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding SRS. As shown in Table 5.8.4-12, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of an A/D/HE Center resulting from radiological air emissions are presented in Section 5.8.11.

Table 5.8.4-12 — Annual Doses Due to Radiological Air Emissions from A/D/HE Center Operations at SRS

Receptor	A/D/HE	CNPC
Offsite MEI ^a (mrem/yr)	2.52×10^{-5}	3.38×10^{-3}
Population within 50 miles (person-rem per year)	3.19×10^{-3}	0.429

^a The offsite MEI is assumed to reside at the site boundary.

Source: Tetra Tech 2007.

5.8.4.3.2.2 Noise

Construction

A/D/HE Center. Anticipated noise impacts from the construction of an A/D/HE Center would be similar to those described for a CPC in Section 5.8.4.2.

Operation

A/D/HE Center and CNPC. Anticipated noise impacts from the operation of an A/D/HE Center and CNPC would be similar to those described for a CPC in Section 5.8.4.2.

5.8.4.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to air quality, SRS is located within the Augusta-Aiken Interstate AQCR. All areas within this region are classified as achieving attainment with the NAAQS (40 CFR 50). Reduced tritium operations would have no significant impact on non-radiological air quality at SRS. With respect to radiological emissions, normal operations tritium air emissions could decrease to approximately 2,500 Curies. In 2005, the estimated dose from atmospheric releases to the MEI was 0.05 mrem, which is 0.5 percent of the DOE Order 5400.5 air pathway standard of 10 mrem per year. Tritium oxide releases accounted for 66 percent of the dose to the MEI. Reducing tritium emissions would not significantly change this already small dose.

5.8.5 Water Resources

Environmental impacts associated with the proposed alternatives at SRS could affect groundwater resources. No impacts to surface water are expected. At SRS, groundwater resources would likely be used to meet all construction and operations water requirements. Table 5.8.5–1 summarizes existing surface water and groundwater resources at SRS, the total SRS site-wide water resource requirements for each alternative, and the potential changes to water resources at SRS resulting from the proposed alternatives.

Table 5.8.5–1 — Potential Changes to Water Resources from the CPC, CNC, and CNPC at SRS - Construction

Proposed Alternatives	Water Availability and Use
No Action Alternative	
Water source	Ground
Water Use (gallons per year)	3,500,000,000
CPC	
Water Requirement (total gallons)	20,900,000
Percent change from No Action Alternative	<1%
CUC	
Water Requirement (total gallons)	5,200,000
Percent change from No Action Alternative	<1%
A/D/HE Center	
Water Requirement (total gallons)	2,022,000
Percent change from No Action Alternative	<1%

Source: NNSA 2007.

5.8.5.1 *No Action Alternative*

The regional drainage is dominated by the north to south running Savannah River. The Savannah River is classified as a freshwater source that is suitable for primary and secondary contact recreation, drinking after appropriate treatment, balanced native aquatic species development, and industrial and agricultural purposes. Data from the river’s monitoring locations generally indicate that South Carolina’s freshwater standards are being met (NRC 2005). SRS is expected to continue using approximately 3.5 billion gallons of water per year.

The SRS is underlain by southeast-dipping wedges of unconsolidated sediments of the Atlantic Coastal Plain that extends from its contact with the Piedmont Province at the Fall Line to the edge of the continental shelf. Contaminant fate and transport models predict that the aquifer is expected to return to an uncontaminated state within 2 to 115 years, depending on the specific contaminant (NRC 2005).

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional

impacts to water resources beyond current and planned activities that are independent of this action. Existing water resources are discussed in Section 4.8.5.

5.8.5.2 DCE Alternative (CPC)

5.8.5.2.1 Surface Water

Construction

Surface water would not be used to support the construction of a CPC at SRS as groundwater is the source of water at SRS. Therefore, there would be no impact to surface water availability from construction. Sanitary wastewater would be generated by construction personnel. As plans include use of portable toilets, no onsite discharge of sanitary wastewater would be minimized.

During construction, an estimated 10.5 million gallons of liquid wastes would be generated. It is expected that construction should take approximately 6 years. Assuming an equal generation of liquid waste over that timeframe, it is estimated that 1.75 million gallons per year of liquid waste would be generated. It is estimated that one-third of the liquid wastes generated during construction would be from sanitary wastewater, with the remaining amount attributed to concrete construction activities. Water runoff from construction would be handled according to SRS's NPDES permit for stormwater involving construction activities.

The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. SRS would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities.

The CPC reference location at SRS is not within the 100-year floodplain. Therefore, no impact on the floodplain is anticipated. Information concerning the 500-year floodplain in the area of the reference location is not available.

Operation

No impacts on surface water resources are expected as a result of operations at SRS. No surface water would be used to support facility activities. Sanitary wastewater would be generated as a result of operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. SRS's current NPDES permit would require modification and approval concerning any increase in wastewater discharges. Sanitary wastewater would be treated, monitored, and discharged into site streams and the Savannah River, as required under SRS's NPDES permit. No industrial or other NPDES-regulated discharges to surface waters are anticipated.

The CPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers

in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, analyzed, and only discharged if uncontaminated. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CPC liquid process waste facilities for the plutonium purification process.

Table 5.8.5–2 — Changes to Water Resources from CPC, CNC, and CNPC - Operation

Proposed Alternatives	Water Availability and Use
No Action Alternative	
Water source	Ground
Water Use (gal/yr)	3,500,000,000
CPC	
Water Requirement (gal/yr)	80,500,000
Percent change from No Action Alternative	2.3%
CUC	
Water Requirement (gal/yr)	105,000,000
Percent change from No Action Alternative	3%
CNC (CPC + CUC)	
Water Requirement (gal/yr)	185,500,000
Percent change from No Action Alternative	5.3%
A/D/HE Center	
Water Requirement (gal/yr)	130,000,000
Percent change from No Action Alternative	3.7%
CNPC (CPC + CUC + A/D/HE Center)	
Water Requirement (gal/yr)	315,500,000
Percent change from No Action Alternative	9%

Source: NNSA 2007.

5.8.5.2.2 Groundwater

Construction

Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require 20,900,000 gallons, of groundwater. The percent change from the No Action Alternative would be less than 1 percent. The total site water requirement including these

quantities would be feasible since SRS has absolute ownership of the groundwater resource underlying SRS land and has no limit on the amount of water withdrawn annually.

There would be no onsite discharge of wastewater to the surface or subsurface, and appropriate spill prevention controls, and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

Operation

Activities at SRS for a CPC would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. Approximately 80.5 million gallons per year is needed for the operation of a CPC. This would represent a 2.3% increase in water use at SRS. SRS has absolute ownership of the groundwater resource underlying SRS land and has no restrictions on the amount of groundwater withdrawn annually. However, SRS withdrawal routinely exceeds 100,120 gallons per day of water, and therefore the withdrawal rate is reported to the South Carolina Water Resource Commission.

No sanitary or industrial effluent would be discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.8.5.3 *CCE Alternative*

5.8.5.3.1 *CNC (CPC + CUC)*

Water resources impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.5.2 as well as the impacts discussed below.

Surface Water

CUC Construction. Surface water would not be used to support the construction of a CUC at SRS as groundwater is the source of water at SRS. Therefore, there would be no impact to surface water availability from construction. The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. SRS would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities.

The CUC reference location at SRS is not within the 100-year floodplain. Therefore, no impact on the floodplain is anticipated. Information concerning the 500-year floodplain in the area of the reference location is not available.

CNC Operation. No impacts on surface water resources are expected as a result of operations at SRS. No surface water would be used to support facility activities. Sanitary wastewater would be generated as a result of operations stemming from staff use of lavatory, shower, and breakroom facilities, and from miscellaneous potable and sanitary uses. SRS's current NPDES permit would require modification and approval concerning any increase in wastewater discharges. Sanitary wastewater would be treated, monitored, and discharged into site streams and the Savannah River, as required under SRS's NPDES permit. No industrial or other NPDES-regulated discharges to surface waters are anticipated. Minimal impacts to groundwater quality are expected from the operation of a CNC because groundwater extracted would be collected and treated in on-site treatment facilities to meet the discharge limits of the NPDES permit prior to release to surface water. Utility and sanitary wastewater would be treated prior to discharge in accordance with the applicable permits.

A CNC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CNC liquid process waste facilities for the plutonium purification process.

Groundwater

CUC Construction. Water would be required during construction for such uses as dust control and soil compaction, washing and flushing activities, and meeting the potable and sanitary needs of construction employees. The proposed use of portable toilets by construction personnel would greatly reduce water use over that normally required during construction. In addition, the water required for concrete mixing would likely be procured offsite. As a result, it is estimated that construction activities would require 5.2 million gallons of groundwater. The percent change from the No Action Alternative is less than 1 percent. The total site water requirement including these quantities would be feasible since SRS has absolute ownership of the groundwater resource underlying SRS land and has no limit on the amount of water withdrawn annually.

There would be no onsite discharge of wastewater to the surface or subsurface, and appropriate spill prevention controls, and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNC Operation. Activities at SRS for a CNC would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. The percent change from the No Action Alternative would be 5.3 percent. SRS has absolute ownership of the groundwater resource underlying SRS land and has no restrictions on the amount of groundwater withdrawn annually.

No sanitary or industrial effluent would be discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control.

5.8.5.3.2 CNPC (CPC + CUC + A/D/HE Center)

Water resource impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.5.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Surface Water

A/D/HE Center Construction. Surface water impacts from the construction of an A/D/HE Center would be similar to those discussed for the construction of a CPC and CUC.

CNPC Operation. Surface water impacts from the operation of an A/D/HE Center would be similar to those discussed for a CPC and CUC.

Groundwater

A/D/HE Center Construction. It is estimated that construction activities would require approximately 2 million gallons of groundwater. Additional impacts from the construction of an A/D/HE Center would be similar to those discussed for the construction of a CPC and CUC.

CNPC Operation. Activities at SRS for a CNPC would use groundwater primarily to meet the potable and sanitary needs of facility support personnel and for cooling tower water makeup. The percent change in water consumption from the No Action Alternative would be approximately 9 percent. SRS has absolute ownership of the groundwater resource underlying SRS land and has no restrictions on the amount of groundwater withdrawn annually.

No sanitary or industrial effluent would be discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control.

5.8.5.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to water resources, the reduction in water use would be inconsequential, as SRS has plentiful water supplies. Reduced operations could reduce tritium effluents. Tritium accounts for more than 99 percent of the total amount of radioactivity released from the site to the Savannah River. In 2005, a total of 4,480 Ci of tritium were released to the river. This total—based on the measured tritium concentration at River Mile 118.8—includes releases from Georgia Power Company's Vogtle Electric Generating Plant (1,860 Ci). The 12-month average tritium concentration measured in Savannah River water

near River Mile 118.8 (5.46×10^{-4} pCi per liter) was 17 percent less than the 2004 concentration of 6.61×10^{-4} pCi per liter. These concentrations are well below the EPA maximum tritium contaminant level of 20,000 pCi per liter for drinking water.

5.8.6 Geology and Soils

5.8.6.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to geology and soil resources beyond current and planned construction of the MOX/PDCF facilities which are expected to have minor impacts on Coastal Plain Sediments, which would be mitigated by soil erosion and surface water runoff protective measures. Existing geology and soils resources are discussed in Section 4.8.6.

5.8.6.2 *DCE Alternative (CPC)*

5.8.6.2.1 Construction

The construction of a CPC is expected to disturb land adjacent to existing facilities at SRS. An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the CPC. The land required for the proposed CPC construction would represent 0.07 percent of SRS's total land area of 310 square miles. The reference location has adequate space to accommodate the total CPC footprint, whether a Greenfield facility or use of the MOX/PDCF infrastructure. The post-construction developed area would be approximately 110 acres.

While the soils that would be disturbed are classified as prime farmland, the disturbed area would not be converted from farming to other purposes as it is not presently farmed. The FPPA (7 USC 4201 et seq.) and associated regulations require agencies to make evaluations of the conversion of farmland to non-agricultural uses by Federal projects and programs. SRS is exempt from FPPA under section 1540(c)(4) since the acquisition of SRS property occurred prior to FPPA's effective date of June 22, 1982 (7 USC 4201 et seq.).

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at SRS, but these resources are abundant in the South Carolina area. In addition to CPC construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. Because the land area to be disturbed is relatively small, the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's environmental restoration program and in accordance with appropriate requirements and agreements. Construction of a CPC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

As discussed in Chapter 4, there are no faults located within SRS. While the risk for an earthquake exists in association with faults offsite, ground shaking could occur that would affect primarily the integrity of inadequately designed or non-reinforced structures, but not damaging property or specially designed facilities. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines. Thus, site geologic conditions would not likely affect the facilities.

5.8.6.2.2 Operation

The operation of a CPC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1B, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.8.6.3 CCE Alternative

5.8.6.3.1 CNC (CPC + CUC)

Geologic and soil resource impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.6.2 as well as the impacts discussed below.

Construction

CUC. A CUC would primarily be made up of a new structure to contain a nuclear facility composed of the Uranium Processing Facility (UPF) and HEU storage (described in Sections 3.4.2 and 3.5.1.1) within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. The land required for CUC construction would represent 0.03 percent of SRS's total land area of 310 square miles. The reference location has adequate space to accommodate the total facilities footprint.

While the soils that would be disturbed are classified as prime farmland, the disturbed area would not be converted from farming to other purposes as it is not presently farmed. The Farmland Protection Policy Act (FPPA) (7 USC 4201 et seq.) and associated regulations require agencies to make evaluations of the conversion of farmland to non-agricultural uses by Federal projects and programs. SRS is exempt from FPPA under section 1540(c)(4) since the acquisition of SRS property occurred prior to FPPA's effective date of June 22, 1982 (7 USC 4201 et seq.).

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at SRS, but these resources are abundant in the South Carolina area. In addition to CUC construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. Because the land area to be disturbed is relatively small, the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to

commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's environmental restoration program and in accordance with appropriate requirements and agreements. Construction of a CUC would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

As discussed in Chapter 4, there are no faults located within SRS. While the risk for an earthquake exists in association with faults offsite, ground shaking could occur that would affect primarily the integrity of inadequately designed or non-reinforced structures, but not damaging property or specially designed facilities.

Operation

CNC. An estimated 195 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNC. Of this, approximately 55 acres would be located within a PIDAS. The land required for CNC operations would represent 0.09 percent of SRS's total land area of 310 square miles, an extremely small proportion.

The operation of a CNC would not be expected to result in impacts on geologic and soil resources. New, upgraded, and modified facilities would be evaluated, designed, and constructed in accordance with DOE Order 420.1, which requires that nuclear and non-nuclear facilities be designed, constructed, and operated so that workers, the public, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes.

5.8.6.3.2 CNPC (CPC + CUC + A/D/HE Center)

Geologic and soil resource impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.6.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. Construction of an A/D/HE Center would require an estimated 300 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace. The land required for A/D/HE Center construction would represent 0.03 percent of SRS's total land area of 310 square miles. The reference location has adequate space to accommodate the total facilities footprint.

While the soils that would be disturbed are classified as prime farmland, the disturbed area would not be converted from farming to other purposes because it is not presently farmed. The FPPA (7 USC 4201 et seq.) and associated regulations require agencies to make evaluations of the conversion of farmland to non-agricultural uses by Federal projects and programs. SRS is exempt from FPPA under section 1540(c)(4) because the acquisition of SRS property occurred prior to FPPA's effective date of June 22, 1982 (7 USC 4201 et seq.).

Aggregate and other geologic resources (e.g., sand) would be required to support construction activities at SRS, but these resources are abundant in the South Carolina area. In addition to A/D/HE Center construction and upgrades, excavation to remove and replace some existing utility systems would also be conducted. Because the land area to be disturbed is relatively small, the impact on geologic and soil resources would be relatively minor. The potential exists for contaminated soils and possibly other media to be encountered during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under the site's environmental restoration program and in accordance with appropriate requirements and agreements. Construction of the A/D/HE Center would require a stormwater permit that would address erosion control measures to minimize the impacts of erosion.

As discussed in Chapter 4, there are no faults located within SRS. While the risk for an earthquake exists in association with faults offsite, ground shaking could occur that would affect primarily the integrity of inadequately designed or non-reinforced structures, but not damaging property or specially designed facilities. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines. Thus, site geologic conditions would not likely affect the facilities.

Operation

CNPC. An estimated 545 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNPC. Of this, approximately 235 acres would be located within a PIDAS. The operation of a CNPC would not be expected to result in impacts on geologic and soil resources.

5.8.6.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to geology and soils, reduced operations would have no impact.

5.8.7 *Biological Resources*

5.8.7.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to biological resources beyond current and planned activities that are independent of this action. Small animals, reptiles and birds may be temporarily dislocated during the construction process, but no permanent changes to biological resources are expected as a result of construction and operation of the MOX/PDCF facilities. Existing biological resources are discussed in Section 4.8.7.

5.8.7.2 DCE Alternative (CPC)

5.8.7.2.1 Terrestrial Resources

Construction

The area identified for construction of a CPC is located on a heavily wooded tract that is topographically flat and in an area that supports a wide diversity of birds, mammals, reptiles, amphibians, and aquatic species.

Approximately 140 acres of forest and associated wildlife habitat would be cleared or modified during CPC construction. During site-clearing activities, highly mobile wildlife species or wildlife species with large home ranges (such as deer and birds) would be able to relocate to adjacent undeveloped areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. Species relocation may result in additional pressure to lands already at or near carrying capacity. The impacts could include stress and over-wintering mortality. For less mobile species (reptiles, amphibians, and small mammals), direct mortality could occur during the actual construction event or ultimately result from habitat alteration. Acreage used for the development also would be lost as potential hunting habitat for raptors and other predators.

Operation

Approximately 110 acres of land would be modified or lost from operation of a CPC. In addition to the areas to be disturbed, there would be a decrease in quality of the habitat immediately adjacent to the proposed development due to increased noise level, traffic, lights, and other human activity, both pre- and post-construction. The adjacent habitat also would experience a loss of quality from the reduction in size, segmentation of the habitat, and restriction on mobility for some species (Kelly and Rotenberry 1993).

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect terrestrial resources. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations would minimize the potential for any adverse affects to plant and animal communities (terrestrial resources) in the surrounding environment.

5.8.7.2.2 Wetlands

Construction

Of the known 300 isolated upland Carolina bays and wetland depressions at SRS, none are located on the CPC site (Salomone 2002). Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid any indirect

degradation to wetlands in the area. Should SRS be selected, the potential for indirect wetland impacts exists, and the site-specific tiered EIS would analyze those potential impacts.

Operation

There are no adverse impacts predicted to wetlands from implementation of any of a CPC production capacities. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CPC operations are not expected to adversely affect any wetlands.

5.8.7.2.3 Aquatic Resources

This site is located on a topographic divide, so surface drainage is both west toward Upper Three Runs and east toward Fourmile Branch. Upper Three Runs is considered to be a valuable aquatic resource, not only to SRS, but also to regional ecosystem biodiversity (Salomone 2002).

Construction

There are no perennial or seasonal aquatic habitats within the CPC location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downslope and within the SRS watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

Operation

There would be no direct discharge of untreated operational effluent from CPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas are not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other SRS built environments and the quantity would represent a very minor contribution to the watershed.

5.8.7.2.4 Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at SRS, are known to be present within the proposed site location. Prior to any construction activities, NNSA would consult with the USFWS, as appropriate, to discuss the potential impacts of any new facilities on any threatened and endangered species. There are no known threatened or endangered species or species proposed for listing present at the proposed CPC, CUC, and A/D/HE Center site (Salomone 2002).

Construction

Approximately 140 acres of forest and associated wildlife habitat would be cleared or modified during CPC construction. Should SRS be selected for the construction and operation of a CPC, then DOE, prior to any habitat modifying activities, would conduct site-specific surveys at the appropriate time and assess, in concert with the USFWS, the potential impacts to special-interest species. Acreage temporarily modified from construction would be lost as potential habitat, foraging areas, or hunting habitat for special interest species until the area revegetates. Revegetation would probably occur within a 1-3 year timeframe depending upon site maintenance and climate conditions.

Operation

Approximately 110 acres of land would be permanently modified or lost as habitat, foraging areas, or as a prey base for species of special interest. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls for pit production, CPC operations would minimize the potential impacts to any special-interest species population.

5.8.7.3 CCE Alternative

5.8.7.3.1 CNC (CPC + CUC)

Biological resource impacts from the construction and operation of the CNC would include the CPC impacts discussed in Section 5.8.7.2 as well as the impacts discussed below.

Terrestrial Resources

CUC Construction. The area identified for construction of a CUC is located on a heavily wooded tract that is topographically flat (Salomone 2002) and in an area that supports a wide diversity of birds, mammals, reptiles, amphibians, and aquatic species. Approximately 50 acres of land would be modified during CUC construction. Impacts would be similar to those described for the construction of a CPC in Section 5.8.7.2.1.

CNC Operation. An estimated 195 acres of land would be modified or lost. Of this, approximately 55 acres would be located within a PIDAS. Impacts would be similar to those described for a CPC in Section 5.8.7.2.1.

Wetlands

CUC Construction. Of the known 300 isolated upland Carolina bays and wetland depressions at SRS, none are located on the CUC site (Salomone 2002). Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid

any indirect degradation to wetlands in the area. Should SRS be selected, the potential for indirect wetland impacts exists, and the site-specific tiered EIS would analyze those potential impacts.

CNC Operation. There are no adverse impacts predicted to wetlands from operation of a CNC. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations are not expected to adversely affect any wetlands.

Aquatic Resources

CUC Construction. There are no perennial or seasonal aquatic habitats within the proposed CUC location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downslope and within the SRS watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNC Operation. There would be no direct discharge of untreated operational effluent from CNC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas are not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other SRS built environments and the quantity would represent a very minor contribution to the watershed.

Threatened and Endangered Species

CUC Construction. Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. There are no known threatened or endangered species or species proposed for listing present at the proposed CUC site (Salomone 2002).

CNC Operation. Acreage permanently modified or lost as habitat, foraging areas, or as a prey base for species of special interest would be approximately 195 acres. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNC operations would minimize the potential impacts to any special-interest species population.

5.8.7.3.2 CNPC (CPC + CUC + A/D/HE Center)

Biological resources impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.8.7.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Terrestrial Resources

A/D/HE Center Construction. An estimated 300 acres of land would be required to construct the A/D/HE Center. Additional impacts would be similar to those described for a CPC in Section 5.8.7.2.1.

CNPC Operation. An estimated 545 acres of land would be required to support CNPC operations. Potential impacts would be similar to those described in Section 5.8.7.2.1.

Wetlands

A/D/HE Center Construction. Of the known 300 isolated upland Carolina bays and wetland depressions at SRS, none are located on the A/D/HE Center site (Salomone 2002). Therefore, there would be no direct impacts to wetlands. Implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan would avoid any indirect degradation to wetlands in the area. Should SRS be selected, the potential for indirect wetland impacts exists, and the site-specific tiered EIS would analyze those potential impacts.

CNPC Operation. There are no adverse impacts predicted to wetlands from implementation of any of the CNPC production capacities. There would be no direct untreated effluent discharges to the environment. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNPC operations are not expected to adversely affect any wetlands.

Aquatic Resources

A/D/HE Center Construction. There are no perennial or seasonal aquatic habitats within the proposed A/D/HE Center location. Thus, there would be no direct impacts to aquatic resources. Indirect effects to aquatic resources downslope and within the SRS watershed would be avoided by implementation of standard construction practices to minimize site runoff and erosion along with implementation of a stormwater pollution prevention plan.

CNPC Operation. There would be no direct discharge of untreated operational effluent from CNPC operations. Stormwater runoff from new facilities, roadways, parking lots, and other impervious areas are not predicted to result in any indirect adverse impacts on area aquatic resources. The quality of runoff waters would be similar to runoff from other SRS built environments and the quantity would represent a very minor contribution to the watershed.

Threatened and Endangered Species

A/D/HE Center Construction. An estimated 300 acres of land would be modified or lost during construction activities for an A/D/HE Center. Additional impacts would be similar to those described for the construction of a CPC in Section 5.8.7.2.1.

CNPC Operation. Acreage permanently modified or lost as habitat, foraging areas, or as a prey base for species of special interest would be approximately 545 acres. There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, CNPC operations would minimize the potential impacts to any special-interest species population.

5.8.6.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to biological resources, reduced operations would have no impact.

5.8.8 **Cultural and Archaeological Resources**

5.8.8.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to cultural and archeological resources beyond current and planned activities that are independent of this action. Construction of the MOX/PDCF facilities are not expected to impact any of the 800 recorded archeological sites at SRS. Prior to any soil disturbance, a thorough screening of all recorded sites and an on-site investigation for the presence of archeological sites or artifacts would be conducted. Existing cultural and archaeological resources are discussed in Section 4.8.8.

5.8.8.2 *DCE Alternative (CPC)*

5.8.8.2.1 **Cultural Resources**

Construction

CPC. Under this alternative, a block of land would be disturbed during construction. The size of the disturbed area would vary by the output of the facility, and would include SRS buildings and structures (inside the PIDAS fence), security fencing and perimeter roads, support buildings and parking, a retention basin, a concrete batch plant, a construction laydown area, and buffer zone surrounding the facility. For purposes of analyzing impacts to cultural resources, approximately 140 acres of land could be disturbed/affected.

The presence of cultural resources that would be impacted during construction of a CPC at the reference location or any other location at SRS is unknown. However, the reference location at SRS is located in Archaeological Zone 2 (moderate archaeological potential) and very close to Zone 1 (high archaeological potential). This location has not been previously disturbed by construction. Thus, there is a moderate probability that cultural resources are located within the reference location and would be impacted by the construction of a CPC. The probability that

resources would be disturbed by construction of a CPC at another location within SRS is dependent on what archaeological zone the facility would be located in and whether that location has been previously disturbed. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

Because the exact location of a CPC at SRS is not yet determined, cultural resources arising from infrastructure construction (such as water, sewer, gas, electricity, access roads) are not analyzed here, but will be in the site-specific tiered EIS. However, like the facility itself, the greater the number of acres disturbed, the greater the possibility for impacts to cultural resources.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by construction of a CPC. Methods for identification could include field survey, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the South Carolina SHPO and in accordance with the *Archaeological Resources Management Plan of the Savannah River Archaeological Research Program* (SRARP 1989). If previously unknown cultural resources, such as subsurface resources, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the South Carolina SHPO.

Operation

CPC. Operation of the CPC would have no impact on cultural resources.

5.8.8.2.2 Archaeological Resources

Construction

CPC. Archaeological resources at SRS are comprised exclusively of marine invertebrate fossils. These types of fossils are relatively widespread and common, and have a relatively low research potential or scientific value, except for deposits containing giant oysters. Thus, it is probable that archaeological resources would be impacted due to construction of a CPC or the associated infrastructure at the reference location. This is also true for any other area at SRS. The probability for impacts to archaeological resources would increase with an increase in the number of acres disturbed.

Archaeological resources would be included in the scope of any cultural resource inventories conducted prior to the beginning of construction. If previously unknown archaeological resources are discovered during construction, activities in the area of the discovery would stop and the discovery would be treated appropriately, as determined by DOE.

Operation

CPC. Operation of a CPC would have no impact on archaeological resources.

5.8.8.3 ***CCE Alternative***

5.8.8.3.1 **CNC (CPC + CUC)**

Cultural and archaeological resources impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.8.2 as well as the impacts discussed below.

Cultural Resources

CUC Construction. As described in Section 3.5.2, a CUC would be comprised of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Construction of these facilities would require approximately 50 acres of land, which includes a construction laydown area and temporary parking. Upon construction completion, the construction laydown area and temporary parking area would be removed and the area could be returned to its original state. Once constructed, a CUC would be approximately 35 acres. All buildings would be either one or two stories.

The presence of cultural resources that would be impacted during construction of a CUC at the reference location or any other location at SRS is unknown. However, the reference location at SRS is located in Archaeological Zone 2 (moderate archaeological potential) and very close to Zone 1 (high archaeological potential). This location has not been previously disturbed by construction. Thus, there is a moderate probability that cultural resources are located within the reference location and would be impacted by the construction of a CUC. The probability that resources would be disturbed by construction of a CUC at another location within SRS is dependent on what archaeological zone the facility would be located in and whether that location has been previously disturbed. Although the number of resources that would be impacted is unknown, the probability for resource impacts would increase with an increase in the number of acres disturbed.

Because the exact location of a CUC at SRS is not yet determined, cultural resources arising from infrastructure construction (such as water, sewer, gas, electricity, access roads) are not analyzed here, but will be in the site-specific tiered EIS. However, like the facility itself, the greater the number of acres disturbed, the greater the possibility for impacts to cultural resources.

Prior to any ground-disturbing activity, NNSA would identify and evaluate any cultural resources that could potentially be impacted by construction of a CUC. Methods for identification could include field survey, shovel tests, archival research, and consultation with interested Native American tribes. NNSA would determine the possibility for impacts to the resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the South Carolina SHPO and in accordance with the *Archaeological Resources Management Plan of the Savannah River Archaeological Research*

Program (SRARP 1989). If previously unknown cultural resources, such as subsurface resources, are discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by NNSA in consultation with the South Carolina SHPO.

CNC Operation. Operation of a CNC would have no impact on cultural resources.

Archaeological Resources

CUC Construction. It is probable that archaeological resources would be impacted due to construction of a CUC or the associated infrastructure at the reference location. This is also true for any other area at SRS. The probability for impacts to archaeological resources would increase with an increase in the number of acres disturbed.

Archaeological resources would be included in the scope of any cultural resource inventories conducted prior to the beginning of construction. If previously unknown archaeological resources are discovered during construction, activities in the area of the discovery would stop and the discovery would be treated appropriately, as determined by DOE.

CNC Operation. Operation of a CNC would have no impact on cultural resources.

5.8.8.3.2 CNPC (CPC + CUC + A/D/HE Center)

Cultural and archaeological resource impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.8.8.2, the CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Cultural Resources

A/D/HE Center Construction. Approximately 300 acres of land would be disturbed during construction activities of an A/D/HE Center. Additional impacts to cultural resources would be similar to those described for the construction of a CPC in Section 5.8.8.2.1

CNPC Operation. Operation of a CNPC would have no impact on cultural resources.

Archaeological Resources

A/D/HE Center Construction. Approximately 300 acres of land would be disturbed during construction activities of an A/D/HE Center. Additional impacts to archaeological resources would be similar to those described for the construction of the CPC in Section 5.8.8.2.2

CNPC Operation. Operation of a CNPC would have no impact on cultural resources.

5.8.8.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to cultural resources, reduced operations would have no impact.

5.8.9 **Socioeconomics**

This section analyzes the impacts to socioeconomic resources from the No Action Alternative, DCE Alternative, CCE Alternative, and Capability-Based Alternative.

5.8.9.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to socioeconomic resources beyond current and planned activities that are independent of this action. The current employment level at SRS is about 15,000 employees. The construction of the MOX/PDCF facilities would add about 1,968 construction jobs to this level and the operation of these two facilities would require 1,120 additional employees. Existing socioeconomic characteristics at SRS are discussed in Section 4.8.9.

5.8.9.2 *DCE Alternative (CPC)*

5.8.9.2.1 **Regional Economy Characteristics**

Construction

Construction of a CPC would require approximately 2,900 worker-years of labor. During peak construction, about 850 workers would be employed at the site for a Greenfield CPC, and 770 workers for the MOX/PDCF option. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. For a Greenfield CPC, it is estimated that 611 indirect jobs would be created, for a total of 1,461 jobs. This represents less than 1 percent of the total ROI labor force.

ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$32,300 for the construction industry, direct income would increase by \$27.5 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$44.5 million (\$27.5 million direct and \$17 million indirect). Table 5.8.9-1 presents the impacts to socioeconomic resources from construction of the CPC.

Table 5.8.9-1 — Socioeconomic Impacts from Construction of Greenfield CPC

Socioeconomic Resource	CPC
Worker Years	2,900
Peak Workers	850
Indirect Jobs Created	611
Total Jobs Created	1,461
ROI Average Earning	\$32,300
Direct Income Increase	\$27,455,000
Indirect Income Increase	\$17,025,000
Total Impact to the ROI	\$44,480,000

Source: NNSA 2007, BEA 2007a.

Operation

Operation of a CPC would require 1,780 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 1,573 indirect jobs would be created, for a total of 3,353 jobs. The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$40,600 for the government services industry, direct income would increase by \$72.3 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$108.2 million (\$72.3 million direct and \$35.9 million indirect). Table 5.8.9-2 illustrates the impacts to socioeconomic resources from operation of a CPC.

5.8.9.2.2 Population and Housing

Construction

The influx of new workers would increase the ROI population and could create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (850 new workers), 1,275 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-1 presents the impacts to socioeconomic resources from construction of a CPC.

Operation

The influx of new workers would increase the ROI population and could create new housing demand. This analysis assumes that one-third of the operational jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,780 new workers), 1,780 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-2 illustrates the impacts to socioeconomic resources from operation of the CPC.

5.8.9.2.3 Community Services

Construction

The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.8.9-1 presents the impacts to socioeconomic resources from construction of a CPC.

Operation

The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing Table 5.8.9-2 illustrates the impacts to socioeconomic resources from operation of a CPC.

Table 5.8.9-2 — Socioeconomic Impacts from Operations, All Facilities/Alternatives

Socioeconomic Resource	CPC	CUC	CNC	AD/HE	CNPC
Peak Workers	1,780	935	2,715	1,785	4,500
Indirect Jobs Created	1,573	826	2,091	1,577	3,466
Total Jobs Created	3,353	1,761	4,806	3,362	7,966
ROI Average Earning	\$40,600	\$40,600	\$40,600	\$40,600	\$40,600
Direct Income Increase	\$72,268,000	\$37,961,000	\$110,229,000	\$72,471,000	\$182,700,000
Indirect Income Increase	\$35,910,000	\$18,863,000	\$54,773,000	\$36,011,000	\$90,784,000
Total Impact to the ROI	\$108,178,000	\$56,824,000	\$165,002,000	\$108,482,000	\$273,484,000

Source: NNSA 2007, BEA 2007a.

5.8.9.3 CCE Alternative

5.8.9.3.1 CNC (CPC + CUC)

Socioeconomic impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.9.2 as well as the impacts discussed below.

Regional Economy Characteristics

CUC Construction. As shown in Table 5.8.9-3, construction of a CUC would require approximately 4,000 worker-years of labor. During peak construction, 1,300 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 934 indirect jobs would be created, for a total of 2,234 jobs. This represents less than 1 percent of the total ROI labor force. Income within the ROI would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$32,300 for the construction industry, direct income would increase by \$42 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$68 million (\$42 million direct and \$26 million indirect). Table 5.8.9-3 presents the impacts to socioeconomic resources from construction of the CUC.

Table 5.8.9-3 — Socioeconomic Impacts from Construction of the CUC

Socioeconomic Resource	CUC
Worker Years	4,000
Peak Workers	1,300
Indirect Jobs Created	934
Total Jobs Created	2,234
ROI Average Earning	\$32,300
Direct Income Increase	\$41,990,000
Indirect Income Increase	\$26,038,000
Total Impact to the ROI	\$68,028,000

Source: NNSA 2007, BEA 2007a.

CNC Operation. Operation of a CUC would require 935 workers. In addition to the direct jobs created by operations, additional jobs would be created in other supporting industries. It is estimated that 826 indirect jobs would be created, for a total of 1,761 jobs.

The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$40,600 for the government services industry, direct income would increase by approximately \$38 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$56.8 million (\$38 million direct and \$18.8 million indirect). Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNC as well as from individual operation of a CPC and CUC.

Population and Housing

CUC Construction. The influx of new workers would increase the ROI population and could create new housing demand. For the peak year of construction (1,300 new workers), 1,950 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-3 presents the impacts to socioeconomic resources from construction of a CUC.

CNC Operation. The influx of new workers would increase the ROI population and could create new housing demand. For operations (935 new workers), 935 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNC as well as from individual operation of a CPC and CUC.

Community Services

CUC Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.8.9-3 presents the impacts to socioeconomic resources from construction of a CUC.

CNC Operation. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNC as well as from individual operation of a CPC and CUC.

5.8.9.3.2 CNPC (CPC + CUC + A/D/HE Center)

Socioeconomic impacts from the construction and operation of a full CNPC would include the CPC and CUC impacts discussed above, and the A/D/HE Center impacts discussed below.

Regional Economy Characteristics

A/D/HE Center Construction. Construction of an A/D/HE Center would require 6,850 worker-years of labor. During peak construction, 3,820 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 2,745 indirect jobs would be created, for a total of 6,565 jobs. This represents less than 4 percent of the total ROI labor force. Based on the ROI average earnings of \$32,300 for the construction industry, direct income would increase by \$123.4 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$199.9 million (\$123.4 million direct and \$76.5 million indirect). Table 5.8.9-4 presents the impacts to socioeconomic resources from construction of an A/D/HE Center.

Table 5.8.9-4 — Socioeconomic Impacts from Construction of the A/D/HE Center

Socioeconomic Resource	AD/HE
Worker Years	6,850
Peak Workers	3,820
Indirect Jobs Created	2,745
Total Jobs Created	6,565
ROI Average Earning	\$32,300
Direct Income Increase	\$123,386,000
Indirect Income Increase	\$76,512,000
Total Impact to the ROI	\$199,898,000

Source: NNSA 2007, BEA 2007a.

CNPC Operation. Operation of a CNPC would require 4,500 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 3,466 indirect jobs would be created, for a total of 7,966 jobs. The Based on the ROI average earnings of \$40,600 for the government services industry, direct income would increase by \$182.7 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be \$273.5 million (\$182.7 million direct and \$90.8 million indirect). Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNPC as well as from the individual operation of an A/D/HE Center.

Population and Housing

A/D/HE Center Construction. The influx of new workers would increase the ROI population and could create new housing demand. For the peak year of construction (3,820 new workers), 5,730 new residents would be expected in the ROI, including workers and their families. This is an increase of approximately 1.5 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-4 presents the impacts to socioeconomic resources from construction of an A/D/HE Center.

CNPC Operation. The influx of new workers would increase the ROI population and could create new housing demand. For operations (4,500 new workers), 4,500 new residents would be expected in the ROI, including workers and their families. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the population. Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNPC as well as from the individual operation of an A/D/HE Center.

Community Services

A/D/HE Center Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.8.9-4 presents the impacts to socioeconomic resources from construction of the AD/HE Center.

CNPC Operation. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.8.9-2 presents the impacts to socioeconomic resources from operation of a CNPC as well as from the individual operation of an A/D/HE Center.

5.8.9.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to socioeconomics, reduced tritium operations would reduce the workforce by 25 workers. This reduction would be inconsequential relative to the total site workforce of approximately 15,000.

5.8.10 *Environmental Justice*

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as being Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; or another non-White race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income.

Section 4.8.10 presents the existing environmental justice characteristics of the ROI, including census tracts for minority and low-income populations. Impacts for all of the alternatives do not differ significantly; as such, the analysis in this section discusses potential environmental justice impacts for all impacts.

In 2000, minority populations comprised 39.3 percent of the ROI populations surrounding SRS. In 2000, minorities comprised 30.9 percent of the population nationally, 37.4 percent of the population in Georgia, and 33.9 percent of the population in South Carolina. The percentage of persons below the poverty level in the ROI at the time of the 2000 Census was 16.4 percent, which is higher than the 2000 national average of 12.4 percent and the statewide figures of 13 percent and 14.1 percent for South Carolina and Georgia, respectively.

Based on the analysis of impacts for resource areas, few high and adverse impacts from construction and operation activities at SRS are expected under any of the alternatives; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land uses, visual resources, noise, water, geology and soils, biological resources, socioeconomic resources, cultural and archaeological resources. As shown in Section 5.8.11, there are no large adverse impacts to any populations.

5.8.11 Health and Safety

5.8.11.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to health and safety beyond current and planned activities that are independent of this action. In 2005, the estimated dose from atmospheric releases to MEI, at SRS, was 0.05 mrem, which is 0.5 percent of the DOE Order 5400.5 air pathway standard of 10 mrem/year. Operation of the MOX/PDCF facilities are expected to add less than 1.8 person-rem to the 50-mile population surrounding SRS. Existing health and safety at SRS is discussed in Section 4.8.11.

5.8.11.2 *DCE Alternative (CPC)*

5.8.11.2.1 Construction

No radiological risks would be incurred by members of the public from construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CPC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept ALARA.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide

programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CPC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown below in Table 5.8.11-1.

Table 5.8.11-1 — Injury, Illness, and Fatality Estimates for Construction of the CPC, CUC, and A/D/HE Center at SRS

Injury, Illness, and Fatality Categories	Projects Under Consideration		
	Greenfield CPC/MOX	CUC	A/D/HE Center
Peak Annual Employment	850/770	1,300	3,820
Total Recordable Cases	81/73	112	329
Total Lost Workday Cases	38/35	54	159
Total Fatalities	0.2/0.2	0.3	0.8
Project Duration (6 years)			
Total Recordable Cases	276/251	384	1,128
Total Lost Workday Cases	143/121	184	541
Total Fatalities	0.7/0.6	0.9	2.6

Source: NNSA 2007, BLS 2002b.

No chemicals have been identified that would be a risk to members of the public from construction activities associated with a CPC. Construction workers would be protected from overexposure to hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals. Implementation of ISMS programs to construction activities would also decrease the potential for worker exposures by providing hazards identification and control measures for construction activities.

5.8.11.2.2 Operation

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public from routine DOE operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an EDE in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61, Subpart H) limit exposure to the MEI of the public from all air emissions to 10 mrem/yr.

DOE expects minimal public health impacts from the radiological consequences of CPC operations. Public radiation doses would likely occur from airborne releases only (Section 5.8.4). Table 5.8.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both the EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be approximately 2×10^{-15} per year (i.e., a risk of 1 in more than a billion). The projected number of fatal cancers to the population within 50 miles would be less than or equal to 4×10^{-10} per year (i.e., a risk of 1 in more than a billion).

Table 5.8.11-2 — Annual Radiological Impacts on the Public from CPC, CNC, and CNPC Operations at SRS

Receptor	Projects Under Consideration		
	CPC	CNC	CNPC
Population within 50 miles			
Collective dose (person-rem)	5.9×10^{-7}	0.426	0.429
Percent of natural background radiation ^a	1.8×10^{-10}	1.3×10^{-4}	1.3×10^{-4}
LCFs ^b	4×10^{-10}	2.6×10^{-4}	2.6×10^{-4}
Offsite MEI			
Dose (mrem)	3.6×10^{-9}	3.36×10^{-3}	3.39×10^{-3}
Percent of regulatory dose limit	3.6×10^{-8}	3.36×10^{-2}	3.36×10^{-2}
Percent of natural background radiation ^a	1.2×10^{-11}	1.1×10^{-5}	1.1×10^{-5}
Cancer fatality risk ^b	2.2×10^{-15}	2.02×10^{-9}	2.1×10^{-9}

^a The average annual dose from background radiation at SRS is approximately 300 mrem; based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS.

^b Based on a cancer risk estimate of 0.0006 LCFs per rem or person-rem.

^c The offsite MEI is assumed to reside at the site boundary, approximately 6.7 miles from the CPC. An actual residence may not currently be present at this location.

Source: Tetra Tech 2007.

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, *Occupational Radiation Protection*, which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The worker radiation dose projected in this SPEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose and internal dose, as required by 10 CFR Part 835.

Estimates of annual radiological doses to workers involved with CPC operations are independent of geographical location. These dose estimates are solely a function of:

- The number of radiological workers, as determined in the development of the CPC staffing estimate for each throughput alternative. The current estimates were developed by application of a factor to the total workers for each work group based on operating experience in plutonium facilities. Approximately 60 percent of total operating staff are estimated to be radiological workers.
- The working dose rate at the glovebox surface for each unit operation or workstation. These dose rates were calculated based on the maximum mass (plutonium, americium) and form (metal, oxide) of material being handled. Standard “weapons grade” isotopic distribution, and americium content of 0.5 percent were assumed.
- The amount of time spent by direct operators/first line supervisors in the radiation area. This was determined from a time-motion estimate of direct “hands-in-gloves” labor required to perform each individual operation and the number of parts processed per year

for a given pit production rate. Efficiency scaling factors were applied for various operations. For Foundry and Machining operations, this was assumed to be 50 percent; for Assembly and Post-Assembly & Testing, efficiencies were 90 percent.

As indicated above, the collective annual dose (mrem/yr) received by individual direct operators is calculated based on the number of operators required for the various production rates, the time spent in the radiation area, and the associated dose rates for each operation. The collective exposures for support group workers were added to these numbers and were calculated using empirical data that implies that exposure for these workers can be estimated as a percentage of direct operator exposure (e.g., Analytical Laboratory Technician ~25 percent of direct operator exposure). The average individual dose is calculated as the collective exposure divided by the estimated number of radiological workers for each throughput alternative.

The estimates of annual radiological doses to workers are provided in Table 5.8.11-3. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 mrem (10 CFR 835) and the DOE-recommended control level of 1,000 mrem (10 CFR 835). Operations in a CPC would result in an average individual worker dose of approximately 290 mrem annually. The total dose to workers associated with the CPC operations would be 333 person-rem. Statistically, a total dose of 333 person-rem would result in 0.2 annual LCFs to a CPC workforce. The projected number of fatal cancers in the workforce from CPC annual operations would be 0.2 (or 2 chances in 10 that the worker population would experience a fatal cancer per year of operations).

Table 5.8.11-3 — Annual Radiological Impacts on CPC, CNC, and CNPC Workers at SRS from Operations

	CPC	CNC	CNPC
Number of Radiological Workers	1,150	1,640	2,040
Individual Workers^a			
Average individual dose, mrem/yr ^b	290	210	189
Average worker cancer fatality risk ^c	2×10^{-4}	1.4×10^{-4}	1.3×10^{-4}
Worker Population			
Collective dose (person-rem)	333	344	386
Cancer fatality risk ^c	0.20	0.21	0.23

^aThe regulatory dose limit for an individual worker is 5,000 mrem/yr (10 CFR 835). However, the maximum annual dose to a worker would be kept below the DOE Control Level of 1,000 mrem/yr, as established in 10 CFR 835. Further, DOE recommends that facilities adopt a more limiting 800-mrem/yr Administrative Control Level (DOE 1999e). To reduce doses to levels that are as low as reasonably achievable, an effective dose reduction plan would be enforced.

^bLess than one third of all radiological workers would receive doses greater than, but no more than 90 percent above, the average worker dose.

^cBased on a cancer risk estimator of 0.0006 LCFs per rem or person-rem.

Source: Tetra Tech 2007.

During normal (accident-free) operations, total facility staffing at the CPC would be 1,780. The potential risk of occupational injuries and fatalities to workers operating the CPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown below in Table 5.8.11-4.

Table 5.8.11-4 — Injury, Illness, and Fatality Annual Estimates for Normal Operations of the CPC, CNC, and CNPC at SRS

Injury, Illness, and Fatality Categories	Projects Under Consideration		
	CPC	CNC	CNPC
Total Workers	1,780	2,715	4,500
Total Recordable Cases	77	117	195
Total Lost Workday Cases	40	61	101
Total Fatalities	0.07	0.11	0.18

Source: NNSA 2007, BLS 2002b.

No chemical-related health impacts are associated with normal (accident-free) operations of a CPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as ISMS, work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (WSRC 2002c).

5.8.11.3 *CCE Alternative*

5.8.11.3.1 CNC (CPC + CUC)

Health and safety impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.11.2 as well as the impacts discussed below.

Construction

CUC. No radiological risks would be incurred by members of the public from CUC construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CUC reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CUC would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.8.11-1.

Operation

CNC. DOE expects minimal public health impacts from the radiological consequences of CNC operations. Public radiation doses would likely occur from airborne releases only (Section 5.8.4). Table 5.8.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table. As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both the EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be approximately 2×10^{-9} per year (i.e., a risk of 1 in approximately 500 million). The projected number of fatal cancers to the population within 50 miles would be approximately 3×10^{-4} (i.e., a risk of 1 in 3,333).

The estimates of annual radiological doses to workers are provided in Table 5.8.11-3. As shown in the table, 1,640 radiological workers would be required to conduct CNC operations. Operations in a CNC would result in an average individual worker dose of 210 mrem annually. The total annual dose to workers associated with CNC operations would be 344 person-rem. Statistically, an annual dose of 344 person-rem would result in 0.21 LCFs to a CNC workforce.

During normal (accident-free) operations, total facility staffing would be 2,715. The potential risk of occupational injuries and fatalities to workers operating a CNC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.8.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of a CNC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as ISMS, work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.8.11.3.2 CNPC (CPC + CUC + A/D/HE Center)

Health and safety impacts from the construction and operation of a CNPC would include the CNC impacts discussed above, as well as the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. No radiological risks would be incurred by members of the public from A/D/HE Center construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the A/D/HE Center reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered

to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable.

Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the A/D/HE Center would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.8.11-1.

Operation

CNPC. DOE expects minimal public health impacts from the radiological consequences of CNPC operations. Public radiation doses would likely occur from airborne releases only (Section 5.8.4). Table 5.8.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table. As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both the EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from operations would be approximately 2×10^{-9} per year (i.e., a risk of 1 LCF approximately every 500 million years). The projected number of fatal cancers to the population within 50 miles would be approximately 3×10^{-4} (i.e., a risk of 1 LCF every 3,333 years).

The estimates of annual radiological doses to workers are provided in Table 5.8.11-3. As shown in the table, 2,040 radiological workers would be required to conduct CNPC operations. Operations in a CNPC would result in an average individual worker dose of 189 mrem annually. The total annual dose to workers associated with CNPC operations would be 386 person-rem. Statistically, an annual dose of 386 person-rem would result in 0.23 LCFs to the CNPC workforce.

During normal (accident-free) operations, total facility staffing would be 4,500. The potential risk of occupational injuries and fatalities to workers operating a CNPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.8.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of a CNPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth

controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.8.11.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to health and safety, reduced tritium operations would reduce the total tritium worker dose from 4.1 person-rem to 3.1 person-rem. Statistically, the number of LCFs would be reduced from 2.5×10^{-3} to 1.9×10^{-3} , which would be an inconsequential change. Impacts to the surrounding population would also be inconsequential.

5.8.12 **Facility Accidents**

This section presents the potential impacts on workers (both involved and non-involved) and the public due to potential accidents associated with the operation of a CPC, CUC, and A/D/HE Center at SRS. Additional details supporting the information presented here are provided in Appendix C.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved

computer models, DOE predicted the dispersion of released hazardous materials and their effects. However, prediction of potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident.

Emergency Preparedness— Each DOE site has established an emergency management program. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts— DOE estimated radiological impacts to three receptors: (1) the MEI at the SRS boundary; (2) the offsite population within 50 miles of SRS; and (3) a non-involved worker 3,281 feet from the accident location. DOE did not evaluate total dose from accidents to the involved workforce because this would depend upon the specific location of the facilities on each site, which is not an issue that will be decided as a result of this SPEIS. In any tiered, project-specific EIS, accident impacts to the involved workforce would be analyzed to evaluate alternative locations on the selected site.

5.8.12.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional accident risks beyond those associated with current and planned activities that are independent of this action. Potential accident scenarios for the No Action Alternative are addressed in existing NEPA documents.

In order to provide a baseline for accidents related to the No Action Alternative at SRS, including operations involving waste management, tritium operations, and plutonium disposition, NNSA reviewed relevant NEPA documents, including the SRS Tank Closure EIS (DOE/EIS-0303), the Tritium Extraction Facility EIS (DOE/EIS-0271), and the Surplus Plutonium Disposition EIS (DOE/EIS-0283). For the SRS Tank Closure EIS, the bounding accident analyzed would cause an MEI dose of less than 1 rem. The maximum population dose was 11,000 rem, which would equate to approximately 6.6 LCFs. For the Tritium Extraction Facility EIS, the bounding accident analyzed would cause less than 1 LCF to the surrounding population. For the Surplus Plutonium Disposition EIS, the bounding accident analyzed would cause an MEI dose of approximately 8.8 rem. The maximum population dose was 21,000 rem, which would equate to approximately 12.6 LCFs.

5.8.12.2 Consolidated Plutonium Center

5.8.12.2.1 Radiological Accidents

Table 5.8.12–1 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CPC) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. Table 5.8.12-2 shows the accident risks, obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CPC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.8.12-1 — CPC Radiological Accident Frequency and Consequences at SRS

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	3.39	0.00203	17,500	10.5	1,580	1
Fire in a single building	1.0×10^{-4}	1.57	0.000942	7,890	4.73	1,070	1
Explosion in a feed casting furnace	1.0×10^{-2}	1.83	0.0011	9,250	5.55	1,260	1
Nuclear Criticality	1.0×10^{-2}	3.42×10^{-6}	2.05×10^{-9}	0.00728	4.37×10^{-6}	0.00146	8.76×10^{-7}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	0.122	7.32×10^{-5}	617	0.37	83.7	0.1
Radioactive material spill	1×10^{-2}	0.00367	2.20×10^{-6}	18.5	0.0111	2.51	0.00151

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.8.12-2 — Annual Cancer Risks for CPC - SRS

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^b	Non-involved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	2.03x10 ⁻⁸	1.05x10 ⁻⁴	1x10 ⁻⁵
Fire in a Single Building	9.42x10 ⁻⁸	4.73x10 ⁻⁴	1x10 ⁻⁴
Explosion in a Feed Casting Furnace	1.1x10 ⁻⁵	5.55x10 ⁻²	1x10 ⁻²
Nuclear Criticality	2.05x10 ⁻¹¹	4.37x10 ⁻⁸	8.76x10 ⁻⁹
Fire-induced Release in the CRT Storage Room	7.32x10 ⁻⁷	0.37 x10 ⁻⁷	1x10 ⁻³
Radioactive Material Spill	2.20x10 ⁻⁸	1.11x10 ⁻⁴	1.51x10 ⁻⁵

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.8.12-1) is the beyond evaluation basis earthquake and fire. Approximately 10.5 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a dose of approximately 3 rem. Statistically, the MEI would have a 0.002 chance of developing a LCF, or about 1 in 500. This accident has a probability of occurring once every 100,000 years.

When probabilities are taken into account (see Table 5.8.12-2), the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 1x10⁻⁵, or approximately 1 in 100,000. For the population, the LCF risk would be approximately 6x10⁻², meaning that an LCF would statistically occur once every 18 years in the population.

5.8.12.2.1 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. For this analysis, ERPG values are used to develop hazard indices for chemical exposures. ERPG definitions are provided below.

ERPG DEFINITIONS

ERPG 1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG 2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG 3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at the CPC. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in

the area around the point of release. Table 5.8.12-3 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released.

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 3,281 feet from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting in calculated down-wind concentrations. Both Gaussian Plume and ALOHA methodologies were used to evaluate the potential consequences associated with a release of each chemical in an accident situation. Table 5.8.12-3 shows the consequences of the dominant loss of containment accident scenarios.

The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.8.12-3 — CPC Alternative Chemical Accident Frequency and Consequences, SRS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary ^a (ppm)	
Nitric acid	10,500	6	0.17	0.189	<0.01	10 ⁻⁴
Hydrofluoric acid	550	20	0.12	0.21	<0.01	10 ⁻⁴
Formic acid	1,500	10	0.1	0.02	0	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.

Source: Tetra Tech 2007

5.8.12.2.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.8.12.3 Consolidated Uranium Center

5.8.12.3.1 Radiological Accidents

The accident scenarios, material at risk, and source term for a CUC are shown below:

Operation	Accident	Source Term	Notes/Assumptions
EU Metal Fabrication	Major fire	EU = 17.9 kg (sum of metal and chips) DU = 452 kg (sum of metal and chips)	Release height = ground level Release duration = 1 hour
Assembly	Explosion	2 kg EU 0.04 kg DU (sum of metal and chips)	Release height = 7.6 m Release duration = 1 hour
EU Warehouse	Fire	EU = 22.6 kg DU = 20.1 kg U-233 = 0.0066 kg Th = 0.13 kg (the above all represent the sum of metals, oxides, and combustibles)	Release height = 4 m Release duration = 1 hour
HEUMF	Design-basis fires	Pu = 1.0×10^{-6} kg Np-237 = 1.6×10^{-5} kg EU = 2.58 kg DU = 0.55 kg	Release height = 11.3 m Release duration = 1 hour
EU Operations	Aircraft crash	37.8 kg EU (includes metals, chips, oxides, and aqueous and organic solutions)	Release height = "roof level" Release duration = 15 min

Source: Tetra Tech 2007.

Table 5.8.12-4 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the CUC) and a hypothetical non-involved worker, as well as the accident risks (Table 5.8.12-5), obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CUC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.8.12-4 —CUC Radiological Accident Frequency and Consequences at SRS

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.00535	3.21 x 10 ⁻⁶	27	0.0162	3.66	0.0022
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.000528	3.17 x 10 ⁻⁷	2.67	0.0016	0.313	0.000188
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.00625	3.75 x 10 ⁻⁶	31.5	0.0189	4.11	0.00247
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.000682	4.09 x 10 ⁻⁷	3.45	0.00207	0.344	0.000206
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.011	6.60 x 10 ⁻⁶	47.3	0.0284	1.28	0.000768

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.8.12-5 — Annual Cancer Risks for CUC at SRS

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	3.21 x 10 ⁻¹⁰	1.62 x 10 ⁻⁶	2.2 x 10 ⁻⁷
Explosion	3.17 x 10 ⁻¹¹	1.6 x 10 ⁻⁷	1.88 x 10 ⁻⁸
Fire in EU Warehouse	3.75 x 10 ⁻¹⁰	1.89 x 10 ⁻⁶	2.47 x 10 ⁻⁶
Design-basis fires for HEU Storage	4.09 x 10 ⁻⁹	2.07 x 10 ⁻⁵	2.06 x 10 ⁻⁶
Aircraft crash	6.60 x 10 ⁻¹⁰	2.84 x 10 ⁻⁶	7.68 x 10 ⁻⁸

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.8.12-4) is the aircraft crash into the EU facilities. Approximately 0.03 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a maximum dose of 0.01 rem. Statistically, this MEI would have a 7x10⁻⁶ chance of developing a LCF, or about 1 in 150,000. This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.8.12-5), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 4x10⁻⁹, or approximately 1 in 250 million. For the population, the LCF risk would be 2x10⁻⁵, or approximately 1 in 50,000.

5.8.12.3.2 Hazardous Chemicals Impacts

The CUC would store and use a variety of hazardous chemicals. The quantities of chemicals would vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel

would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public. DOE estimated the impacts of the potential release of the most hazardous chemical used at the CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.8.12-6 shows the consequences of the dominant loss of containment accident scenario.

Table 5.8.12-6 — CUC Chemical Accident Frequency and Consequences at SRS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.17	0.189	<0.01	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.
 Source: Tetra Tech 2007.

5.8.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.8.12.4 Assembly/Disassembly/High Explosives Center

5.8.12.4.1 Radiological Accidents

The accident scenarios and representative source terms for the A/D/HE Center are shown below:

Scenario	Representative Source Terms	
	Pu Release (Ci)	Tritium Release (Ci)
Scenario 1: Explosive Driven Plutonium and Tritium Dispersal from an Internal Event	400	3.0×10^5
Scenario 2: Tritium Reservoir Failure from an Internal Event	0	2.0×10^5
Scenario 3: Pit Breach from an Internal Event	1.8×10^{-5}	0
Scenario 4: Multiple Tritium Reservoir Failure from an External Event or Natural Phenomena	0	4.0×10^7
Scenario 5: Fire Driven Dispersal Involving Stored Pits from an External Event or Natural Phenomena	50	0
Scenario 6: Plutonium and Tritium Dispersal from an External Event or Natural Phenomena	1.2×10^{-2}	3.0×10^5

Source: Tetra Tech 2007

Tables 5.8.12–7 and 5.8.12-8 show the consequences and risks of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of an A/D/HE Center) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table was selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the A/D/HE Center. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.8.12-7 — A/D/HE Center Radiological Accident Consequences at SRS

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities ^b	Dose (Person-rem)	Latent Cancer Fatalities ^c	Dose (rem)	Latent Cancer Fatalities ^c
Scenario 1	0.495	0.000297	2,490	1.49	339	0.407
Scenario 2	0.000354	2.12×10^{-7}	1.79	0.00107	0.243	0.000146
Scenario 3	2.96×10^{-8}	1.78×10^{-11}	0.000149	8.94×10^{-8}	2.03×10^{-5}	1.22×10^{-8}
Scenario 4	0.065	0.000039	368	0.221	12.1	0.00726
Scenario 5	0.068	4.08×10^{-5}	385	0.231	12.6	0.00756
Scenario 6	0.000504	3.02×10^{-7}	2.85	0.00171	0.0936	5.62×10^{-5}

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table 5.8.12-8 — Annual Cancer Risks for A/D/HE Center Accidents at SRS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Scenario 1	2.97x10 ⁻⁸	1.49 x10 ⁻⁴	4.07x10 ⁻⁵
Scenario 2	2.12x10 ⁻⁹	1.07x10 ⁻⁵	1.46x10 ⁻⁶
Scenario 3	1.78x10 ⁻¹³	8.94x10 ⁻¹⁰	1.22x10 ⁻¹⁰
Scenario 4	3.9x10 ⁻¹¹	2.21x10 ⁻⁷	7.26x10 ⁻⁹
Scenario 5	4.08x10 ⁻⁹	2.31x10 ⁻⁵	7.56x10 ⁻⁷
Scenario 6	3.02x10 ⁻⁹	1.71x10 ⁻⁵	5.62x10 ⁻⁷

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

The results of the accident analysis indicate that potential consequences would not exceed the NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The accident with the highest potential consequences to the offsite population (see Table 5.8.12-7) is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 1.49 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a dose of 0.5 rem. Statistically, this MEI would have a 0.0003 chance of developing a LCF, or about 1 in 3,300. The overall likelihood of this scenario occurring is less than 1×10^{-4} per year.

When probabilities are taken into account (see Table 5.8.12-8), the accident with the highest overall risk is also the explosive driven plutonium and tritium dispersal from an internal event. For this accident, the LCF risk to the MEI would be 3×10^{-8} , or approximately 1 in 33 million. For the population, the LCF risk would be 1×10^{-4} , or approximately 1 in 6,500.

5.8.12.4.2 Hazardous Chemicals Impacts

DOE estimated the impacts of the potential release of the most hazardous chemicals used at the A/D/HE Center. A chemical’s vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical’s hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Table 5.8.12–9 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released. The American Industrial Hygiene Association defines ERPG-2 as the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical’s release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.8.12-9 — A/D/HE Center Chemical Accident Frequency and Consequences at SRS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Chlorine	408.23	3	1.8	15	<0.2	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.

Source: Tetra Tech 2007

5.8.12.4.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.8.12.5 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to accidents, potential consequences would be virtually unaffected, as consequences are related to the *types* of operations which are conducted, including the material-at-risk, which would not change. The probability that a particular accident would occur would also be relatively unchanged, as most probabilities are small (less than once every 100-1,000,000 years), which means that accident probabilities are largely a function of the operation being conducted, rather than the number of times the operation is conducted. Nonetheless, it is acknowledged that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

5.8.13 Transportation

5.8.13.1 No Action Alternative

Under the No Action Alternative, there would be no change in the transportation activities at SRS, and impacts would remain unchanged from the baseline presented in Section 4.8.12.

5.8.13.2 DCE Alternative (CPC)

5.8.13.2.1 Construction

Construction of a CPC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.8.12 and would be temporary.

5.8.13.2.2 Operation

Radiological transportation for a CPC would include transport of pits from Pantex to SRS, recycle of enriched uranium parts to Y-12, return of pits and enriched uranium parts to Pantex, and shipment of TRU waste to WIPP. Section 5.10 presents the impacts of transportation for the CPC at SRS. The addition of new employees for a CPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.8.12.

5.8.13.3 CCE Alternative

5.8.13.3.1 CUC Construction

Construction of the CUC would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.8.12 and would be temporary.

5.8.13.3.1 CNC Operation

Radiological transportation for a CNC would include the impacts associated with a CPC plus the impacts described in Section 5.10 for a CUC. The addition of new employees for a CUC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.8.12.

5.8.13.3.2 CNPC (CPC + CUC + A/D/HE Center)

Construction

A/D/HE Center. Construction of an A/D/HE Center would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.8.12 and would be temporary.

Operations

CNPC. If an A/D/HE Center was located at SRS as part of a CNPC, the annual radiological transportation impacts associated with the CPC (Section 5.8.13.2) and the impacts associated with the CUC (Section 5.8.13.3.1) would not occur, with the exception of TRU waste transportation described for the CPC. There would be a one-time transport of SNM from Y-12 and Pantex to the CNPC, as described in Section 5.10. The addition of new employees for a CNPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to

exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.8.12.

5.8.13.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to local transportation, a reduction in total ROI workers by 25 would have an inconsequential impact on local transportation. A reduction in tritium operations would reduce both the transportation of tritium producing burnable absorber rods from the Watts Bar nuclear reactor in Tennessee to SRS, as well as the transportation of filled tritium reservoirs from SRS to Pantex. As explained in Section 5.10, the annual transportation impacts for tritium components, for both incident-free transportation and potential accidents, would be small (less than 1 death related to non-radiological impacts and less than 1 LCF for radiological impacts).

5.8.14 **Waste Management**

5.8.14.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at SRS would continue as required to support the missions described in Section 3.2.8. There would be no additional impacts to waste management resources beyond current and planned activities that are independent of this action. SRS currently manages high-level waste, LLW, mixed LLW, TRU waste, hazardous waste and sanitary waste. SRS has a RCRA licensed hazardous and mixed waste storage facility.

Table 5.8.14-1 presents annual waste generation volumes from SRS operations. For convenience, this table is shown again below, to facilitate comparisons of the additional alternatives presented.

Table 5.8.14-1 — Annual Routine Waste Generation from SRS Operations (m³)

Waste type	1996	1997	1998	1999	2000	2001
Transuranic (yd ³)	165	119	61.9	42.4	54	64.1
Low-level (yd ³)	5,780	6,620	6,520	4,970	5,220	4,610
Mixed (yd ³)	452	286	463	402	290	380
Hazardous ^a (yd ³)	57.0	55.0	177	26.5	30.8	45.3
Sanitary ^b (yd ³)	2,780	2,770	2,640	1,760	1,550	1,560

^aHazardous waste reported in metric tons.

^bFrom DOE 2002o (1996 data) and DOE's Central Internet Database. Sanitary waste reported in metric tons.
Source: DOE 2002o.

5.8.14.2 *DCE Alternative (CPC)*

5.8.14.2.1 **CPC Construction Impacts**

Construction of a CPC would generate liquid hazardous waste and both liquid and solid non-hazardous waste. Table 5.8.14-2 summarizes the total volume of waste expected to be generated over the 6 years of construction activity for a CPC.

Table 5.8.14-2 — Total Waste Generation from CPC Construction at SRS

Waste Type	CPC
TRU Waste, solid (yd ³)	0
LLW (yd ³)	0
Hazardous Waste (tons)	7.0
Nonhazardous Solid (yd ³)	10,900
Nonhazardous Liquid (gal)	56,000

Source: NNSA 2007.

Although CPC construction activities would increase annual non-hazardous waste generation levels substantially, the infrastructure and available disposal capacity exists at SRS to adequately manage this waste stream on an ongoing basis. The waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were sufficient demand, DOE could also pursue a permit for an additional onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. This combination of disposal facilities would provide adequate capacity to handle the projected amount of waste.

CPC construction activities would increase the annual routine hazardous waste generation by approximately 50 percent of 2004 generation rates for SRS operations. The hazardous waste would be sent offsite for treatment and disposal at a commercial facility. Commercial treatment is readily available and currently used to treat most SRS hazardous wastes.

Sanitary wastewater generated during CPC construction would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary wastes would not be expected to have any effect on the existing capacity of the SRS sanitary sewer system.

A retention pond would be constructed to manage stormwater runoff from the entire CPC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at the CPC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CPC construction is completed.

5.8.14.2.2 CPC Operation Impacts

Normal operation of the CPC would generate LLW, hazardous waste, and sanitary waste. Table 5.8.14-3 summarizes the estimated waste generation rates for the operation of a CPC.

Table 5.8.14–3 — Annual Waste Generation from Operations of the CPC at SRS

Waste Category	CPC
TRU Solid Waste (yd ³)	950
Mixed TRU Solid Waste (yd ³)	340
Low Level Solid Waste (yd ³)	3,900
Mixed Low Level SolidWaste (yd ³)	2.5
Mixed Low Level Liquid Waste (yd ³)	0.4
Hazardous waste, solid (tons)	4
Hazardous waste, liquid (tons)	0.6
Non-Hazardous Solid Waste (yd ³)	8,100
Non-Hazardous Liquid Waste (gal)	75,000

Source: NNSA 2007.

SRS currently manages an inventory of 43,167 cubic yards of legacy TRU waste (WSRC 2002a). The projected TRU waste volumes for a CPC represents an increase by a factor of about 2 percent in the annual routine TRU waste generation at SRS. TRU waste generated from plutonium pit manufacturing includes gloves, filters, and other operations/maintenance waste from the CPC gloveboxes. Americium process waste would be solidified and packaged as TRU waste. About 36 percent of the TRU waste would be mixed waste. The TRU waste would be transferred from the CPC process buildings to the Waste Staging/TRU Packaging Building, which would be located outside of the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 978 yd³ of TRU waste). A drum loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transport to WIPP.

LLW from CPC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CPC operations would be solidified prior to leaving the facility. LLW generation for the CPC would almost double the annual LLW generation volumes presently being generated at SRS. The LLW would be transferred to E-Area for disposal. Offsite disposal could also be used for LLW that is not technically or economically suitable for disposal at SRS. The estimated capacity of the E-Area facilities is 963,711 yd³ and the projected volumes for disposal are about 456,566 yd³ (DOE 2000g). The remaining capacity would be adequate to dispose of all the projected LLW from CPC operations and still allow for the disposal of LLW generated by other operations at SRS.

CPC operations would generate small amounts of hazardous waste and mixed LLW. These wastes include lead acid batteries, lubricating oils/fluids, rags, and sorbents. The projected hazardous waste volumes from CPC operations represent less than twenty-five percent of the annual routine volumes currently managed at SRS. Commercial treatment and disposal is readily available and currently used to treat most SRS hazardous wastes.

Operation of a CPC would increase annual routine mixed LLW generation at SRS by about seventeen percent relative to current site operations. Depending on the characteristics of the mixed LLW, it would be transferred to onsite treatment facilities or shipped to commercial or DOE treatment and disposal facilities.

Nonhazardous waste from CPC operations includes sanitary solid waste and wastewater. The solid waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were sufficient demand, DOE may pursue a permit for an onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. Although CPC operations would increase annual sanitary waste generation, the combination of disposal facilities is expected to provide adequate disposal capacity.

Sanitary wastewater generated during CPC operations would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary wastes would not be expected to have any effect on the existing capacity of the SRS sanitary sewer system.

CPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process (NNSA 2007).

5.8.14.3 CCE Alternative

CNC (CPC + CUC)

Waste Management impacts from the construction and operation of a CNC would include the CPC impacts discussed in Section 5.8.14.2 as well as the impacts of a CUC, as discussed below.

Construction

CUC. Construction of a CUC would entail construction of a CPC, already discussed in Section 5.8.14.2.1, above, and construction of a CUC, discussed in this section.

Construction of a CUC would entail the generation of LLW, hazardous waste, and both solid and liquid sanitary waste. Table 5.8.14-4 summarizes the total volume of waste generated over the 6 years of construction activity for a CUC.

Table 5.8.14-4 — CUC Construction Wastes at SRS

Waste Category	Quantity
Low-level Solid (yd ³)	70
Mixed Low-level Solid (yd ³)	0
Hazardous (tons)	6
Nonhazardous (Sanitary) (tons)	1,000

Source: NNSA 2007.

CUC construction activities would increase annual sanitary waste generation by less than five percent, relative to current SRS operations. The waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were

sufficient demand, DOE may pursue a permit for an onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. This combination of disposal facilities would provide adequate capacity to handle the projected amount of waste.

CUC construction activities would more increase the annual routine hazardous waste currently generated by SRS operations by an additional 40 percent. The hazardous waste would be sent offsite for treatment and disposal at a commercial facility along with the hazardous waste normally generated by SRS. Commercial treatment is readily available and currently used to treat most SRS hazardous wastes.

Sanitary wastewater generated during CUC construction would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary wastes would not be expected to have any effect on the existing capacity of the SRS sanitary sewer system.

A retention pond would be constructed to manage stormwater runoff from the entire CUC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at the CUC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CUC construction is completed.

Operation

CNC. Normal operation of a CNC would generate TRU waste, LLW, mixed LLW, mixed TRU waste, hazardous waste, and sanitary waste. Table 5.8.14-5 summarizes the estimated waste generation rates for a CNC.

Table 5.8.14-5 — Annual CNC Operational Waste at SRS

	CPC	CUC	CNC
TRU Solid Waste (including Mixed TRU)(yd ³)	950	0	950
Mixed TRU Solid Waste (included in TRU, above) (yd ³)	340	0	340
Low Level Solid Waste (yd ³)	3,900	8,100	12,000
Low Level Liquid Waste (gal)	0	3,515	3,515
Mixed Low Level Solid Waste (yd ³)	2.5	70	72.5
Mixed Low Level Liquid Waste (yd ³)`	0.4	3,616	3,616.4
Hazardous waste solid (tons)	4.0	15	19
Hazardous waste liquid (tons)	0.6	0	0.6
Non-Hazardous Solid Waste (tons)	8,100	7,500	15,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	125,000

Source: NNSA 2007.

SRS currently manages an inventory of 43,167 cubic yards of legacy TRU waste (WSRC 2002a). The projected TRU waste volumes which would be generated by the operation of a CNC at SRS would represent an increase of about two percent of the annual routine TRU waste SRS already processes. About a third of the TRU waste generated by a CNC would be mixed waste. The

TRU waste would be transferred from the CNC process buildings to the Waste Staging/TRU Packaging Building, which would be located outside of the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 978 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transport to WIPP.

LLW generation for the CNC would increase the annual LLW generation at SRS by more than three fold. The LLW would be transferred to E-Area for disposal. The estimated capacity of the E-Area facilities is 963,711 cubic yards and the projected volumes for disposal are about 456,566 cubic yards (DOE 2000g). The remaining capacity would be adequate to dispose of all the projected LLW from CNC operations and still allow for disposal of LLW generated by other activities at SRS. LLW from CNC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CNC operations would be solidified prior to leaving the facility. Offsite disposal at a commercial facility, such as near-by Barnwell, could also be used for LLW that is not technically or economically suitable for disposal at SRS.

The projected hazardous waste volumes from CNC operations would be large in comparison to the annual routine volumes of hazardous waste currently managed at SRS. Commercial treatment is readily available and currently used to treat and dispose of most SRS hazardous wastes. Sufficient hazardous waste transfer points exist, at SRS, for the collection of sufficient quantities to facilitate shipment.

Operation of a CNC would increase annual routine mixed LLW generation at SRS by less than five percent relative to current site operations. Depending on the characteristics of the mixed LLW, it would be treated at the RCRA-permitted mixed waste treatment facility, transferred to onsite treatment facilities at other facilities at SRS, or shipped to commercial or DOE treatment and disposal facilities. These wastes include lead acid batteries, lubricating oils/fluids, rags, and absorbents.

Non-hazardous waste from CNC operations includes sanitary solid waste and wastewater. The solid waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were sufficient demand, DOE may pursue a permit for an onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. Although CNC operations would substantially increase the annual sanitary waste generation at SRS, the combination of disposal facilities is expected to provide more than adequate disposal capacity.

Sanitary wastewater generated during CNC operations would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary wastes would not be expected to have any effect on the existing capacity of the SRS sanitary sewer system.

CNC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in

contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge. Any contaminated wastewater would be solidified by processing through the liquid-process waste facilities for the plutonium purification process (NNSA 2007).

5.8.14.3.2 CNPC (CPC + CUC + A/D/HE Center)

Waste management impacts from the construction and operation of the full CNPC would include the CPC impacts discussed in Section 5.8.14.5, the CUC impacts discussed above, and the A/D/HE Center. The expected waste impacts are discussed below.

Construction

A/D/HE Center. The construction of an A/D/HE Center would generate low level waste, and solid and liquid sanitary waste. Table 5.8.14-6 summarizes the total volume of waste generated over the 6 years of construction of an A/D/HE Center.

Table 5.8.14-6 — Total Waste Generation from Construction of the A/D/HE Center

Waste Category	A/D/HE Center
TRU Solid Waste (yd ³)	0
Low Level Solid Waste (yd ³)	9,900
Mixed TRU Solid Waste (yd ³)	0
Hazardous waste (tons)	0
Non-Hazardous Solid Waste (yd ³)	7,100
Non-Hazardous Liquid Waste (gal)	45,000

Source: NNSA 2007.

A/D/HE Center construction activities would increase annual sanitary waste generation by less than ten percent relative to current SRS operations. The waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were sufficient demand, DOE may pursue a permit for an onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. This combination of disposal facilities would provide adequate capacity to handle the projected amount of waste.

The 45,000 gallons of liquid non-hazardous waste (sanitary wastewater) generated during the 6 year A/D/HE Center construction period would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary waste is well within the existing capacity and would not be expected to have any detrimental effects on the existing operations of the SRS sanitary sewer system.

LLW generation from the construction of an A/D/HE Center at SRS would generate substantial volumes of additional LLW to be managed by SRS. This waste, however would be generated over a multi-year timeframe (more like half of the 6 year construction period) making its volume less of a jolt to the system. The LLW would be transferred from the A/D/HE Center to E-Area for processing and disposal. Offsite disposal could also be used for LLW that is not technically or economically suitable for disposal at SRS. The estimated capacity of the E-Area facilities is 963,711 cubic yards and the projected volumes for disposal of waste normally generated at SRS

are about 456,566 cubic yards (DOE 2000g). The remaining capacity would be more than adequate to dispose of all the projected LLW from A/D/HE Center operations and still allow for disposal of LLW generated by other activities not yet planned for at SRS. Any liquid LLW resulting from A/D/HE Center operations would be solidified prior to leaving the center.

A retention pond would be constructed to manage stormwater runoff from the entire A/D/HE Center site, including the construction laydown area and concrete batch plant. The basin of this retention pond would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at an A/D/HE Center site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once A/D/HE Center construction is completed.

Operation

CNPC. Normal operation of a CNPC would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.8.14-7 summarizes the estimated waste generation rates for the operation of a CNPC at SRS.

SRS currently manages an inventory of 14,389 cubic yards of legacy TRU waste (WSRC 2002a). The projected TRU waste volumes represent an increase by a factor of less than two percent of the annual routine TRU waste generation at SRS. About one third of the TRU waste would be mixed waste. The TRU waste would be transferred from the CNPC process buildings to the Waste Staging/TRU Packaging Building, which would be located outside of the PIDAS. The Waste Staging/TRU Packaging Building would include a staging area with capacity for approximately 1,200 TRU waste drums (about 326 cubic yards of TRU waste). A drum-loading area equipped with overhead bridge cranes would load the waste drums into TRUPACT-II shipping containers and load the TRUPACT-II containers onto trucks for transport to WIPP.

Table 5.8.14-7 — Annual Waste Generation from Operations at SRS-- CNPC

Waste Type	CPC	CUC	A/D/HE Center	CNPC
TRU Solid Waste(including mixed TRU) (yd ³)	950	0	0	950
Mixed TRU Solid Waste (included in TRU, above)(yd ³)	340	0	0	340
Low Level Solid Waste (yd ³)	3,900	8,100	40	12,040
Low Level Liquid Waste (gal)	0	3,515	5,410	8,925
Mixed Low Level Solid Waste (yd ³)	2.5	70	0	782.5
Mixed Low Level Liquid Waste (gal)	0.4	3,616	6	3,622.4
Hazardous waste solid (tons)	4.0	15	.9	19.9
Hazardous waste liquid (tons)	0.6	0	5.9	6.5
Non-Hazardous Solid Waste (yd ³)	8,100	7,500	12,000	27,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	46,000	171,000

Source: NNSA 2007.

LLW from CNPC operations would include job control waste, failed equipment, and other general operations/maintenance waste. Any liquid LLW resulting from CNPC operations would be solidified prior to leaving the facility. LLW generation for the CNPC would substantially increase the annual LLW generation at SRS by a factor of about 4. The LLW would be transferred to E-Area for disposal. Offsite disposal could also be used for LLW that is not technically or economically suitable for disposal at SRS. The estimated capacity of the E-Area facilities is 321,237 cubic yards and the projected volumes for disposal are about 155,518 cubic yards (DOE 2000g). The remaining capacity would be more than adequate to dispose of all the projected LLW from CNPC operations and still allow for disposal of low level waste generated from other operations at SRS.

The projected hazardous waste volumes from CNPC operations would substantially increase the annual routine volumes currently managed at SRS. This waste would be collected at a hazardous waste transfer point until sufficient quantities are obtained for a shipment to an off-site, RCRA-permitted commercial treatment and disposal facility. Commercial treatment is readily available and currently used to treat and dispose of most of SRS hazardous wastes.

Non-hazardous waste from CNPC operations includes sanitary solid waste and wastewater. The solid waste would be disposed in an onsite structural fill or the Three Rivers Regional Landfill, located within SRS boundaries. If there were sufficient demand, DOE may pursue a permit for an onsite construction and debris landfill, replacing the Burma Road Landfill that was filled to capacity in 2001. Although CNPC operations would substantially increase the current annual sanitary waste generation at SRS, the combination of existing disposal facilities is expected to provide adequate disposal capacity.

Sanitary wastewater generated as a result of CNPC operations would be treated in the Centralized Sanitary Wastewater Treatment Facility. The anticipated volume of sanitary wastes would not be expected to have any effect on the existing capacity of the SRS sanitary sewer system.

CNPC operations are not expected to generate radioactive wastewater. However, the potential does exist for generating radioactively contaminated water from the operation and maintenance of safety showers in contamination areas, the operation of decontamination stations, the mopping of floors in contamination areas, and the testing of fire sprinkler systems located in contamination areas. Wastewaters that could potentially be contaminated would be collected, sampled, and analyzed prior to discharge.

5.8.14.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at SRS would continue as required to support smaller stockpile requirements. With respect to waste management, reduced tritium operations would reduce LLW by approximately 50 percent, from 138 cubic yards to 69 cubic yards. No other waste streams would be significantly affected. Because SRS has adequate facilities to manage LLW under either alternative, no major impacts to waste management are expected with a fifty percent reduction in volume.

5.9 Y-12 NATIONAL SECURITY COMPLEX (Y-12)

This section discusses the potential environmental impacts associated with the following programmatic alternatives at the Y-12 Complex:

- **No Action Alternative:** under the No Action Alternative, NNSA would continue operations to support national security requirements using the nuclear weapons complex as it exists today. Y-12 would continue to perform its existing missions as described in Section 3.2.9.
- **DCE Alternative:** this alternative includes an analysis of adding a CPC to the existing enriched uranium mission at Y-12. It is noted that the combination of a CPC with the existing enriched uranium mission would constitute a Consolidated Nuclear Center (CNC). For the enriched uranium mission, this SPEIS also assesses the impacts of a UPF and an upgrade of existing Y-12 facilities, because NNSA is considering these options in the Y-12 SWEIS as potential replacements for facilities that currently perform enriched uranium operations.
- **CCE Alternative:** this alternative would be a full CNPC (which would consist of a CPC, the UPF, and an A/D/HE Center). By definition, there is no “CNC Alternative” at Y-12, because locating a CPC at Y-12 (in combination with the existing enriched uranium mission) would amount to a CNC. In general, CNPC alternatives would produce additive construction impacts because construction activities would occur in series as follows: UPF, 2010-2018; CPC, 2017-2022; A/D/HE Center, 2020-2025.
- **Capability-Based Alternative:** under this alternative, HEU operations at Y-12 would be reduced to support stockpile requirements below levels established by the Moscow Treaty.

The environmental impacts are presented below for each of the following environmental resource areas: land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, and waste management.

5.9.1 Land Use

This section presents a discussion of the potential impacts to land associated with the No Action Alternative, the DCE Alternative, and the CCE Alternative. Table 5.9.1-1 describes the potential effects on land use from construction and operation of facilities under the DCE and CCE Alternatives.

Table 5.9.1-1—Potential Effects on Land Use at the Proposed Sites

CPC Alternatives		
Greenfield Alternative	Construction (acres)	Operation (acres)
	140	110 ^a
	PIDAS	Non-PIDAS
	40	70
Upgrade Alternative	13	6.5 (All within PIDAS)
50/80 Alternative	6.5	2.5 (All within PIDAS)
CUC		
Construction (acres)	50	
Operation (acres)	Total Area: 35 ^b	
	PIDAS	Non-PIDAS
	15	20
A/D/HE CENTER ^d		
Construction (acres)	300	
Operation (acres)	Total Area: 300 ^e	
	PIDAS	Non-PIDAS
	Weapons A/D/Pu Storage: 180	Administrative and High Explosives Area: 120
CNC		
	Total Area: 195 ^f	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 55 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	Total: 140 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Buffer Area: 50
CNPC		
	Total Area: 545 ^g	
Operation (acres)	PIDAS	Non-PIDAS
	Total: 235 <ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	Total: 310 <ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 • Buffer Area: 100

^a Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^b At Y-12, a UPF would be constructed (see Section 3.4.2).

^c Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^d At NTS, an A/D/HE Center would require 200 acres, due to use of existing infrastructure.

^e Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

^f Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

^g Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

5.9.1.1 No Action Alternative

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at Y-12 beyond those of existing and future activities that are independent of this action. Additional information on land use resources for Y-12 may be found in Section 4.9.1.

Table 5.9.1-2 — Y-12 Major Facility Overview

Facility	• Function	• Mission	Current Status
EU Complex	<ul style="list-style-type: none"> • Uranium Recovery Operations • Metallurgical Operations • In-Process Storage • X-ray density 	<ul style="list-style-type: none"> • Recovery of EU to a form suitable for storage • Casting EU metal (for weapons, storage, reactors, or other uses) • EU down-blending • Accountability of EU from Y-12 activities • Nondestructive evaluation of parts • Packaging for Off-site Transportation 	Operating
Intermediate Assay Building	<ul style="list-style-type: none"> • Chemical recovery of intermediate enrichments of EU (20% to 85% ²³⁵U) • In-Process Storage 	<ul style="list-style-type: none"> • Recovery of EU to a form suitable for storage 	Not Operating- EU materials will be transferred to other areas for processing or to a storage location. Operations in this building will not resume
EU By-Products Storage Building	<ul style="list-style-type: none"> • Storage of combustibles, residues and other solid by-product material contaminated by EU 	<ul style="list-style-type: none"> • Storage of combustibles, residues, and other solid materials awaiting chemical recovery of EU 	In use as a storage facility
Metalworking Building	<ul style="list-style-type: none"> • Storage • Fabrication (rolling, heat treating, forming, shearing, machining, inspection, etc.) of parts 	<ul style="list-style-type: none"> • Storage and handling of EU and DU • Fabrication and inspection of metal parts 	Operating
EU Storage Building	<ul style="list-style-type: none"> • Storage of EU • Receiving • Shipping • SNM vehicle material transfers 	<ul style="list-style-type: none"> • Warehouse for shipping and receiving EU from other sites • Transient, interim, and long-term storage of EU • In-plant material transfers in SNM vehicle 	Operating

Table 5.9.1-2 — Y-12 Major Facility Overview (continued)

Facility	• Function	• Mission	Current Status
Assembly and Special Materials Process Buildings	<ul style="list-style-type: none"> • Assembly • Product Certification • Disassembly • Storage • Quality Evaluation 	<ul style="list-style-type: none"> • Assembly of new or replacement weapons components/assemblies • Quality operations for certification • Disassembly of retired weapons components/assemblies and part recovery • Storage of retired weapons assemblies, subassemblies, and components • LiH/LiD production • Shelf Life Program – Medium and Long Term Evaluations 	Operating
Quality Evaluation Building	<ul style="list-style-type: none"> • Quality Evaluation/Disassembly • DU Metalworking • Testing 	<ul style="list-style-type: none"> • Quality Evaluation/Disassembly is conducted 	Operating
Plant Laboratory Building	<ul style="list-style-type: none"> • Analytical Chemistry Organization 	<ul style="list-style-type: none"> • Provides analytical support services for Y-12 and regulatory compliance 	Operating
Special Materials Machining	<ul style="list-style-type: none"> • Metal machining 	<ul style="list-style-type: none"> • Machining of metal parts 	Not operating
DU Metalworking Building	<ul style="list-style-type: none"> • Machining • Dimensional Inspection • Electroplating • X-ray density 	<ul style="list-style-type: none"> • Depleted uranium and stainless-steel machining • Dimensional inspection of parts • Electroplating of parts • Nondestructive evaluation of parts 	Operating
Development Buildings	<ul style="list-style-type: none"> • Process Development • Beryllium Operations 	<ul style="list-style-type: none"> • Development and refinement of manufacturing processes employed at Y-12 • Technology transfer support 	Operating
Tooling Storage Building	<ul style="list-style-type: none"> • Storage 	<ul style="list-style-type: none"> • Tooling and material storage 	Operating

Table 5.9.1-2 — Y-12 Major Facility Overview (continued)

Facility	• Function	• Mission	Current Status
General Manufacturing Building	<ul style="list-style-type: none"> • Metal and graphite machining 	<ul style="list-style-type: none"> • General machine shop • Machining and tooling • Work for others • Technology transfer 	Operating
DU Processing Building	<ul style="list-style-type: none"> • Machining processes • Dimensional Inspection • Nondestructive Evaluation (X-ray density) 	<ul style="list-style-type: none"> • DU operations • Dimensional inspection of parts • Nondestructive evaluation of parts 	Operating
HEUMF	<ul style="list-style-type: none"> • Storage of EU • Receiving • Shipping • SNM vehicle material transfers 	<ul style="list-style-type: none"> • Warehouse for shipping and receiving EU from other sites • Transient, interim, and long-term storage of EU • In-plant material transfers in SNM vehicle 	Under Construction
Purification Facility	<ul style="list-style-type: none"> • Chemical Processing 	<ul style="list-style-type: none"> • Special Material production 	Operating

Note: SNM - special nuclear material, EU – enriched uranium, DU – depleted uranium, LiH – lithium hydride, LiD – lithium deuteride.
 Source: BWXT 2005b.

5.9.1.2 DCE Alternative

5.9.1.2.1 Construction

CPC. As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. There would be four separate nuclear buildings: Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D. These buildings would be surrounded by a PIDAS. The area outside the PIDAS and buffer area would consist of a number of smaller support facilities, a Waste Staging/TRU Packaging Building, roads and parking areas, and a runoff retention area. In addition to these structures, a construction laydown area and a concrete batch plant would be built for the construction phase only. Upon construction completion, they would be removed and the area could be returned to its original state.

All buildings would be either one or two stories. The site would require two HVAC exhaust stacks; the tallest, standing 100 feet, would be located inside the PIDAS. Facility exhausts would be HEPA-filtered prior to discharge through the stacks. The CPC reference location at Y-12 is adjacent to the Pine Ridge and Bear Creek parking Lots. The UPF and HEUMF is located to the east of the CPC reference location. This site is outside of, but adjacent to the existing PIDAS.

An estimated 140 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct a CPC. The land required for CPC construction would represent approximately 17.5 percent of Y-12's total land area of

approximately 800 acres. The post-construction developed area would be approximately 110 acres. Although there would be a change in land use, a CPC is compatible and consistent with land use plans and the current industrial land use designation. No impacts to Y-12 land use plans or policies are expected.

UPF. A UPF would be compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists at the proposed location. Construction of and future operations at a UPF would be consistent with the Y-12 Ten Year Comprehensive Site Plan (TYCSP) and would be a significant contribution to achieving an optimum configuration of Y-12. A UPF would enable the EU operations to be consolidated into an area that would be approximately 10 percent of the current size of the Y-12 complex.

The UPF site is in the Pine Ridge and Bear Creek Parking Lots, located to the west of the Highly Enriched Uranium Materials Facility (HEUMF). This site is outside of, but adjacent to, the existing PIDAS. This site is close to the existing HEU processing complex and represents a large level site with minimal site preparation requirements.

Construction of a UPF would require approximately 35 acres of land, which includes land for a construction laydown area and temporary parking. The construction laydown area for the UPF would be developed on the west side of the proposed UPF site. This area would be finished with an 8-inch-thick compacted, stabilized base for the construction phase. Interim employee parking lots would be developed west of the proposed construction laydown area. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards.

Upgraded Y-12 Facilities. Under this alternative, NNSA would upgrade the existing enriched uranium (EU) and non-nuclear processing facilities to contemporary environmental, safety, and security standards to the extent possible within the limitations of the existing structures and without prolonged interruptions of manufacturing operations. The Upgrade Alternative would be both compatible and consistent with the current land use at Y-12 and would not change the current industrial use classification that exists. Construction activities would consist of internal modifications to existing facilities.

5.9.1.2.2 Operation

CPC and UPF. An estimated 118 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CPC (110 acres) and UPF (8 acres). The reduction in required acreage from construction to operations represents the removal of the construction laydown area and the concrete batch plant upon construction completion. The land required for CPC and UPF operations would represent approximately 15 percent of Y-12's total land area of approximately 800 acres. The UPF would allow the EU operations at Y-12 to be reduced from approximately 150 acres to 15 acres. Although there would be a change in land use, a CPC and UPF would be compatible and consistent with land use plans and the current industrial land use designation. No impacts to Y-12 land use plans or policies are expected.

Upgraded Y-12 Facilities. Operation of the Upgraded EU and other processing facilities would have no impact on the current land use at Y-12 and would not change the current industrial use classification that exists at Y-12. Upgrading the existing facilities would not allow the EU operations to be reduced from approximately 150 acres to 15 acres.

5.9.1.3 CCE Alternative

5.9.1.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.1.3.2 CNPC (CPC + UPF + A/D/HE Center)

Construction

A/D/HE Center. As described in Section 3.5.1.2, an A/D/HE Center would consist of a nuclear facility within the PIDAS and non-nuclear support facilities outside the PIDAS. Approximately 300 acres would be required for an A/D/HE Center. An area of 180 acres would be provided in the PIDAS for the weapons assembly and disassembly facilities, and the associated weapons and plutonium component storage. These functions would be located on the west end of Y-12. Located outside the PIDAS area would be a buffer area, administrative support buildings, and other non-nuclear support facilities, on approximately 63 acres. The high explosives (HE) fabrication would be located on approximately 120 acres of ORR, approximately 4.5 miles from the Y-12 industrialized area (see Figure 3.5.1-7).

The land required for an A/D/HE Center construction would represent approximately 37.5 percent of Y-12’s total land area of approximately 800 acres. The reference location has adequate space to accommodate the total facilities footprint. Although there would be a change in land use, an A/D/HE Center is compatible and consistent with land use plans and the current industrial land use designation. No impacts to Y-12 land use plans or policies are expected.

Operation

CNPC. An estimated 518 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate a CNPC. Of this, approximately 398 acres would be located on Y-12, and 120 acres (HE fabrication) would be located on ORR, approximately 4.5 miles from the Y-12 industrialized area. The land required for CNPC operations at Y-12 (would represent approximately 50 percent of Y-12’s total land area of approximately 800 acres. Although there would be a change in land use, a CNPC is compatible and consistent with land use plans and the current industrial land use designation. No impacts to Y-12 land use plans or policies are expected. The HE fabrication would be located on approximately 120 acres of ORR, which would be less than 1 percent of the ORR (35,000 acres)

5.9.1.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on land use would occur at Y-12. Reduced operations would not change land use at Y-12.

5.9.2 **Visual Resources**

5.9.2.1 *No Action Alternative*

The landscape at ORR is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. Currently, there is no BLM classification for Y-12; however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes). Existing visual resources are discussed in Section 4.9.2.

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on visual resources would occur at Y-12 that are independent of this action.

5.9.2.2 *DCE Alternative*

5.9.2.2.1 **Construction**

CPC and UPF. A CPC and UPF would consist of multiple aboveground facilities. Activities related to the construction of new buildings required for a CPC and UPF would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust.

Cranes used during construction of a CPC and UPF could create short-term visual impacts, but would not be out of character for an industrial site such as Y-12. The construction laydown areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. After construction of the facilities are complete, cranes and temporary construction office trailers would be removed, and construction lay-down areas would be re-graded and seeded after removal of any soil that may have become contaminated with construction-related materials such as diesel fuel. Alternatively, the lay-down areas could be used to provide for additional parking.

Upgraded Y-12 Facilities. The Upgrade Alternative would consist mainly of internal upgrades to existing facilities, and would not change the current visual impact of Y-12. Y-12 would still remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected.

5.9.2.2.2 Operation

CPC and UPF. As described in Section 3.4.3, a CPC would include one- and two-story buildings, storage tanks, and two HVAC exhaust stacks, would change the appearance of the reference location. The CPC reference location at Y-12 is adjacent to the Pine Ridge and Bear Creek parking Lots. The UPF and HEUMF are located to the east of the CPC reference location.

Upon completion of UPF and CPC construction (approximately 2022), the PIDAS would be extended to surround the new facilities. When the new PIDAS is completed, the existing EU operations would be relocated to the UPF, the current EU facilities could be declared surplus, and evaluated for D&D. Although the ultimate disposition of these facilities would be determined by a separate NEPA review in the future, when such actions are ripe for decisionmaking, this SPEIS acknowledges that approximately 633,000 square feet of facilities could become excess if the UPF is constructed. Ultimately, this could improve the visual character of the site by reducing the density of industrial facilities. Nonetheless, Y-12 would remain a highly developed area with an industrial appearance, and no change to the VRM classification would be expected. The CPC placement would be consistent with the current Class IV BLM Visual Resources Management rating of developed areas.

Upgraded Y-12 Facilities. Operation of the Upgraded EU and other processing facilities would have no impact on the current visual impact of Y-12.

5.9.2.3 CCE Alternative

5.9.2.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.2.3.2 CNPC (CPC + UPF + A/D/HE Center)

Construction

A/D/HE Center. Activities related to the construction of new buildings required for an A/D/HE Center would be similar in nature to the CPC. An A/D/HE Center would consist of multiple aboveground facilities. Activities related to the construction of new buildings required for an A/D/HE Center would result in a change to the visual appearance of the reference location due to the presence of construction equipment, new buildings in various stages of construction, and possibly increased dust. Impacts on visual resources during construction would be minimal.

Operation

CNPC. A CNPC would be a large complex of industrial facilities, parking lots, and a buffer zone encompassing approximately 518 acres. The CNPC reference location at Y-12 is adjacent to the Pine Ridge and Bear Creek parking Lots. The CNPC placement would be consistent with the current Class IV BLM Visual Resources Management rating of developed areas. Y-12 would remain a highly developed area with an industrial appearance and no change to the VRM

classification would be expected.

5.9.2.3.3 Capability-Based Alternative

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on visual resources would occur at Y-12. Reduced operations would not change visual resource impacts at Y-12.

5.9.3 Site Infrastructure

The analysis of site infrastructure focuses on the ability of the site to provide the electrical power needed to support the programmatic alternatives. The ability of the site to provide the water requirements is addressed in the water resource section (Section 5.9.5). Other infrastructure demands, such as fuels or industrial gases, are not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS.

5.9.3.1 No Action Alternative

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. There would be no additional impacts to site infrastructure beyond current and planned activities that are independent of this action. The baseline characteristics of these systems are presented in Table 4.9.3-1. Y-12 would be expected to continue using from 360 to 480 MWh of electricity per year.

5.9.3.2 DCE Alternative

5.9.3.2.1 Construction

CPC and UPF. The projected demands on electricity associated with construction activities for a CPC, UPF, and A/D/HE Center are shown in Table 5.9.3-1.

Table 5.9.3-1 — Electrical Requirements for Construction of a CPC, UPF, and A/D/HE Center at Y-12

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity	3,766,800	390
No Action Alternative		
Total site requirement	349,251	40
Percent of site capacity	9.3%	9.3%
CPC		
CPC requirement	13,000	3.3
Percent of site capacity	<1%	1%
UPF		
UPF requirement	11,000	2.5
Percent of site capacity	<1%	<1%

Table 5.9.3-1 — Electrical Requirements for Construction of a CPC, UPF, and A/D/HE Center at Y-12 (continued)

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
A/D/HE Center		
A/D/HE Center requirement	55,000	12.7
Percent of site capacity	1.5%	3.3%

Source: NNSA 2007.

The existing electrical infrastructure at Y-12 would be adequate to support annual construction requirements. Infrastructure requirements for construction would have a negligible impact on current site infrastructure resources.

Upgraded Y-12 Facilities. The Upgrade Alternative would involve internal upgrades to existing facilities and would have negligible energy and infrastructure requirements.

5.9.3.2.2 Operation

CPC and UPF. The estimated annual site electrical requirements for the programmatic alternatives are presented in Table 5.9.3-2. There would be negligible impacts to site infrastructure. Existing site infrastructure would be adequate to support operation of a CPC and UPF.

Table 5.9.3-2 — Electrical Requirements for Operation of the CPC, UPF, and CNPC at Y-12

Proposed Alternatives	Electrical	
	Energy (MWh/yr)	Peak Load (MWe)
Site capacity	3,766,800	390
No Action Alternative		
Total site requirement	349,251	40
Percent of site capacity	9.3%	9.3%
CPC		
CPC requirement	48,000	11
Percent of site capacity	1.3%	2.8%
CPC + UPF		
CPC + UPF requirement	168,000	29.4
Percent of site capacity	3.4%	7.5%
CNPC (CPC + UPF + A/D/HE Center)		
CNPC requirement	268,000	41.3
Percent of site capacity	7.1%	10.5%

Source: NNSA 2007.

Upgraded Y-12 Facilities. The Upgrade Alternative would not change energy and infrastructure requirements compared to the No Action Alternative.

5.9.3.3 *CCE Alternative*

5.9.3.3.1 **CNC (CPC + UPF)**

By definition, there is no “CNC Alternative” at Y-12. A CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.3.3.2 **CNPC (CPC + UPF + A/D/HE Center)**

Site infrastructure impacts from the construction and operation of a full CNPC would include the CPC impacts discussed in Section 5.9.3.2 and the A/D/HE Center impacts discussed below.

Construction

A/D/HE Center. The existing electrical infrastructure at Y-12 would be adequate to support annual construction requirements for an A/D/HE Center for the projected 6-year construction period. Infrastructure requirements for construction would have a negligible impact on current site infrastructure resources. The estimated site electrical requirements for construction of an A/D/HE Center are presented in Table 5.9.3-1.

Operation

CNPC. During operations, a CNPC would utilize approximately 10 percent of Y-12’s available peak electrical site capacity. The estimated annual site electrical requirements for operation of a CNPC are presented in Table 5.9.3-2. There would be negligible impacts to the site electrical infrastructure.

5.9.3.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to infrastructure, electrical use would be reduced by approximately 25 percent. Because there is currently adequate electrical capacity at the site, this reduction would not have any major impact on operations. Steam use, which is largely used for building heating, would be expected to decrease from approximately 1.5 billions of pounds per year to approximately 900 million pounds per year.

5.9.4 **Air Quality and Noise**

5.9.4.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. The ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207, and Y-12 is completely within Anderson County. The EPA has designated Anderson County as a basic non-attainment area for the 8-hour ozone standard, as part of the larger Knoxville basic 8-hour ozone non-attainment area that encompasses several counties; and for PM_{2.5} based on a revision to the

standards (EPA 2005a). For all other criteria pollutants for which EPA has made attainment designations, existing air quality in the greater Knoxville and Oak Ridge areas is in attainment with the NAAQS. There would be no additional impacts to air quality beyond current and planned activities that are independent of this action.

Major noise emission sources within Y-12 include various industrial facilities, and equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so that noise levels at the boundary from these sources are not distinguishable from background noise levels. Within the Y-12 site boundary, noise levels from Y-12 mission operations are typical of industrial facilities, ranging from 50 to 70 dBA (DOE 2001a). Traffic is the primary source of noise at the Y-12 site boundary and at residences located near roads. During peak hours, the Y-12 worker traffic is a major contributor to traffic noise levels in the area (DOE 2001a). There would be no additional impacts to noise levels beyond current and planned activities that are independent of this action.

5.9.4.2 *DCE Alternative*

5.9.4.2.1 **Air Quality**

Construction

Non-radiological Air Impacts from CPC and UPF. Construction of new facilities would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, PM₁₀, total suspended particulates, and carbon monoxide. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 1.20 tons per acre/month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. Facility construction would necessitate a concrete batch plant at the building site. Particulate matter, consisting primarily of cement dust, would be the only regulated pollutant emitted in the concrete mixing process. Emission factors for the concrete batch plant were obtained from AP-42 (EPA 1995).

The estimated maximum annual pollutant emissions resulting from CPC construction activities are presented in Table 5.9.4-1. The temporary increases in pollutant emissions due to construction activities are too small to result in violations of the NAAQS beyond the Y-12 site boundary, with the exception of PM-2.5 and PM-10 concentrations (which could be mitigated using dust suppression), and the 8-hour ozone concentration (see Table 5.9.4-2). The 8-hour ozone concentration exceedance is not a result of Y-12-specific activities. Instead, the EPA has designated Anderson County as a basic non-attainment area for the 8-hour ozone standard, as part of the Knoxville basic 8-hour ozone non-attainment area that encompasses several counties.

Table 5.9.4-1 — Estimated Peak Non-radiological Air Emissions—CPC Construction

Pollutant	Estimated Annual Emission Rate (metric tons/yr)
	CPC
Carbon monoxide	409.6
Carbon dioxide	7,084.2
Nitrogen dioxide	177.7
Sulfur dioxide	11.6
Volatile organic compounds	28.7
PM ₁₀	686
Total Suspended Particulates	915

Source: NNSA 2007.

Construction of the UPF would result in temporary increases in air quality impacts from construction equipment, trucks, and employee vehicles. Fugitive dust generated during the clearing, grading, and other earth moving operations would also cause short-term impacts to air quality, predominantly to particulate matter in the air. Construction impacts of the UPF would be similar to the construction impacts for the CPC (discussed above), as both facilities are similarly sized (approximately 400,000 square feet of floorspace for the UPF versus approximately 650,000 square feet of floorspace for the CPC) and have the same construction durations (6 years). As such, the non-radiological emissions presented in Table 5.9.4-2 would be representative of the UPF construction non-radiological air impacts.

Table 5.9.4-2 — Estimated NAAQs Concentrations at Y-12 — CPC Construction

Pollutant	Averaging Time	Maximum standard (µg/m ³)	Background Concentration (µg/m ³)	Additional Contribution to Background from Releases During Construction (µg/m ³)
Sulfur dioxide	3-hr	1,300	398	22.15
	24-hr	365	47.1	5.03
	Annual	80	10.5	0.02
PM ₁₀	Annual	50	25.4	1.25
	24-hr	150	77	301.33
PM _{2.5}	Annual	15	No Data	0.125*
	24-hr	35	48.2	30.1*
Carbon monoxide	1-hr	40,000	12,712	1184.9
	8-hr	10,000	4,466	391.03
Ozone	1-hr	235	225	No Data
	8-hr	157	188.4	No Data
Nitrogen dioxide	Annual	100	15.1	0.32
Lead	Calendar quarterly mean	1.5	0.009	No Data No Data

* Assumes PM_{2.5} is approximately 10 percent of the PM₁₀ value due to the smaller quantity of particulates at the 2.5 micron size range. These estimates are based on Gaussian Plume modeling assuming emissions sources are approximated by a small area source relative to the down-wind distances. The modeling used conservative assumptions for wind speed and stability class to develop the estimates.

Source: Janke 2007.

Upgraded Y-12 Facilities. Negligible fugitive dust would be generated because no new land would be disturbed. Temporary decreases in air quality from construction equipment, trucks, and employee vehicles would be much less than the CPC and UPF, discussed above, due to the significantly smaller workforce required for the upgrades.

Radiological Air Impacts from Construction of CPC, UPF, and Upgraded Y-12 Facilities. No radiological releases to the environment are expected in association with construction activities of a CPC or UPF. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, NNSA would survey potentially affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures. No radiological releases to the environment are expected in association with construction activities related to the upgrade of Y-12 facilities.

Operation

Non-radiological Air Impacts from Operation of CPC, UPF, and Upgraded Y-12 Facilities. Pit manufacturing activities would result in the release of criteria and toxic pollutants into the surrounding air. The primary volume contributors are nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Carbon dioxide would be used as a cleaning agent and helium would be used for leak testing operations. Hydrogen and nitrogen dioxide are reaction products from aqueous purification operations (pyrochemical purification would produce lower amounts of hydrogen and nitrogen dioxide). Air emissions from periodic functional testing support systems (primarily standby diesel generators) include carbon monoxide, nitrogen dioxide, PM₁₀, sulfur dioxide, VOCs, and total suspended particulates (WSRC 2002e). The estimated emission rates (kg/yr) for non-radiological pollutants emitted are presented in Table 5.9.4-3. These emissions would be incremental to the Y-12 baseline.

Table 5.9.4-3 — Annual Nonradiological Air Emissions for the CPC—Operations

Chemical Released	Quantity Released (kg/yr)
	200 ppy
Carbon dioxide	1,843,600
Carbon monoxide	8,580
Nitrogen dioxide	42,803.2
PM ₁₀	1,042.8
Sulfur dioxide	2,626.8
Total suspended particulates	2,820.4
Volatile organic compounds	2,626.8

Source: NNSA 2007.

For a UPF, operations would not be expected to increase air emissions at Y-12 because a UPF would replace existing EU operations. No significant new quantities of criteria or toxic pollutants would be generated from the new facility itself. Any additional steam-generated heat required for a UPF would be off-set by the reduction in steam from the phase-out of operations in excess Enriched Uranium facilities. A UPF would not change the level of emissions estimated

for the No Action Alternative. Any releases of nitrogen and argon, which are used to maintain inert atmospheres for glovebox operations, would be less than current releases from existing EU operations. No new hazardous air emissions would result from the facility operation. Additionally, 90 percent of emissions at Y-12 are from operation of the steam plant, which would be relatively unaffected by UPF operations.

As part of its evaluation of the impact of air emissions, NNSA consulted the Guidance on CAA Conformity requirements (DOE 2000a). NNSA determined that the General Conformity rule applies because Y-12 is located in a non-attainment area for one or more criteria pollutants (i.e., 8-hour ozone). However, because construction plans for the CPC and UPF are insufficiently developed to quantify emissions, they do not satisfy the Tennessee Code definition of reasonably foreseeable. For this reason, a complete General Conformity Review cannot be included in the SPEIS. When the construction plans are sufficiently developed to estimate NAAQS emissions, a General Conformity Review must be performed before future construction activities can proceed.

Operation of the Upgraded EU and other processing facilities would not change air quality impacts beyond those presented for the No Action Alternative because there would be no significant change in the operating requirements of the facilities.

Table 5.9.4-4 presents the results of conservative modeling for operations at Y-12, including the CPC and UPF. If Y-12 is selected as the preferred site, a prevention of significant deterioration (PSD) increment analysis would be performed under a project-specific tiered EIS.

Table 5.9.4-4 — Criteria Pollutant Concentrations at Y-12 Boundary—CPC and UPF

Pollutant	Averaging Time	Maximum standard (µg/m ³)	Background Concentration (µg/m ³)	Maximum Modeled Concentration ³ (µg/m ³)	Background Concentration + Maximum Modeled Concentration (Percent of Standard)
SO ₂	3-hr	1,300	398 ¹	523.8	71
	24-hr	365	47.1 ²	174.6	61
	Annual	80	10.5 ²	20.7	39
PM ₁₀	Annual ¹	50	25.4 ²	0.2	51
	24-hr ²	150	77 ¹	1.5	52
PM _{2.5}	Annual ¹	15	No Data	No Data	No Data
	24-hr ²	35	48.2 ¹	No Data	74.1
CO	1-hr	40,000	12,712	4.30	32
	8-hr	10,000	4,466 ²	2.52	44
Ozone	1-hr	235	225 ¹	No Data	96
	8-hr	157	188.4 ¹	No Data	120
NO ₂	Annual	100	15.1 ¹	9.1	24
Lead	Calendar quarterly mean	1.5	0.009 ¹	No Data	0.6

N/A= Not Applicable.

¹TDEC 2005c.

²DOE 2007.

³Janke 2007.

Radiological Air Impacts from Operation of CPC, UPF, and Upgraded Y-12 Facilities.

Radioactive air emissions from pit manufacturing activities would involve plutonium, americium, and enriched uranium. The pit manufacturing activities would be performed within gloveboxes or vaults for radiological containment; and include plutonium recovery using aqueous or pyrochemical processes, foundry, machining, assembly, post assembly operations, inspection and certification, waste handling, and preparing the final product (pits) for shipment. Analytical operations would normally be conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. Sample transfers would occur using a vacuum tube transfer system from the Feed Preparation and Manufacturing Facilities to the Analytical Support Facility. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before being released to the air via a 100-foot tall stack. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of entrained particles from the exhaust air. NNSA estimated routine radionuclide air emissions (see Table 5.9.4-5). Releases would be small. Total radionuclide emissions at Y-12 would be much less than 1 Curie of any radionuclide. To ensure that total emissions are not underestimated, NNSA’s method for estimating emissions was conservative. Therefore, actual emissions from pit manufacturing operations would be smaller. Operation of the UPF would result in some radiological airborne emissions. The current design calls for appropriately sized filtered HVAC systems. Under normal operations, radiological airborne emissions would be no greater than radiological airborne emissions from the existing EU facilities, and are likely to be less due to the incorporation of newer technology into the facility design. However, because detailed design information does not yet exist, these reductions cannot be quantified. As a result, for purposes of this SPEIS analysis, the radiological airborne emissions and resulting impacts from the UPF would remain unchanged from the No Action Alternative, which are estimated to be 0.10 Curies of uranium, based on releases into the atmosphere in 2004 (DOE 2005a).

Table 5.9.4-5 — Annual Radiological Air Emissions—CPC Operations

Isotope	Baseline ^{a,b} (Ci/yr)	CPC Annual Emissions (Ci/yr)
Americium-241	ND	3.12×10^{-7}
Plutonium-239	None	1.02×10^{-5}
Plutonium-240	None	2.66×10^{-6}
Plutonium-241	None	1.96×10^{-4}
Uranium-234	ND	5.02×10^{-9}
Uranium-235	ND	1.58×10^{-10}
Uranium-236	ND	2.56×10^{-11}
Uranium-238	ND	1.42×10^{-12}
Total Uranium	0.10	2.06×10^{-4}
Tritium	None	–
All Other	None	–
Total	0.10	2.09×10^{-4}

ND = No data for these radionuclides.

^a Based on calendar year 2004 data.

^b The No Action Alternative is represented by the baseline.

Source: NNSA 2007.

NNSA estimated the radiation doses to the offsite MEI and the offsite population surrounding Y-12. As shown in Table 5.9.4-6, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the processing facilities resulting from radiological air emissions are presented in Section 5.9.11.

Table 5.9.4-6 — Annual Doses Due to Radiological Air Emissions from CPC and UPF Operations at Y-12

Receptor	CPC	UPF
Offsite MEI ^a (mrem/yr)	1.7×10^{-8}	0.4
Population within 50 miles (person-rem per year) ^a	1.2×10^{-7}	5.8

^a MEI and population dose estimates for the CPC operations were calculated using the radiological emissions in Table 5.9.4-5 and using the CAP88 computer code. The offsite MEI is assumed to reside at the site boundary.

Source: Tetra Tech 2007.

Operation of the upgraded EU facilities would not change the radiological airborne emissions, and impacts would be the same as described for the No Action Alternative.

5.9.4.2.2 Noise

Construction

CPC, UPF, and Upgraded Y-12 Facilities. Construction of new buildings or upgrade of existing facilities would involve the movement of workers and construction equipment and would result in some temporary increase in noise levels near the area. Although noise levels in construction areas could be as high as 110 dBA, these noise levels would not extend far beyond the boundaries of the construction site. Table 5.9.4-7 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55-85 dBA. The *Environmental Impact Data Book* (Golden et al. 1980) suggests that noise levels higher than 80-85 dBA are sufficient to startle or frighten birds and small mammals. Given the distance to the site boundary (approximately 1.3 miles) there would be no major change in noise impacts on the public as a result of construction activities, except for a small increase in traffic noise levels.

Table 5.9.4-7 — Peak and Attenuated Noise Levels Expected from Operation of Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68

Table 5.9.4-7 — Peak and Attenuated Noise Levels Expected from Operation of Construction Equipment (continued)

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, NNSA has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Operation

CPC, UPF, and Upgraded Y-12 Facilities. The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations at the new buildings would be expected to be similar to those from existing operations. There would be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (approximately 1.3 miles) noise emissions from equipment would not likely disturb the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. But these noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur onsite and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with the operation of these facilities would likely increase traffic noise levels along roads used to access the site.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (29 CFR 1926.52). However, NNSA has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.9.4.3 CCE Alternative

5.9.4.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.4.3.2 CNPC (CPC + UPF + A/D/HE Center)

Air quality and noise impacts from the construction and operation of the CNPC would include the CPC and UPF impacts discussed in Section 5.9.11.2 as well as the impacts discussed below for the A/D/HE Center.

5.9.4.3.2.1 Air Quality

Construction

A/D/HE Center Non-radiological Impacts. Non-radiological impacts of A/D/HE Center construction are expected to be similar to the impacts described above for the CPC and UPF. However, due to the potential to disturb approximately 300 acres of land during construction, modeling was performed to determine if PM₁₀ emissions (which were considered to be the most likely criteria pollutant to exceed regulatory limits) at the site boundary would exceed regulatory limits. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. Fugitive emissions were estimated based on the EPA emission factor of 1.20 tons/acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM₁₀ (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent. The estimated maximum annual PM₁₀ emissions resulting from construction activities are presented in Table 5.9.4-7a. Actual construction emissions are expected to be less, since conservative emission factors and other assumptions were used in the modeling of construction activities and tend to overestimate impacts.

Table 5.9.4-7a — A/D/HE Center Construction — PM₁₀ Impacts

Parameter	Guideline or limit ($\mu\text{g}/\text{m}^3$)	Concentration at Site Boundary ($\mu\text{g}/\text{m}^3$)
Particulate Matter emitted: 1,620 tons/year		
Annual	50	2.62
24-hour	150	638

Source: Janke 2007.

The results presented above represent a conservative estimate of PM₁₀ emissions at the site boundary. The source strength was assumed to come from a relatively concentrated area for application to the Gaussian Plume equation. Use of an area source would not reduce the emissions by an order of magnitude. Therefore, the results in the table potentially overestimate the impact by about a factor of 5. Based on this analysis, a more detailed site-specific analysis would need to be performed, using project-specific information, if Y-12 is selected for a CNPC. If that analysis shows that regulatory limits would be exceeded, then mitigation measures would need to be developed.

A/D/HE Center Radiological Impacts. No radiological releases to the environment are expected in association with construction activities. However, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site preparation activities. Prior to commencing ground disturbance, NNSA would survey potentially

affected areas to determine the nature and extent of any contamination and would be required to remediate any contamination in accordance with established site procedures.

Operation

CNPC Non-radiological Impacts. A CNPC would release non-radiological contaminants into the atmosphere during operations. CPC and UPF non-radiological emissions are discussed in Sections 5.9.4.2 and are not repeated here. The total non-radiological air impacts of the CNPC would be additive of a CPC, UPF, and an A/D/HE Center (which is discussed in this section). During normal operations, an A/D/HE Center would release the non-radionuclides to the air in the quantities presented in Table 5.9.4-8. These emissions would be incremental to the Y-12 baseline.

Table 5.9.4-8 — Annual Nonradiological Air Emissions— A/D/HE Center Operations

NAAQS emissions	(tons/year)
Oxides of Nitrogen	91
Carbon Monoxide	31
Volatile Organic Compounds	31
Particulate Matter	18
Sulfur Dioxide	5
Hazardous Air Pollutants and Effluents	22

Source: NNSA 2007.

The maximum concentrations ($\mu\text{g}/\text{m}^3$) at the Y-12 site boundary that would be associated with the release of criteria pollutants presented in Table 5.9.4-9. These concentrations were compared to the most stringent (Federal or state) ambient air quality standards. Because the estimated emissions are maximum potential emissions and all emergency generators would not operate at the same time, the estimated emissions and resulting concentrations are conservative.

Table 5.9.4-9 — Criteria Pollutant Concentrations at Y-12 Boundary—CNPC Operations

Pollutant	Averaging Time	Maximum standard ($\mu\text{g}/\text{m}^3$)	Background Concentration ($\mu\text{g}/\text{m}^3$)	Maximum Modeled Concentration for CPC and UPF ($\mu\text{g}/\text{m}^3$)	A/D/HE Center Maximum Incremental Concentration ($\mu\text{g}/\text{m}^3$)	CNPC Concentration ($\mu\text{g}/\text{m}^3$)
Sulfur dioxide	3-hr	1,300	398	523.8	9.6	533.4
	24-hr	365	47.1	174.6	2.2	176.8
	Annual	80	10.5	20.7	0.01	20.7
PM10	Annual ¹	50	25.4	0.2	0.03	25.6
	24-hr ²	150	77	1.5	7.8	9.3
PM2.5	Annual ¹	15	No Data	No Data	0.03	No Data
	24-hr ²	35	48.2	No Data	7.8	56.0
Carbon monoxide	1-hr	40,000	12,712	4.30	89.7	91.9
	8-hr	10,000	4,466	2.52	29.6	4498.1
Ozone	1-hr	235	225	No Data	No Data	No Data
	8-hr	157	188.4	No Data	No Data	No Data
Nitrogen dioxide	Annual	100	15.1	9.1	0.2	24.4
Lead	Calendar quarterly mean	1.5	0.009	N/A	N/A	N/A

Source: Janke 2007.

As part of its evaluation of the impact of air emissions, NNSA consulted the Guidance on CAA Conformity requirements (DOE 2000a). NNSA determined that the General Conformity rule applies because Y-12 is located in a non-attainment area for one or more criteria pollutants (i.e., 8-hour ozone). However, because construction plans for the A/D/HE Center are insufficiently developed to quantify emissions, they do not satisfy the Tennessee Code definition of reasonably foreseeable. For this reason, a complete General Conformity Review cannot be included in the SPEIS. When the construction plans are sufficiently developed to estimate NAAQS emissions, a General Conformity Review must be performed before future planned construction activities can proceed.

A/D/HE Center and CNPC Radiological Impacts. A CNPC would release radiological contaminants into the atmosphere during operations. The total radiological air impacts of a CNPC would be additive of a CPC, UPF, and an A/D/HE Center. During normal operations, an A/D/HE Center would release the radionuclides to the air in the quantities indicated in Table 5.9.4-10.

Table 5.9.4-10 — Annual Radiological Air Emissions for A/D/HE Center Operations

Radiological Air Emissions	Emissions
Tritium (Ci)	1.41×10^{-2}
Total Uranium (Ci)	7.50×10^{-5}
Total Other Actinides (Ci)	2.17×10^{-15}

Source: NNSA 2007.

After determining the emissions rates, the CAP88 computer code was used to estimate radiological doses to the maximally exposed individual (MEI) and the population surrounding Y-12 from an A/D/HE Center. As shown in Table 5.9.4-10, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The maximum estimated dose to the offsite population residing within a 50-mile radius would also be very low. The impacts on the public and on a hypothetical non-involved worker in the vicinity of the A/D/HE Center resulting from radiological air emissions are presented in Section 5.9.11. Table 5.9.4-11 also shows the total annual doses from a CNPC. As can be seen, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem/yr set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity.

Table 5.9.4-11 — Annual Doses Due to Radiological Air Emissions from A/D/HE Center Operations and a CNPC at Y-12

Receptor	A/D/HE Center	CNPC
Offsite MEI ^a (mrem/yr)	0.004	0.4
Population within 50 miles (person-rem per year)	0.03	5.8

^a The offsite MEI is assumed to reside at the site boundary.

Source: Tetra Tech 2007.

5.9.4.3.2.2 Noise

Construction

A/D/HE Center. Anticipated noise impacts from the construction of the A/D/HE Center would be similar to those described for the CPC and UPF.

Operation

A/D/HE Center and CNPC. Anticipated noise impacts from the operation of a CNPC would be similar to those described for a CPC and UPF.

5.9.4.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to air quality, Y-12 is located in the Eastern Tennessee-Southwestern Virginia AQCR 207. The EPA has designated this area as a basic non-attainment area for the 8-hour ozone standard, as part of the larger Knoxville basic 8-hour ozone non-attainment area that encompasses several counties; and for PM_{2.5} based on a revision to the standards (EPA 2005a). For all other criteria pollutants for which EPA has made attainment designations, existing air quality in the greater Knoxville and Oak Ridge areas is in attainment with the NAAQS. Reduced operations could reduce the emissions from the steam plant boilers and emissions from onsite vehicles. Because 90 percent of emissions at Y-12 are from operation of the steam plant, this represents the most significant factor in any air quality changes. Reduced operations would reduce the basic needs for steam by approximately 40 percent, which would improve non-radiological impacts to air quality associated with Y-12 operations. With respect to radiological emissions, the total 2004 dose to the MEI from the Y-12 activities was 0.4 mrem, which is 4 percent of the regulatory limit. If radiological emissions decreased from 0.01 Curies to 0.006 Curies (per Table 3.6.1-2), the MEI dose would decrease to 0.24 mrem, which would be an inconsequential change.

5.9.5 Water Resources

Environmental impacts associated with the proposed alternatives at Y-12 could affect water resources. No impacts to groundwater are expected. At Y-12, surface water resources would likely be used to meet all construction and operations water requirements. Table 5.9.5-1 summarizes potential changes to water resources at Y-12 resulting from the construction of a CPC, UPF, and an A/D/HE Center. Table 5.9.5-2 summarizes potential changes to water resources at Y-12 resulting from the operation of a CPC, UPF, and CNPC.

5.9.5.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. Y-12 uses approximately 2,000 million gallons per year of water while the ORR uses approximately twice as much. The ORR water supply system, which includes the city of Oak Ridge treatment facility and the ETPP treatment facility, has a capacity of 11,715 million gallons per year (DOE 2005b).

Under this alternative no additional buildings or facilities would be built beyond current and planned activities, and no additional impacts on surface water or groundwater resources would be expected to occur at Y-12 that are independent of this action. Baseline water resources are discussed in Section 4.9.5.

5.9.5.2 DCE Alternative

5.9.5.2.1 Surface Water

Construction

CPC. Construction requirements for the CPC are described in Section 3.4.1. Y-12 surface water withdrawals and discharges would not increase during construction of the CPC. Construction water requirements for a CPC would not raise the average annual water use for Y-12. Approximately 20,900,000 gallons of water would be needed for construction of the CPC; this is less than 1 percent of the average annual water use at Y-12. No impact from flooding would be expected. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits and minimized.

Table 5.9.5-1 — Potential Changes to Water Resources from Construction of a CPC, UPF, and A/D/HE Center at Y-12

Proposed Alternatives	Water Use
Water Use (gal/yr)	2,000,000,000
CPC	
Water Requirement (gal)	20,900,000
Percent of Average Annual Water Use	1%
UPF	
Water Requirement (gal)	4,000,000
Percent of Average Annual Water Use	<1%
A/D/HE Center	
Water Requirement (gal)	2,022,000
Percent of Average Annual Water Use	<1%

Source: NNSA 2007.

Table 5.9.5-2 — Potential Changes to Water Resources from Operation of the CPC, UPF, and CNPC at Y-12

Proposed Alternatives	Water Use
Average Annual Water Use	2,000,000,000
CPC	
Water Requirement (gal/yr)	88,500,000
Percent of Average Annual Water Use	4.4%
UPF	
Water Requirement (gal/yr)	105,000,000
Percent of Available Site Capacity	5.2%
CPC + UPF	
Water Requirement (gal/yr)	193,500,000
Percent of Average Annual Water Use	9.7%
A/D/HE Center	
Water Requirement (gal/yr)	130,000,000
Percent of Available Site Capacity	6.5%
CNPC (CPC + UPF + A/D/HE Center)	
Water Requirement (gal/yr)	403,500,000
Percent of Average Annual Water Use	20.1%

Source: NNSA 2007.

The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. Y-12 would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities. The CPC reference location at Y-12 is not within the 100-year or 500-year floodplains. Therefore, no impact on the floodplain is anticipated.

UPF. Y-12 surface water withdrawals and discharges would not increase substantially during construction of the UPF. Construction water requirements for a UPF (approximately 4 million gallons per year) would not raise the average annual water use for Y-12 (approximately 2,000 million gallons per year). The proposed UPF site is not located within either the 100-year or 500-year floodplains.

Upgrade Y-12 Facilities. Construction activities associated with upgrading existing Y-12 facilities would require approximately 4 million gallons/year of water. This would represent an increase of less than 1 percent compared to existing water uses at Y-12.

Operation

CPC. Operation of a CPC would require an estimated 88,500,000 gallons, less than 4.4 percent of the average annual water usage at Y-12. Operation of a CPC would not increase water demands at Y-12. It is not anticipated that operation of a CPC would impact surface water quality.

A CPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures.

UPF. UPF operation would require an estimated 105,000,000 gallons/year, approximately 5.2% of the water usage under the No Action Alternative (approximately 2,000 million gallons/year). A UPF would not increase water demands at the site because EU operations would be phased out in existing facilities once the UPF becomes operational. It is not anticipated that operation of a UPF would impact surface water quality beyond impacts described for the No Action Alternative. EU operations would be phased out in existing facilities once a UPF becomes operational. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with NPDES permit limits.

Upgraded Y-12 Facilities. No significant change in water requirements would result from upgrading Y-12 facilities.

5.9.5.2.2 Groundwater

Construction

CPC, UPF, and Upgraded Y-12 Facilities. Minimal amounts of groundwater could be used during construction for such uses as dust control and soil compaction, and washing and flushing activities. There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

Operation

CPC, UPF, and Upgraded Y-12 Facilities. Minimal amounts of groundwater would be used. No sanitary or industrial effluent would be directly discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.9.5.3 CCE Alternative

5.9.5.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. A CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.5.3.2 CNPC (CPC + UPF + A/D/HE Center)

A CNPC would be made up of CPC, UPF and A/D/HE Center. A CPC and UPF are discussed in Section 5.9.5.2, and an A/D/HE Center is discussed below.

Surface Water

A/D/HE Center Construction. Y-12 surface water withdrawals and discharges would not increase during construction of an A/D/HE Center. Approximately 2,022,000 gallons of water would be needed for construction of an A/D/HE Center; this is less than 1 percent of the average annual water use at Y-12. No impact from flooding would be expected. No adverse impacts to surface water resources or surface water quality are expected because all discharges would be maintained to comply with permit limits and minimized.

The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. Y-12 would comply with Federal and state regulations to prevent, control, and handle potential spills from construction activities.

The A/D/HE Center reference location at Y-12 is not within the 100-year or 500-year floodplains. Therefore, no impact on the floodplain is anticipated.

CNPC Operation. Operation of a CNPC would require an estimated 403.5 million gallons, approximately 20.1 percent of the average annual water usage at Y-12. Operation of a CNPC would not increase water demands at Y-12. It is not anticipated that operation of a CNPC would impact surface water quality.

A CNPC would not generate any radioactive water emissions. However, there is a potential for generating radioactive contaminated water from the operation and maintenance of safety showers in contaminated areas, the operation of decontamination stations, the mopping of floors in contaminated areas, and the testing of fire sprinkler systems located in contaminated areas. Wastewater that has the potential for being radioactively contaminated would be collected, sampled, and analyzed prior to discharge. Radioactive wastewater would be converted to a solid and disposed of in accordance with DOE procedures. The water emissions that are sampled, analyzed, and determined to be contaminated can be converted to a solid by processing through the CNPC liquid process waste facilities for the plutonium purification process.

Groundwater

A/D/HE Center Construction. Minimal amounts of groundwater could be used during construction for such uses as dust control and soil compaction, and washing and flushing activities. There would be no onsite discharge of wastewater to the subsurface, and appropriate spill prevention controls and countermeasure plans would be employed to minimize the chance of petroleum, oils, lubricants, and other materials used during construction being released to the surface or subsurface and to ensure that waste materials are properly disposed. In general, no impact on groundwater availability or quality is anticipated.

CNPC Operation. Minimal amounts of groundwater would be used. No sanitary or industrial effluent would be directly discharged to the subsurface. Therefore, no operational impacts on groundwater quality would be expected. Routine chemical additives would be added to the domestic water to control bacteria and pH, as well as to cooling tower water makeup for bacteria and corrosion control. Use of these types of chemicals is standard and no adverse impacts would be expected.

5.9.5.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to water resources, the reduction in water use would be inconsequential, as Y-12 has plentiful water supplies. Reduced operations could continue to improve the water quality in surface waters. Of all the parameters measured in the surface water as a best management practice, mercury is the only demonstrated contaminant of concern.

5.9.6 **Geology and Soils**

5.9.6.1 *No Action Alternative*

ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys, which resulted from stream erosion along fault traces, consist of less-resistant shales and shale-rich carbonates (DOE 2001a). Soil erosion from past land uses has ranged from slight to severe. Erosion potential is very high in those areas that have been eroded in the past with slopes greater than 25 percent. Erosion potential is lowest in the nearly flat-lying permeable soils that have a loamy texture. Additionally, shrink-swell potential is low to moderate and the soils are generally acceptable for standard construction techniques (DOE 2001a). Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. There would be no expected impacts to geology and soil resources beyond current and planned activities that are independent of this action.

5.9.6.2 *DCE Alternative*

5.9.6.2.1 **Construction**

CPC and UPF. As described in Section 3.4.1, a CPC would consist of multiple aboveground facilities. The CPC reference location at Y-12 is adjacent to the Pine Ridge and Bear Creek parking Lots. The UPF and HEUMF are located to the east of the CPC reference location. This site is outside of, but adjacent to the existing PIDAS.

Construction of a CPC and UPF would have no impact on geological resources, and the hazards posed by geological conditions are expected to be minor. Slopes and underlying foundation materials are generally stable at Y-12. Landslides or other non-tectonic events are unlikely to

affect the CPC and UPF site. Sinkholes are present in carbonate units such as the Knox Dolomite, but it is unlikely that they would impact the project, as these karst-forming carbonate units are not present in areas of Y-12 under consideration for a CPC and UPF.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. This should not impact the construction and operation of a CPC and UPF. The foundation soils are not susceptible to liquefaction during or after seismic events. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines.

During construction activities, excavation of soil, limestone, and shale bedrock would occur. There is sufficient capacity either to stockpile these materials or dispose of them during the construction at CPC and UPF sites. Soil disturbance from new construction would occur at building, parking, and construction lay-down areas, and lead to a possible temporary increase in erosion as a result of storm water runoff and wind action. Soil loss would depend on the frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of ground disturbance; and the duration of time the soil is bare. A small volume of soil, limestone, and shale bedrock may be excavated during the construction process. However, this material could be stockpiled for use as fill.

The potential for additional soil contamination from project activities at the CPC and UPF sites would be minimized by current waste management procedures. These procedures are based on current Federal, state, and local regulations that regulate the hazardous material releases that could impact soil resources.

Upgraded Y-12 Facilities. The current authorization basis for many of the EU buildings has been designated as Performance Category (PC)¹ 2, which means these buildings must maintain occupant safety and continued operations with minimum interruption. An assessment of the structural adequacy of the buildings indicates they do not meet current codes and standards related to natural phenomena (NP) events (e.g., tornados and earthquakes) required for a PC 2 designation. If the buildings are intended to operate an additional 50 years, they would require structural upgrades to bring the buildings into compliance (BWXT 2004a).

5.9.6.2.2 Operation

During operation, minor soil erosion impacts could occur, but retention basins, runoff control ditches, and cell design components would minimize impacts. The CPC, UPF, or Upgraded Y-12 Facilities would have no added impact on geology or soils during operation because of site design and engineered control measures.

¹ Performance Categories classify the performance goals of a facility in terms of facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). In general, facilities that are classified as: PC 0 do not consider safety, mission, or cost considerations; PC 1 must maintain occupant safety; PC 2 must maintain occupant safety and continued operations with minimum interruption; PC 3 must maintain occupant safety, continued operations, and hazard materials confinement; and PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement.

5.9.6.3 *CCE Alternative*

5.9.6.3.1 **CNC (CPC + UPF)**

By definition, there is no “CNC Alternative” at Y-12. A CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.6.3.2 **CNPC (CPC + UPF + A/D/HE Center)**

A CNPC would be made up of a CPC, UPF and A/D/HE Center. The CPC and UPF are discussed in Section 5.9.6.2, and the A/D/HE Center is discussed below.

Construction

A/D/HE Center. As described in Section 3.5.1.2, an A/D/HE Center would consist of multiple aboveground facilities. The A/D reference location at Y-12 is along Bear Creek Road on the western side of the Y-12 Complex, with the HE fabrication facilities located approximately 4.5 miles west. An estimated 300 acres of land for buildings, walkways, building access, parking, buffer space, and construction-related workspace would be required to construct the A/D/HE Center. Construction of the A/D/HE Center would have no impact on geological resources and the hazards posed by geological conditions are expected to be minor. Slopes and underlying foundation materials are generally stable at Y-12 and ORR. Landslides or other non-tectonic events are unlikely to affect the construction sites. Sinkholes are present in carbonate units such as the Knox Dolomite, but it is unlikely that they would impact the construction of the A/D/HE Center project, as these karst-forming carbonate units are not present in areas of Y-12 under consideration for the project.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. Past earthquake events in this area have not resulted in the liquefaction of foundation soils. All new facilities and building expansions would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1B, *Facility Safety*, and accompanying safety guidelines.

Operation

CNPC. An estimated 518 acres of land for buildings, walkways, building access, parking, and buffer space would be required to operate the CNPC. During operation, minor soil erosion impacts are expected, but retention basins, runoff control ditches, and cell design components would minimize impacts. The CNPC and other new facilities would have no added impact on geology or soils during operation because of site design and engineered control measures.

5.9.6.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to geology and soils, reduced operations would have no impact.

5.9.7 Biological Resources

5.9.7.1 *No Action Alternative*

Within the fenced, developed portion of Y-12, grassy and unvegetated areas surround the entire facility. Building and parking lots dominate the landscape at Y-12, with limited vegetation present. A wetlands survey of the Y-12 area found palustrine, scrub/shrub, and emergent wetlands. Sixty-four fish species have been collected on or adjacent to the ORR. Forty-five Federal- or state-listed threatened, endangered, and other special status species have been identified on the ORR; however none have been observed at Y-12.

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. There would be no additional impacts to biological resources beyond current and planned activities that are independent of this action. Existing biological resources are discussed in Section 4.9.7.

5.9.7.2 *DCE Alternative*

5.9.7.2.1 Terrestrial Resources

Construction

Short-term impacts to terrestrial resources could occur during construction activities. The CPC (140 acres) and UPF (35 acres) would be constructed on approximately 175 acres of land, which includes laydown areas and a temporary parking lot. There would be some disturbance to terrestrial biotic resources due to construction, construction vehicle traffic, and associated utility and parking relocation. Some dislocation of small urban type species (i.e., rodents) could be expected. Because the areas on which these facilities would be constructed are largely developed and paved, terrestrial biotic impacts would be few. The upgrade of Y-12 facilities would not involve any new land disturbance and would not impact terrestrial resources.

Because appropriate stormwater management techniques would be used to prevent pollutants from entering local waterways, aquatic resources should not be negatively impacted. If required, mitigation measures would be used to minimize the impacts to biological resources that might occur during operation activities associated with this alternative.

Operation

Operational impacts to terrestrial resources from the operation of the CPC, UPF, or upgrades would not be expected. The facilities would be located in a developed area. Additionally, the Biological Monitoring and Abatement Program (BMAP) would continue and would be used to ascertain any impacts from the CPC, UPF, or upgraded facilities on local biota. However, if required, mitigation measures would be used to minimize the impacts to biological resources that might occur during operation activities associated with this alternative.

5.9.7.2.2 Wetlands

Construction

There are wetlands along the East Fork Poplar Creek (EFPC), located to the southeast of the sites for the CPC, UPF, and existing facilities, but the stormwater management measures would help protect them from any impacts. The BMAP would continue to monitor effects in both wetlands and waterways from the construction of UPF and other Y-12 activities. Although wetlands have been identified on the Oak Ridge Reservation (ORR), no wetlands have been observed in close proximity to the project area.

Operation

There are no adverse impacts anticipated from the operation of the CPC, UPF, or upgraded facilities. Although wetlands have been identified on the ORR, no wetlands have been observed in close proximity to the project area.

5.9.7.2.3 Aquatic Resources

Construction

There are wetlands along EFPC, located to the southeast of the sites for the new and existing facilities, but the stormwater management measures would help protect them from any impacts. The BMAP would continue to monitor effects in both wetlands and waterways from the construction of the CPC and UPF. If required, mitigation measures would be used to minimize the impacts to biological resources that might occur during operation activities associated with this alternative.

Operation

There are no adverse impacts anticipated from the operation of the CPC, UPF, or facilities that would be upgraded. There would be no direct untreated effluent discharges to the environment. Although wetlands have been identified on the ORR, no wetlands have been observed in close proximity to the project area. If required, mitigation measures would be used to minimize the impacts to biological resources that might occur during operation activities associated with this alternative.

5.9.7.2.4 Threatened and Endangered Species

Section 7 of the *Endangered Species Act* requires all Federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of endangered or threatened species. Agencies must assess potential impacts and determine if proposed projects may affect federally listed or proposed-for-listing species. No Federal- and state-threatened and endangered species, or other species of special interest that may occur at Y-12, are known to be present within the proposed site location. Prior to any construction activities, NNSA would consult with the U.S. Fish and Wildlife Service (USFWS), as appropriate, to discuss the potential impacts of any new facilities on any threatened and endangered species./

Construction

Approximately 175 acres would be cleared or modified during CPC and UPF construction. Because any acreage modified from construction would be in previous developed areas, impacts to threatened and endangered species would not be expected. The upgrade of Y-12 facilities would not involve any new land disturbance.

Operation

Approximately 118 acres of land would be permanently modified. The land to be used for the CPC and UPF is already developed and is accessible via existing roads. Monitoring to assure that threatened and endangered species and other special status species, such as the gray bat (*Myotis grisescens*), which is present in other parts of the ORR but not Y-12, would continue. On January 19, 2007, the NNSA conducted consultations with the USFWS to discuss the potential impacts of the UPF on the Indiana bat and gray bat. As a result of that consultation, NNSA agreed to prepare a biological assessment (BA) to specifically address the potential impacts to the habitats of these bats. That BA is currently being prepared. The upgrade of Y-12 facilities would not involve any new land disturbance.

There would be no direct untreated effluent discharges to the environment and air emissions would be controlled to levels that would not be expected to adversely affect special-interest species. With implementation and adherence to administrative procedures, along with facility design and engineering controls, operations of the CPC, UPF, or upgraded facilities would minimize the potential impacts to any special-interest species population.

5.9.7.3 CCE Alternative

5.9.7.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.7.3.2 CNPC (CPC + UPF + A/D/HE Center)

The CNPC would be made up of CPC, UPF and A/D/HE Center. The CPC and UPF are discussed in Section 5.9.7.2, and the A/D/HE Center is discussed below.

Construction

A/D/HE Center. Approximately 300 acres of land would be permanently modified or lost as habitat, foraging area, or as a prey base during construction activities for the A/D/HE Center. Impacts for terrestrial resources, wetlands, aquatic resources, and threatened and endangered species would be similar to those described for construction of the A/D/HE Center.

Operation

CNPC. Approximately 518 acres of land would be permanently modified or lost as habitat, foraging areas, or as a prey base for species of special interest during operation of the CNPC. Impacts for terrestrial resources, wetlands, aquatic resources, and threatened and endangered species would be similar to those described for construction of the CPC and UPF.

5.9.7.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to biological resources, reduced operations would have no impact.

5.9.8 *Cultural and Archaeological Resources*

5.9.8.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9, and no additional impacts to cultural and archaeological resources are expected.

5.9.8.2 *DCE Alternative*

5.9.8.2.1 *Cultural and Archeological Resources*

Construction

Construction of the CPC, UPF, or upgrades would take place in areas outside of the proposed historic district and there would be no appreciable impacts or changes.

Operation

Operation of the CPC, UPF, or upgraded facilities would have no impact on the current cultural or archaeological resources at Y-12.

5.9.8.3 *CCE Alternative*

5.9.8.3.1 *CNC (CPC + UPF)*

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.4.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.8.3.2 *CNPC (CPC + UPF + A/D/HE Center)*

The CNPC would be made up of CPC, UPF and A/D/HE Center. The CPC and UPF are discussed in Section 5.9.8.2, and the A/D/HE Center is discussed below.

Construction

A/D/HE Center. Construction of the A/D/HE Center, as described in Section 3.5.1.2, would take place in areas outside of the proposed historic district and there would be no appreciable impacts or changes.

Operation

CNPC. Operation of the CNPC and other new facilities would have no impact on the current cultural and archeological resources at Y-12

5.9.8.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to cultural and archeological resources, reduced operations would have no impact.

5.9.9 *Socioeconomics*

This section analyzes the impacts to socioeconomic resources from the No Action Alternative, DCE Alternative, and the CNPC Alternative.

5.9.9.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. There would be no additional impacts to socioeconomic resources beyond current and planned activities that are independent of this action. Y-12 has a total site employment of about 6,500 contract and federal employees. Labor force statistics for the ROI are summarized in Table 4.9.9-1. Existing socioeconomic characteristics for the ROI are described in Section 4.3.9.

5.9.9.2 *DCE Alternative*

5.9.9.2.1 *Regional Economic Characteristics*

Construction

CPC. Construction of the CPC would require 2,900 worker-years of labor. During peak construction, 850 workers would be employed at the site. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 3,570 indirect jobs would be created, for a total of 4,420 jobs.

The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$26,100 for the construction industry, direct income would increase by \$22.2 million annually. This would also generate additional indirect income in supporting industries (the analysis uses the average ROI earnings of \$29,986 for other indirect jobs). The total impact to the ROI income would be approximately \$129 million (\$22 million direct and

\$107 million indirect). Table 5.9.9-1 illustrates the impacts to socioeconomic resources from construction of the CPC.

Table 5.9.9-1 — Socioeconomic Impacts: Construction of the CPC, UPF, or Y-12 Upgrade

Socioeconomic Factor	CPC	UPF	Upgrade
Worker Years	2,900	2,900	1,000
Peak Workers	850	900	300
Indirect Jobs Created	3,570	3,780	1,260
Total Jobs Created	4,420	4,680	1,560
ROI Average Earning (direct)	\$26,100	\$26,100	\$26,100
ROI Average Earning (indirect)	\$29,986	\$29,986	\$29,986
Direct Income Increase	\$22,185,000	\$23,490,000	\$7,830,000
Indirect Income Increase	\$107,050,020	\$113,347,080	\$37,782,360
Total Impact to the ROI	\$129,235,020	\$136,837,080	\$45,612,36

Source: NNSA 2007, BEA 2007a.

UPF. The construction of the UPF would require 900 workers during the peak year of construction. A total of 4,680 additional jobs (900 direct and 3,780 indirect) would be created in the ROI during the peak year of construction. The total new jobs would represent an increase of less than 2 percent in ROI employment. Income increases would be comparable to those expected for construction of the CPC at Y-12. Overall, these changes would be temporary, lasting only the duration of the 6-year construction period, and would be similar in magnitude to the socioeconomic impacts that are currently being experienced at Y-12 with construction of the HEUMF.

Upgraded Y-12 Facilities. The upgrade would require approximately 300 workers, generating a total of 1,560 jobs (300 direct and 1,260 indirect) in the ROI during the peak year of construction. The total jobs would represent an increase of approximately 0.5 percent in ROI employment, while the direct jobs would increase the employment at Y-12 by approximately 4 Percent. These changes would be temporary, lasting only the duration of the 10-year construction period, and would be much less in magnitude than the socioeconomic impacts that are currently being experienced at Y-12 with construction of the HEUMF. The existing ROI labor force could likely fill all of the jobs generated by the increased employment and expenditures. Therefore, there would be no impacts to the ROI's population or housing sector. Because there would be no change in the ROI population, there would be no change to the level of community services provided in the ROI.

Operation

CPC. Operation of the CPC would require 1,780 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 7,476 indirect jobs would be created, for a total of 9,256 jobs. The ROI income would increase less than 1 percent as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$87.6 million annually. This would also generate additional indirect income in supporting industries (based on average ROI income of \$29,986). The total impact to the ROI income would be approximately \$311 million (\$87 million direct and \$224 million indirect). Table 5.9.9-2 describes the impacts to socioeconomic resources from operation of the facilities considered in this SPEIS.

Table 5.9.9-2 — Socioeconomic Impacts from Operation of Facilities

Socioeconomic Resource	CPC	UPF ^a	A/D/HE Center	CNPC
Workers	1,780	600	1,785	4,165
Indirect Jobs Created	7,476	2,520	7,497	17,493
Total Jobs Created	9,256	3,120	9,282	21,658
ROI Average Earning (direct)	\$49,200	\$49,200	\$49,200	\$49,200
ROI Average Earning (indirect)	\$29,986	\$29,986	\$29,986	\$29,986
Direct Income Increase	\$87,576,000	\$29,520,000	\$87,822,000	\$204,918,000
Indirect Income Increase	\$224,175,000	\$75,565,000	\$224,805,000	\$524,545,000
Total Impact to the ROI	\$311,351,000	\$105,085,000	\$312,627,000	\$729,463,000

^a For UPF, the numbers in the table reflect the absolute impacts of that facility. In terms of incremental impacts, once operational, the UPF would actually result in a decrease in employment of 750 direct workers, due to more efficient operations than the current EU operations at Y-12.

Source: NNSA 2007, BEA 2007a.

UPF. Upon completion of construction, the operational workforce for the UPF is expected to be smaller than the existing EU workforce due to efficiencies associated with the new facility. NNSA estimates that the total number of EU workers should decrease by approximately 35 percent, to 600, which is a reduction of 350 workers. The consolidation of the Protected Area from 150 acres to 15 acres is also expected to reduce the security forces at Y-12 by 400 workers. Coupled together, the total workforce reduction should be 750 workers, which is approximately 11 percent of the total Y-12 workforce. These reductions are expected to be met through normal attrition/retirements, as about 50 percent of the work force at Y-12 is eligible to retire within the next 5 years.

Upgraded Y-12 Facilities. Upon completion of the upgrades (approximately 2015), operation of the EU facilities would not result in any significant change in Y-12 workforce requirements and the facilities would be staffed by the existing Y-12 workforce. Therefore, there would be no change from the baseline Y-12 employment and no impacts to ROI employment, income, population, housing, or community services. Upgrading the existing facilities would not allow the EU operations at Y-12 to be reduced from approximately 150 acres to 15 acres, and would not reduce security force requirements

5.9.9.2.2 Population and Housing

Construction

CPC. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-half of the construction jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for the peak year of construction (850 workers), a total of 1,275 new residents would be expected in the ROI. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population.

UPF. The influx of new workers would increase the ROI population and could create new housing demand. For construction (900 new workers), 1,350 new residents would be expected in

the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population.

Upgrade Y-12 Facilities. The influx of new workers would increase the ROI population and create new housing demand. For construction (300 new workers), 450 new residents would be expected in the ROI, including workers and their families. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population.

Operation

CPC. The influx of new workers would increase the ROI population and create new housing demand. This analysis assumes that one-third of the operations jobs would be filled by incoming workers and that each worker would bring an average of two family members to the ROI. Consequently, for operations (1,780 workers), a total of 1,780 new residents would be expected in the ROI. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.9.9-2 presents the impacts to socioeconomic resources from operation of the CPC.

UPF. The total workforce reduction should be 750 workers, which is approximately 11 percent of the total Y-12 workforce. These reductions are expected to be met through normal attrition/retirements, as about 50 percent of the work force at Y-12 is eligible to retire within the next 5 years. As such, UPF should have a minimal impact on the ROI's population or housing sector.

5.9.9.2.3 Community Services

Construction and Operation

CPC. There would be no impact to ROI community services because increases in the ROI population would be less than 1 percent.

UPF. There would be no impact to ROI community services because increases in the ROI population during construction would be less than 1 percent. Once operational, there would be no impact to ROI community services because any jobs lost from more efficient operations in the UPF would likely be met through normal attrition.

5.9.9.3 CCE Alternative

5.9.9.3.1 CNC (CPC + UPF)

By definition, there is no "CNC Alternative" at Y-12. The CPC and UPF, discussed in Section 5.9.9.2, would constitute a "CNC" if both projects were implemented at Y-12.

5.9.9.3.2 CNPC (CPC + UPF + A/D/HE Center)

Regional Economy Characteristics

A/D/HE Center Construction. Construction of the A/D/HE Center would require 6,850 worker-years of labor. During peak construction, 3,820 workers would be employed at the site. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that 16,044 indirect jobs would be created, for a total of 19,864 jobs. This represents approximately 10 percent of the total ROI labor force. Income within the ROI would increase as a result of the new jobs created. Based on the ROI average earnings of \$44,900 for the construction industry, direct income would increase by \$171.5 million at peak construction. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$700.5 million (\$171.5 million direct and \$529 million indirect). Table 5.9.9-3 describes the impacts to socioeconomic resources from construction of the AD/HE Center.

Table 5.9.9-3 — Socioeconomic Impacts from Construction of A/D/HE Center

Socioeconomic Factor	AD/HE
Worker Years	6,850
Peak Workers	3,820
Indirect Jobs Created	16,044
Total Jobs Created	19,864
ROI Average Earning (direct)	\$44,900
Direct Income Increase	\$171,518,000
Indirect Income Increase	\$529,019,000
Total Impact to the ROI	\$700,537,000

Source: NNSA 2007, BEA 2007a.

CNPC Operation. Operation of the CNPC would require 4,500 workers. In addition to the direct jobs created by the operation of the facility, additional jobs would be created in other supporting industries. It is estimated that 17,493 indirect jobs would be created, for a total of 21,658 jobs. The ROI income would increase as a result of the new jobs created. Based on the ROI average earnings of \$49,200 for the government services industry, direct income would increase by \$204.9 million annually. This would also generate additional indirect income in supporting industries. The total impact to the ROI income would be approximately \$729 million (\$205 million direct and \$524 million indirect).

Population and Housing

A/D/HE Center Construction. The influx of new workers would increase the ROI population and create new housing demand. For the peak year of construction (3,820 workers), a total of 5,730 new residents would be expected in the ROI. This is an increase of approximately 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.9.9-3 presents the impacts to socioeconomic resources from construction of the A/D/HE Center.

CNPC Operation. The influx of new workers would increase the ROI population and create new housing demand. For operations (4,500 workers), a total of 4,500 new residents would be expected in the ROI. This is an increase of less than 1 percent over the current population. The current housing market would likely be sufficient to absorb this increase in the ROI population. Table 5.9.9-2 presents the impacts to socioeconomic resources from operation of the facilities that would comprise a CNPC.

Community Services

A/D/HE Center Construction. The increase in population would not increase demand on local community services. Comparable levels of service could be maintained without increased staffing. Table 5.9.9-3 describes the impacts to socioeconomic resources from construction of the A/D/HE Center.

CNPC Operation. There would be no significant impact to the ROI community services from a 5 percent increase over the current population.

5.9.9.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to socioeconomic, reduced operations would reduce the workforce from 6,500 to 3,900. This workforce, which currently represents approximately 3.1 percent of the ROI employment, would fall to 1.9 percent. DOE has a significant impact on the economies both of the ROI and of Tennessee. The loss of 2,600 direct jobs could result in the loss of up to 10,920 indirect jobs. The total job loss in the ROI (13,520 jobs) would represent 6.5 percent of the total ROI employment.

5.9.10 **Environmental Justice**

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify themselves as being Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and other Pacific Islander; or another non-White race; or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income.

Section 4.9.10 presents the existing environmental justice characteristics of the ROI, including census tracts for minority and low-income populations. Impacts for all of the alternatives do not differ significantly, as such; the analysis in this section discusses potential environmental justice impacts for all impacts.

In 2000, minority populations comprised 7.4 percent of the ROI population surrounding Y-12. In 2000, minorities comprised 30.9 percent of the population nationally and 20.8 percent of the population in Tennessee. The percentage of persons within the ROI below the poverty level at the time of the 2000 Census was 13.4 percent, which is higher than the 2000 national average of 12.4 percent and the statewide figure of 13.5 percent.

Based on the analysis of impacts for resource areas, few high and adverse impacts from construction and operation activities at Y-12 are expected under any of the alternatives; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land uses, visual resources, noise, water, geology and soils, biological resources, socioeconomic resources, cultural and archaeological resources. As shown in Section 5.9.11, Human Health and Safety, there are no large adverse impacts to any populations.

5.9.11 Health and Safety

5.9.11.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. There would be no additional impacts to health and safety beyond current and planned activities that are independent of this action. It is expected that total dose to the MEI for continued Y-12 activities would be about 0.4 mrem per year. Existing health and safety at Y-12 is discussed in Section 4.9.11.

5.9.11.2 *DCE Alternative*

Construction

CPC, UPF, and Upgraded Y-12 Facilities. No radiological risks would be incurred by members of the public from construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the CPC and UPF reference sites are “Greenfield” sites, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept ALARA. Non-radiological impacts to workers were evaluated using occupational injury, illness, and fatality rates obtained from BLS, U.S. Department of Labor data. DOE values are historically lower than BLS values owing to the increased focus on safety fostered by complex-wide programs, including ISM and the VPP. Additionally, the small number of fatal accidents reported in the CAIRS makes associated calculated fatality rates statistically invalid.

The potential risk of occupational injuries and fatalities to workers constructing the CPC, UPF, or upgrading Y-12 facilities would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown below in Table 5.9.11-1.

Table 5.9.11-1 — Injury, Illness, and Fatality Estimates for Construction of the CPC, UPF, and A/D/HE Center at Y-12

Injury, Illness, and Fatality Categories	Projects Under Consideration			
	CPC	UPF	Upgrade Y-12	A/D/HE Center
Peak Annual Employment	850	900	300	3,820
Total Recordable Cases	81	85	28	329
Total Lost Workday Cases	38	41	14	159
Total Fatalities	0.2	0.2	0.1	0.8
Project Duration				
Total Recordable Cases	276	292	97	1,128
Total Lost Workday Cases	143	141	47	541
Total Fatalities	0.7	0.7	0.2	2.6

Source: NNSA 2007, BLS 2002b.

No chemicals have been identified that would be a risk to members of the public from construction activities associated with the CPC. Construction workers would be protected from overexposure to hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals. Implementation of worker protection programs to construction activities would also decrease the potential for worker exposures by providing hazards identification and control measures for construction activities.

Operation

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its facilities. Environmental radiation protection is currently regulated by DOE Order 5400.5. This Order sets annual dose standards to members of the public from routine DOE operations of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an EDE in a year greater than 10 mrem from airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61, Subpart H) limit exposure to the MEI of the public from all air emissions to 10 mrem per year.

NNSA expects minimal public health impacts from the radiological consequences of CPC and UPF operations. Table 5.9.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Table 5.9.11-2 — Annual Radiological Impacts on the Public from CPC, UPF, Y-12 Upgrade, and A/D/HE Center Operations at Y-12

Receptor	Projects Under Consideration		
	CPC	UPF or Y-12 Upgrade	A/D/HE Center
Population within 50 miles			
Collective dose (person-rem)	1.2×10^{-7}	10.8	0.032
Percent of natural background radiation ^a	8.5×10^{-11}	7.6×10^{-3}	2.2×10^{-5}
LCFs ^b	7×10^{-11}	6.5×10^{-3}	1.9×10^{-5}
Offsite MEI			
Dose (mrem)	1.7×10^{-8}	0.8	3.75×10^{-3}
Percent of regulatory dose limit	1.7×10^{-7}	8.0	0.037
Percent of natural background radiation ^a	5.1×10^{-9}	0.23	1.1×10^{-3}
Cancer fatality risk ^b	1×10^{-11}	4.8×10^{-4}	2.25×10^{-6}

^aThe average annual dose from background radiation at Y-12 is 335 mrem; the 422,287 people living within 50 miles of Y-12 in the year 2043 would receive an annual dose of 141,466 person-rem from the background radiation.

^b Based on a cancer risk estimate of 0.0006 Latent Cancer Fatalities per rem or person-rem.

^c The offsite MEI is assumed to reside at the site boundary, 1.3 miles from the CPC. An actual residence may not currently be present at this location.

Source: Tetra Tech 2007.

As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity. The risk of a LCF to this individual from CPC operations would be approximately 1×10^{-11} per year (i.e., about 1 chance in 100 billion years of operation) for the CPC and approximately 4.8×10^{-4} per year (i.e., about 1 chance in 2000 years of operation) for the UPF.

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, *Occupational Radiation Protection*, which limits the occupational dose for an individual worker at 5,000 mrem per year. DOE/NNSA has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The worker radiation dose projected in this SPEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose and internal dose, as required by 10 CFR Part 835.

Estimates of annual radiological doses to workers involved with CPC operations are independent of geographical location. These dose estimates are solely a function of:

- The number of radiological workers, as determined in the development of the CPC staffing estimate for each throughput alternative. The current estimates were developed by application of a factor to the total workers for each work group based on operating experience in plutonium facilities. Approximately 60 percent of total operating staff are estimated to be radiological workers.
- The working dose rate at the glovebox surface for each unit operation or workstation. These dose rates were calculated based on the maximum mass (plutonium, americium) and form (metal, oxide) of material being handled. Standard “weapons grade” isotopic distribution, and americium content of 0.5 percent were assumed.

- The amount of time spent by direct operators/first line supervisors in the radiation area. This was determined from a time-motion estimate of direct “hands-in-gloves” labor required to perform each individual operation and the number of parts processed per year for a given pit production rate. Efficiency scaling factors were applied for various operations. For Foundry and Machining operations, this was assumed to be 50 percent; for Assembly and Post-Assembly & Testing, efficiencies were 90 percent.

As indicated above, the collective annual dose (mrem per year) received by individual direct operators is calculated based on the number of operators required for the various production rates, the time spent in the radiation area, and the associated dose rates for each operation. The collective exposures for support group workers were added to these numbers and were calculated using empirical data that implies that exposure for these workers can be estimated as a percentage of direct operator exposure (e.g., Analytical Laboratory Technician ~25 percent of direct operator exposure). The average individual dose is calculated as the collective exposure divided by the estimated number of radiological workers for each throughput alternative.

The estimates of annual radiological doses to workers are provided in Table 5.9.11-3. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 mrem (10 CFR 835) and the DOE-recommended control level of 1,000 mrem (10 CFR 835). Operations in the CPC would result in an average individual worker dose of approximately 290 mrem annually. The total dose to workers associated with the CPC operations would be approximately 333 person-rem. Statistically, a total dose of 333 person-rem would result in 0.2 annual LCFs to the CPC workforce. The projected number of fatal cancers in the workforce from CPC annual operations would be 0.2 (or 2 chances in 10 that the worker population would experience a fatal cancer per year of operations).

Table 5.9.11-3 — Annual Radiological Impacts on CPC, UPF, and A/D/HE Center Workers at Y-12 from Operations

	CPC	UPF or Y-12 Upgrade	A/D/HE Center
Number of Radiological Workers	1,150	600 ^d	400
Individual Workers^a			
Average individual dose, mrem/yr ^b	290	21	103
Average worker cancer fatality risk ^c	2×10^{-4}	1.3×10^{-5}	6.2×10^{-5}
Worker Population			
Collective dose (person-rem)	333	12.6	41.2
Cancer fatality risk ^c	0.20	0.008	0.025

^a The regulatory dose limit for an individual worker is 5,000 mrem/yr (10 CFR 835). However, the maximum annual dose to a worker would be kept below the DOE Control Level of 1,000 mrem/yr, as established in 10 CFR 835. Further, DOE recommends that facilities adopt a more limiting 500-mrem/yr Administrative Control Level (DOE 1999e). To reduce doses to levels that are as low as reasonably achievable, an effective dose reduction plan would be enforced.

^b Less than one third of all radiological workers would receive doses greater than, but no more than 90 percent above, the average worker dose.

^c Based on a cancer risk estimator of 0.0006 LCFs per rem or person-rem.

^d Total workforce for UPF is 600., of which 315 are considered “radiological workers”. For purposes of assessing UPF worker impacts, it is assumed all 600 workers receive radiation dose.

Source: Tetra Tech 2007.

Operations in the UPF or upgraded facilities would result in a total dose to workers of approximately 12.6 person-rem. Statistically, a total dose of 12.6 person-rem would result in 0.008 annual LCFs to the Y-12 workforce.

During normal (accident-free) operations, total facility staffing at the CPC and UPF (or upgraded facilities) would be approximately 1,780 and 600, respectively. The potential risk of occupational injuries and fatalities to workers operating the CPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are presented below in Table 5.9.11-4.

Table 5.9.11-4 — Injury, Illness, and Fatality Annual Estimates for Normal Operations of the CPC, UPF, and CNPC at Y-12

Injury, Illness, and Fatality Categories	Projects Under Consideration		
	CPC	UPF or Y-12 Upgrade	CNPC
Total Workers	1,780	600	4,500
Total Recordable Cases	77	26	195
Total Lost Workday Cases	40	14	101
Total Fatalities	0.07	0.02	0.18

Source: NNSA 2007, BLS 2002b.

No chemical-related health impacts are associated with normal (accident-free) operations of the CPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (WSRC 2002c).

5.9.11.3 CCE Alternative

5.9.11.3.1 CNC (CPC + UPF)

By definition, there is no “CNC Alternative” at Y-12. The CPC and UPF, discussed in Section 5.9.11.2, would constitute a “CNC” if both projects were implemented at Y-12.

5.9.11.3.2 CNPC (CPC + UPF + A/D/HE Center)

Health and safety impacts from the construction and operation of the CNPC would include the CPC and UPF impacts discussed in Section 5.9.11.2 as well as the impacts discussed below.

Construction

No radiological risks would be incurred by members of the public from the A/D/HE Center construction activities. Construction workers could be at a small radiological risk. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, because the A/D/HE Center reference site is a “Greenfield” site, the likelihood of exposure from contamination is considered to be low during construction. Additionally, workers would be protected through appropriate training, monitoring, and management controls. Their exposures would be limited to ensure that doses were kept as low as reasonably achievable. The potential risk of occupational injuries and

fatalities to workers constructing the A/D/HE Center would be expected to be bounded by injury and fatality rates for general industrial construction. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for both the peak workforce loading and for the duration of construction activities. These values are shown in Table 5.9.11-1.

Operation

DOE expects minimal public health impacts from the radiological consequences of A/D/HE Center operations. Table 5.9.11-2 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs. To put the doses into perspective, comparisons with natural background radiation levels are included in the table. As shown in the table, the expected annual radiation dose to the offsite MEI would be much smaller than the limit of 10 mrem per year set by both EPA (40 CFR 61) and DOE (DOE Order 5400.5) for airborne releases of radioactivity.

The estimates of annual radiological doses to workers are provided in Table 5.9.11-3. As shown in the table, approximately 400 radiological workers would be required to conduct A/D/HE Center operations. Operations in the A/D/HE Center would result in an average individual worker dose of approximately 103 mrem annually. The total annual dose to workers associated with the CNPC operations would be approximately 41.2 person-rem. Statistically, an annual dose of 41.2 person-rem would result in 0.025 LCFs to the A/D/HE Center workforce.

The potential risk of occupational injuries and fatalities to workers operating the CNPC would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Using BLS data for 1997-2001, Total Recordable Cases, Lost Workday Cases, and Fatalities were estimated for facility operations. These values are shown in Table 5.9.11-4.

No chemical-related health impacts are associated with normal (accident-free) operations of the CNPC. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness.

5.9.11.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to health and safety, reduced operations would reduce the number of workers involved in radiological operations from approximately 839 to 500. This would reduce the total worker dose from 32.0 person-rem to 19.1 person-rem. Statistically, the number of LCFs would be reduced from 1.9×10^{-2} to 1.1×10^{-2} .

5.9.12 *Facility Accidents*

This section presents the potential impacts on workers (both involved and non-involved) and the

public due to potential accidents associated with the operation of the CPC, UPF, and the A/D/HE Center at Y-12. Additional details supporting the information presented here are provided in Appendix C.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, NNSA predicted the dispersion of released hazardous materials and their effects. However, prediction of potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident.

Emergency Preparedness— Each NNSA site has established an emergency management program to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts— NNSA estimated radiological impacts to three receptors: (1) the MEI at the Y-12 boundary; (2) the offsite population within 50 miles of Y-12; and (3) a non-involved worker 3,281 feet from the accident location. NNSA did not evaluate total dose from accidents to the involved workforce because this would depend upon the specific location of the facilities

on each site, which is not an issue that will be decided as a result of this SPEIS. In any tiered, project-specific EIS, accident impacts to the non-involved workforce would be analyzed to evaluate alternative locations on the selected site.

5.9.12.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.3. There would be no additional accident risks beyond those associated with current and planned activities that are independent of this action. Potential accident scenarios for the No Action Alternative are addressed in existing documentation included by reference (DOE 2001a). Section 5.9.12.1 includes an analysis of accidents associated with existing enriched uranium operations, which would be applicable to the No Action Alternative.

5.9.12.2 *Consolidated Plutonium Center*

5.9.12.2.1 **Radiological Accidents**

Table 5.9.12-1 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of a CPC) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. Table 5.9.12-2 shows the accident risks, obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur.

The accidents listed in these tables were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the CPC. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 5.9.12-1 — CPC Radiological Accident Frequency and Consequences at Y-12

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	219	0.263	295,000	177	857	1
Fire in a single building	1.0×10^{-4}	173	0.208	152,000	91.2	4,760	1
Explosion in a feed casting furnace	1.0×10^{-2}	203	0.244	178,000	107	5,580	1
Nuclear Criticality	1.0×10^{-2}	0.000301	1.81×10^{-7}	0.117	7.02×10^{-5}	0.00544	3.26×10^{-6}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	13.5	0.0081	11,900	7.14	372	0.446
Radioactive material spill	1×10^{-2}	0.406	0.000244	357	0.214	11.2	0.00672

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.9.12-2 — Annual Cancer Risks for CPC—Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	2.63×10^{-6}	1.77×10^{-3}	1×10^{-5}
Fire in a Single Building	2.08×10^{-5}	9.12×10^{-3}	1×10^{-4}
Explosion in a Feed Casting Furnace	2.44×10^{-3}	1.07	1×10^{-2}
Nuclear Criticality	1.81×10^{-9}	7.02×10^{-7}	3.26×10^{-8}
Fire-induced Release in the CRT Storage Room	8.1×10^{-5}	7.14×10^{-2}	4.46×10^{-3}
Radioactive Material Spill	2.44×10^{-6}	2.14×10^{-3}	6.72×10^{-5}

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The results of the accident analysis indicate potential consequences that exceed the NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The analyses in these cases are based on unmitigated releases of radioactive material in order to identify any differences among candidate sites for a CPC. Additional NEPA analyses would be conducted to identify specific mitigating features that would be incorporated in a CPC design to ensure compliance with exposure guidelines if NNSA were to decide to build a CPC at one of the candidate sites. These could include procedural and equipment safety features, HEPA filtration systems, and other design features to protect radioactive materials from release and to contain any material that might be released.² Upon completion of these additional analyses, NNSA would prepare safety analysis documentation such as a safety analysis report to further

² For example, installing safety basis HEPA filters could reduce releases by orders of magnitude.

ensure that exposure guidelines would not be exceeded. The results of the safety analysis report are incorporated into facility and equipment design and establish procedures to ensure public and worker safety. Once specific mitigation measures were incorporated into a CPC design and operating procedures, it is unlikely that the potential consequences would exceed the guidelines of 25 rem for a member of the public at the nearest site boundary for any of the site alternatives.

The accident with the highest potential consequences to the offsite population (see Table 5.9.12-1) is the beyond evaluation basis earthquake and fire. Approximately 177 LCFs in the offsite population could result from this accident in the absence of mitigation. An offsite MEI would receive a dose of 219 rem. Statistically, the MEI would have a 0.1 chance of developing a LCF, or about 1 in 10. This accident has a probability of occurring once every 100,000 years.

When probabilities are taken into account (see Table 5.9.12-2), the accident with the highest risk to the MEI is the explosion in a feed casting furnace. For this accident, the LCF risk to the MEI would be 2×10^{-3} , or approximately 1 in 500. For the population, the LCF risk would be 1.07, meaning that approximately 1 LCF would statistically occur once every year in the population.

5.9.12.2.2 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. For this analysis, ERPG values are used to develop hazard indices for chemical exposures. ERPG definitions are provided below.

ERPG DEFINITIONS

ERPG 1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG 2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG 3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at the CPC. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Table 5.9.12-3 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released.

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the

ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Both Gaussian Plume and ALOHA methodologies were used to evaluate the potential consequences associated with a release of each chemical in an accident situation. Table 5.9.12-3 shows the consequences of the dominant loss of containment accident scenarios.

The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.9.12-3 — CPC Chemical Accident Frequency and Consequences at Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.28	0.5	0.01	10 ⁻⁴
Hydrofluoric acid	550	20	0.35	2.0	0.016	10 ⁻⁴
Formic acid	1,500	10	0.08	0.07	0	10 ⁻⁴

^a Site boundary is at a distance of approximately 1.3 miles.
 Source: Tetra Tech 2007

5.9.12.2.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.9.12.3 Uranium Processing Facility or Upgrade of Y-12 Facilities

5.9.12.3.1 Radiological Accidents

Table 5.9.12-4 shows the frequencies and consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the UPF or upgraded facilities) and a hypothetical non-involved worker, as well as the accident risks (Table 5.9.12-5), obtained by multiplying the consequences by the likelihood (frequency per year) that an accident would occur. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem. If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the

accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the UPF or upgraded facilities.

Table 5.9.12-4 — UPF or Upgraded Facilities, Radiological Accident Frequency and Consequences at Y-12

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.592	0.000355	520	0.312	16.3	0.00978
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.0577	0.0000346	51.2	0.0307	1.18	0.000708
Fire in UPF Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.689	0.000413	608	0.365	17.4	0.0104
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.0734	0.000044	66.1	0.0397	1.08	0.000648
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.259	0.000155	665	0.399	0.388	0.000233

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.9.12-5 — Annual Cancer Risks for UPF or Upgraded Facilities at Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	3.55 x 10 ⁻⁸	3.12 x 10 ⁻⁵	9.78 x 10 ⁻⁷
Explosion	3.46 x 10 ⁻⁹	3.07 x 10 ⁻⁶	7.08 x 10 ⁻⁸
Fire in UPF Warehouse	4.13 x 10 ⁻⁸	3.65 x 10 ⁻⁵	1.04 x 10 ⁻⁶
Design-basis fires for HEU Storage	4.4 x 10 ⁻⁷	3.97 x 10 ⁻⁴	6.48 x 10 ⁻⁶
Aircraft crash	1.55 x 10 ⁻⁸	3.99 x 10 ⁻⁵	2.33 x 10 ⁻⁸

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The accident with the highest potential consequences to the offsite population (see Table 5.9.12-4) is the aircraft crash into the EU facilities. Approximately 0.4 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a maximum dose of 0.3 rem. Statistically, this MEI would have a 2x10⁻⁴ chance of developing a LCF, or about 1 in 5,000. This accident has a probability of occurring approximately once every 100,000 years.

When probabilities are taken into account (see Table 5.9.12-5), the accident with the highest risk is the design-basis fire for HEU storage. For this accident, the maximum LCF risk to the MEI would be 5x10⁻⁷, or about 1 in 2 million. For the population, the LCF risk would be 4x10⁻⁴, or about 1 in 2,500.

The UPF Alternative would decrease the overall Y-12 facility accident risks presented above. This is because many of the operations and materials in the existing Y-12 nuclear facilities would be consolidated into the UPF, reducing the accident risks associated with those older facilities. However, detailed design descriptions for the UPF are not available. Without these detailed descriptions, this reduction in accident risks cannot be quantified. New facilities such as the UPF would be constructed to current building design standards and would be designed and built to withstand higher seismic accelerations and thus would be more resistant to earthquake damage. These new facilities would experience damage from earthquakes and other external initiators less frequently. Also, controls would be incorporated into the design of new Y-12 facilities to reduce the frequency and consequence of internally initiated accidents. Therefore, the risks presented above for the current Y-12 facilities (both individually and additive) would be bounding for the UPF; but not overly bounding given that the risks presented above are small.

5.9.12.3.2 Hazardous Chemicals Impacts

The UPF or upgraded facilities would store and use a variety of hazardous chemicals. The quantities of chemicals vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public. NNSA estimated the impacts of the potential release of the most hazardous chemical used at the CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.9.12-6 shows the consequences of the dominant loss of containment accident scenario.

Table 5.9.12-6 — Chemical Accident Frequency and Consequences of UPF or Upgraded Facilities at Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.28	0.5	0.01	10 ⁻⁴

^a Site boundary is at a distance of approximately 1.3 miles.
 Source: Tetra Tech 2007

5.9.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.9.12.4 Assembly/Disassembly/High Explosives Center

5.9.12.4.1 Radiological Accidents at Y-12

The accident scenarios and representative source terms for the A/D/HE Center are shown below:

Scenario	Representative Source Terms	
	Pu Release (Ci)	Tritium Release (Ci)
Scenario 1: Explosive Driven Plutonium and Tritium Dispersal from an Internal Event	400	3.0×10^5
Scenario 2: Tritium Reservoir Failure from an Internal Event	0	2.0×10^5
Scenario 3: Pit Breach from an Internal Event	1.8×10^{-5}	0
Scenario 4: Multiple Tritium Reservoir Failure from an External Event or Natural Phenomena	0	4.0×10^7
Scenario 5: Fire Driven Dispersal Involving Stored Pits from an External Event or Natural Phenomena	50	0
Scenario 6: Plutonium and Tritium Dispersal from an External Event or Natural Phenomena	1.2×10^{-2}	3.0×10^5

Source: Tetra Tech 2007.

Table 5.9.12–8 shows the consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the A/D/HE Center) and a hypothetical non-involved worker. The dose shown in the tables are calculated by the MACCS computer code based on accident data. The LCF values are calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. The accidents listed in this table was selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007). The selection process, screening criteria used, and conservative estimates of material at risk and source term (see Appendix C) ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur at the A/D/HE Center.

Table 5.9.12-8 — A/D/HE Center Radiological Accident Consequences at Y-12

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	54.7	0.0656	48,100	28.9	1,500	1
Scenario 2	0.0392	2.35x10 ⁻⁵	34.4	0.0206	1.08	0.000648
Scenario 3	3.28x10 ⁻⁶	1.97x10 ⁻⁹	0.00288	1.73x10 ⁻⁶	9.02x10 ⁻⁵	5.41x10 ⁻⁸
Scenario 4	2.3	0.00138	5,390	3.23	4.11	0.00247
Scenario 5	2.41	0.00145	5,630	3.38	4.3	0.00258
Scenario 6	0.0179	1.07x10 ⁻⁵	41.8	0.0251	0.0319	1.91x10 ⁻⁵

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table 5.9.12-9 — Annual Cancer Risks for A/D/HE Center Accidents at Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Scenario 1	6.56x10 ⁻⁶	2.89x10 ⁻³	1x10 ⁻⁴
Scenario 2	2.35x10 ⁻⁷	2.06x10 ⁻⁴	6.48x10 ⁻⁶
Scenario 3	1.97x10 ⁻¹¹	1.73x10 ⁻⁸	5.41x10 ⁻¹⁰
Scenario 4	1.38x10 ⁻⁹	3.23x10 ⁻⁶	2.47x10 ⁻⁹
Scenario 5	1.45x10 ⁻⁷	3.38x10 ⁻⁴	2.58x10 ⁻⁷
Scenario 6	1.07x10 ⁻⁷	2.51x10 ⁻⁴	1.91x10 ⁻⁷

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

The results of the accident analysis indicate potential consequences that exceed the NNSA exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The analyses in these cases are based on unmitigated releases of radioactive material in order to identify any differences among candidate sites for an A/D/HE Center. Additional NEPA analyses would be conducted to identify specific mitigating features that would be incorporated in an A/D/HE Center design to ensure compliance with exposure guidelines if NNSA were to decide to build an A/D/HE Center at one of the candidate sites. These could include procedural and equipment safety features, HEPA filtration systems, and other design features to protect radioactive materials from release and to contain any material that might be released.³ Upon completion of these additional analyses, NNSA would prepare safety analysis documentation such as a safety analysis report to further ensure that exposure guidelines would not be exceeded. The results of the safety analysis report are incorporated into facility and equipment design and establish procedures to ensure public and worker safety. Once specific mitigation measures were incorporated into an A/D/HE Center design and operating procedures, it is unlikely that the potential consequences would exceed the guidelines of 25 rem for a member of the public at the nearest site boundary for any of the site alternatives.

³ For example, installing safety basis HEPA filters could reduce releases by orders of magnitude.

The accident with the highest potential consequences to the offsite population (see Table 5.9.12-8) is the explosive driven plutonium and tritium dispersal from an internal event. Approximately 28.9 LCFs in the offsite population could result from such an accident in the absence of mitigation. An offsite MEI would receive a dose of 55 rem. Statistically, this MEI would have a 0.03 chance of developing a LCF, or about 1 in 30. The overall likelihood of this scenario occurring is less than 1×10^{-4} per year.

When probabilities are taken into account (see Table 5.9.12-9), the accident with the highest overall risk is also the explosive driven plutonium and tritium dispersal from an internal event. For this accident, the LCF risk to the MEI would be 7×10^{-6} , or about 1 in 150,000. For the population, the LCF risk would be 3×10^{-3} , or about 1 in 350.

5.9.12.4.2 Hazardous Chemicals Impacts

NNSA estimated the impacts of the potential release of the most hazardous chemicals used at the A/D/HE Center. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Additional information on the evaporation and dispersion of each chemical is provided in Appendix C. Table 5.9.12-10 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released. The American Industrial Hygiene Association defines ERPG-2 as the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons onsite and offsite that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. The distance to the nearest site boundary is 5.4 miles. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

Table 5.9.12-10 — A/D/HE Center Chemical Accident Frequency and Consequences, Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Chlorine	408.23	3	2.3	16	4.5	10^{-4}

^a Site boundary is at a distance of approximately 1.3 miles.
Source: Tetra Tech 2007

5.9.12.4.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of

shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.9.12.5 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to accidents, potential consequences would be virtually unaffected, as consequences are related to the *types* of operations which are conducted, including the material-at-risk, which would not change. The probability that a particular accident would occur would also be relatively unchanged, as most probabilities are small (less than once every 100-1,000,000 years), which means that accident probabilities are largely a function of the operation being conducted, rather than the number of times the operation is conducted. Nonetheless, it is acknowledged that performing an operation less frequently would have a linear reduction in the overall probability that an accident would occur.

5.9.13 **Transportation**

5.9.13.1 *No Action Alternative*

Under the No Action Alternative, there would be no change in the transportation activities at Y-12, and impacts would remain unchanged from the baseline presented in Section 4.9.12.

5.9.13.2 *DCE Alternative*

5.9.13.2.1 **Construction**

CPC, UPF, and Upgrade to Y-12 Facilities. Construction of the CPC, UPF, or upgrades would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.9.12 and would be temporary.

5.9.13.2.2 **Operation**

Radiological transportation for the CPC, UPF, or upgraded facilities would include transport of pits from Pantex to Y-12, return of pits and enriched uranium parts to Pantex, and shipment of TRU waste to WIPP. Section 5.10 presents the impacts of radiological transportation.

The addition of new employees for the CPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.9.12.

5.9.13.3 *CCE Alternative*

5.9.13.3.1 **CNC (CPC + UPF)**

By definition, the DCE Alternatives at Y-12 would amount to a CNC.

5.9.13.3.2 **CNPC (CPC + UPF + A/D/HE Center)**

Construction

A/D/HE Center. Construction of the A/D/HE Center would result in increased traffic due to commuting construction workers and deliveries of construction materials and equipment. Although this traffic increase would tend to exacerbate congestion on local roads, the increase would be small compared to the average daily traffic levels reported in Section 4.9.12 and would be temporary.

Operation

CNPC. If the A/D/HE Center were located at Y-12 as part of a CNPC, the annual radiological transportation impacts associated with the CPC and UPF would not occur, with the exception of TRU waste transportation for the CPC. There would be a one-time transport of SNM from Pantex to the CNPC, as described in Section 5.10. The addition of new employees for the CNPC would represent an increase in ROI employment of less than 1 percent, with a corresponding increase in commuting traffic. Although this traffic increase would tend to exacerbate congestion on local roads, the increase is small compared to the overall average daily traffic level reported in Section 4.9.12.

5.9.13.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to local transportation, a reduction in total ROI workers by 13,520, which would represent 6.5 percent of the total ROI employment, could cause a short-term decrease in road congestion, although it is acknowledged that these employees could seek and find other employment in the ROI. Regarding the radiological transportation of secondaries and cases between Y-12 and Pantex, reduced operation would reduce these transportation requirements by approximately 25 percent. As discussed in Section 5.10, the annual transportation impacts for secondaries and cases, for both incident-free transportation and potential accidents, would be small (less than 1 death related to non-radiological impacts and less than 1 LCF for radiological impacts).

5.9.14 Waste Management

5.9.14.1 *No Action Alternative*

Under the No Action Alternative, current and planned activities at Y-12 would continue as required to support the missions described in Section 3.2.9. Y-12 presently manages LLW, hazardous waste, mixed LLW, high-level waste, and sanitary waste. There would be no additional impacts to waste management resources beyond current and planned activities that are independent of this action. Table 4.9.13-1, in Chapter 4, shows annual waste generation volumes from Y-12 operations for 2003. For convenience, this table is shown again, below, as Table 5.9.14-1 to facilitate comparisons of the additional alternatives presented.

Table 5.9.14-1 — Waste Generation Totals by Waste Type for Routine Operations at Y-12

Waste Type	Waste Volume (FY-2003)
Low-Level Waste (Liquid) (yd ³)	17.42
Low-Level Waste (Solid) (yd ³)	7,796.69
Mixed Low Level Waste (Liquid) (yd ³)	17.87
Mixed Low Level Waste (Solid) (yd ³)	21.12
RCRA (hazardous) Waste (tons)	14.37
TSCA Waste (tons)	14.84
Mixed TSCA (tons)	32.04
Nonhazardous Sanitary Waste (tons)	7923.71

Source: NNSA 2007.

Previously, DOE has made decisions on the various waste types in a series of RODs that have been issued under the Waste Management PEIS (DOE 1997). With respect to wastes that could be affected by this SPEIS, the initial transuranic (TRU) waste ROD was issued on January 20, 1998 (63 FR 3629) with several subsequent amendments; and the low-level radioactive waste and mixed low-level radioactive waste ROD was issued on February 18, 2000 (65 FR 10061). The TRU waste ROD states that DOE will develop and operate mobile and fixed facilities to characterize and prepare TRU waste for disposal at WIPP. Y-12 does not generate TRU waste. Each DOE site that has or will generate TRU waste will, as needed, prepare and store its TRU waste onsite until the waste is shipped to WIPP. The ROD for low-level waste (LLW) and mixed LLW (MLLW) states that, for the management of LLW, minimal treatment will be performed at all sites and disposal will continue, to the extent practicable, onsite at Idaho National Laboratory (INL), LANL, ORR, and SRS. In addition, the Hanford Site and NTS will be available to all DOE sites for LLW disposal. Mixed-LLW will be treated at the Hanford Site, INL, ORR, and SRS and disposed of at the Hanford Site and the NTS.

It is current DOE policy to treat, store and dispose of low level and low level radioactive mixed waste at the site where the waste is generated, if practical; or at another DOE facility (DOE Order 435.1, DOE Manual 435.1-1). If DOE capabilities are not practical or cost-effective, exemptions to this policy may be approved to allow use of non-DOE facilities. The RODs under the Waste Management PEIS designate NTS and Hanford as the regional disposal facilities for DOE sites to send LLW or MLLW waste where it is not practical to treat, store or dispose of those wastes on-site. For purposes of analysis in this SPEIS, NTS is used as a representative site for LLW or MLLW disposal because it is the current site in use for this purpose. Over the life of

the program, LLW or MLLW may be disposed of on the site where it is generated or, in compliance with DOE Order 435.1, at NTS, Hanford, other DOE sites, or at licensed commercial disposal facilities.

The DOE MLLW disposal facility at NTS is permitted by the State of Nevada through December 2010 and NNSA may not be able to ship MLLW to NTS after that. LLW and MLLW cannot currently be shipped to Hanford until the new Tank Waste and Solid Waste EIS are completed and RODs are in place. Hanford may be available for disposal of MLLW before the MLLW disposal facility at NTS closes. EM disposal facilities at Hanford are not scheduled to operate beyond the completion of the cleanup mission at Hanford, which would be in about 40 years. Commercial disposal facilities, such as Clive, UT, or a new facility in Texas may be available to dispose of LLW and MLLW. The analysis of disposition of LLW or MLLW at NTS in this SPEIS approximates the impacts that would be expected to occur at NTS, Hanford, other possible DOE sites or the available commercial sites. Appropriate NEPA review would be conducted, where necessary, to address changes in the options available to DOE/NNSA for disposition of these specific waste streams.

5.9.14.2 DCE Alternative

5.9.14.2.1 CPC Construction Impacts

Construction of a CPC would generate liquid hazardous waste and both liquid and solid non-hazardous waste. Table 5.9.14–2 summarizes the total volume of waste expected to be generated over the 6 years of construction activity for the proposed CPC.

Table 5.9.14-2 — Total Waste Generation from CPC Construction at Y-12

Waste Type	CPC
TRU Waste, solid (yd ³)	0
LLW (yd ³)	0
Hazardous Waste (tons)	7.0
Nonhazardous Solid (yd ³)	10,900
Nonhazardous Liquid (gal)	56,000

Source: NNSA 2007.

Hazardous waste generated by the construction of the CPC would amount to less than 30 percent of the normal annual hazardous waste generation at Y-12. Y-12 collects, packages, and ships hazardous waste, off-site, to either another DOE site or a commercial facility for treatment and disposal. The hazardous waste generated from construction of the CPC at Y-12 would be handled in the same manner. Sufficient on-site resources and off-site capacity exist to allow for this.

Non-hazardous solid waste at Y-12 is disposed of on-site in construction/demolition landfills. The total amount of solid non-hazardous waste generated over the entire construction period for the CPC at Y-12 is a fraction of the amount of non-hazardous waste Y-12 currently generates in a year. Sufficient on-site capacity exists to accommodate the projected volumes of non-hazardous waste generated by the construction of the CPC at Y-12. Every opportunity to minimize waste generation in this category will be made and waste reduction techniques will also be utilized.

Non-hazardous liquid wastewater at Y-12 is collected, commingled with industrial waste and then treated and discharged in accordance with Industrial and Commercial User Wastewater Permit No. 1-91. At 56,000 cubic yards, the total amount generated throughout the entire construction process amounts to a very small percentage of the amount of wastewater treated and discharged by Y-12 in a year of routine operation. There is more than sufficient treatment capacity to handle the liquid non-hazardous waste generated by the construction of the CPC at Y-12.

A retention pond would be constructed to manage stormwater runoff from the entire CPC site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at a CPC site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once CPC construction was completed.

Waste generation impacts associated with operation of a CPC at Y-12 are discussed in Section 5.9.14.2.3, together with the operation of a UPF.

5.9.14.2.2 UPF Construction Impacts

Construction of an UPF at Y-12 would generate small levels of LLW, Low Level Mixed Waste, hazardous waste, and non-hazardous solid waste. Table 5.9.14-3 shows the expected wastes to be generated from the construction of the UPF at Y-12.

Table 5.9.14-3 —Waste Generation from Construction of the UPF

Waste Category	Volume
TRU Solid Waste (yd ³)	0
Low Level Solid Waste (yd ³)	70
Low Level Mixed Solid Waste (yd ³)	4
Mixed TRU Solid Waste (yd ³)	0
Hazardous waste (tons)	4
Non-Hazardous Solid Waste (tons)	800

Source: NNSA 2007.

Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, glovebox parts, and discarded process equipment and parts, is generated routinely at Y-12. In 2003, Y-12 generated 7797 cubic yards of solid LLW. Construction of the UPF is expected to generate 70 cubic feet of solid LLW over the entire construction period. This amounts to less than one percent of annual amount of solid LLW generated by routine operations at Y-12. There is more than sufficient capacity to collect this waste ship it to the West End Treatment Facility where it would be processed and packaged with the low level waste generated by normal operational activities at Y-12. Once packaged, this waste will either be sent to NTS or a commercial facility for treatment and disposal.

Mixed LLW waste is presently generated and stored at Y-12 under the provisions of a State Agreement (October 1, 1995) and pursuant to the provisions of this agreement, Y-12 will dispose of this waste in accordance with the Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation and in compliance with a Federal Facilities Compliance Act Agreement (June 12, 1992). In 2003, Y-12 generated about 39 cubic yards of mixed LLW waste. The 4 cubic yards of mixed LLW waste expected to be generated throughout the entire construction process of the UPF amounts to about ten percent of the annual amount of mixed LLW waste generated by routine operations at Y-12. There is more than sufficient capacity to collect this waste transport it to the West End Treatment Facility where it would be treated, packaged for storage and ultimate disposal along with quantities of this type of waste generated on a routine basis at Y-12.

At four tons, the amount of hazardous waste expected to be generated by the construction of the UPF at Y-12 is comparable to the normal annual generation of 14 tons. Y-12 collects, packages, and ships hazardous waste off-site, either to another DOE site or to a commercial facility for treatment and disposal. The hazardous waste generated from construction of the UPF, at Y-12, would be collected and would be handled in the same manner. Sufficient on-site resources and off-site capacity exist to allow for this.

Non-hazardous solid waste at Y-12 is disposed of on-site in a construction/demolition landfill. At 800 tons, the total amount of solid non-hazardous waste generated over the entire construction period for the UPF at Y-12 is a little more than ten percent of the amount of non-hazardous waste Y-12 currently generates in a year. Sufficient on-site capacity exists to accommodate the projected volumes of non-hazardous waste generated by the construction of the UPF at Y-12.

A retention pond would be constructed to manage stormwater runoff from the entire UPF site including the construction laydown area and concrete batch plant. The basin would be sized to limit stormwater discharge from the developed site to no greater than the pre-existing conditions, with a basin area of approximately 1 acre per 40 acres of developed land.

A concrete batch plant would operate at the UPF site during the construction phase. The concrete batch plant would include a basin to manage wastewater from equipment washout activities. The facility would be located on approximately 10 acres adjacent to the PIDAS. The concrete batch plant would be disassembled and the area would be restored once UPF construction is completed.

The upgrade of existing facilities would generate minimal wastes compared to existing waste quantities shown on Table 5.9.14-1.

5.9.14.2.3 CPC and UPF Operation Impacts

Normal operation of the CPC and UPF, at Y-12, would generate LLW, hazardous waste, and sanitary waste. Table 5.9.14-4 summarizes the estimated waste generation rates for the operation of the CPC and UPF, at Y-12.

Table 5.9.14-4 — Waste Generation from Operations of CPC and UPF at Y-12

	CPC	UPF	CNC
TRU Solid Waste (including Mixed TRU)(yd ³)	950	0	950
Mixed TRU Solid Waste (included in TRU, above) (yd ³)	340	0	340
Low Level Solid Waste (yd ³)	3,900	7,800	11,700
Low Level Liquid Waste (gal)	0	3,515	3,515
Mixed Low Level Solid Waste (yd ³)	2.5	70	72.5
Mixed Low Level Liquid Waste (yd ³)	0.4	3,616	3,616.4
Hazardous waste solid (tons)	4.0	15	19
Hazardous waste liquid (yd ³)	0.6	0	0.6
Non-Hazardous Solid Waste (tons)	8,100	7,500	15,600
Non-Hazardous Liquid Waste (gal)	75,000	50,000	125,000

Source: NNSA 2007

Y-12 does not now generate or manage any TRU waste. Quantities of TRU waste generated through the operation of the CPC (the UPF does not generate TRU waste) would be collected at the CPC, packaged in accordance with the WIPP WAC, placed in TRUPACT containers and transported to the WIPP for disposal. If needed, this waste could be collected, transported to the West End Treatment Facility for any treatment required to meet the WIPP WAC, and then packaged, placed in TRUPACTs and transported to the WIPP for disposal.

Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, glovebox parts, and discarded process equipment and parts, is generated routinely at Y-12. In 2003, Y-12 generated 7797 cubic yards of solid LLW. Operation of the DCE Alternative (CPC and UPF) would generate just a little under 11,700 cubic yards of solid LLW. Although this amount is more than double the amount of LLW routinely generated at Y-12, there is more than sufficient capacity to collect this waste, ship it to the West End Treatment Facility where it would be processed, the liquid waste solidified, and packaged with the LLW generated by normal operational activities at Y-12. It would then be shipped off-site, either to the NTS or a commercial facility, for treatment and disposal.

Mixed LLW waste is presently generated and stored at Y-12 under the provisions of a State Agreement (October 1, 1995) and pursuant to the provisions of this agreement, Y-12 will dispose of this waste in accordance with the Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation and in compliance with a Federal Facilities Compliance Act Agreement (June 12, 1992). In 2003, Y-12 generated about 39 cubic yards of mixed LLW. The amount of mixed LLW expected to be generated by the operation of the DCE Alternative (CPC and UPF) dwarfs that amount. A CPC, however, would have as a part of it a waste handling module sufficient to accumulate this LL-mixed waste treat this waste, package it and either dispose of this waste on-site, if acceptable to the regulators, or have this waste shipped to a commercial LLW disposal site, or NTS.

Like TRU waste, Y-12 does not now generate mixed TRU waste. Quantities of TRU mixed waste generated through the operation of the CPC (the UPF does not generate TRU waste) would be collected at the CPC, transported to the West End Treatment Facility where it would be treated, packaged in accordance with the WIPP Waste Acceptance Criteria, placed in TRUPACT containers and transported to the WIPP for disposal.

The 19 tons of hazardous waste generated by the operation of the DCE Alternative (CPC and UPF) would amount to substantially more hazardous waste than is presently generated, on a routine basis, by Y-12. Y-12 collects, packages, and ships hazardous waste off-site to either another DOE site or a commercial facility for treatment and disposal. The hazardous waste generated from operation of the DCA Alternative would be handled in the same manner. Sufficient on-site resources and off-site capacity exist to allow for this.

Non-hazardous solid waste at Y-12 is disposed of on-site in construction/demolition landfills. The 15,225 cubic yards of solid non-hazardous waste which would be generated from the operation of the DCE Alternative (CPC and UPF) at Y-12 would amount to more than the amount presently generated at Y-12. Sufficient on-site capacity; however exists to accommodate the projected volumes of non-hazardous waste generated by the operation of the CPC at Y-12. Every opportunity to minimize waste generation in this category will be made and waste reduction techniques will also be utilized. Metal and other recyclable materials would be removed from this waste stream, to the extent practicable, prior to disposal.

Non-hazardous liquid wastewater at Y-12 is collected commingled with industrial waste and then treated and discharged in accordance with Industrial and Commercial User Wastewater Permit No. 1-91. At 55,000 gallons, the amount generated by the CPC (UPF does not generate wastewater) is approximately 8 percent of the amount of wastewater treated and discharged by Y-12 in a year of routine operation. There is more than sufficient treatment capacity to handle the liquid non-hazardous waste generated by the operation of the DCA Alternative (CPC and UPF) at Y-12.

5.9.14.3 *CCE Alternative (CPC + UPF)*

For Y-12, by definition, there is no CNC Alternative. The CPC and UPF, as already discussed in Section 5.9.14.2, would constitute a “CNC” if both projects were to be implemented at Y-12.

5.9.14.4 *CNPC Alternative (CPC + UPF + A/D/HE Center)*

Waste management impacts from the construction and operation of the full CNPC would include the CPC and UPF impacts, already discussed in DCE Alternative, in Section 5.9.14.2, above, and the A/D/HE Center, the impacts of which will be presented in this section. The expected waste impacts of construction and operation of the CNPC at Y-12 are discussed below.

5.9.14.4.1 *CNPC Construction Impacts*

Construction of CNPC would entail the construction of the DCE Alternative, discussed in Section 5.8.14.2, above, and the construction of an A/D/HE Center, discussed in this section. The additional construction of the A/D/HE Center would generate low level waste (LLW), and solid and liquid sanitary waste. Table 5.9.14-5 summarizes the total volume of waste generated over the construction period for an A/D/HE Center.

Table 5.9.14-5 — Annual Waste Generation from Construction of the A/D/HE Center at Y-12

Waste Category	A/D/HE Center
TRU Solid Waste (yd ³)	0
Low Level Solid Waste (yd ³)	9,900
Mixed TRU Solid Waste (yd ³)	0
Hazardous waste (tons)	0
Non-Hazardous Solid Waste (yd ³)	7,100
Non-Hazardous Liquid Waste (gal)	45,000

Source: NNSA 2007.

Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, glovebox parts, and discarded process equipment and parts, is routinely generated at Y-12. In 2003, Y-12 generated 7797 cubic yards of solid LLW. Construction of the A/D/HE Center would generate an expected 9,900 cubic yards over the entire construction period. This is about thirty percent more than Y-12 routinely generates in a year. There is more than sufficient capacity to collect this waste, ship it to the West End Treatment Facility where it would be processed and packaged with the low level waste generated by normal operational activities at Y-12, and shipped off-site, either to the NTS, or a commercial facility, for treatment and disposal.

Non-hazardous solid waste at Y-12 is disposed of on-site in a construction/demolition landfill. Construction of an A/D/HE Center at Y-12 is expected to generate 7,100 cubic yards of non-hazardous solid waste over the entire construction period. This amounts to about the same amount Y-12 generates in a year of normal operation. Sufficient on-site capacity exists to accommodate the projected volumes of non-hazardous waste generated by the construction of the A/D/HE Center at Y-12. Every opportunity to minimize waste generation in this category will be made and waste reduction techniques will also be utilized.

The 45,000 gallons of non-hazardous liquid waste could easily be handled by the existing infrastructure and wastewater treatment facilities at Y-12

5.9.14.4.2 CNPC Operation Impacts

Normal operation of the CNPC would generate TRU waste, LLW, mixed LLW, hazardous waste, and sanitary waste. Table 5.9.14-6 summarizes the estimated waste generation rates for the operation of a CNPC at Y-12.

Table 5.9.14-6 — Annual Waste Generation from Operations of the CNPC at Y-12

Waste Type	CPC	UPF	A/D/HE Center	CNPC
TRU Solid Waste(including mixed TRU) (yd ³)	950	0	0	950
Mixed TRU Solid Waste(included in TRU, above)(yd ³)	340	0	0	340
Low Level Solid Waste (yd ³)	3,900	7,800	40	11,740
Low Level Liquid Waste (gal)	0	3,515	5,410	8,925
Mixed Low Level Solid Waste (yd ³)	2.5	21	0	23.5
Mixed Low Level Liquid Waste (gal)	0.4	3,616	6	3,622.4
Hazardous waste solid (tons)	4.0	14	.9	18.9
Hazardous waste liquid (tons)	0.6	0	5.9	6.5
Non-Hazardous Solid Waste (yd ³)	8,100	7,125	12,000	27,225
Non-Hazardous Liquid Waste (gal)	75,000	50,000	46,000	171,000

Source: NNSA 2007.

Y-12 does not now generate or manage any TRU waste. Quantities of TRU waste generated through the operation of the CNPC would be collected at the CNPC, packaged in accordance with the WIPP WAC, placed in TRUPACT containers and transported to the WIPP for disposal. If treatment of this waste needed to meet the WIPP WAC, this waste could be collected, transported to the West End Treatment Facility for any required treatment, and then packaged, placed in TRU PACS and transported to the WIPP for disposal.

Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, glovebox parts, and discarded process equipment and parts, is generated routinely at Y-12. In 2003, Y-12 generated 7,797 cubic yards of solid low level waste. Operation of the CNPC would generate an expected 11,740 cubic yards of LLW. Although this amount is more than the amount of LLW routinely generated at Y-12, there is more than sufficient capacity to collect this waste, ship it to the West End Treatment Facility where it would be processed and packaged with the low level waste generated by normal operational activities at Y-12, and shipped off-site, either to the NTS or a commercial facility, for treatment and disposal.

Low level mixed waste is presently generated and stored at Y-12 under the provisions of a State Agreement (October 1, 1995) and pursuant to the provisions of this agreement, Y-12 will dispose of this waste in accordance with the Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation and in compliance with a Federal Facilities Compliance Act Agreement (June 12, 1992). In 2003, Y-12 generated about 39 cubic yards of mixed LLW. The LLW expected to be generated by the operation of the CNPC (18 cubic yards solidified liquid, 21 cubic yards solid) is about equal to the amount routinely generated by Y-12. There is sufficient capacity to collect this waste, transport it to the West End Treatment Facility where it would be treated, packaged for storage and ultimate disposal along with quantities of this type of waste generated on a routine basis at Y-12.

Like TRU waste, Y-12 does not now generate mixed TRU waste. Quantities of TRU mixed waste generated through the operation of the CNPC would be collected at the CNPC, transported to the West End Treatment Facility where it would be treated, packaged in accordance with the WIPP WAC, placed in TRUPAC containers and transported to the WIPP for disposal. Hazardous waste generated by the CNPC would exceed levels generated at Y-12. These wastes

would be captured at the CNPC, packaged, and shipped off-site, either to another DOE facility or a commercial facility for treatment and disposal. Sufficient infrastructure at Y-12 and off-site disposal capacity exist to allow for this.

Non-hazardous solid waste at Y-12 is disposed of on-site in construction/demolition landfills. The total amount of solid non-hazardous waste which would be generated from the operation of the CNPC at Y-12 would amount to just under fifty percent more than the normal amount generated at Y-12. Sufficient on-site capacity exists to accommodate the projected volumes of non-hazardous waste generated by the construction of the CPC at Y-12. Every opportunity to minimize waste generation in this category will be made and waste reduction techniques will also be utilized.

Non-hazardous liquid wastewater at Y-12 is collected commingled with industrial waste and then treated and discharged in accordance with Industrial and Commercial User Wastewater Permit No. 1-91. At a little more than 120,000 gallons, the amount generated by the operation of the CNPC is a little less than a sixth of the amount of industrial wastewater treated and discharged by Y-12 in a year of routine operation. There is more than sufficient treatment capacity to handle the liquid non-hazardous waste generated by the operation of the CNPC at Y-12.

5.9.14.4 *Capability-Based Alternative*

Under the Capability-Based Alternative, current and planned activities at Y-12 would continue as required to support smaller stockpile requirements. With respect to waste management, reduced operations would have a direct impact reduction on wastes generated as shown in Table 5.9.14-7.

Table 5.9.14-7 — Annual Radiological Wastes Generated by Y-12 for the No Action Alternative and the Capability-Based Alternative

Waste Category	No Action Alternative	Capability-Based Alternative
Low-level Waste		
Liquid (yd ³)	17.4	10.4
Solid (yd ³)	7,800	4,700
Mixed Low-level Waste		
Liquid (yd ³)	17.9	10.7
Solid (yd ³)	21.1	12.7

Source: NNSA 2007.

Because Y-12 has adequate facilities to manage the wastes under either alternative, no major impacts to waste management are expected. Reductions in LLW generation would reduce the transportation of LLW to NTS. As discussed in Section 5.10, these impacts are small (less than 1 death related to non-radiological impacts and less than 1 LCF for radiological impacts) under the No Action Alternative.

5.9.15 *Closure and D&D of the Production Facilities at Y-12*

The closing of the Y-12 production facilities would entail a substantial D&D and remediation effort. Although it is not possible without specific and extensive site characterization to give a

precise estimate of what this would entail, it is possible to look at known contamination issues, to look at other sites at which DOE has closed facilities and performed D&D, and to develop general estimates of what the D&D effort associated with the closure of the Y-12 production facilities might be. The Rocky Flats Plant has completed extensive D&D activities and closure. For nearly 40 years, the plant, located about 16 miles northwest of Denver, served as a nuclear weapons production facility. Over the years in which this site manufactured plutonium parts for nuclear weapons, the site developed both chemical and radioactive contamination issues affecting the soil, groundwater, surface water, and many of the buildings at the site. Contaminants included radionuclides, such as plutonium and uranium; toxic metals, such as beryllium; and hazardous chemicals, such as cleaning solvents and degreasers. While the site comprises approximately 6,300 acres, the majority of that land was a buffer zone with the industrialized area concentrated in the center of the site on about 385 acres. About one-fourth of the sites more than 800 original structures (buildings and storage tanks) were radioactively or chemically contaminated.

Although not on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) NPL, Rocky Flats was cleaned-up pursuant to CERCLA requirements (as well as RCRA) through a Federal Facilities Compliance agreement developed and signed by EPA, the State of Colorado and DOE. The D&D of the plant identified 360 separate clean-up areas. D&D activities started in 1995 and were completed (except for some groundwater treatment activities which will continue) in 2006, with about 90 percent of the work being accomplished from 2001 to 2005. Remediation included the removal of more than 15,000 cubic meters of transuranic and other radioactive waste, more than 800,000 cubic meters of sanitary waste and more than 4,300 cubic meters of hazardous waste. A substrata of shale minimized contamination of deeper aquifers. More than 11 million gallons of contaminated groundwater had to be treated. In addition, 5 million gallons of seep water was collected and treated. Between 1995 and 2005, 6,616 employees (including salaried employees, hourly employees, and security policy officers) were involved in the clean-up activities at a cost of more than \$10 billion.

The Y-12 site is similar to Rocky Flats, but at 811 acres is twice the size. Although Y-12 has about 450 buildings they are all much larger than the structures at Rocky Flats. For the past 65 years, Y-12 has been involved in, the enrichment of uranium for use in weapons, and in the design and manufacture of the HEU secondary components for nuclear weapons. Environmental issues include known releases of mercury, beryllium, uranium, cesium, PCPs and degreasing chemicals. In November 1989 the Oak Ridge Reservation, on which Y-12 is located, was placed on the CERCLA National Priority List. Closure of the production facilities on Y-12 would require compliance with the CERCLA clean-up standards, and approval of EPA.

Using this comparison it is possible to get a general idea of the costs and the effort involved in the closure and cleanup of the production facilities at Y-12. Table 5.9.15-1 provides a summary of the Rocky Flats actions and multiplies them by a factor of two giving an idea of what the D&D of the production facilities at Y-12 might entail:

Table 5.9.15-1 — Y-12 Plant D&D Estimates

	Rocky Flats	Y-12
Time for clean-up	6 Years	12 Years
TRU Waste Removed	15,000 m ³	0 ^a
LLW Removed	500,000 m ³	1,000,000 m ³
Sanitary Waste Removed	800,000 m ³	1,600,000 m ³
Hazardous Waste Removed	4,300 m ³	8,600 m ³
Groundwater Treated	11 million gal	22 million gal
Seep Water Treated	5 million gal	10 million gal
Shipped to other DOE sites	21 tons SNM	247 tons HEU to CNPC
Employment	40,000 worker-years	80,000 worker-years
Cost	\$10 billion	\$20 billion

^a Y-12 has never handled plutonium, so it is not expected that any TRU waste would be involved.

Source: NNSA 2007.

5.10 COMPLEX-WIDE TRANSPORTATION IMPACTS

This section presents the environmental impacts of transporting Category I/II SNM for the programmatic alternatives.

5.10.1 No Action Alternative

Since the 1940s, NNSA and its predecessor agencies have moved nuclear weapons, nuclear weapons components, and SNM by a variety of commercial and Government transportation modes. In the late 1960s, worldwide terrorism and acts of violence prompted a review of procedures for safeguarding these materials. As a result, a comprehensive new series of regulations and equipment was developed to enhance the safety and security of these materials in transit.

The Transportation Safeguards Division (TSD) subsequently was established in 1975 at the Albuquerque Operations Office. That office is now referred to as the Office of Secure Transportation (OST), which will be the name used here. OST modified and redesigned transport equipment to incorporate features that more effectively enhance protection and deny unauthorized access to the materials. During that time, OST curtailed the use of commercial transportation systems and moved to a total federal operation.

5.10.1.1 *OST Management*

Management, control, and direction of OST is centralized at Albuquerque, New Mexico. The federal agents who drive the transportation vehicles, as well as the escorts, are Nuclear Materials Couriers or Couriers for short. There are three federal agent operations centers located at Amarillo, Texas; Oak Ridge, Tennessee; and Albuquerque. Approximately 100 shippers and receivers of SNM and other sensitive materials are served at approximately 33 locations throughout the continental United States.

5.10.1.2 *Transportation Safety*

Since its establishment in 1975, OST has accumulated over 100 million miles of experience transporting DOE cargo with no accidents causing a fatality or release of radioactive material. This is due largely to the OST philosophy that safety and security are of equal and paramount importance in the accomplishment of DOE's transportation safeguards mission.

5.10.1.3 *Transportation & Emergency Control Center (TECC)*

Transportation and Emergency Control Center (TECC) is a nationwide communications system operated by the OST and located in Albuquerque. This system provides a capability to monitor the status, location and maintain real-time communications 24 hours a day, 365 days a year, with every convoy. The control center maintains an emergency contact directory of federal, state, and local response organizations located throughout the contiguous U.S. This capability is available to OST 24 hours a day, 365 days a year.

5.10.1.4 *Transportation Vehicles*

The Safeguards Transporter (SGT) is a specially designed trailer for an 18-wheel rig that incorporates various deterrents to prevent unauthorized removal of cargo. The trailer has been designed to afford the cargo protection against damage in the event of an accident. This is accomplished through superior structural characteristics and a highly reliable cargo tie-down system similar to that used aboard aircraft. The tractors are standard production units which have been modified to provide protection against attack. The thermal characteristics of the SGT would allow the trailer to be totally engulfed in a fire without incurring damage to the cargo. These vehicles are equipped with communications, electronic, radiological monitoring, and other equipment that further enhance safety and security.

The vehicles used by OST must meet maintenance standards significantly more stringent than those for similar commercial transport equipment. All vehicles undergo an extensive maintenance check prior to every trip, as well as periodic preventative maintenance inspections. In addition, these vehicles are replaced more frequently than commercial shippers. As a result, OST experiences few en route breakdowns and has had no accidents due to equipment malfunction.

5.10.1.5 *Travel Precautions*

OST convoys do not travel during periods of inclement weather (ice, fog, etc.). Should the convoys encounter adverse weather, provisions exist for the convoys to seek secure shelter at previously identified facilities. Although OST provides sleeper berths in all vehicles, couriers accompanying OST shipments do not exceed 32 hours of continuous travel without being afforded the opportunity for eight hours of uninterrupted, stationary bed rest. OST has also imposed a maximum 65 mile/hour speed limit on its convoys, even if the posted limit is greater.

5.10.1.6 *Law Enforcement Liaison*

OST has a liaison program through which it communicates with law enforcement and public safety agencies throughout the country, making them aware of these shipments. OST has established procedures should a Safeguards Transporter be stopped by an officer. The liaison program provides law enforcement officers information to assist them in recognizing one of these vehicles should it be involved in an accident, and what actions to take in conjunction with the actions of the couriers in the rig and escort vehicles. Through the liaison program OST offers in-depth briefings at the state level.

5.10.1.7 *Armed Couriers*

Armed nuclear materials couriers accompany each shipment containing special nuclear material. They also drive the highway tractors and escort vehicles while operating the communications and other convoy equipment. Couriers are non-uniformed federal agents and are authorized by the *Atomic Energy Act* to make arrests and carry firearms in the performance of their duties. They carry both a photo identification card and a shield that certify their federal status. Couriers are required to obey all traffic laws and to cooperate with law enforcement officers.

After careful screening and selection, courier trainees undergo a 16-week basic training course, during which they receive instruction in tractor-trailer driving, electronic and communications systems operation, and firearms. Tests in operating procedures, physical fitness, driving, firearms, and other job-related subjects must be passed in order to pass the training and be certified as a courier. Following basic training, the courier spends the balance of the first year in on-the-job training. The first year of employment is probationary, which the courier must successfully complete to be retained. Couriers are given in-service training throughout their careers. These classes are designed to refresh and update the training taught during basic training, in addition to preparing couriers for demonstrations or armed attacks. Subjects such as team tactics, terrorist tactics, and new adversary technology are taught. Additionally, physical and firearm proficiencies are tested.

Couriers must continue to meet periodic qualification requirements relative to firearms, physical fitness and driving proficiency. They must also undergo and pass an annual medical examination for continued certification under the DOE Human Reliability Program. In addition, couriers are subject to the DOE's randomized drug and alcohol testing program. If a courier fails to meet any of the minimum requirements necessary for courier certification, the individual is temporarily removed from active status and provided additional training until demonstrated performance reaches an acceptable level.

OST operations are in compliance with the requirements of 49 CFR 177 for selecting, notifying drivers of, and adhering to preferred routes. The majority of OST travel (90 percent) is over interstate highway; the remaining 10 percent is over routes that meet the conditions for deviating from the preferred route. Regulations permit deviation from the preferred route when safety or security requirements dictate such deviation. Regulations permit OST deviation from the requirements regarding notification of the routes used. Routes used are classified, compartmented information that may not be disseminated except to persons with appropriate security clearance and a need to know.

All SGT couriers wear radiation dosimeters. Because of the nature of the material and the design of the containers, the transport of both nuclear explosives and plutonium/uranium weapons components has led to ionizing radiation doses to SGT couriers. SGT couriers are required to inspect the cargo within the trailer prior to shipment. This action is the primary contributor to dose for the crew.

Under the No Action Alternative, the major radiological transportation actions involving Category I/II SNM would be as follows:

- Pits (assume up to 50 pits per year) would continue to be shipped between Pantex and LANL;
- Canned subassemblies (CSAs) (assume approximately 200 units per year) would continue to be shipped between Pantex and Y-12; and
- Removal of SNM from LLNL.

CSAs that may contain HEU and depleted uranium (DU) are shipped between Pantex and Y-12. CSAs are transported intersite by SGTs in DOT-criteria Type B packages. The actual number of

CSAs shipped to and from Pantex is classified. When a shipment of CSAs is made from Pantex, the containers, staged in an approved storage facility, are loaded onto a pallet and driven by electric forklift to a loading dock. These containers are loaded and secured into an SGT that is then driven to Y-12. Arriving containers are unloaded and brought into a facility where a transfer check is performed. The transfer check confirms the identity and quantity of the shipment and verifies the integrity of the tamper-indicating devices on the containers.

Pits shipped between Pantex to LANL are transported intersite by SGTs in approved Type B packages. When a shipment of pits to LANL is required, the pits are repacked into Type B containers and sealed with a tamper-indicating device. The containers are loaded onto a pallet and driven by electric forklift to a loading dock. The containers are loaded and secured into an SGT and driven to LANL. The actual number of pit shipments to and from Pantex is classified.

Table 5.10-1 presents the estimated radiological impacts of the annual transportation activities associated with the A/D/HE mission at Pantex, a 50 pits per year capacity at LANL, and a 200 unit capacity for CSAs at Y-12. The radiological incident-free impacts provided in the following sections are an estimate of LCFs due to exposure of radiation from the radioactive materials payloads proposed in the SPEIS alternatives. The RADTRAN 5.6 computer analyzes the exposure within a half-mile zone surrounding the transportation routes.

Table 5.10-1 — Annual Radiological Transportation Impacts, No Action Alternative

Movement Description	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
Pits	Handling	Note 1	0.00559	0.00559
	Intersite Transportation	3.58×10^{-12}	8.95×10^{-5}	8.95×10^{-5}
	Stops		6.82×10^{-10}	6.82×10^{-10}
	MEI		3.60×10^{-10}	3.60×10^{-10}
CSAs	Handling	Note 2	0.0224	0.0224
	Intersite Transportation	1.51×10^{-19}	0.00145	0.00145
	Stops		2.73×10^{-9}	2.73×10^{-9}
	MEI		1.51×10^{-9}	1.51×10^{-9}

Note 1: accident impacts associated with handling accidents are included in the accident analyses for the No Action pit production at LANL.

Note 2: accident impacts associated with handling accidents are included in the accident analyses for the Y-12 No Action Alternative.

Assumptions: All materials in metal form

ES-3100 or similar container used

Release and aerosol fractions based on West Valley Demonstration Project (WVDP) Waste Management EIS (DOE/EIS- 0337) values, which were determined to bound release fractions for pits and secondaries.

Source: Dimsha 2007.

With respect to accident impacts, RADTRAN calculates risks and consequences of potential accidents based a number of input parameters including:

- Probability and severity fraction of accident types;
- Deposition velocity of the material;
- Release fraction from the container;
- Aerosol and respirable factors for the material; and
- Weather conditions.

The inputs for the materials, containers, and vehicles were adopted from industry standards. The probability and severity fractions were taken from DOE-accepted studies and reports. The

weather conditions were based on Pasquill weather stability classes. Analyses were conducted in Stability Class D (most frequently occurring weather conditions) and Class F (most stable weather conditions). All results presented in this chapter are for Stability Class F, which yields the most conservative case.

The maximally-exposed individual (MEI) results represent health impacts to a theoretical person that would receive the maximum exposure due to the proposed transportation. Often the MEI represents personnel associated with the material transport, such as a vehicle escort.

Handling impacts reflect the sum total exposure impacts to crews involved in the storage, packaging, and loading/unloading of the material to be transported. The number of personnel, time spent handling the material, and distance to the material are dependant on the individual transportation campaigns.

The impact results at stops are presented for two theoretical receptor groups: the worker at the truck stop and residents that live within a half-mile radius of the truck stop. An average suburban population density is assumed for the area residents results. Table 5.10-2 presents the estimated non-radiological impacts for the No Action Alternative.

Table 5.10-2 — Annual Non-Radiological Transportation Impacts, No Action Alternative

Origin/ Destination Pair	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non- radiological Emissions Fatalities
Pantex/LANL	Pits	1,500	5.64×10^{-4}	2.70×10^{-5}	1.74×10^{-6}
Pantex/Y-12	CSAs	17,700	6.06×10^{-3}	2.93×10^{-4}	3.41×10^{-5}

Source: Dimsha 2007.

5.10.2 Distributed Centers of Excellence Alternative

Under the DCE Alternative, the major radiological transportation actions involving Category I/II SNM would be as shown in Table 5.10-3. Table 5.10-3 provides the estimated radiological health impacts of proposed transportation 200 pits between Pantex and the four other CPC candidate sites. For incident-free transportation, impacts are presented for both the transport crew and the population along the routes. The MEI would receive an additional dose of 2.51×10^{-6} rem from the transport of the pits, translating to 1.51×10^{-9} additional LCFs. For accidents, impacts are presented in terms of risk (probability times consequence). Appendix C, Section C.7 presents additional information related to transportation accidents. The transportation impacts of CSAs would be the same as under the No Action Alternative.

Table 5.10-3 – Annual Radiological Transportation Impacts, DCE Alternative

CPC Site	Transportation Assessed	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
LANL	200 ppy	1.43×10^{-11}	3.58×10^{-4}	3.58×10^{-4}
NTS	200 ppy	2.20×10^{-11}	1.08×10^{-3}	1.08×10^{-3}
SRS	200 ppy	1.18×10^{-10}	1.99×10^{-3}	1.99×10^{-3}
Y-12	200 ppy	2.85×10^{-11}	1.45×10^{-3}	1.45×10^{-3}

Assumptions:

- All materials in metal form
- ES-3100 or similar container used
- Release and aerosol fractions based on WVDP Waste EIS values

Source: Dimsha 2007.

Table 5.10-4 provides estimated exposure due to handling of the materials transported in this alternative and the estimated exposure at stops (inspections, refueling, others).

Table 5.10-4 — Annual Estimated Impacts Due to Handling and Stops, DCE Alternative

	Per Shipment Dose (person-rem)	Total Dose (person-rem)	Total LCFs
<i>Movement of pits from Pantex to CPC Sites</i>			
Handling		37.3	0.0224
Person at truck stop	2.10×10^{-9}	3.36×10^{-8}	2.02×10^{-11}
Residents in vicinity of stop	2.82×10^{-7}	4.51×10^{-6}	2.71×10^{-9}

Source: Dimsha 2007.

Table 5.10-5 presents the estimated non-radiological transportation impacts for the DCE Alternative.

Table 5.10-5 — Annual Non-Radiological Transportation Impacts, DCE Alternative

CPC Candidate Site	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
LANL	Pits	5,800	0.00226	0.000108	6.96×10^{-6}
NTS	Pits	14,200	0.00323	0.000206	1.30×10^{-5}
SRS	Pits	21,700	0.0109	0.000432	6.46×10^{-5}
Y-12	Pits	17,700	0.0606	0.000293	3.41×10^{-5}

Source: Dimsha 2007.

Additionally, if the CPC is located at a site other than LANL, as described in Section 3.4.1.4, all Category I/II inventories of radioactive material would be transferred from LANL to sites within the NNSA Complex. For purposes of this analysis, the radioactive materials have been categorized as *Programmatic*, *Surplus*, and *Excess*. The subsections below describe potential impacts for each material category.

5.10.2.1 Programmatic Material

Category I/II inventories of nuclear material essential to the programmatic mission of NNSA would be transferred to the eventual CPC/CNPC Site. This would represent 4 shipments of material. Shipments to the candidate sites (NTS, Pantex, SRS, and Y-12) were modeled and analyzed. A summary is provided in Table 5.10-6.

Table 5.10-6 — Impacts of Transporting LANL Programmatic Materials

Candidate Recipient	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
NTS	4	0.294	1.76 x 10 ⁻⁴	0.0680	4.08 x 10 ⁻⁵	2.04 x 10 ⁻⁹	1.22 x 10 ⁻¹²
Pantex	4	0.120	7.20 x 10 ⁻⁵	0.0291	1.75 x 10 ⁻⁵	3.65 x 10 ⁻⁷	2.19 x 10 ⁻¹⁰
SRS	4	0.684	4.10 x 10 ⁻⁴	0.285	1.71 x 10 ⁻⁴	3.37 x 10 ⁻⁸	2.02 x 10 ⁻¹¹
Y-12	4	0.552	3.31 x 10 ⁻⁴	0.192	1.15 x 10 ⁻⁴	1.09 x 10 ⁻⁸	6.54 x 10 ⁻¹²

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem.
Source: Dimsha 2007.

5.10.2.2 Surplus Material¹

Surplus materials held at LANL are assigned to the Office of Fissile Material Disposition. This material has not been declared waste, but may potentially be added to waste streams at SRS. Table 5.10-7 presents the transportation impacts associated with disposition of all surplus HEU and plutonium from LANL to SRS. A second option is to transport surplus HEU to Y-12 and plutonium to SRS. Impacts associated with this option are provided in Table 5.10-8.

Table 5.10-7 — Impacts of Transporting LANL Surplus Materials to SRS

Shipment Description	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
HEU/Pu Consolidated	1	0.171	1.03 x 10 ⁻⁴	0.0712	4.27 x 10 ⁻⁵	6.17 x 10 ⁻¹²	3.70 x 10 ⁻¹⁵

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem.
Source: Dimsha 2007.

Table 5.10-8 — Impacts of Transporting LANL Surplus Materials to Y-12 & SRS (Option 2)

Shipment Description	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
HEU to Y-12	1	0.138	8.28 x 10 ⁻⁵	0.0481	2.88 x 10 ⁻⁵	1.50 x 10 ⁻¹⁶	9.00 x 10 ⁻²⁰
Pu to SRS	1	0.171	1.03 x 10 ⁻⁴	0.0712	4.27 x 10 ⁻⁵	6.15 x 10 ⁻¹²	3.69 x 10 ⁻¹⁵
Total	2	0.309	1.86 x 10⁻⁴	0.119	7.15 x 10⁻⁵	6.15 x 10⁻¹²	3.69 x 10⁻¹⁵

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem.
Source: Dimsha 2007.

5.10.2.3 Excess Material⁷

Three scenarios have been analyzed for disposition of materials designated as *Excess* at LANL:

- Shipping excess HEU to Y-12 and excess plutonium to SRS;
- Shipping all excess materials to SRS; and

¹ In 2007, the DOE prepared a SA, which determined that the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium from Hanford, LLNL and LANL would not be a significant change from the potential environmental impacts associated with the alternatives analyzed in previous NEPA reviews (DOE 2007d). As a result of this SA, DOE does not need to conduct additional NEPA review prior to transferring surplus non-pit weapons-usable plutonium materials from LANL to SRS for consolidated storage. Nonetheless, for completeness, this SPEIS includes an analysis of the transportation risk associated with disposition of all surplus plutonium from LANL to SRS.

- Shipping all excess materials to Y-12.

Tables 5.10-9, 5.10-10, and 5.10-11 summarize these impacts.

Table 5.10-9 – Impacts of Transporting LANL Excess Materials to Y-12 & SRS

Shipment Description	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
HEU to Y-12	1	0.138	8.28 x 10 ⁻⁵	0.0481	2.88 x 10 ⁻⁵	6.50 x 10 ⁻¹⁶	3.90 x 10 ⁻¹⁹
Pu to SRS	1	0.171	1.03 x 10 ⁻⁴	0.0712	4.27 x 10 ⁻⁵	1.91 x 10 ⁻¹¹	1.15 x 10 ⁻¹⁴
Total	2	0.309	1.86 x 10⁻⁴	0.119	7.15 x 10⁻⁵	1.91 x 10⁻¹¹	1.15 x 10⁻¹⁴

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem. Source: Dimsha 2007.

Table 5.10-10 — Impacts of Transporting LANL Excess Materials to SRS

Shipment Description	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
HEU/Pu Consolidated	1	0.171	1.03 x 10 ⁻⁴	0.0712	4.27 x 10 ⁻⁵	1.91 x 10 ⁻¹¹	1.15 x 10 ⁻¹⁴

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem. Source: Dimsha 2007.

Table 5.10-11 – Impacts of Transporting LANL Excess Materials to Y-12

Shipment Description	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
HEU/Pu Consolidated	1	0.138	8.28 x 10 ⁻⁵	0.0481	2.88 x 10 ⁻⁵	6.18 x 10 ⁻¹²	3.71 x 10 ⁻¹⁵

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using a dose-to-LCF conversion factor of 0.0006 LCFs per rem. Source: Dimsha 2007.

5.10.3 Consolidated Centers of Excellence Alternative

5.10.3.1 CNPC (CPC + CUC + A/D/HE Center at one site)

Under the CNPC Alternative, the major radiological transportation actions involving Category I/II SNM would be as follows:

- Pits currently stored at Pantex would be transported to the CNPC site;
- HEU currently stored at Y-12 would be transported to the CNPC site.

After these one-time shipments are completed, there would be no annual shipment of pits and CSAs.

Table 5.10-12 provides the estimated radiological health impacts of the one-time in-transit transportation of pits from Pantex, and HEU from Y-12, to the CNPC site alternatives. The MEI would receive an additional dose of 7.38 x 10⁻⁵ and 8.48 x 10⁻⁵ person-rem from the transport of the pits and secondaries respectively. These respective doses translate to 4.43 x 10⁻⁸ and 5.09 x 10⁻⁸ additional LCFs. Table 5.10-13 provides estimated exposure due to handling of the

materials transported in this alternative and the estimated exposure at stops (inspections, refueling, others).

Table 5.10-12 — Radiological Transportation Impacts Associated with the One-Time Transportation of Pits and HEU to the CNPC Site

CNPC Site	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
LANL	Pits	4.20×10^{-10}	0.0105	0.0105
	HEU	2.70×10^{-9}	0.0603	0.0603
	Total	3.12×10^{-9}	0.0708	0.0708
NTS	Pits	6.39×10^{-10}	0.0316	0.0316
	HEU	2.89×10^{-9}	0.0846	0.0846
	Total	9.28×10^{-9}	0.116	0.116
Pantex	Pits ^a	0	0	0
	HEU	1.86×10^{-9}	0.0489	0.0489
	Total	1.86×10^{-9}	0.0489	0.0489
SRS	Pits	3.46×10^{-9}	0.0584	0.0584
	HEU	5.89×10^{-9}	0.0251	0.0251
	Total	9.35×10^{-9}	0.0835	0.0835
Y-12	Pits	8.36×10^{-10}	0.0426	0.0426
	HEU ^b	0	0	0
	Total	8.36×10^{-10}	0.0426	0.0426

^a Pits are currently stored at Pantex. No pits would be transported from other sites.

^b HEU is currently stored at Y-12. No HEU would be transported from other sites.

Assumptions:

- All materials in metal form
- ES-3100 or similar container used
- Shipments of Pu from Pantex to the CNPC would require 470 shipments
- Shipment of HEU from Y-12 to the CNPC would require 540 shipments
- Release and aerosol fractions based on WVDP Waste EIS values

Source: Dimsha 2007.

Table 5.10-13 — Estimated Impacts Due to Handling and Stops, CNPC Alternative

	per shipment dose (person-rem)	total dose for campaign (person-rem)	Total LCFs
<i>Movement of pits from Pantex to CNPC Sites</i>			
Handling		1,100	0.657
Person at truck stop	2.10×10^{-9}	9.87×10^{-7}	5.92×10^{-10}
Residents in vicinity of stop	2.82×10^{-7}	1.34×10^{-4}	7.95×10^{-8}
<i>Movement of HEU from Y-12 to CNPC Sites</i>			
Handling	8.18	4,420	2.65
Person at truck stop	2.10×10^{-8}	1.13×10^{-5}	6.80×10^{-9}
Residents in vicinity of stop	2.82×10^{-7}	1.52×10^{-4}	9.14×10^{-8}

Source: Dimsha 2007.

Table 5.10-14 presents the estimated non-radiological transportation impacts for the CNPC Alternative.

Table 5.10-14 — Non-Radiological Transportation Impacts, CNPC Alternative

CNPC Candidate Site	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
LANL	Pits	170,000	0.00663	0.00317	0.000204
	HEU	782,000	0.270	0.0133	0.00138
	Total	953,000	0.277	0.0165	0.00158
NTS	Pits	416,000	0.0663	0.00317	0.000381
	HEU	1,180,000	0.364	0.0188	0.00182
	Total	1,596,000	0.430	0.0220	0.00220
Pantex	Pits	No transportation assessed (materials onsite)			
	HEU	597,000	0.205	0.00988	0.0115
	Total	597,000	0.205	0.00988	0.0115
SRS	Pits	637,000	0.319	0.0127	0.00190
	HEU	212,000	0.175	0.00589	0.00101
	Total	849,000	0.494	0.01859	0.00291
Y-12	Pits	520,000	0.178	0.00860	0.00100
	HEU	No transportation assessed (materials onsite)			
	Total	520,000	0.178	0.00860	0.00100

Source: Dimsha 2007.

Additionally, if the CNPC is located at a site other than LANL, all Category I/II inventories of radioactive material would be transferred from LANL to the CNPC, as discussed in Section 5.10.2.

5.10.3.2 CNC (CPC + CUC at one site, A/D/HE Center at Pantex or NTS)

For the CNC Option (the CCE Alternative that does not include the A/D/HE Center), pit production and CSA production would be consolidated at one of the candidate CNC sites (NTS, LANL, Pantex, Y-12, or SRS), and the A/D/HE activities would continue to be conducted at Pantex or transferred to NTS. Pit storage would be located with the A/D/HE Center. Table 5.10-15 provides the annual estimated radiological impacts of transporting pits and CSAs between the A/D/HE at Pantex and the four other CNC candidate sites. Tables 5.10-12 and 5.10-13 (located in Section 5.10.3.1) provide the estimated radiological health impacts of the one-time transportation of HEU from Y-12 to the CNC site alternatives.

Table 5.10-15 — Annual Radiological Impacts for CNC (A/D/HE Center at Pantex)

CNC Site	Transportation Assessed	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
LANL	200 pits	4.20×10^{-10}	0.0105	0.0105
	200 CSAs	7.57×10^{-17}	3.58×10^{-4}	3.58×10^{-4}
NTS	200 pits	6.39×10^{-10}	0.0316	0.0316
	200 CSAs	1.16×10^{-16}	1.08×10^{-3}	1.08×10^{-3}
SRS	200 pits	3.46×10^{-9}	0.0584	0.0584
	200 CSAs	6.25×10^{-16}	1.99×10^{-3}	1.99×10^{-3}
Y-12	200 pits	8.36×10^{-10}	0.0426	0.0426
	200 CSAs	1.82×10^{-16}	1.92×10^{-3}	1.92×10^{-3}

**Table 5.10-15 — Annual Radiological Impacts for CNC (A/D/HE Center at Pantex)
(continued)**

Associated Impacts Common to both Pit and CSA Transportation Activities				
Handling	Truck Stop	Impacts to Residents in Vicinity of Stop	In-Transit MEI Impacts	
0.0224	2.02×10^{-11}	2.71×10^{-9}	1.51×10^{-9}	

Assumptions:

- All materials in metal form
- ES-3100 or similar container used
- Release and aerosol fractions based on WVDP Waste Management EIS values

Source: Dimsha 2007.

Table 5.10-16 presents the annual impacts of transporting pits and CSAs between the A/D/HE Center at NTS and the CNC candidate sites.

Table 5.10-16 — Annual Radiological Impacts for CNC (A/D/HE Center at NTS)

CNC Site	Transportation Assessed	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
LANL	200 pits	7.98×10^{-12}	8.69×10^{-4}	8.69×10^{-4}
	200 CSAs	4.23×10^{-17}	8.69×10^{-4}	8.69×10^{-4}
SRS	200 pits	1.36×10^{-10}	2.76×10^{-3}	2.76×10^{-3}
	200 CSAs	7.20×10^{-16}	2.76×10^{-3}	2.76×10^{-3}
Y-12	200 pits	5.18×10^{-11}	2.48×10^{-3}	2.48×10^{-3}
	200 CSAs	2.74×10^{-16}	2.48×10^{-3}	2.48×10^{-3}
Associated Impacts Common to both Pit and CSA Transportation Activities				
Handling	Truck Stop	Impacts to Residents in Vicinity of Stop		In-Transit MEI Impacts
0.0224	2.02×10^{-11}	2.71×10^{-9}		1.51×10^{-9}

Assumptions:

- All materials in metal form
- ES-3100 or similar container used
- Release and aerosol fractions based on WVDP Waste Management EIS values

Source: Dimsha 2007.

Tables 5.10-17 and 5.10-18 present the estimated non-radiological transportation impacts for the CNC Options.

**Table 5.10-17 — Annual Non-Radiological Transportation Impacts, CNC Option
(Pantex as A/D/HE)**

CNC Candidate Site	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
LANL	Pits	5,800	0.00226	0.000108	6.96×10^{-6}
	CSAs	23,200	0.008	0.000394	4.20×10^{-5}
	Total	29,000	0.0103	0.000502	4.90×10^{-5}
NTS	Pits	14,200	0.00323	0.000206	1.30×10^{-5}
	CSAs	35,000	0.0108	0.000558	5.38×10^{-5}
	Total	49,200	0.0140	0.000764	6.68×10^{-5}
Pantex	CSAs	17,700	0.00606	0.000293	3.41×10^{-5}
	Total	17,700	0.00606	0.000293	3.41×10^{-5}

**Table 5.10-17 — Annual Non-Radiological Transportation Impacts, CNC Option
 (Pantex as A/D/HE) (continued)**

CNC Candidate Site	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
SRS	Pits	21,700	0.0109	0.000432	6.46 x 10 ⁻⁵
	CSAs	6,300	0.00518	0.000174	2.98 x 10 ⁻⁵
	Total	28,000	0.0161	0.000606	9.44 x 10 ⁻⁵
Y-12	Pits	17,700	0.0606	0.000293	3.41 x 10 ⁻⁵
	Total	17,700	0.0606	0.000293	3.41 x 10 ⁻⁵

Source: Dimsha 2007.

**Table 5.10-18 — Annual Non-Radiological Transportation Impacts, CNC Option
 (NTS as A/D/HE)**

CNC Candidate Site	Material Shipped	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
LANL	Pits	10,600	0.00323	0.000206	1.30 x 10 ⁻⁵
	CSAs	23,200	0.008	0.000394	4.20 x 10 ⁻⁵
	Total	33,800	0.0112	0.000600	5.50 x 10 ⁻⁵
NTS	CSAs	35,000	0.0108	0.000558	5.38 x 10 ⁻⁵
	Total	35,000	0.0108	0.000558	5.38 x 10 ⁻⁵
SRS	Pits	39,000	0.0156	0.000698	8.42 x 10 ⁻⁵
	CSAs	6,300	0.00518	0.000174	2.98 x 10 ⁻⁵
	Total	45,300	0.0208	0.000872	1.15 x 10 ⁻⁴
Y-12	Pits	35,000	0.0108	0.000558	5.39 x 10 ⁻⁵
	Total	35,000	0.0108	0.000558	5.39 x 10 ⁻⁵

Source: Dimsha 2007.

5.10.4 Capability-Based Alternative

Under the Capability-Based Alternative, the major radiological transportation actions involving Category I/II SNM would be as follows:

- Pits (assume 50 pits per year) would continue to be shipped between Pantex and LANL; and
- CSAs (assume 50 units per year) would continue to be shipped between Pantex and Y-12.

The impacts of transportation for this Alternative would be the same as the No Action Alternative for pits and 25 percent as much as the impacts for the No Action Alternative for CSAs (see Section 5.10.1).

5.10.5 Waste Shipments

5.10.5.1 Low-level Waste (Y-12 to NTS)

The radiological health impacts due to transportation of LLW from Y-12 to NTS were estimated for three different annual waste generation levels; 7,800 cubic yards, 12,300 cubic yards, and 24,000 cubic yards. It is assumed that Class A 55-gallon drums would be used to transport this

waste. Considering this, the number of containers and shipments of LLW provided in Table 5.10-19 would be required to meet the generation levels.

Table 5.10-19 — Number of LLW Drums and Shipments

Annual Waste Generation (yd ³)	Number of Drums	Number of Shipments
7,800	30,620	383
12,300	48,300	604
24,000	94,200	1178

Source: Dimsha 2007.

For this analysis, waste inventories were assumed to be similar to those provided in the West Valley Demonstration Project Waste Management (WVDP WM)_EIS (DOE/EIS-0337F). Accident conditional probabilities and release fractions were also used based on WVDP WM EIS values for Class A LLW and drum containers. The estimated human health impacts for accidents and incident-free transportation in LCFs are provided in Table 5.10-20. Non-radiological impacts are summarized in Table 5.10-21.

Table 5.10-20 — Health Impacts Due to LLW Transportation (in LCF)

	Annual Waste Generation (yd ³)		
	7,800	12,300	24,000
Handling	0.662	0.826	1.61
Incident-Free In-Transit Exposure	0.05680599	0.09456	0.184
Truck Stop Personnel	4.5782×10^{-9}	7.2160×10^{-9}	1.4048×10^{-8}
Resident Near Stop	6.1448×10^{-8}	1.02968×10^{-7}	1.8999×10^{-7}
Accident Exposure	4.12269×10^{-8}	6.50424×10^{-8}	1.27827×10^{-8}

Source: Dimsha 2007.

Table 5.10-21 — Non-Radiological Health Impacts due to LLW Transportation

Annual Waste Generation (yd ³)	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
7,800	837,000	0.258	0.01340152	0.00129
12,300	1,320,000	0.408	0.02110240	0.00204
24,000	2,572,000	0.0794	0.04110467	0.00397

Source: Dimsha 2007.

5.10.5.2 Low-level Waste (Pantex to NTS)

The radiological health impacts due to transportation of LLW from Pantex to NTS were estimated for three different annual waste generation levels; 7,800 cubic yards, 12,300 cubic yards, and 24,000 cubic yards. It is assumed that Class A 55-gallon drums would be used to transport this waste. Considering this, the number of containers and shipments of LLW provided in Table 5.10-21 would be required to meet the generation levels.

For this analysis, waste inventories were assumed to be similar to those provided in the West Valley Demonstration Project Waste Management (WVDP WM) EIS (DOE/EIS-0337F). Accident conditional probabilities and release fractions were also used based on WVDP WM

EIS values for Class A LLW and drum containers. The estimated human health impacts for accidents and incident-free transportation in LCFs are provided in Table 5.10-22. Non-radiological impacts are summarized in Table 5.10-23.

Table 5.10-22 — Health Impacts Due to LLW Transportation (in LCF)

	Annual Waste Generation (yd ³)		
	7,800	12,300	24,000
Handling	0.662	0.826	1.61
Incident-Free In-Transit Exposure	0.0258	0.0407	0.0794
Truck Stop Personnel	4.82 x 10 ⁻⁹	7.60 x 10 ⁻⁹	1.48 x 10 ⁻⁸
Resident Near Stop	6.48 x 10 ⁻⁸	1.02 x 10 ⁻⁷	1.99 x 10 ⁻⁷
Accident Exposure	1.18 x 10 ⁻⁸	1.86 x 10 ⁻⁸	3.63 x 10 ⁻⁸

Source: Dimsha 2007.

Table 5.10-23 — Non-Radiological Health Impacts due to LLW Transportation

Annual Waste Generation (yd ³)	Total Mileage	Accidents	Accident Fatalities	Non-radiological Emissions Fatalities
7,800	421,000	0.121	0.00670	4.77 x 10 ⁻⁴
12,300	664,000	0.191	0.0106	7.52 x 10 ⁻⁴
24,000	1,295,000	0.372	0.0206	0.00147

Source: Dimsha 2007.

5.10.5.2 TRU Waste

The radiological health impacts due to transportation of TRU waste from a CPC to WIPP were calculated as shown in Table 5.10-24. The estimated human health impacts for accidents and incident-free transportation in LCFs are provided.

Table 5.10-24— Health Impacts Due to TRU Waste Transportation.

CPC Site	Estimated Health Impacts (LCFs)		
	Accident	Incident-Free	Total
LANL	1.3 x 10 ⁻⁷	6.6 x 10 ⁻⁴	6.6 x 10 ⁻⁴
NTS	6.6 x 10 ⁻⁷	2.2 x 10 ⁻³	2.2 x 10 ⁻³
Pantex	3.2 x 10 ⁻⁷	7.8 x 10 ⁻⁴	7.8 x 10 ⁻⁴
SRS	7.2 x 10 ⁻⁶	3.7 x 10 ⁻³	3.7 x 10 ⁻³
Y-12	3.7 x 10 ⁻⁶	3.3 x 10 ⁻³	3.3 x 10 ⁻³

Source: Dimsha 2007.

5.11 RESPONSIVENESS TO FURTHER STOCKPILE REDUCTIONS

This section presents a qualitative analysis of the possible effects on programmatic alternatives of stockpile reductions beyond those specified in the Moscow Treaty. The purpose of this analysis is to enhance NNSA's understanding of how infrastructure requirements might change if the President were to reduce stockpile levels. It is noted that any such change in requirements would be highly dependent upon two factors, (1) when a decision is made to reduce the stockpile; and (2) the size of the future stockpile. For purposes of this analysis, it is assumed that the President might sometimes direct that the stockpile be reduced to several hundred weapons between 2012 and 2015.

5.11.1 Distributed Centers of Excellence

Assuming that NNSA proceeds with the DCE Alternative, if the nuclear weapons stockpile were significantly reduced, NNSA would be in position to reduce production activities to the levels that could be supported by capability-based alternatives described in Section 3.6. Because both Y-12 and Pantex would need to support increased dismantlements, these facilities would continue to operate. NNSA might continue to proceed with a UPF at Y-12, if warranted by security and cost savings compared to upgrading existing uranium facilities. If NNSA decides to proceed with a CPC, depending upon the date when the President directs even further reductions in the stockpile, NNSA would assess alternatives for reducing the facility, consolidating additional missions into the CPC, or upgrading LANL plutonium facilities (if LANL is not chosen as the site for the CPC).

At some point following completion of the bulk of dismantlements, closure of production sites could become reasonable. In such a case, NNSA envisions that such a Complex could be reconfigured to look as follows:

- LLNL, LANL, and SNL would remain as R&D laboratories;
- The CPC site or Y-12 (assuming the UPF is built) would become the likely location for all Category I/II SNM production;
- NTS would become the site for A/D/HE operations and any high-hazard testing;
- SRS would remain the tritium production site;
- Pantex would be closed; and
- Y-12 would be closed if not selected for the CPC and the UPF is not built.

Transitioning to a complex as described above would produce the greatest environmental changes at Pantex, which would be closed (and perhaps Y-12, if it were closed). The impacts of D&D associated with such closure are addressed in this SPEIS in Sections 5.5.15 and 5.9.15, as part of the analysis for locating a CNPC at sites other than Pantex and Y-12. The impacts of such D&D are not repeated in this section. Once D&D was complete these sites could be used for a variety of purposes from use as industrial sites to a wildlife refuge, as is the plan for the former Rocky Flats Plant. Depending upon the future use, the changes in environmental impacts could be negative or positive.

Transitioning to a Complex as described above would result in minimal impacts at SRS. Tritium operations would be further reduced, which would have positive impacts related to the amount of wastes generated, the number of radiological workers, tritium emissions, and radiological exposures to both workers and the public. However, as described in Section 5.8, the impacts from tritium operations do not result in significant impacts; as such, any reductions in impacts would not be major. Likewise, minor impacts would be expected at LLNL, LANL, and SNL, which would continue ongoing R&D missions, but could be further downsized.

Major additional quantities of SNM might be declared surplus, which would create a need to extend ongoing disposition activities. Surplus plutonium could be used for mixed-oxide fuel for commercial reactors, or as a fuel source for advanced reactors that might be fueled with transuranic materials, or dispositioned with other surplus plutonium. Surplus HEU could be

down-blended as fuel for commercial reactors, or used a fuel source for future naval reactors.

Transitioning to a much smaller Complex would result in mission changes at NTS, as the A/D/HE mission would be transferred to this site. For the small throughputs envisioned to support steady-state operations, the existing DAF would likely be large enough to support this mission. The DAF is a collection of more than 30 individual steel-reinforced concrete buildings connected by a rectangular common corridor. The entire complex, covered by compacted earth, spans an area of 100,000 square feet. Safety systems include fire detection and suppression, electrical grounding, independent heating, ventilation and air-conditioning systems with high-efficiency particulate air filters, loud speaker and alarm systems, and warning lights. In operational areas, pairs of blast doors, designed to mitigate the effects of an explosion, are interlocked so that only one door may open at a time.

The operational buildings in the DAF include: five assembly cells; four high bays; three assembly bays; one of which houses a glove box, and one of which houses a down draft table; and two radiography bays. Five staging bunkers provide space for staging nuclear components and high explosives. Minor new construction would likely be required to produce HE components.

5.11.2 Consolidated Centers of Excellence/Consolidated Nuclear Production Center

Assuming that NNSA decides to build a CNPC, the difference in nuclear floor space required to meet programmatic production requirements would probably not impact the design and construction of the facility to any appreciable extent (in comparison to overall costs of the project) due to the minimum amount of equipment necessary to achieve specific capacities and the corresponding floor space required. For example, the amount of equipment to produce one pit has an inherent capacity to produce a larger quantity. There are few differences in the amount of equipment between- capacities of 70 to 80 pits compared to 125 pits that would significantly alter the amount of needed floor space required such that significant cost savings would be accrued in comparison to total project costs. In addition, there would probably be only small cost and benefits likely to operation because a large measure of the costs to maintain the facilities and their operation, would be close to the same regardless of the size of the facility due to the safety and security aspects of handling Category I/II levels of material.

If the stockpile is reduced to several hundred weapons and the decision to reduce the stockpile was made after all the new facilities (e.g. uranium, plutonium, and assembly/disassembly) were in place, there would be nuclear floor space in excess of what would be required. However, the costs and benefits of the excess space would have to be weighed against a number of factors. There would be positive cost benefits by having the facilities needed to transform the stockpile quickly, and allowing for further reduction of the stockpile with associated cost savings. In addition, consolidation of nuclear material would still bring cost savings; and synergy between plutonium and uranium component production infrastructure would still exist. Any decision to reduce the stockpile would increase dismantlement activities and reduce production activities. Transition of personnel from one activity to another would be facilitated more quickly with the personnel already at the site. Although the facilities might be larger than necessary, much of the costs to maintain the facilities, due to the safety and security aspects of handling Category I/II

levels of material would still be realized regardless of the facility size. Additional space would also serve as a contingency should there be changes in requirements for the stockpile or other NNSA responsibilities.

The candidate sites for a CNPC if the stockpile were reduced to several hundred weapons would not be different than the ones under consideration now. The possibility of stockpile reductions to the level of several hundred would make alternatives that locate more capabilities at a single site more attractive. A small stockpile requires less work in all mission areas. Therefore, total consolidation allows greater flexibility in cross-training and cross-utilization of key skills. The sites to be considered for a total consolidation would be the same as the sites considered for larger stockpiles.

Any new structures NNSA may decide to build would probably not be constructed at the same time the President makes a decision to reduce the stockpile further. During the construction of CNPC facilities, savings could occur through redesign of facilities in line with the new stockpile. However, NNSA would have to evaluate whether there would be significant cost benefits in redesigning and constructing the facility or continuing based on the status of the project and programmatic requirements.

5.11.3 Capability-Based Alternative

The Capability-Based Alternative would support a smaller stockpile in the same way as described for the DCE.

5.12 CONSOLIDATING CATEGORY I/II SPECIAL NUCLEAR MATERIAL

This section analyzes the environmental impacts of consolidating Category I/II SNM as described in Section 3.7. The analysis focuses on the resources that are most likely to be affected. For removal of Category I/II SNM from LLNL, the analysis focuses on the: (1) transportation impacts of moving the Category I/II SNM from LLNL to SRS, LANL, and WIPP; and (2) reductions in emissions, exposures, and wastes from the phase out of Category I/II SNM operations at Superblock, and socioeconomic impacts. For Category I/II SNM consolidation actions at Pantex, the analysis focuses on the potential construction impacts in Zone 12, the handling operations associated with the transfer of the Category I/II SNM on-site, and the decontamination and decommissioning impacts for vacated facilities in Zone 4.

5.12.1 Remove Category I/II SNM from LLNL

NNSA has decided to remove Category I/II SNM from LLNL by approximately 2012 in the Record of Decision on the LLNL SWEIS (64 FR 50797). Although the exact quantities of Category I/II SNM are classified, the Category I/II SNM at LLNL can be divided up into three basic categories, in the approximate percentages indicated:

Category I/II SNM Category	Percentage	Receiver Site	# Trips
SNM Excess to Programmatic Missions	49	SRS ²	10
SNM Required for Programmatic Missions	47	LANL ³	9
Waste	4	WIPP	1

Source: NNSA 2007.

The removal of SNM from LLNL involves:

- Packaging and Un-packaging Category I/II SNM
- Transporting Category I/II SNM from LLNL to Receiver Sites
- Phasing out Category I/II SNM Operations from LLNL

The maximum number of containers per shipment would be 75, the maximum number of shipments per year would be approximately 4, and all shipment would be made by truck.

- All oxide and non-weapon component metal would be packaged to meet the DOT 9975 Type B shipping container.
- All weapon components would be packaged to meet DPP-1 Type B Shipping Container Requirements.
- All Enriched Uranium oxide would be packaged to meet Type B Shipping Container Requirements.
- Excess Enriched Uranium would be packaged to meet DOT 6M, ES3100, or DPP-2 Type B Shipping Container Requirements.
- Natural and Depleted Uranium would be processed to meet Type A Shipping container requirements.
- All TRU waste would be packaged to meet the WIPP WAC and shipped in TRUPAC-II.
- The remaining Category III SNM work in Superblock would be within the bounds of impacts analyzed in LLNL SWEIS (DOE 2005a).

Transferring the LLNL Category I/II SNM would also mean that the Category I/II SNM operations from the Superblock would be phased out. This SPEIS describes the impacts from this phase-out in Section 5.12.2. As described in Section 3.7.1, all Category I/II SNM inventories at LLNL that are not waste would be transferred to LANL (or NTS for interim storage) and SRS as programmatic and surplus material respectively. Packaging used by NNSA for hazardous materials shipments are either certified to meet specific performance requirements or built to specifications described in DOT hazardous materials regulations (49 CFR Subchapter C). Plutonium and HEU are unique hazardous materials that require special protection. In

² Excess SNM transported to SRS would be stored at the K-Area Materials Storage (KAMS) facility. DOE is developing plans to store approximately 5,000 packages, containing about 22 metric tons of plutonium, in KAMS. The LLNL excess material would be an insignificant addition to these quantities. In 2007, the DOE prepared a SA, which determined that the potential environmental impacts associated with the consolidation at SRS of surplus, non-pit, weapons-usable plutonium from Hanford, LLNL and LANL would not be a significant change from the potential environmental impacts associated with the alternatives analyzed in previous NEPA reviews (DOE 2007d). As a result of this SA, DOE does not need to conduct additional NEPA review prior to transferring surplus non-pit weapons-usable plutonium materials from LLNL to SRS for consolidated storage. Nonetheless, for completeness, this SPEIS includes an analysis of the transportation risk associated with disposition of all surplus plutonium from LLNL to SRS.

³ This analysis also evaluates NTS as an interim storage location of the LLNL Category I/II SNM required for programmatic missions. Under this option, the material would be transferred to NTS for interim storage in the DAF until eventual transfer to LANL.

addition to meeting the stringent Type B containment and confinement requirements of the NRC’s 10 CFR 71 and DOT’s 49 CFR, packaging for nuclear weapons and components must be certified separately by DOE/NNSA. NNSA employs a closed Transportation Safeguards System for the intersite transport of nuclear weapons and components, including Pu and HEU. Specially designed SGTs are utilized to ensure high levels of safety and physical protection.

Materials would be placed into packages for shipment. These packages would be loaded at LLNL, shipped to the receiving site, unpacked and placed into storage. The collective dose due to normal operational exposure to cargo handlers and other workers for each loading operation is estimated to be 0.06 person-rem and 0.004 person-rem, respectively. Because the loading would take place at LLNL in a secure area, there would be no exposure to the public. Table 5.12-1 provides a summary of the impacts of the 19 radioactive material shipments. The total dose to workers for shipments of all Category I/II materials would be 3.5 person-rem (2.6 + 0.9), resulting in 0.002 LCF. The incident-free dose to the public from these shipments would be 1.15 person-rem (0.21 + 0.94), resulting in a potential increase of 6.8×10^{-4} LCFs. The total exposure due to potential accidents is estimated to be 1.13×10^{-7} person-rem, resulting in less than 1×10^{-10} LCFs to the general population. As a point of reference, LLNL is authorized to transport approximately 584 shipments annually under the LLNL ROD (DOE 2005a). As such, these SNM shipments would represent approximately 3 percent of the 584 shipments.

Table 5.12-2 provides a summary of the impacts of transporting the LLNL Category I/II SNM to NTS for interim storage at the DAF followed by transportation to LANL. The total dose to workers for shipments of all Category I/II materials would be approximately 1.1 person-rem, resulting in approximately 6.6×10^{-4} LCFs. The incident-free dose to the public from these shipments would be less than 2.5 person-rem, resulting in a potential increase of 1.3×10^{-3} LCFs.

Table 5.12-1 — Risks of Transporting LLNL Non-Waste Category I/II Materials

Material Movement	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose ^a	LCF ^b
		Dose ^a	LCF ^b	Dose ^a	LCF ^b		
Programmatic Material to LANL	9	0.9	5.3×10^{-4}	0.21	1.27×10^{-4}	6.51×10^{-9}	3.9×10^{-12}
Surplus Material to SRS	10	2.6	1.55×10^{-3}	0.94	5.62×10^{-4}	1.07×10^{-7}	6.42×10^{-11}

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using conversion factor of 0.0006 LCF per person-rem.
Source: Dimsha 2007.

Table 5.12-2 — Risks of Transporting LLNL Programmatic Category I/II Materials to NTS for Interim Storage followed by Transportation to LANL

Material Movement	Number of Shipments	Incident-Free				Accident	
		Crew		Population		Dose	LCFs
		Dose	LCFs	Dose	LCFs		
LLNL-NTS	9	0.446	2.67×10^{-4}	0.898	5.39×10^{-4}	6.83×10^{-8}	4.10×10^{-11}
NTS-LANL	9	0.662	3.97×10^{-4}	1.44	8.62×10^{-4}	7.98×10^{-8}	4.79×10^{-11}

a – Dose presented in person-rem. b – Latent cancer fatalities calculated using conversion factor of 0.0006 LCF per person-rem.
Source: Dimsha 2007.

The packaging and handling of LLNL’s materials would generate less than 90 lbs of TRU waste,

representing less than one routine shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico. The impacts of this shipment would be less than 1/8 – 1/10 of the impacts presented in Table 5.12-1 for LANL and SRS, respectively. As a point of reference, LLNL is authorized to transport approximately 300 shipments annually of hazardous and radioactive waste, based on the analysis in the LLNL SWEIS (DOE 2005a).

5.12.2 Impacts of Phasing Out Category I/II SNM Operations from LLNL Superblock

Phasing out the Category I/II SNM operations from the Superblock would reduce the material-at-risk (MAR) for plutonium in the Superblock from 40 kg to lower limits associated with Category III SNM quantities (either 400g high purity Pu metal, 2000g Pu in high purity oxide, or 16 kg Pu in low grade materials). A reduction in the MAR would reduce the source term associated with potential accidents, thereby reducing potential accident impacts.

The bounding accident analyzed in the LLNL SWEIS for the Superblock was an evaluation-basis room fire of sufficient magnitude that the entire room is threatened, that all of the radioactive MAR within the room is engulfed in the fire, and the fire burns long enough to release the material from storage containers to the glovebox, room, and the environment (see LLNL SWEIS, DOE 2005, Appendix D, Section D.2.4.9). Table 5.12-3 lists consequences of this accident if the MAR in Superblock were reduced by approximately 60 percent.

Table 5.12-3 — Consequences of Bounding Accident at Superblock with MAR of 40 kg and MAR of 16kg

Accident	Frequency (per year)	MEI		Offsite Population ^b		Individual Noninvolved Worker	
		Dose (rem)	LCFs ^c	Dose (person-rem)	LCFs ^d	Dose (rem)	LCFs ^c
Room Fire Unfiltered In Building 332 (Superblock) with MAR of 40 kg	3.90×10^{-7}	5.60	3.36×10^{-3}	2.17×10^3	1.30	29.8	3.58×10^{-2}
Room Fire Unfiltered in Building 332 (Superblock) with MAR of 16 kg	3.90×10^{-7}	2.24	1.34×10^{-3}	868	0.52	11.9	7.1×10^{-3}

Source: Tetra Tech 2007.

Once Category I/II SNM is phased out of Superblock, it is expected that several pieces of equipment and hardware that would not be needed for remaining Category III missions would undergo D&D. In the short term, this could increase the wastes from the Superblock. Because a study has not been conducted for these D&D activities, this SPEIS uses conservative assumptions. Based on the analysis in the LLNL SWEIS (DOE 2005a), LLNL is expected to generate approximately 50 cubic meters per year of routine TRU waste (equivalent to approx. 240 drums per year) and an additional 60 cubic meters per year of non-routine TRU waste. Similarly, LLNL is expected to generate 330 cubic meters per year of routine LLW (equivalent to approximately 1,600 drums per year) and an additional 710 cubic meters per year of non-

routine LLW (DOE 2005a). In the bounding case, it is expected that an additional 100 drums of TRU waste and 400 drums of LLW would be generated per year for several years due to D&D activities.

Initially, employment at the Superblock would be expected to increase because of the D&D work; however, this would likely not be significant and would be offset by the transfer of some personnel to LANL. It is also expected that scientists and engineers would travel back and forth between LLNL and LANL. After the D&D work is completed, it is expected that there would be some decrease in personnel at LLNL because of the Category I/II SNM component of LLNL's plutonium mission would be located at LANL. However, personnel required to conduct R&D activities involving Category III quantities of SNM and maintaining the Superblock in a safe operating mode would be expected to be the same. It is expected that there would be some decrease in security personnel, but the decrease is unclear at this time.

Because there are no emissions of radionuclides from Superblock, phasing out Category I/II SNM would have no effect on population doses to the surrounding population. There would be no major impacts on the amount of utilities when missions involving Category I/II SNM operations have been eliminated because the ventilation systems, lighting, heat and cooling would still be required.

The Plutonium Facility (Building 332) in the Superblock has been determined eligible for listing on the National Register of Historic Places (NRHP) as a historic property by the California State Historic Preservation Officer (SHPO) (SHPO, 2005). Prior to D&D activities, the building would be recorded and photo-documented to accepted standards.

After phase-out of Category I/II SNM the Superblock facilities would continue to operate with Category III quantities of SNM. During Complex Transformation the Superblock facilities would continue to perform machining, foundry operations, analytical chemistry, and materials characterization on SNM originating from LANL facilities. These activities involving Category III quantities of SNM are well within the bounds of impacts analyzed for Superblock facilities in LLNL SWEIS (DOE 2005a).

5.12.3 Impacts of Transferring Category I/II SNM from Pantex Zone 4 to Zone 12

Consolidation of SNM at Pantex would entail the construction of a new storage facility in Zone 12, moving up to 60 metric tons of pits from Zone 4 to Zone 12, and the demolition of the old storage facilities in Zone 4 (Figure 5.12-1).

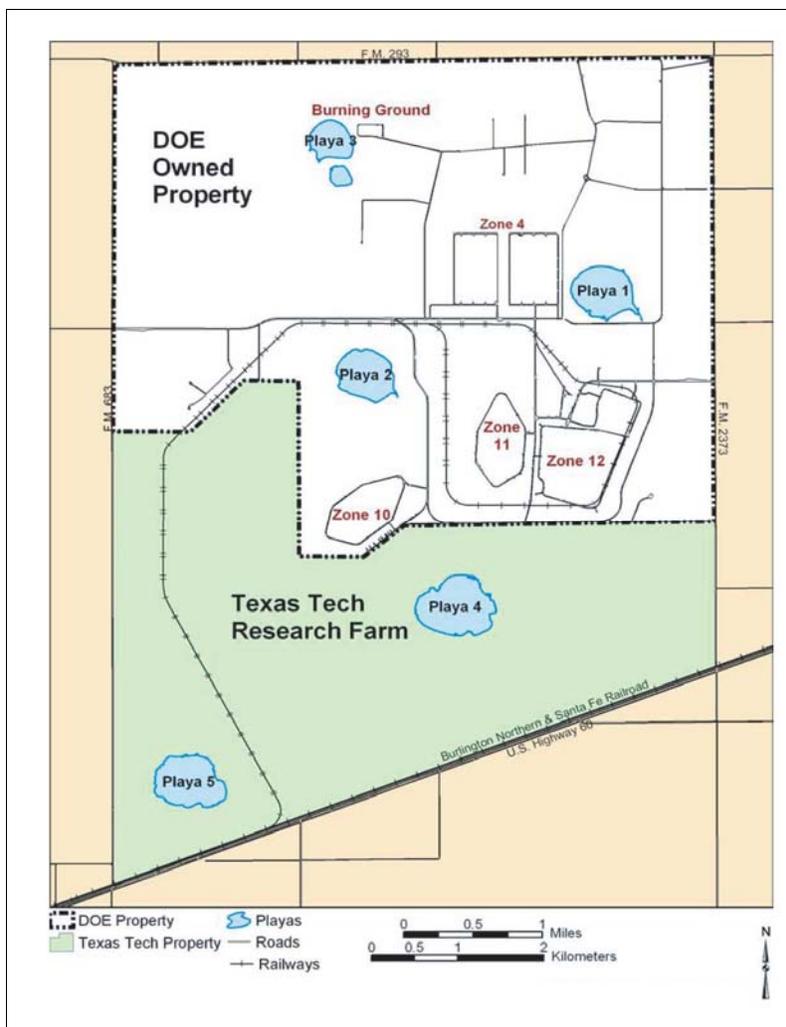


Figure 5.12-1 —Zone 4 and Zone 12 at Pantex

5.12.3.1 Construction Impacts

As shown in Table 3.7-2, the new SNM storage facility would be a steel-reinforced, concrete, underground structure (up to approximately 456,600 square feet), encompassing 11 acres of storage space on a 57 acre site. The construction period would take five years with a peak workforce of 120. The construction water requirement would be 2,950,000 gallons over the five year construction period.

Zone 12 is a highly developed area of Pantex which contains gravel gerties atop the assembly/disassembly bays and cells. The new storage facility would be similar in size to existing structures in Zone 12, and being underground, would not change the visual character of this area. During the construction phase, a little more than two and a half acres of temporary laydown area would be required. After construction, this area would be used to site a 1.5 acre parking lot.

Pantex has known contamination of soils surrounding a cooling tower and a drainage ditch flowing into Playa 1. The soil surrounding the cooling tower contains chromates and other heavy metals associated with algae treatment. The drainage ditch and immediate perched groundwater surrounding this ditch is contaminated with VOCs, metals and explosives. There is a known gasoline spill from a motor pool maintenance facility. In addition several old landfills have been identified in Zone 12 as being contaminated with VOCs, pesticides, PCBs, and radionuclides. Because there are known areas of contamination in Zone 12, the construction or post-construction landscaping has the potential to disturb potential release sites (PRSs). Where possible, PRSs would be avoided. If disturbance of PRSs were necessary, soils from PRSs would be returned to the excavated area after disturbance when feasible or would be characterized and treated or disposed of appropriately. Should a previously unknown or suspect disposal site be disclosed during subsurface construction work, work would cease until the Pantex project staff could review the site and would identify appropriate procedures for working within that site area.

Construction of a new underground SNM storage facility in Zone 12 is not expected to have an appreciable negative impact on water resources at or near the Pantex Plant. The new facility is not proposed for construction within the delineated floodplains of the four onsite playas; thus, there would be no direct impacts to surface water features at Pantex or vicinity.

Facility construction could generate storm water runoff, but all construction activities would be conducted in accordance with best management practices for soil erosion and sediment control, and in accordance with applicable permit requirements. Although the new facilities would increase site storm water runoff due to the creation of additional impervious surface area, the increase in developed area would constitute less than 0.1 percent of the DOE-owned land at the site. The new facilities would be located primarily in previously developed areas of the site. Storm water runoff from the facilities would be routed to existing storm water discharge outfalls that are monitored and regulated in accordance with permit requirements. Engineering best management practices (BMPs) would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

The proposed storage facility would not require large volumes of water. After construction, where water would be used for dust suppression, water demands would primarily be those needed to meet the sanitary and domestic needs of facility personnel. Furthermore the proposed storage facility replaces an existing facility so it is not expected that there would be any increase in the present water use of the existing storage facility. As a result, wastewater generation volumes and water use should continue to be bounded by the levels forecasted in the SWEIS.

Clearing or excavation activities during site construction and during the D&D of the closed facility would have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized

air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality. Noise from the construction would be audible primarily to the involved workers. Involved site workers would be required to wear appropriate personal protective equipment (PPE), including hearing protection.

Foot and vehicular traffic would be minimally affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 120 construction workers would be onsite during the peak construction period, adding an estimated additional 80 personal vehicles to local roadways during the construction period and another 20 construction vehicles (such as dump trucks, bulldozers, drill rigs, cranes, and cement mixer trucks). These vehicles would operate primarily during the daylight hours and could be left onsite over night. Temporary construction lighting would be directed toward the work area.

Because Zone 12 is highly developed, no adverse effects to cultural or archeological resources, or biological resources (specifically animal and plant species) would result from construction activities. Small animals and birds at the construction could be temporarily displaced. The black-tailed prairie dog and the snowy plover have been recently added to the site listing at Pantex. The black-tailed prairie dog was designated a Federal candidate species in February 2000 (65 FR 5476); surveys of the Pantex Plant site in 2000 estimated a population of 1,426 black-tailed prairie dogs. This is a considerably lower population than estimates made in 1997 (10,000) and 1998 (13,000) that were based on burrows, rather than actual counts of prairie dogs (Pantex 2006).

Construction of a new storage facility in Zone 12 could result in the loss of some vegetation and less mobile animals (i.e., reptiles, small mammals). Because the construction would occur in previously disturbed areas and would affect less than 1 percent of the DOE-owned land at the site, potential impacts on biological resources would be negligible. A biological assessment of the Pantex Plant completed in 1996 for the Pantex SWEIS which included planned, new construction, addressed the impacts of continuing operations on listed species and species of concern that may occur in or migrate through the area. The assessment was approved in 1996, and the Fish and Wildlife Service (FWS) concurred with the conclusion that continued Pantex Plant operations, including new construction, are not likely to adversely affect any federally listed threatened or endangered species (DOE 1996b).

During the construction, there would be no increase in the number of Pantex employees as a result of this project. The estimated additional 120 peak construction jobs would be easily filled by the existing employees in the regional work force. Because these temporary jobs would be filled by the construction contractor and subcontractors with workers from the existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in the Pantex ROI. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in the immediate area.

Construction activities would not be expected to have any adverse health effects on Pantex workers or the public. NNSA and Pantex workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The

construction is not expected to result in an adverse effect on the health of construction workers. Approximately 120 peak-period construction workers would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). If the peak construction period lasts for the entire five year construction period, no deaths (0.005) would be expected for the estimated 120 construction workers from construction or demolition-related activities that include falls, exposure to harmful substances, fires and explosions, transportation incidents, and being struck by objects, equipment, or projectiles.

Outside of the Amarillo metropolitan area, most of the minority and low-income population continue to be located at the outer reaches of the ROI. Therefore, the minority and low-income populations have not experienced any disproportionately high or adverse human health, social, economic, or environmental effects from Pantex activities. The construction of a new storage facility at Pantex would not result in any new environmental impacts that could give rise to any environmental justice impacts.

5.12.3.2 Movement of Category I/II SNM from Pantex Zone 4 to Zone 12

Section 5.10.3.1 of this SPEIS estimates the impacts, including handling, of moving Category I/II SNM (pits) from Pantex to the various CNPC alternative sites. Table 5.12-4 shows the handling (loading and offloading) portion of this analysis as represented in Table 5.10-13. Moving this same material from Zone 4 to Zone 12, within the Pantex site, should have similar health effects related to the handling portion of this analysis. This equates to an estimated total dose of 1,100 person-rem, which would statistically translate into approximately 0.657 LCFs. Because the actual transportation would be within the Pantex sites, no doses to the public would result from transportation.

Table 5.12-4 – Radiological Impacts of Moving Pantex SNM from Zone 4 to Zone 12

	per shipment dose (person-rem)	total dose for campaign (person-rem)	Total LCFs
Movement of pits from Pantex to CNPC Sites			
Handling		1,100	0.657

Source: Dimsha 2007.

5.12.3.3 Operation of New Storage Facility

Once placed in the new storage facility, the material would be stored in a manner similar to the current storage in Zone 4, with the exception that it would be underground. The number of workers associated with storage operations would not change, although there would be a reduction in security force requirements, due to the consolidation of storage into an already secure area. Because the new storage facility would be located underground, the risks associated with external hazards would be expected to be reduced compared to the existing, above ground Zone 4 storage. Risks associated with internal hazards should not change. Table 5.12-5 displays

the operational requirements associated with the operation of the new storage facility.

Table 5.12-5 – Operational Requirements for Zone 12 Storage Facility

OPERATIONAL REQUIREMENTS	
Data	
Plant footprint (acres)	11
Employment (no. of workers)	
Total	40
Radiation Workers	10
Average Dose to Radiation Worker(mrem)	12
Water Use (gallons/year)	70,000
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Emissions	
Radionuclide emissions (Ci/yr)	0

Source: NNSA 2007.

5.12.3.4 D&D of Zone 4 Facilities

Once all Category I/II SNM is removed from Zone 4, these storage facilities would be demolished and facilities in Zone 4 would undergo D&D. Table 5.12-6 displays the relevant information associated with the D&D of these Zone 4 facilities. As shown on that table, approximately 700 cubic yards of LLW would result over the 2-year D&D period. This LLW would be packaged for shipment and transported to NTS for disposal. The annual LLW from this D&D would represent an increase of approximately 350 percent compared to the 96.8 cubic yards of LLW generated by Pantex in 2005.

Table 5.12-6 - Demolition and D&D of Existing Storage Facilities

Requirements	Consumption/Use
Solid D&D (yd ³)	12,300
LLW generated (yd ³)	700
Hazardous Waste (yd ³)	0
D&D Related Employment	10
Peak workers	10
Total worker hours	62,400

Source: NNSA 2007.

Steel and other non-hazardous debris would be disposed of on-site at one of the Pantex landfills. This material could also be used for backfill at other Pantex construction sites. An additional 10 construction workers with an additional 7 personal vehicles would be added to the local roadways for the D&D activities. There would also be an additional 3 construction vehicles to enable the D&D activities to be conducted.

5.13 PROJECT-SPECIFIC ANALYSIS OF HE R&D

This section analyzes the environmental impacts of the reasonable alternatives, described in Section 3.8, for HE R&D. For each alternative, the analysis focuses on the resources that are most likely to be affected. For example, for alternatives that do not involve new construction, and no associated land disturbance, the following resources would not be affected: land use,

visual resources, air and noise, water resources, geology and soils, biotic resources, and cultural resources. As such, this analysis does not discuss these resources any further. Rather, the analysis focuses on the following resources: emissions and exposures, which affect human health, socioeconomic impacts, and wastes. For alternatives that do involve new construction, and associated land disturbance, this analysis discusses impacts to all relevant resources.

As explained in Section 3.8.1, HE R&D activity is currently distributed primarily among five sites within the nuclear weapons complex based on their respective roles in support of the nuclear weapon stockpile. This SPEIS analyzes a full spectrum of alternatives associated with HE R&D as shown on Table 5.13-1.

Table 5.13-1 — HE R&D Alternatives

Alternatives		Donor Site	Receiver Site
1	No Action Alternative	N/A	N/A
2a	Downsize in Place	N/A	N/A
2b	Relocate HE Processing & Fabrication from Site 300	LLNL	Pantex, LANL
2b'	LLNL HEAF Annex for local part fabrication	LLNL	Pantex, HEAF, Private industry
2c	Consolidate open-air 1-10 kg HE R&D experiments from LANL and Sandia to HEAF and over 10 kg thru 100 kg HE R&D experiments at LANL.	<u>1-10 kg HE R&D</u> LANL, SNL, Pantex <u>10-100 kg HE R&D</u> LLNL, SNL	<u>1-10 kg HE R&D</u> LLNL <u>10-100 kg HE R&D</u> LANL, NTS
2d	Consolidate unconfined firing to one or no sites.	ALL	One undetermined site
2e	Consolidate Maincharge HE R&D Experiments and Testing to one or both nuclear labs.	SNL	LANL, LLNL
3a	Consolidate HE R&D Experimentation and Fabrication Activities to LANL	SNL, LLNL, Pantex	LANL
3b	Consolidate HE R&D Experimentation and Fabrication Activities to LLNL	SNL, LANL, Pantex	LLNL
3c	Consolidate HE R&D Experimentation and Fabrication Activities to Pantex	SNL, LANL, LLNL	Pantex
3d	Consolidate HE R&D Experimentation and Fabrication Activities to SNL	LANL, LLNL, Pantex	SNL
3e	Consolidate HE R&D Experimentation and Fabrication Activities from LANL to LLNL or Pantex or NTS	LANL	LLNL, Pantex, NTS
3f	Consolidate HE R&D Experimentation and Fabrication Activities from LLNL to LANL or Pantex or NTS	LLNL	LANL, Pantex, NTS
3g	Consolidate HE R&D Experimentation and Fabrication Activities from LANL and LLNL to Pantex or NTS	LANL, LLNL	Pantex, NTS
3h	Consolidate HE R&D Experimentation and Fabrication Activities to NTS	LANL, LLNL, SNL, Pantex	NTS

Source: NNSA 2007.

For all alternatives, activities involving the handling or work on HE could lead to the accidental detonations resulting in severe or fatal injury of many personnel. The consequences of an accidental detonation of HE could include severe injury or death to the facility workers and the destruction of the building or facility that the accident occurred in. These potential consequences

could occur at any site that conducts HE operations. Blast pressures and fragments could also cause injury to other personnel in the open area outside the facility and cause damage to nearby facilities. Additionally, low-level environmental releases and low-level exposures of personnel to airborne hazardous materials may occur from resulting plumes. Because the potential impacts are generally localized, off-site impacts from HE accidents are not expected.

No Action Alternative. Under the No Action Alternative, HE R&D activities would continue at five sites within the weapons complex, as described in Section 3.8.1. LLNL and LANL are where most of the R&D related to main charge explosives is performed. SNL has responsibility for the cradle-to-grave of the non-nuclear explosive components such as gas generators, ignitors, actuators, and timer-drivers. HE R&D is also conducted at the Pantex Plant, principally for safety and quality control purposes and manufacturing process development and improvement. NTS is used for testing of high explosives. At all five sites, compared to other NNSA activities, HE R&D activities comprise a minor part of the overall operations. HE R&D activities are responsible for less than 1 percent of the air emissions, electrical usage, water use, employment, and generated wastes (NNSA 2007). At all sites, high-explosive detonations produce impulse noises which could be audible off-site and potentially cause annoyances. In some instances, NNSA procedures require notification of potentially affected offsite residents prior to such detonations. For example, at Pantex, procedures require telephone notification of potentially affected offsite residents, as well as the use of warning sirens and lights prior to detonations greater than 1 pound. In general, these noises would be intermittent rather than continuous events and would be similar to thunder in their intensity.

5.13.1 HE R&D Minor Downsizing/Consolidation Alternatives

5.13.1.1 *Alternative 2a - Downsize in Place*

Under this alternative, LLNL and LANL would downsize existing HE R&D experimentation and fabrication activities in place, with no transfer of activities between any HE R&D sites. At LANL, any further downsizing would be accomplished within the bounding analysis of the previous DX Consolidation Plan EA and FONSI. At LLNL, B825/B826, B817, and some machining bays in B806/B807 would close. No construction would be required for this alternative, however, B825 and B826 would be decommissioned. There would be no staffing change for this alternative (175 scientists, engineers, and technicians) and no significant change in effluents, emissions, or wastes compared to the No Action Alternative (see Section 3.8.1). As some building close and the work is transferred to other buildings, as specified above, the effluents, emissions and wastes would transfer also. As such, the net effect at LLNL would be no change in effluents, emissions, and wastes. No additional downsizing would occur at Pantex, SNL/NM, or NTS. Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards.

5.13.1.2 *Alternative 2b - Relocate HE Processing & Fabrication from Site 300*

Under this alternative, NNSA would relocate HE processing and fabrication from Site 300. The activities and configuration of the High Explosives Application Facility (HEAF), as described in the No Action Alternative, would remain unchanged. However, the HE R&D facilities at Site

300 would be closed, and HE R&D parts that are fabricated at Pantex or LANL would be shipped to LLNL for testing in HEAF.⁴

The facilities at Site 300 that would close under this alternative are:

Chemistry Area (scale-up of formulation and synthesis of HE)

- B825 – 1- and 2-inch mechanical presses
- B826 – small deaerator/loader; 1-pint, 1-gallon mixers
- B827 Complex – 50-pound deaerator/loader; heating ovens; 2-gallon to 5-gallon mixers; melt cast kettles; synthesis pilot plant; slurry kettles, grinders, reaction vessels
- HE storage magazines – long term and temporary storage

Process Area

- B809 Complex – 25-inch isostatic press, drying ovens
- B817 Complex – 14- & 18-inch isostatic presses, drying ovens
- B823 Complex – 9-Mev, 2-Mev, 120-kev radiography of HE R&D parts
- B806 Complex, B807 – machining of HE R&D parts
- B855 Complex – Large HE part machining
- B810 Complex – assembly of HE R&D parts
- B805 – general machine shop, explosives waste packaging, numerically controlled (NC) machine programming
- HE storage magazines – long term and temporary storage

Explosives Waste Storage Facility

- 5 HE storage magazines – State permitted storage facility

Explosives Waste Treatment Facility

- B845 Complex – State permitted for Open Burn/Open Detonation of explosives waste

No construction at LLNL would be required for this alternative. Approximately 50 staff would lose their positions. Table 5.13.1-2 shows changes from eliminating the HE R&D mission from the Site 300 buildings.

⁴ This alternative could only be implemented if other activities at Site 300 that require a HE processing and fabrication infrastructure, specifically hydrotesting at the Contained Firing Facility (see Section 5.16) and system environmental testing at the Environmental Test Facility (see Section 5.17), have been transferred to new facilities.

Table 5.13-2 — Operational Changes at LLNL Site 300 for Alternative 2b

Requirements	Reductions
Plant footprint (acres)	2
Employment (workers)	50
Waste Category	Volume
Low level	
Liquid (gal)	100
Solid (yd ³)	10
Hazardous	
Liquid (gal)	20,000
Solid (yd ³)	25
Nonhazardous (Sanitary)	
Liquid (gal)	200,000

Source: NNSA 2007.

HEAF averages about 500 HE R&D shots per year. The explosive parts for these shots would have to be shipped from Pantex or LANL to LLNL. This would require an estimated 100 truck trips per year, inasmuch as R&D parts often have to be made and tested one-off before the design of the next part can be finalized. Relocating the Site 300 processing and fabrication activities would reduce impacts from these HE R&D activities as follows:

In the short-term, land use would be unaffected. However, the vacated facilities at Site 300 would eventually undergo decommissioning. This would entail the cleanup and demolition of these facilities. The specific impacts of such demolition cannot be estimated until detailed site-specific surveys are conducted.

Before any demolition, surfaces and fixtures would be tested or sampled to determine if contamination is present and in what quantities. Based on the sampling results, the buildings to be demolished would then be divided into contaminated and uncontaminated zones. Physical barriers would be established between work areas to protect workers and manage wastes and emissions. Workers would remove contaminated materials before demolition of uncontaminated areas begins. Asbestos could be present in the buildings being considered for demolition. The asbestos would be removed according to established industry and regulatory procedures. Asbestos wastes generated during renovation and demolition activities are regulated under the NESHAP for Asbestos (40 CFR 61) and would be managed in accordance with all applicable regulations. Air emissions generated during asbestos removal activities would be controlled by use of containment tents (such as plastic drapes) and of high-efficiency particulate air (HEPA) filtered particulate collection devices, as necessary. Similar methods of containment would be used for removal and demolition of materials and structures that are contaminated with radioactive or hazardous materials. As wastes are removed, they would be packaged and managed according to established LLNL procedures.

After contaminated materials are removed, general demolition of the remaining materials and structural elements would begin. Demolition of uncontaminated and decontaminated structures would be performed using standard industry demolition processes. After roof and walls are removed, concrete foundations and paved areas would be removed. A variety of equipment and techniques may be used in the demolition process. Typical equipment used in demolition include front-end loaders, bulldozers, wrecking balls, and pneumatic hammers, as well as various hand

tools for removing such items as windows and copper wiring. Materials removed in the demolition process would be segregated to the extent feasible to facilitate recycling and waste management. Dust suppression would be conducted as necessary using best available control measures (BACMs), such as spraying with water or chemical dust suppressants. The application of specific BACMs would be determined on a case-by-case basis. After demolition is completed and waste and recycled materials are removed from the site, the area would be recontoured and revegetated or landscaped as appropriate.

Before starting demolition activities, a site-specific health and safety plan would be prepared and approved. Appropriate personnel protection measures, such as the use of personnel protection equipment (PPE) (gloves, hard hats, steel-toed boots, eye shields, and ear plugs or covers), monitoring of hazards and worker exposures, and engineered controls would be a routine part of the demolition activities required to protect worker health and safety. In addition, LLNL staff can provide site-specific hazard training as needed. Waste Minimization and Pollution Prevention Plans would be prepared under the Proposed Action to address waste issues for the demolition of the vacated buildings. As already discussed, building demolition materials would be recycled and reused to the extent practicable. All waste requirements for demolition-generated wastes would be met.

Waste minimization practices (such as material substitution, source reduction, hazard segregation, recycling, and reuse) would be incorporated into all waste-generating activities. Waste disposal would occur only after waste minimization options have been implemented or when other options are not safe or are not technically or economically feasible. Wastes would be recycled or salvaged in accordance with LLNL's property management process. Wastes would be managed through the LLNL waste management program. Solid waste would be disposed of offsite; hazardous waste would be shipped offsite to commercial facilities for treatment and disposal. Clean fill dirt would be placed on the sites of the demolished buildings, and the entire area would be landscaped.

Buildings 825, 826, 817A, B, & F, 806 A & B, and 807 are contributing elements to the Hydrodynamics Test Facility Historic District, determined eligible for listing on the NRHP as a historic property by SHPO (SHPO, 2005). Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards. Following decommissioning, NNSA would use best management practices to restore the land to a natural state. Because the facilities to be closed represent much less than one percent of the acreage at Site 300, no impacts to biological resources, soils, geology, and cultural resources would be expected.

Because the Site 300 HE R&D facilities do not utilize any significant quantities of water or electricity, infrastructure demands would not change. Additionally, none of the Site 300 facilities that would close emit significant quantities of air pollutants (individually and cumulatively all facilities emit less than 1 ton of any NAAQS pollutant or other hazardous air pollutants). As such, no changes to air quality would be expected. The changes to employment (reduction of 50 workers) would be inconsequential to the ROI. Reductions in wastes generated would be less than one percent of wastes generated at LLNL and would not change the overall waste management impacts for the site.

5.13.1.3 *Alternative 2b'- LLNL HEAF Annex for local part fabrication*

Under this alternative, NNSA would implement alternative 2b (described above in Section 5.13.1.2), then construct an annex onto HEAF for local fabrication of HE R&D parts. A HEAF Annex would be constructed adjacent to HEAF containing explosives processing cells and support areas (e.g. control room, explosive storage) to provide fabrication capability that is currently provided at Site 300 and does not exist in HEAF. Construction and operational data for this alternative are shown in Tables 5.13-3 and 5.13-4, respectively.

The construction activities at HEAF would add about 1,500 square feet. Operationally, approximately 25 workers might lose their positions in this alternative. Infrastructure requirements, emissions, and wastes from the Site 300 buildings would be reduced as described in Section 5.13.2. At the LLNL Main Site, the effluents, emissions, and wastes from HEAF would increase about twenty percent over the existing values from HEAF (see Appendix A for a listing of effluents, emissions, and wastes from the HEAF). These increases in effluents, emissions, and wastes would amount to a less than one percent increase in these values compared to the overall LLNL Main Site values.

Table 5.13-3 — Construction Data at LLNL for Alternative 2b'

Construction Requirements	Consumption / Use
Electrical energy (MWe)	13
Concrete (yd ³)	600
Steel (t)	50
Water (g)	1500
Land (acre)	0.2
Laydown Area Size (size of parking lot)	3000
Parking Lots (sq. ft.)	
Employment	
Total employment (worker years)	8
Peak employment (workers)	15
Construction period (years)	1
Waste Generated	
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	2000
Solid (yd ³)	0
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd ³)	150

Source: NNSA 2007.

Table 5.13-4 — Operational Changes at LLNL for Alternative 2b'

Requirements	Additions/Subtractions
Plant footprint (acres)	-2
Net Change in Employment (workers)	-25
Waste Category	Volume
Low level	
Liquid (gal)	-100
Solid (yd ³)	-10
Hazardous	
Liquid (gal)	-7,000
Solid (yd ³)	-25
Nonhazardous (Sanitary)	
Liquid (gal)	-200,000

Source: NNSA 2007.

5.13.1.4 *Alternative 2c - Consolidate open-air 1-10 kg HE R&D experiments from LANL and Sandia to HEAF and over 10 kg thru 100 kg HE R&D experiments at LANL or NTS*

Under this alternative, NNSA would consolidate open-air 1-10 kg HE R&D experiments from LANL and Sandia to HEAF, and >10 kg through 100 kg HE R&D experiments at LANL or the NTS. There would be no new construction.

To accommodate the higher firing load at HEAF, more LLNL staff would be required to support the work in addition to the staff that LANL and SNL would rotate in for their respective experiments. Because no new facilities would be required for this alternative, there would be no construction impacts. Operationally, approximately 15 additional workers would be required, which would be inconsequential relative to the No Action Alternative. No significant changes in effluents, emissions, and waste would be expected from this transfer.

At SNL, this alternative would not eliminate HE R&D experiments and testing that are conducted at the ECF, nor would it decrease the laboratory space currently required to do this work. The impact to work at the TBF is also not likely to experience a major impact in this scenario, as most tests at TBF are less than 10kg. The SNL firing sites most likely affected by this alternative would be 9920, 9939, 9940 and Thunder Range. However, because these facilities are mostly funded by work-for-others, no significant changes in operational data at SNL are expected.

At LANL, consolidation of open-air 1-10 kg shots at HEAF with simultaneous consolidation of 10-100 kg shots to LANL would be expected to have no significant net effect on HE product effluent. Consolidation of 1-10 kg shots to HEAF would result in the transfer of the firing and assembly of approximately 200-250 shots/year to LLNL. LANL would transfer from 4-8 technicians to LLNL. At LANL or NTS, receiving the 10-100 kg shots could be accepted without additional environmental impacts. LANL or NTS would need to hire up to 5 individuals to meet these demands. However, none of these impacts would be consequential.

5.13.1.5 *Alternative 2d - Consolidate unconfined firing to one or no sites*

Under this alternative, all unconfined firing operations would be consolidated at one site or eliminated. In any case, unconfined firing operations would be eliminated at LLNL. Currently, HE R&D unconfined firing at LLNL is limited to destruction of excess explosive parts and explosives waste, through open burn or open detonation (OB/OD) at the Explosives Waste Treatment Facility located at Site 300. Therefore, the impact of this alternative to LLNL is the elimination of OB/OD destruction of explosives.

Because no new facilities would be required for this alternative, no construction impacts would occur. At LLNL, Building 845 would be decommissioned. Eliminating Building 845 would change effluents, wastes, and emissions by less than one percent compared to the No Action Alternative. The number of HE shipments from LLNL would increase, as a large fraction of explosive waste is shipped to other disposal sites. This could require an additional 50 shipments per year. LANL currently has the capacity to absorb all unconfined firing operations, but would need additional contained firing facilities to eliminate open-air firing in the future. Thus, construction of a 2000 square foot facility would be the bounding case, and would fall within the bounding condition set by the DX Consolidation Plan, which is covered under the No Action Alternative.

Receiving all unconfined firing would force limited closure of LANL's firing points in order to meet the needs of these demands. This would include receiving shots from LLNL's 850 and 851, SNL's 9920, 9930, 9939, 9940, Thunder Range, and surveillance and destructive testing from Pantex. This is in contrast to the LANL downsizing that is planned/occurring under the No Action Alternative, under which open firing sites would be closed and replaced with containment vessels. However, given LANL's current permitted status, this work could be accepted without additional environmental impacts. LANL would need to hire up to 10 individuals to meet these demands.

5.13.1.6 *Alternative 2e - Consolidate Maincharge HE R&D Experiments and Testing to one or both nuclear labs*

In this alternative, main charge HE R&D experiments at SNL would be transferred to LANL or LLNL. Pantex main charge experiments are considered part of production or plant support or surveillance, not HE R&D, and are therefore not in the scope of this alternative. If the SNL experiments were transferred to LLNL, they could be accommodated in existing laboratories in HEAF. The main charge HE R&D effort is small at SNL, so there is a negligible impact on current HEAF activities. No new facilities are required in this alternative. There would be no construction required for this alternative, no impact on staffing, and effluents, emissions, and wastes would be unchanged from the No Action Alternative.

If the SNL experiments were transferred to LANL, LANL has the current infrastructure to absorb main charge HE R&D experiments and testing that SNL is currently conducting at its site, with minimal or no impact. No new facilities would be required for this alternative. There would be no impact on staffing, and effluents, emissions, and wastes would be unchanged from the No Action Alternative.

If SNL had LLNL or LANL conduct the experiments instead, this would not decrease the need for supporting work at SNL. Design of components and experiments up to the point of HE assembly would continue. SNL also has components that utilize secondary HE, which is the same family of explosives as the main charge explosives. Furthermore, SNL uses these same capabilities for the explosive materials in the non-nuclear components. If work on the main charge explosives ceased at SNL, the work would continue on the other explosive materials that are in the non-nuclear components. As a result, there would be no change in personnel and no net downsize in facility footprints.

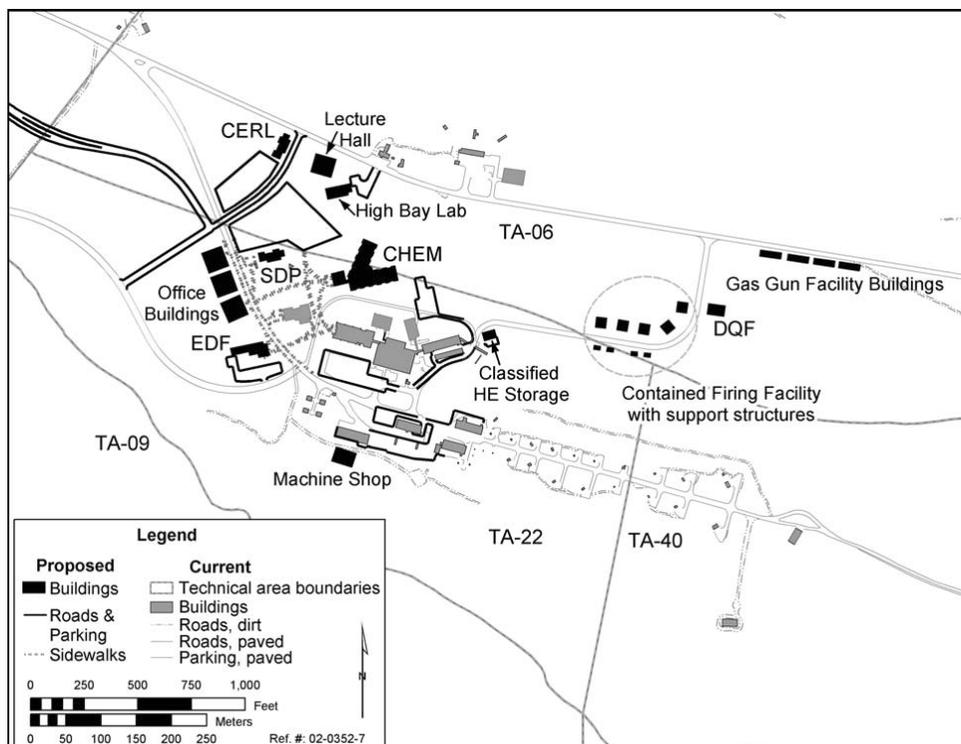
5.13.2 HE R&D Major Consolidation Alternatives

Alternatives 3a – 3g address alternatives that would transfer the entire HE R&D experimental and fabrication activities from one site to one or more other sites. It is noted that the R&D *mission* that has been assigned to each laboratory and plant would continue to be conducted by the scientists and engineers at those sites, although they may have to travel to a “user facility” at the consolidation site. It is the *capability*, i.e. facilities, machines, equipment, that is being consolidated at a single site or smaller number of sites. Some personnel (facility operating staff and technicians) may move with the capability to the consolidation site. The potential environmental impacts of each alternative would be as follows.

5.13.2.1 *Alternative 3a - Consolidate HE R&D experimentation and fabrication activities to LANL*

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated to LANL. The following impacts at the potentially affected sites would occur:

LANL: Consolidating HE R&D at LANL would involve an increase of capacity for the types of experiments and capabilities that currently exist at LANL. LANL would need to add approximately 170,000 square feet of office and laboratory space to add the LLNL and SNL experimental and fabrication activities. Figure 5.13-1 shows the proposed location for this new facility. Data for the construction and operation at LANL are contained in Table 5.13-5 and Table 5.13-6, respectively. No additional construction would be needed to add the Pantex HE R&D experimentation and fabrication activities. LANL would add up to 300 jobs under this consolidation.



Source: NNSA 2007.

Figure 5.13-1 — New Construction Location for LANL Consolidation Alternative

Construction impacts could disturb approximately 5 acres in the vicinity of the Two-Mile Mesa Complex, which includes portions of TA-6, TA-22, and TA-40, as shown on Figure 5.13-1. Some mature trees may need to be removed from areas near the periphery of the complex. No construction would be conducted within a floodplain or a wetland. The construction area would be sited to avoid impacts to prehistoric and Homestead Era cultural resources and to sensitive habitat areas. Should previously unknown cultural resources be discovered during construction, work would cease in that area until LANL’s cultural resources specialists could review the evidence, identify procedures for working in the vicinity of the cultural resources, and initiate any necessary consultations with Federal, state, and tribal entities.

Table 5.13-5 — Construction Requirements at LANL for Alternative 3a

Construction to absorb SNL and LLNL	Consumption/Use
Peak Electrical energy (MWe)	NM
Diesel Generators (Yes or No)	Yes
Land (acre)	
Lay down Area Size, Parking lots	5
Employment	
Total employment (worker years)	125
Peak employment (workers)	125
Construction period (years)	1
Waste Generated	Volume
Non-hazardous Solid (yd ³)	4,930

Source: NNSA 2007.

Table 5.13-6 — Operational Requirements at LANL for Alternative 3a

Operation Requirements	Consumption/Use
Additional electrical energy (megawatt-hours [MWh])	2.6
Additional water (millions of gal.)	4.7
Added plant footprint (acres)	5
Added employment (workers)	300
NAAQS emissions (lbs/yr)	
PM ₁₀	1,495
NO _x	1,105
CO	940
VOC	180
SO _x	58
Waste Category	Volume
Low-Level	
Liquid (gal.)	1,800
Solid (cubic yd)	13
Hazardous	
Liquid (gal.)	120,000
Solid (pounds)	60
Nonhazardous	
Liquid (gal.)	200,000
Solid (pounds)	10,500

Source: NNSA 2007

The construction or post-construction landscaping could disturb some potential release sites (PRSs). When possible, PRSs would be avoided. If disturbance of PRSs were necessary, soils from PRSs would be returned to the excavated area after disturbance when feasible or would be characterized and disposed of appropriately. Should a previously unknown or suspect disposal site be disclosed during subsurface construction work, work would cease until LANL’s Project staff could review the site and would identify procedures for working within that site area.

Construction would be performed using common construction industry methods since the operational uses of these structures do not have potential hazards that would entail unique structural requirements. The new building would be constructed in accordance with seismic criteria in current building codes. The building would not be constructed over known faults or within 50 feet of known seismic faults active since the beginning of the Holocene (approximately 100,000 years ago). The new building would be designed according to general design criteria for a new facility (LANL 1999a), with a minimum lifetime expectancy of 30 years of operation. The building would consist of a concrete slab foundation with a one- to two-story superstructure. The total height of the building above ground level would be less than 32 feet.

The building exterior (such as surface finish, roof lines, and windows) would be designed to be architecturally compatible with one another and with other recent buildings in the Two-Mile Mesa Complex. Typically roof drains would collect snowmelt and rain water from these buildings and would channel the runoff to appropriate release points, such as landscaped areas. Storm water runoff systems would be designed to minimize soil erosion.

Construction activities would have some local short-term adverse effects; long-term effects on the viewscape from construction and demolition are expected to be minimal. The Two-Mile Mesa Complex is generally not visible from public roads; the proposed building would be similar

in height to existing buildings. The visual effects of construction would be confined to the immediate area of the existing Two-Mile Mesa Complex. Short-term temporary adverse visual effects would occur during the construction period. These effects involve staging and use of construction vehicles and erecting construction fences. Occasional fugitive airborne dust from soil disturbance may temporarily obscure local views for short periods of time. In the long term, the area would experience minimal effects. After completion of proposed construction, the Two-Mile Mesa Complex would still resemble an industrial park but on an expanded scale.

The newly constructed building would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Onsite utilities (gas, water, sewer, electric, communications, computer networks) at the Two-Mile Mesa Complex are currently being reconfigured and upgraded for efficient distribution to new buildings associated with the DX Consolidation.

LANL is considered a major air emission source under the State of New Mexico Operating Permit program because it emits more than 100 tons per year of certain non-radioactive substances. Specifically, LANL is a major source of nitrogen oxides, emitted primarily from the TA-3 steam plant boilers. Combustion units are the primary point sources of criteria pollutants (nitrogen oxides, sulfur oxides, particulate matter, and carbon monoxide) emitted at LANL. The new building would be located in Los Alamos County, which is in attainment with NAAQS and all New Mexico Ambient Air Quality Standards (NMAAQs). The ambient air quality in and around LANL meets all EPA and DOE standards for protecting the public and workers (LANL 2001a).

Clearing or excavation activities during site construction have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality. During operations, increases in pollutants would be less than approximately 1 percent of site emissions and would have no noticeable affect on any air quality concentrations.

Work at the site would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at the site would be audible primarily to the involved workers and to workers housed in the Two-Mile Mesa Complex area. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, space in the immediate vicinity would be available for equipment storage and material staging. Temporary parking areas, staging areas, laydown yards, and construction access roads may be established during the construction phases. These areas would be reclaimed or used for permanent parking.

During operations, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased HE testing. Such testing currently occurs at LANL. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control their entry into explosives firing site detonation points. The public is not allowed within the fenced TAs that have firing sites, and noise levels produced by explosives tests are sufficiently reduced at locations where the public would be present to preclude hearing damage.

Such tests would not be expected to adversely affect offsite sensitive receptors (such as those at Bandelier National Monument or at White Rock). Noises heard at that distance would be similar to thunder in their intensity, and air blast and ground vibrations are not expected to be present outside LANL at intensities great enough to adversely affect real properties. Sensitive wildlife species are unlikely to be adversely affected by “thunder-like” explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average lightning event areas and their continued presence on the LANL site over the past 10 years. In fact, the continued thriving of resident and long-term migratory populations of these sensitive species on the LANL site indicates that the level of noise generated by explosives testing under the No Action Alternative is at least tolerable to these particular species (LANL 2007).

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 120 construction workers would be onsite during the peak construction period, adding approximately 60 personal vehicles to local roadways during the construction period. These construction workers would park their personal vehicles either in existing parking lots or in other designated parking areas.

Vehicles (such as dump trucks) and heavy machinery (such as bulldozers, drill rigs, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite over night. Temporary construction lighting would be directed toward the work area.

There would be no effects to sensitive species or their critical habitat due to construction. Small mammals and birds at the Two-Mile Mesa Complex building sites would be temporarily displaced by construction activities. These would be expected to return to the area after

construction was completed. Game animal migration is not likely to be altered.

There are no floodplains or wetlands within the area of the proposed action. There are, however, riparian and wetland areas immediately north of the Two-Mile Mesa Complex and a floodplain in Two-Mile Canyon north of Two-Mile Mesa Complex. The new building would not entail any direct effects on floodplains or wetlands since there are none within the areas proposed for construction or demolition. BMPs would be established so that there would be no indirect effects from construction.

During construction, 125 peak construction jobs would be filled by the existing employees in the regional work force, which includes mostly Los Alamos, Rio Arriba, and Santa Fe Counties. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in Los Alamos or the region. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in New Mexico.

Construction would not be expected to have any adverse health effects on LANL workers or the public. NNSA and LANL workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 120 peak-period construction workers, including approximately 50 construction vehicles, would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). If the peak construction period lasts for the entire one year construction period, no deaths (0.0049) would be expected for the estimated 125 onsite construction workers from construction nor demolition-related activities that include falls, exposure to harmful substances, fires and explosions, transportation incidents, and being struck by objects, equipment, or projectiles. Because no significant off-site health risks are associated with the HE R&D operations, no environmental justice impacts are expected.

The new construction would generate non-hazardous solid waste that would be disposed of at the Los Alamos Country Landfill, its replacement facility, or other New Mexico solid waste landfills in accordance with the waste minimization plan. Construction solid waste is estimated at 4,930 cubic yards.

Proposed operations would have minimal effects on the LANL environment. Operations would produce the same types of waste as are generated in other LANL facilities in the Two-Mile Mesa Complex. No new radioactive or other wastewater or hazardous waste streams would be generated. The operations would not affect or be affected by geological conditions. A review of existing information on local geology at the Two-Mile Mesa area indicates that there are no *known* geologic hazards in the immediate vicinity of this site. With respect to air quality, the

new facility would emit less than one percent of the existing LANL emissions.

Water quality in this area would not be affected by the operations. The new facility would be designed using pollution prevention processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by implementing the Proposed Action. Water quality would not change as a result of operations of the new building in the Two-Mile Mesa Complex.

Removal of asphalt in some areas would decrease surface water runoff and would increase surface water infiltration. Establishment of new asphalt parking areas would have the reverse effect. Water use would be expected to be static. The net increased infiltration is not expected to have any adverse effects on groundwater quality.

During operations, there would be a 300 person increase in the number of LANL employees as a result of this project. Compared to the existing workforce at LANL, this project would not have a long-term effect on socioeconomic conditions in north-central New Mexico.

LLNL: Under this alternative, LLNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 175 jobs. Effluents, emissions, and wastes from HE R&D experimentation and fabrication activities would decrease to zero. In the short-term, land use would be unaffected. However, the vacated facilities at Site 300 would eventually undergo decommissioning. This would entail the cleanup and demolition of these facilities. The specific impacts of such demolition cannot be estimated until detailed site-specific surveys are conducted. Following decommissioning, NNSA would use best management practices to restore the land to a natural state. Because the facilities to be closed represent much less than one percent of the acreage at Site 300, no impacts to biological resources, soils, and geology would be expected. Several buildings at Site 300 that have been determined eligible for listing in the NRHP would be affected by decommissioning. Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards.

Because the Site 300 HE R&D facilities do not utilize any significant quantities of water or electricity, infrastructure demands would not change. Additionally, none of the Site 300 facilities that would close emit significant quantities of air pollutants (individually and cumulatively all facilities emit less than 1 ton of any NAAQS pollutant or other hazardous air pollutants). As such, no changes to air quality would be expected. The changes to employment (reduction of 50 workers) would be inconsequential to the ROI. Reductions in wastes generated would be less than one percent of wastes generated at LLNL and would not change the overall waste management impacts for the site.

SNL: Under this alternative, SNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 45 jobs. Effluents, emissions, and wastes from HE R&D experimentation and fabrication activities would decrease to zero. A minor decrease in operational impacts would be expected from phasing-out HE testing. This could result in a reduction of the emissions shown on Table 5.13-6a.

Table 5.13-6a — SNL HE R&D Annual Air Emissions (in Pounds based on 2006 data)

Facility	CO	NO _x	SO ₂	PM ₁₀	HAPs
Explosive Components - Bldg 905	0.5	0.8	0.0	4.3	0.0
Terminal Ballistic Site(Bldg 6750)	3.8	6.4	0.1	35.3	0.0
Site 9940	15.5	26.0	0.2	144.2	0.0
Thunder Range	100.0	168.0	1.4	930.0	0.0
Sites 9920, 9930, 9939	9.0	15.1	0.1	83.7	0.0
Star Facility (Bldg 9956	10.3	15.5	0.0	221.5	2.3

Source: NNSA 2007.

These reductions would represent less than 5 percent of SNL emissions, and would not have a noticeable affect on air quality.

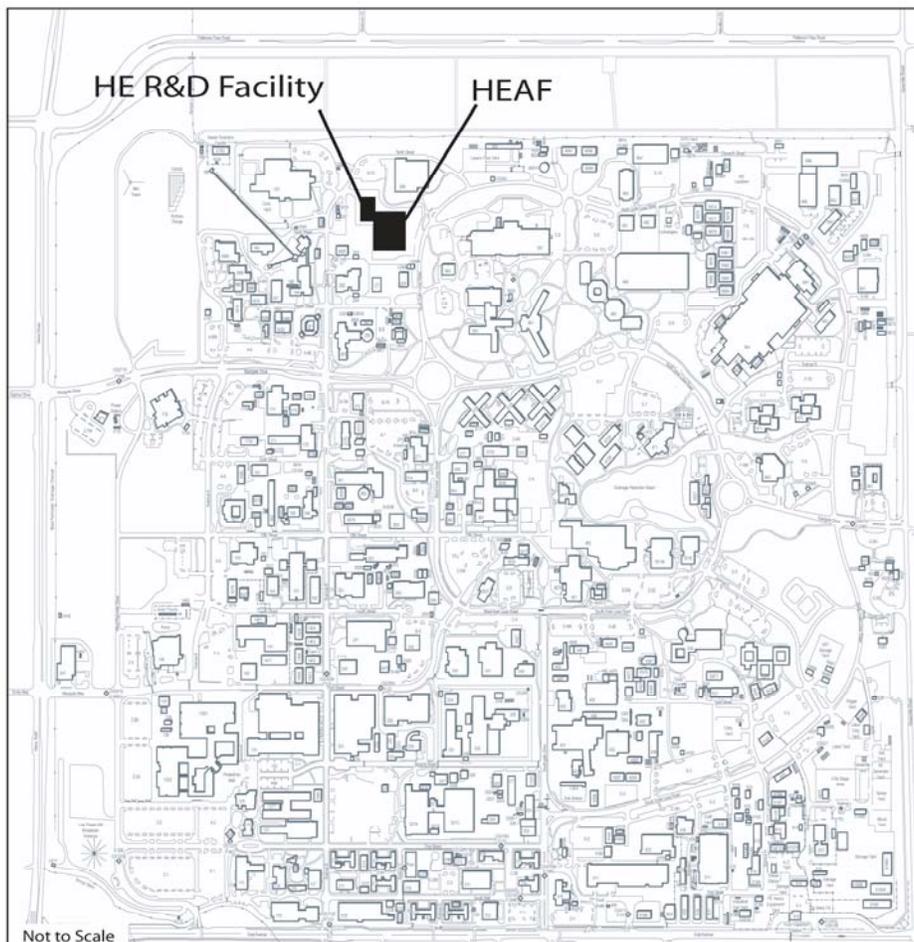
Pantex: Under this alternative, Pantex would cease HE R&D activities. However, because there are currently no Pantex facilities or personnel dedicated entirely to HE R&D experimentation and fabrication activities, only approximately 10 jobs would be lost at Pantex and there would be no major changes in facility operations. Effluents, emissions, and wastes from HE R&D experimentation and fabrication activities would decrease by approximately 5 percent.

5.13.2.2 *Alternative 3b - Consolidate HE R&D experimentation and fabrication activities to LLNL*

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated to LLNL. The following impacts at the potentially affected sites would occur:

LLNL: Construction of a new facility at LLNL would be necessary to provide the HE R&D experimentation and fabrication activities capacity from LANL and SNL⁵. A new experimental facility with about 400,000 square feet and 300 offices is projected. The new facility would be located nearby HEAF, as shown below in Figure 5.13-2. Construction data for this new facility would be as shown in Table 5.13-7.

⁵ For this alternative, HE R&D at Site 300 would have to remain in place – alternatives 2b or 2b’ could not also be adopted.



Note: map not to scale

Figure 5.13-2 — Location for New HE R&D Facility at LLNL

Table 5.13-7 — Construction Requirements at LLNL for Alternative 3b

Construction Requirements	Consumption/Use
Electrical energy (MWh)	526
Concrete (yd ³)	24,400
Steel (t)	2,000
Water (g)	62,600
Land (acre)	8-10
Laydown Area Size (part of parking lot)	
Parking Lots (sq feet)	120,000
Employment	
Total employment (worker years)	315
Peak employment (workers)	150
Construction period (years)	3.5
Waste Generated	Volume
Nonhazardous (sanitary)	
Liquid (gal)	87,500
Nonhazardous (other)	
Solid (yd ³)	6,200

Source: NNSA 2007.

Operationally, the HE R&D staff would increase by approximately 300 personnel. The effluents, emissions, and waste would increase as shown below in Table 5.13-8.

Table 5.13-8 — Operational Requirements at LLNL for Alternative 3b

Operation Requirements	Consumption/Use
Additional electrical energy (megawatt-hours [MWh])	25.6
Additional water (gal.)	4.7 million
Added plant footprint (acres)	8-10
Added employment (workers)	300
NAAQS emissions (lbs/yr)	
PM10	5,200
NOx	4,275
CO	3,460
VOC	420
SOx	375
Waste Category	Volume
Low-Level	
Liquid (gal.)	0
Solid (cubic yd)	0
Hazardous	
Liquid (gal.)	300
Solid (pounds)	35
Nonhazardous	
Liquid (gal.)	63,000
Solid (pounds)	10,500

Source: NNSA 2007

Construction impacts could disturb approximately 8-10 acres in the vicinity of the HEAF, as shown on Figure 5.13-2. Some mature trees may need to be removed to support construction. No construction would be conducted within a floodplain or a wetland. The construction area would be sited to avoid impacts to prehistoric and historic cultural resources and to sensitive habitat areas. Should previously unknown cultural resources be discovered during construction, work would cease in that area until LLNL’s cultural resources specialists could review the evidence, identify procedures for working in the vicinity of the cultural resources, and initiate any necessary consultations with Federal, state, and tribal entities.

New building construction could disturb some previous areas of unknown contamination. Should a previously unknown or suspect disposal site be disclosed during subsurface construction work, work would cease until LLNL’s Project staff could review the site and would identify procedures for working within that site area.

Construction of the new building would be performed using common construction industry methods since the operational uses of these structures do not have potential hazards that would entail unique structural requirements. The new building would be constructed in accordance with seismic criteria in current building codes. The building would not be constructed over known faults or within 50 feet of known seismic faults active since the beginning of the Holocene (approximately 100,000 years ago). The new building would be designed according to general design criteria for a new facility, with a minimum lifetime expectancy of 30 years of operation. The building would typically consist of a concrete slab foundation with a one- or

two-story superstructure. The total height of the building above ground level would be less than 32 feet.

The building exterior (such as surface finish, roof lines, and windows) would be designed to be architecturally compatible with other buildings at LLNL. Typically roof drains would collect snowmelt and rain water and would channel the runoff to appropriate release points, such as landscaped areas. Storm water runoff systems would be designed to minimize soil erosion.

Construction activities would have some local short-term adverse effects; long-term effects on the viewscape from construction would be expected to be minimal. The visual effects of construction would be confined to the immediate area of LLNL. Short-term temporary adverse visual effects would occur during the construction period. These effects involve staging and use of construction vehicles and erecting construction fences. Occasional fugitive airborne dust from soil disturbance may temporarily obscure local views for short periods of time. In the long term, the area would experience minimal effects. After the completion of construction, LLNL would still resemble a highly-developed industrial area.

The newly constructed building would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Utilities (gas, water, sewer, electric, communications, computer networks) would be extended to the new facility from the HEAF.

As described in Section 4.2, both the Bay Area and San Joaquin Valley have been designated as nonattainment areas with respect to both the Federal ozone standard and the more stringent state standard. The Bay Area air district is classified as nonattainment with respect to California standards for particulates, attainment for the Federal PM₁₀ annual standard, and unclassified for both PM_{2.5} and 24-hour PM₁₀ standards. The San Joaquin Valley air district is classified as nonattainment for state particulate matter standards and as a serious nonattainment area for Federal PM₁₀ standards. Although particulates are not measured in Tracy, it is recognized as a regional problem.

Both the Bay Area Air Quality Management District (BAAQMD) and San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) have adopted “no net increase” provisions within their clean air plans. The “no net increase” programs require that, as a precondition to the issuance of an air permit for a significant new or modified emission source, any increases in emissions of nonattainment pollutants or precursors be offset by mandatory reductions in emissions of other sources onsite or potentially at other facilities. In the BAAQMD, the offset requirement is triggered for mid-size facilities (emissions of 15 tons per year or more of nonattainment pollutants), and a greater burden is placed on large facilities (emissions of 50 tons per year or more). The Livermore Site falls into the mid-size facility category and must abide by the requirements of the BAAQMD for emission offsets. Site 300, the majority of which lies within San Joaquin County, is under the jurisdiction of the SJVUAPCD.⁶ In SJVUAPCD, offset requirements are triggered at 10 tons per year. The new building, which would be located at the

⁶ A small portion of Site 300 falls within Alameda County, which is under the jurisdiction of the BAAQMD.

Livermore Site, would have emissions well below the requirements of the BAAQMD for emission offsets.

Clearing or excavation activities during site construction have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers⁵) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality. During operations, increases in pollutants would be less than approximately 1 percent of site emissions and would have no noticeable affect on any air quality concentrations.

Work at the site would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at the site would be audible primarily to the involved workers and to workers housed in HEAF area. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, space in the immediate vicinity would be available for equipment storage and material staging. Temporary parking areas, staging areas, laydown yards, and construction access roads may be established during the construction phases. These areas would be reclaimed or used for permanent parking.

During operations, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. Noises heard at that distance would be similar to thunder in their intensity, and air blast and ground vibrations are not expected to be present outside LLNL at intensities great enough to adversely affect real properties. Sensitive wildlife species are unlikely to be adversely affected by “thunder-like” explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average lightning event areas. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased HE testing. Such testing currently occurs at LLNL. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control their entry into explosives firing site detonation points.

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 150 construction workers would be onsite during the peak construction period, adding approximately 75 personal vehicles to local roadways during the construction period. These construction workers would park their personal vehicles either in existing parking lots or in other designated parking areas.

Vehicles (such as dump trucks) and heavy machinery (such as bulldozers, drill rigs, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite over night. Temporary construction lighting would be directed toward the work area.

There would be no effects to biological resources, as the area under consideration is located in an area of previous development. There are no floodplains or wetlands within the area of the proposed action.

During construction, approximately 150 peak construction jobs would be filled by the existing employees in the regional workforce. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in LLNL or the region. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in California.

Construction would not be expected to have any adverse health effects on LLNL workers or the public. NNSA and LLNL workers would perform site inspections and monitor construction during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 150 peak-period construction workers, including approximately 50 construction vehicles, would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). During the construction period (3.5 years), no deaths (0.012) would be expected for the estimated 315 worker-years.

The new construction would generate non-hazardous solid waste that would be disposed of off-site in solid waste landfills in accordance with the waste minimization plan. Construction solid waste is estimated at 6,200 cubic yards.

Proposed operations would have minimal effects on the LLNL environment. Operations would produce the same types of waste as are generated in the HEAF. No new radioactive or other wastewater or hazardous waste streams would be generated. With respect to air quality, the new facility would emit less than one percent of the existing LLNL emissions. Because no significant

off-site health risks are associated with the HE R&D operations, no environmental justice impacts are expected.

Water quality in this area would not be affected by the operations. The facility would require approximately 4.7 million gallons of water per year, which would be approximately one percent of the current usage at the Livermore Site. The new facility would be designed using pollution prevention processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by operating the new building. Water quality would not change as a result of operations of the new building.

During operations, there would be a 300 person increase in the number of LLNL employees as a result of this project. Compared to the existing workforce at LLNL, this project would not have a long-term effect on socioeconomic conditions in the ROI.

LANL: Under this alternative, LANL would cease HE R&D experimentation and fabrication activities, which could result in a loss of approximately 150 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero. Air pollution emissions would be reduced by about 0.30 tons per year, which would not have a noticeable affect on air quality

SNL: Under this alternative, SNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 45 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero. Similar to LANL, a minor decrease in operational impacts would be expected from phasing-out HE testing. This could result in a reduction of the emissions shown on Table 5.13-6a. These reductions would represent less than 5 percent of SNL emissions, and would not have a noticeable affect on air quality.

Pantex: Under this alternative, Pantex would cease HE R&D activities. However, because there are currently no Pantex facilities or personnel dedicated entirely to HE R&D experimentation and fabrication activities, only approximately 10 jobs would be lost at Pantex and there would be no major changes in facility operation. Effluents, emissions, and wastes from HE R&D would decrease by approximately 5 percent.

5.13.2.3 *Alternative 3c - Consolidate HE R&D experimentation and fabrication activities to Pantex*

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated to Pantex. The following impacts at the potentially affected sites would occur:

Pantex: Consolidating HE R&D experimentation and fabrication activities at Pantex would result in the need for both new construction and modifications to existing facilities. Data for the construction at Pantex are contained in Table 5.13-9.

Operationally, the HE R&D staff would increase by approximately 160 personnel, and office accommodations for traveling laboratory staff would be added. The effluents, emissions, and waste would increase as shown below in Table 5.13-10.

Table 5.13-9 — Construction Requirements at Pantex for Alternative 3c

Construction Requirements	Consumption/Use
Peak electrical energy (MWe)	23
Concrete (yd ³)	10,700
Steel (tons)	500
Water (gal)	1,500,000
Land (acre)	5.7
Laydown Size	1.7
Parking Lots	1
Total Footprint (new or added) square feet	100,000
Employment	
Total employment (worker years)	420
Peak Employment (workers)	210
Construction period (years)	3
Waste Generated (yd ³)	
Low-Level Hazardous	1
Hazardous	12

Source: NNSA 2007.

Table 5.13-10 — Operational Requirements at Pantex for Alternative 3c

Operation Requirements	Consumption/Use
Additional electrical energy (megawatt-hours [MWh])	25.6 MWh
Additional water (gal.)	4.7 million
Added plant footprint (acres)	5.7
Added employment (workers)	160
NAAQS emissions (lbs/yr)	
PM10	5,300
NOx	5,150
CO	4,300
VOC	600
SOx	540
Waste Category	Volume
Low-Level	
Liquid (gal.)	1,800
Solid (cubic yd)	13
Hazardous	
Liquid (gal.)	120,000
Solid (pounds)	60
Nonhazardous	
Liquid (gal.)	263,000
Solid (pounds)	10,500

Source: NNSA 2007

Construction impacts could disturb approximately 5.7 acres in the vicinity of Zone 11 and Zone 12, as shown on Figure 5.13-3. No construction would be conducted within a floodplain or a wetland.

Construction would be performed using common construction industry methods since the operational uses of these structures do not have potential hazards that would entail unique structural requirements. The new building would be constructed in accordance with seismic criteria in current building codes. The new building would be designed according to general

design criteria for a new facility, with a minimum lifetime expectancy of 30 years of operation. The building would consist of a concrete slab foundation with a one- to two-story superstructure. The total height of the building above ground level would be less than 32 feet.

Roof drains would collect snowmelt and rain water from the building and would channel the runoff to appropriate release points, such as landscaped areas. Storm water runoff systems would be designed to minimize soil erosion.

Construction activities would have some local short-term adverse effects; long-term effects on the viewscape from construction and demolition are expected to be minimal. Plant facilities are visible from U.S. 60 and the local Farm-to-Market roads adjacent to the Pantex boundaries. The new building would be similar in height to existing buildings. The visual effects of construction would be confined to the immediate area of Zones 11 and 12. Short-term temporary adverse visual effects would occur during the construction period. These effects involve staging and use of construction vehicles and erecting construction fences. Occasional fugitive airborne dust from soil disturbance may temporarily obscure local views for short periods of time. In the long term, the area would experience minimal effects.

The newly constructed building would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Onsite utilities (gas, water, sewer, electric, communications, computer networks) would be extended to the new facility.

The Pantex Plant is located within the Amarillo-Lubbock Intrastate AQCR. The Amarillo-Lubbock Intrastate AQCR is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and PM₁₀) (40 CFR 81.344). Clearing or excavation activities during site construction have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality. During operations, increases in pollutants would be less than approximately 1 percent of site emissions and would have no noticeable affect on any air quality concentrations.

Work at the site would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at the site would be audible primarily to the involved workers and to workers housed in Zones 11 and 12. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, space in the immediate vicinity would be available for equipment storage and material staging.

Temporary parking areas, staging areas, laydown yards, and construction access roads may be established during the construction phases. These areas would be reclaimed or used for permanent parking.

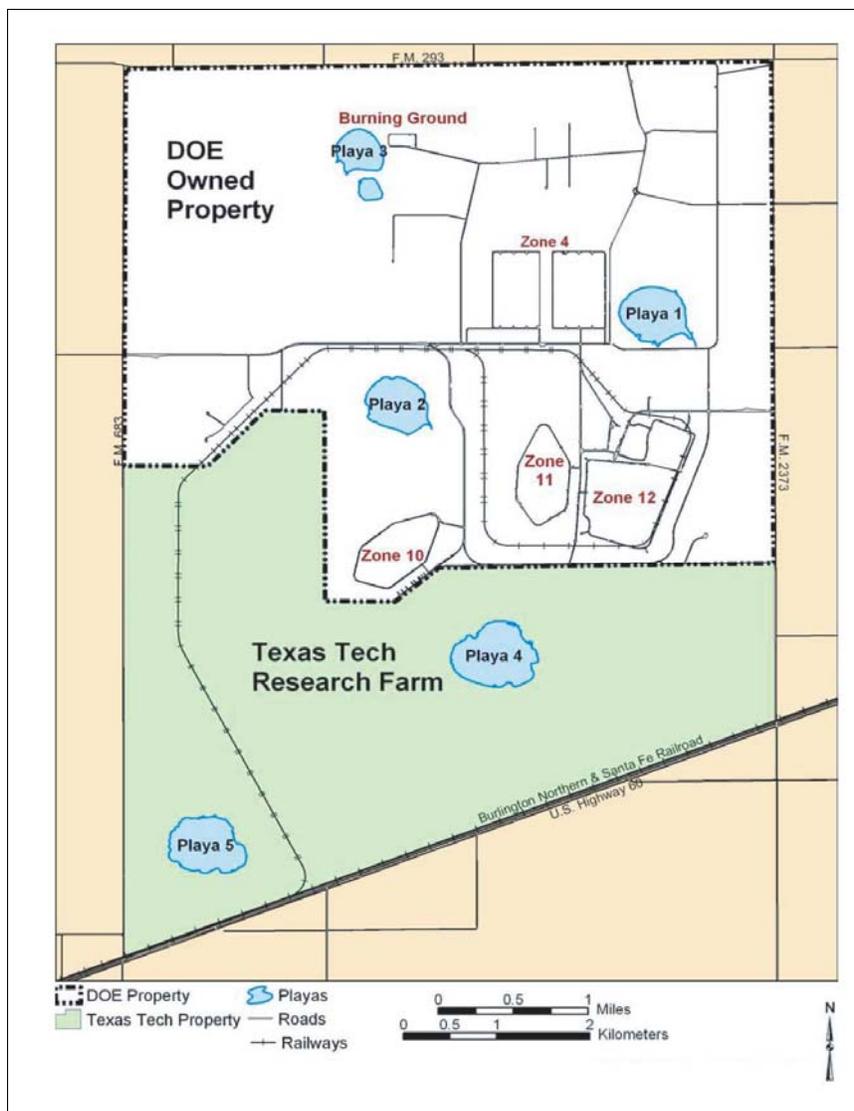


Figure 5.13-3 — Zone 11 and Zone 12 at Pantex.

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 210

construction workers would be onsite during the peak construction period, adding approximately 105 personal vehicles to local roadways during the construction period. These construction workers would park their personal vehicles either in existing parking lots or in other designated parking areas.

Vehicles (such as dump trucks) and heavy machinery (such as bulldozers, drill rigs, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite over night. Temporary construction lighting would be directed toward the work area.

During construction, the 210 peak construction jobs would be filled by the existing employees in the regional work force. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in Amarillo or the region. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in Texas.

Construction would not be expected to have any adverse health effects on Pantex workers or the public. NNSA and Pantex workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 210 peak-period construction workers, including approximately 50 construction vehicles, would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). During the construction period (3 years), no deaths (0.016) would be expected for the estimated 420 worker-years. Because no significant off-site health risks are associated with the HE R&D operations, no environmental justice impacts are expected.

There would be no effects to sensitive species or their critical habitat due to construction as construction would take place in previously disturbed areas. The new construction would generate non-hazardous solid waste that would be disposed of off-site at a solid waste landfill in accordance with the waste minimization plan. Construction solid waste is estimated at 1,550 cubic yards.

Proposed operations would have minimal effects on the Pantex environment. Operations would produce the same types of waste as are generated in other Pantex facilities. No new radioactive or other wastewater or hazardous waste streams would be generated. With respect to air quality, the new facility would emit less than one percent of the existing Pantex emissions.

Water quality in this area would not be affected by the operations. The facility would require approximately 4.7 million gallons of water per year, which would be approximately three percent of the current usage at Pantex. The new facility would be designed using pollution prevention

processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by operating the new building. Water quality would not change as a result of operations of the new building.

During operations, there would be a 160 person increase in the number of Pantex employees as a result of this project. Compared to the existing workforce at Pantex, this project would not have a long-term effect on socioeconomic conditions in the ROI.

LANL: Under this alternative, LANL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 150 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

LLNL: Under this alternative, LLNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 175 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero. Several buildings at Site 300 that have been determined eligible for listing in the NRHP would be affected by decommissioning. Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards

SNL: Under this alternative, SNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 45 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

5.13.2.4 *Alternative 3d - Consolidate HE R&D experimentation and fabrication activities to SNL/NM*

Under this alternative, HE R&D experimentation and fabrication activities would be consolidated to SNL/NM. The following impacts at the potentially affected sites would occur:

SNL: SNL could absorb the HE R&D experimentation and fabrication activities currently performed at Pantex and activities from LANL and LLNL conducted at outdoor firing sites. In order to transfer operations from the LLNL HEAF and Site 300 operations and storage, and the LANL activities located at various facilities there, an additional total of 480,000 square feet of office and laboratory space would be required to be constructed. The construction would likely be located in Technical Areas 2 or 3, as shown on Figure 5.13-4.

The construction data that are associated with the transfer of the HE R&D experimentation and fabrication activities from LLNL and LANL are presented in Table 5.13-11. No construction would be required to accommodate the work that is currently conducted at Pantex. New firing sites would not be required to be constructed. About half of the new construction represents office space for traveling scientists and engineers, and the remaining as laboratory space.

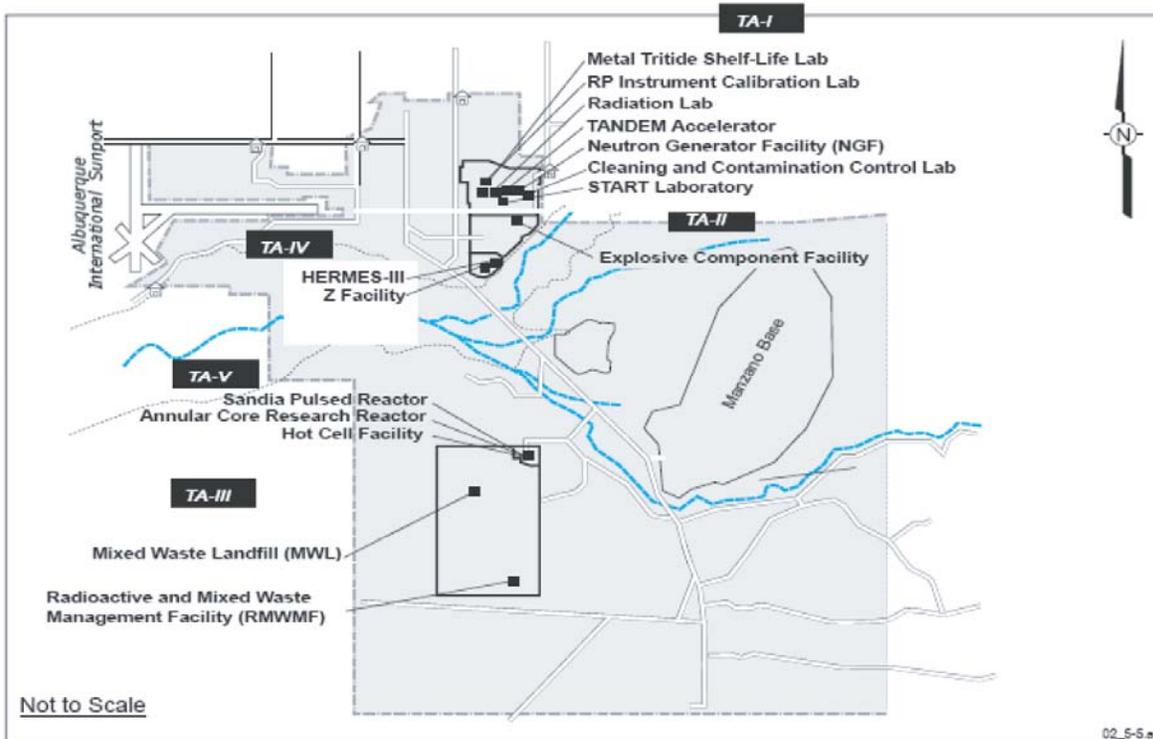


Figure 5.13-4 — SNL Technical Areas

Table 5.13-11 — Construction Requirements at SNL for Alternative 3d

Construction Requirements	Consumption/Use
Peak Electrical energy (MWe) (Fully occupied 6 MW)	100 KW ***
Concrete (yd ³)	7500 ***
Steel (t)	6000 ***
Water (gal) (500 gals/day average)	264,000
Land (acre)	
Laydown Area Size	5 acres *
Parking Lots (Based on ½ offices & ½ Lab Space)	8.5 acres ***
Employment	
Total employment (worker years)	225 *
Peak employment (workers)	220 *
Construction period (years)	2 years *
Waste Generated	
Hazardous	
Liquid (gal) (no anticipated spills)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal) (Portable Toilet waste to be hauled off site)	0
Solid (yd ³)	0
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd ³)	2,650**

* Based on data from the recently completed MESA/WIF (Weapons Integrated Facility) Project.

** Based on recently completed office buildings on the SNL Site.

***System Engineers input based on square feet of building and code requirements.

***Parking Lot Size based on a 480,000 sq. ft. building to be occupied ½ offices and ½ lab space has no large presentation rooms.

Source: NNSA 2007.

Operationally, approximately 325 new jobs would be added at SNL/NM to support the new processes and capabilities at the new lab. The existing SNL/NM waste management infrastructure without modification can be applied to manage and treat all anticipated waste streams from this alternative. SNL/NM does not have an OBOD site to expel excess or waste explosive samples. SNL/NM utilizes the EOD on the USAF base for this capability. Transportation would require explosive transportation from the donor sites (LANL, LLNL, Pantex) to SNL. The effluents, emissions, and waste would increase as shown below in Table 5.13-12.

Table 5.13-12 — Operational Requirements at SNL for Alternative 3d

Operation Requirements	Consumption/Use
Additional electrical energy (megawatt-hours [MWh])	25.6 MWh
Additional water (gal.)	4.7 million
Added plant footprint (acres)	13.5
Added employment (workers)	325
NAAQS emissions (lbs/yr)	
PM ₁₀	5,300
NO _x	4,900
CO	4,125
VOC	600
SO _x	540
Waste Category	Volume
Low-Level	
Liquid (gal.)	1,800
Solid (cubic yd)	13
Hazardous	
Liquid (gal.)	120,000
Solid (pounds)	25
Nonhazardous	
Liquid (gal.)	261,000
Solid (pounds)	0

Source: NNSA 2007

Construction impacts could disturb approximately 13.5 acres in the vicinity of Technical Areas 2 or 3. No construction would be conducted within a floodplain or a wetland.

Construction would be performed using common construction industry methods since the operational uses of these structures do not have potential hazards that would entail unique structural requirements. The new building would be constructed in accordance with seismic criteria in current building codes. The new building would be designed according to general design criteria for a new facility, with a minimum lifetime expectancy of 30 years of operation. The building would consist of a concrete slab foundation with a one- to two-story superstructure. The total height of the building above ground level would be less than 32 feet.

Roof drains would collect snowmelt and rain water from the building and would channel the runoff to appropriate release points, such as landscaped areas. Storm water runoff systems would be designed to minimize soil erosion.

Construction activities would have some local short-term adverse effects; long-term effects on the viewscape from construction and demolition are expected to be minimal. Most SNL/NM

facilities are well within the KAFB boundary and away from public view. Because of their location and the surrounding terrain characteristics, most facilities are not visible from roads and areas with public access. The new building would be similar in height to existing buildings. The visual effects of construction would be confined to the immediate area of Technical Areas 2 or 3. Short-term temporary adverse visual effects would occur during the construction period. These effects involve staging and use of construction vehicles and erecting construction fences. Occasional fugitive airborne dust from soil disturbance may temporarily obscure local views for short periods of time. In the long term, the area would experience minimal effects.

The newly constructed building would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Onsite utilities (gas, water, sewer, electric, communications, computer networks) would be extended to the new facility.

SNL is located within the Bernalillo County AQCR, which has been designated as a maintenance area under the CAA for carbon monoxide (CO) emissions and is in attainment for other federally regulated pollutants. In 2005, there were no exceedences of the criteria pollutant standards at SNL/NM. Clearing or excavation activities during site construction have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality. During operations, NAAQS emissions would increase by approximately 7 tons annually, which is well below the 100 tons per year threshold that would require an air conformity analysis (20 NMAC Part 11.04.II.1.2, paragraph B).

Work at the site would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at the site would be audible primarily to the involved workers and to workers housed in Technical Areas 2 or 3. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, space in the immediate vicinity would be available for equipment storage and material staging. Temporary parking areas, staging areas, laydown yards, and construction access roads may be established during the construction phases. These areas would be used for permanent parking. Construction solid waste is estimated at 2,650 cubic yards.

During operations, the primary noise would be generated by air blast waves and ground vibration impacts associated with HE tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. Noises heard at that distance would be similar to thunder in their intensity, and air blast and ground vibrations are not expected to be present outside SNL at intensities great enough to adversely affect real properties. Sensitive wildlife species are unlikely to be adversely affected by “thunder-like” explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average

lightning event areas. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers. Because the HE R&D would be similar in nature to existing HE R&D at SNL, it is not expected to introduce any significant new noise impacts.

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 220 construction workers would be onsite during the peak construction period, adding approximately 110 personal vehicles to local roadways during the construction period. These construction workers would park their personal vehicles either in existing parking lots or in other designated parking areas.

Vehicles (such as dump trucks) and heavy machinery (such as bulldozers, drill rigs, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite over night. Temporary construction lighting would be directed toward the work area.

During construction, the 220 peak construction jobs would be filled by the existing employees in the regional work force. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in Albuquerque or the region. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in New Mexico.

Construction would not be expected to have any adverse health effects on SNL/NM workers or the public. NNSA and SNL/NM workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 220 peak-period construction workers, including approximately 50 construction vehicles, would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction. Because no significant off-site health risks are associated with the HE R&D operations, no environmental justice impacts are expected.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). During the construction period (2 years), no deaths (0.009) would be expected for the estimated 225 worker-years.

There would be no effects to sensitive species or their critical habitat due to construction. The new construction would generate non-hazardous solid waste that would be disposed of off-site at a solid waste landfill in accordance with the waste minimization plan.

Proposed operations would have minimal effects on the SNL/NM environment. Operations would produce the same types of waste as are generated in other SNL/NM facilities. No new radioactive or other wastewater or hazardous waste streams would be generated. With respect to air quality, the new facility would emit less than one percent of the existing SNL/NM emissions.

Water quality in this area would not be affected by the operations. The facility would require approximately 4.7 million gallons of water per year, which would be approximately four percent of the current usage at SNL/NM. The new facility would be designed using pollution prevention processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by operating the new building. Water quality would not change as a result of operations of the new building.

During operations, there would be a 325 person increase in the number of SNL/NM employees as a result of this project. Compared to the existing workforce at SNL/NM, this project would not have a long-term effect on socioeconomic conditions in the ROI.

LANL: Under this alternative, LANL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 150 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

LLNL: Under this alternative, LLNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 175 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero. Several buildings at Site 300 that have been determined eligible for listing in the NRHP would be affected by decommissioning. Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards

Pantex: Under this alternative, Pantex would cease HE R&D activities. However, because there are currently no Pantex facilities or personnel dedicated entirely to HE R&D experimentation and fabrication activities, only approximately 10 jobs would be lost at Pantex and there would be no major changes in facility operation. Effluents, emissions, and wastes from HE R&D would decrease by approximately 5 percent.

5.13.2.5 *Alternative 3e - Consolidate HE R&D experimentation and fabrication activities from LANL to either LLNL or Pantex*

Under this alternative, HE R&D experimentation and fabrication activities would be transferred from LANL to either LLNL or Pantex. The following impacts at the potentially affected sites would occur:

LANL: Under this alternative, LANL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 150 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

LLNL (if receiver): Construction of a new facility at LLNL would be necessary to provide the HE R&D experimentation and fabrication activities capacity from LANL. The impacts of this facility would be similar to the impacts described under alternative 3b. Operationally, approximately 300 jobs would be added at LLNL.

Pantex (if receiver): Construction of new facilities and upgrades to existing facilities at Pantex would be necessary to support the HE R&D capacity from LANL. The impacts of this facility would be similar to the impacts described under alternative 3c. Operationally, approximately 96 jobs would be added at Pantex, and accommodations for traveling laboratory staff would be added.

5.13.2.6 *Alternative 3f - Consolidate HE R&D experimentation and fabrication activities from LLNL to either LANL or Pantex*

Under this alternative, HE R&D experimentation and fabrication activities would be transferred from LLNL to either LANL or Pantex. The following impacts at the potentially affected sites would occur:

LANL (if receiver): Consolidating the LLNL HE R&D experimentation and fabrication activities at LANL would involve an increase of capacity for the types of experiments and capabilities that currently exist at LANL. LANL would need to absorb approximately 65,000 square feet of office and laboratory space to absorb the LLNL experimentation and fabrication activities. The impacts of this facility would be similar to the impacts described under Alternative 3a. Operationally, approximately 175 jobs would be added at LANL.

LLNL: Under this alternative, LLNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 175 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

Pantex (if receiver): Construction of new facilities and upgrades to existing facilities at Pantex would be necessary to support the HE R&D experimentation and fabrication activities capacity from LLNL. The impacts of this facility would be similar to the impacts described under Alternative 3c. Operationally, approximately 96 jobs would be added at Pantex, and office accommodations for traveling laboratory staff would be added.

5.13.2.7 *Alternative 3g - Consolidate HE R&D experimentation and fabrication activities from LLNL and LANL to either Pantex or NTS*

Under this alternative, HE R&D experimentation and fabrication activities would be transferred from LLNL and LANL to either Pantex or NTS (see 5.13.2.8 for the NTS discussion). The following impacts at the potentially affected sites would occur:

Pantex: Consolidating HE R&D experimentation and fabrication activities at Pantex would result in the need for both new construction and modifications to existing facilities. Data for the construction at Pantex are contained in Table 5.13-13. The impacts of this facility would be similar to the impacts described under Alternative 3c. Operationally, approximately 116 jobs would be added at Pantex.

Table 5.13-13 — Construction Data at Pantex for Consolidating LANL & LLNL HE R&D at Pantex (Alternative 3g)

Construction Requirements	Consumption/Use
Peak electrical energy (Mwe)	27
Concrete (yd ³)	13,500
Steel (tons)	2,100
Water (gal)	1,500,000
Land (acre)	8.1
Laydown Size	1.9
Parking Lots	1
Total Footprint (new or added)	78,000
Employment	
Total employment (worker years)	475
Peak Employment (workers)	235
Construction period (years)	3
Waste Generated	Volume
Low-Level Hazardous (yd ³)	12
Hazardous (yd ³)	304.8

Source: NNSA 2007.

LANL: Under this alternative, LANL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 150 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero.

LLNL: Under this alternative, LLNL would cease HE R&D experimentation and fabrication activities. This could result in a loss of approximately 175 jobs. Effluents, emissions, and wastes from HE R&D would decrease to zero. Several buildings at Site 300 that have been determined eligible for listing in the NRHP would be affected by decommissioning. Prior to D&D activities, these buildings should be recorded and photodocumented to accepted standards

5.13.2.8 *Alternatives 3e through 3g - Consolidate HE R&D experimentation and fabrication activities to NTS*

NTS is being considered for the following: (1) alternative 3e: consolidation of LANL HE R&D experimentation and fabrication activities to NTS; (2) alternative 3f: consolidation of LLNL HE R&D experimentation and fabrication activities to NTS; (3) alternative 3g: consolidation of LANL and LLNL HE R&D experimentation and fabrication activities to NTS; and (4) alternative 3g: consolidation of all HE R&D experimentation and fabrication activities at NTS. For purposes of this analysis, the bounding environmental impacts would result from alternative 3g, in which all HE R&D experimentation and fabrication activities are transferred from LLNL, LANL, SNL/NM, and Pantex to the NTS. As such, this analysis focuses on that alternative.

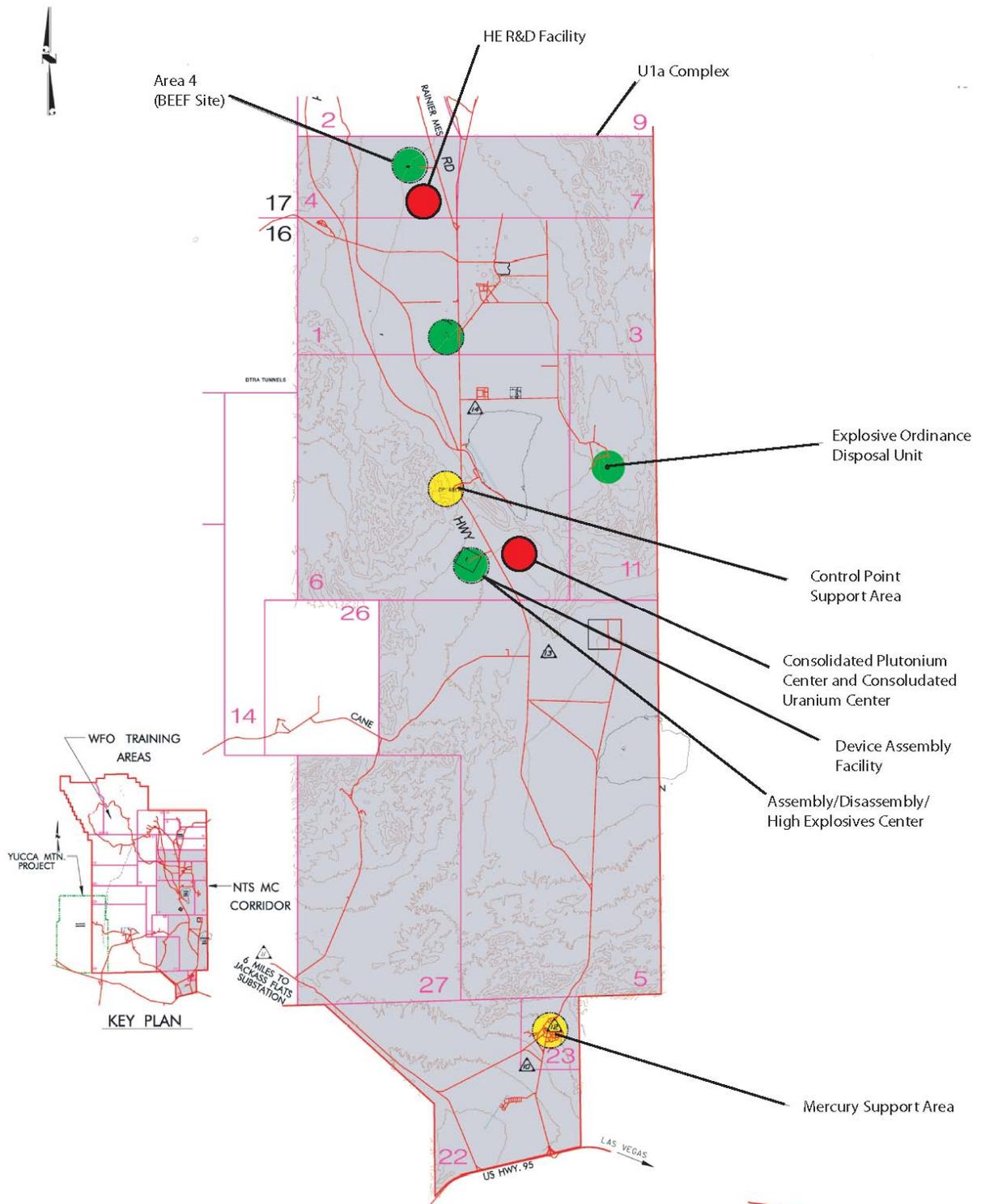
To consolidate all HE R&D experimentation and fabrication activities to the NTS would require a 100,000 square foot Explosive Components type facility to conduct SNL/NM activities and 200,000 square feet of mix use space would be required for HE R&D activities currently being conducted at LANL, LLNL, and Pantex. Construction impacts could disturb approximately 15 acres in the vicinity of the Big Explosives Experimental Facility (BEEF) (see Figure 5.13-5).

No construction would be conducted within a floodplain or a wetland. Construction would be performed using common construction industry methods since the operational uses of these structures do not have potential hazards that would entail unique structural requirements. The new building would be constructed in accordance with seismic criteria in current building codes. The building would not be constructed over known faults or within 50 feet of known seismic faults. The new building would be designed according to general design criteria for a new facility, with a minimum lifetime expectancy of 30 years of operation. The building would consist of a concrete slab foundation with a two-story superstructure. The total height of the building above ground level would be less than 32 feet.

Roof drains would collect snowmelt and rain water from the building and would channel the runoff to appropriate release points, such as landscaped areas. Storm water runoff systems would be designed to minimize soil erosion.

Construction activities would have some local short-term adverse effects; long-term effects on the viewscape from construction and demolition are expected to be minimal. All NTS facilities are not visible from roads and areas with public access. The visual effects of construction would be confined to the immediate area of Area 4 at NTS. Short-term temporary adverse visual effects would occur during the construction period. These effects involve staging and use of construction vehicles and erecting construction fences. Occasional fugitive airborne dust from soil disturbance may temporarily obscure local views for short periods of time. In the long term, the area would experience minimal effects.

The newly constructed building would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Onsite utilities (gas, water, sewer, electric, communications, computer networks) would be extended to the new facility.



Source: NNSA 2007.

Figure 5.13-5 — NTS Location for HE R&D Facility

NTS is located in the Nevada Intrastate AQCR 147. The region is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and particulate matter) under the NAAQS. Clearing or excavation activities during site construction have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality.

Work at the site would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at the site would be audible primarily to the involved workers and to workers housed in Area 4. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, space in the immediate vicinity would be available for equipment storage and material staging. Temporary parking areas, staging areas, laydown yards, and construction access roads may be established during the construction phases. These areas would be used for permanent parking. Construction solid waste is estimated at 4,650 cubic yards.

During operations, the primary noise would be generated by air blast waves and ground vibration impacts associated with HE tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. Noises heard at that distance would be similar to thunder in their intensity. Because of the great distance from NTS activities to any off-site receptors, noise impact would be minimal. Any sensitive wildlife species are unlikely to be adversely affected by “thunder-like” explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average lightning event areas.

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 250-300 construction workers would be onsite during the peak construction period, adding approximately 125-150 personal vehicles to local roadways during the construction period. These construction workers would park their personal vehicles either in existing parking lots or in other designated parking areas. Vehicles (such as dump trucks) and heavy machinery (such as bulldozers, drill rigs, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite over night. Temporary construction lighting would be directed toward the work area.

During construction, the peak construction jobs would be filled by the existing employees in the regional work force. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in the ROI. There would be short-term benefits during construction in the form of jobs and procurement. Most materials would be purchased in Nevada.

Construction would not be expected to have any adverse health effects on NTS workers or the public. NNSA and NVO workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 250-300 peak-period construction workers, including approximately 50 construction vehicles, would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). During the construction period (2 years), no deaths (0.02) would be expected for the estimated 250 to 300 worker-years.

There would be no effects to sensitive species or their critical habitat due to construction. The new construction would generate non-hazardous solid waste that would be disposed of off-site at a solid waste landfill in accordance with the waste minimization plan.

Proposed operations would have minimal effects on the NTS environment. Operations would produce the same types of waste as are generated in other NTS facilities. No new radioactive or other wastewater or hazardous waste streams would be generated. With respect to air quality, the new facility would emit less than one percent of the existing NTS emissions. Because no significant off-site health risks are associated with the HE R&D operations, no environmental justice impacts are expected.

Water quality in this area would not be affected by the operations. The facility would require approximately 5 million gallons of water per year, which would be less than 1 percent of the NTS sustainable site capacity of 1.36 billion gallons per year. The new facility would be designed using pollution prevention processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by operating the new building. Water quality would not change as a result of operations of the new building.

During operations, there would be a 250 person increase in the number of NTS employees as a result of this project. Compared to the existing workforce at NTS, this project would not have a long-term effect on socioeconomic conditions in the ROI.

5.14 PROJECT-SPECIFIC ANALYSIS OF TRITIUM R&D ALTERNATIVES

This section analyzes the environmental impacts of the reasonable alternatives, described in Section 3.9, for tritium R&D. For each alternative, the analysis focuses on the resources that are most likely to be affected. For example, because there would be no new construction associated with any of the alternatives, and no associated land disturbance, the following resources would not be affected: land use, visual resources, air and noise, water resources, geology and soils, biotic resources, and cultural resources. As such, this section does not discuss these resources any further. The analysis focuses on the following resources: emissions and exposures, which affect human health, socioeconomic impacts, and wastes.

No Action Alternative. Under the No Action Alternative, tritium R&D activities would continue at LLNL, LANL, SRS, and SNL/NM, as described in Section 3.9.1. At all four sites, tritium R&D activities comprise a minor part of the overall operations compared to other NNSA activities. For example, at LLNL, tritium R&D activities amount to basically one glove box system. At LANL, tritium R&D activities take place in one facility, the Weapons Engineering Tritium Facility (WETF), and affect approximately 25 people. At SRS, tritium R&D activities are conducted in conjunction with tritium production activities and thus, do not require dedicated facilities or personnel. At SNL/NM, tritium operations are primarily associated with the Neutron Generator Production Facility (NGPF) and would be unaffected by the SPEIS alternatives. At all four sites, tritium R&D activities are responsible for less than 1 percent of the air emissions, electrical usage, water use, employment, and generated wastes (NNSA 2007).

5.14.1 Consolidate Tritium R&D at SRS Alternative

Under this alternative, tritium R&D currently conducted at LLNL⁷ and LANL would be consolidated at SRS into existing facilities. No new construction would be necessary to consolidate these missions, although minor upgrades to existing laboratories may be required. Consolidating tritium R&D at SRS would increase tritium emissions at SRS, increase radiation exposures at SRS, create jobs at SRS, and increase wastes generated at SRS.

5.14.1.1 *Potential Impacts at SRS*

Tritium Emissions. Tritium emissions at SRS would increase by approximately 1,000 Curies per year at SRS. During 2005, about 40,800 Ci of tritium were released from SRS, compared to about 61,300 Ci in 2004. Emitting approximately 1,000 Curies of tritium per year at SRS from increased tritium R&D would represent an increase of approximately 2.4 percent over current tritium emissions.

Health Impacts From Tritium Emissions. In 2005, the estimated dose from atmospheric releases to the MEI was 0.05 mrem, which is 0.5 percent of the DOE Order 5400.5 air pathway standard of 10 mrem per year. Tritium oxide releases accounted for 66 percent of the dose to the MEI. In 2005, the collective 50-mile population dose was estimated at 2.5 person-rem— less than 0.01 percent of the collective dose received from natural sources of radiation (about 214,000

⁷ This does not include NIF target R&D and NIF production target filling. Those operations would remain at LLNL under all alternatives (see Section 3.7.3.5).

person-rem). Tritium oxide releases accounted for about 68 percent of the collective dose. Increasing the tritium emissions by 2.4 percent would increase these doses as follows:

- MEI: increased dose by 0.0008 mrem/year;
- 50-mile population dose: increased dose by 0.041 person-rem.

Based on a risk estimate of 0.0006 LCFs per person-rem, the increased likelihood of a LCF for the MEI would be 4.8×10^{-7} and the likelihood of a LCF to the 50-mile population would be 2.5×10^{-5} . Accident risk at SRS would be unaffected, as these new operations would be inconsequential compared to existing tritium production operations. Because no significant off-site health risks are associated with the tritium R&D operations, no environmental justice impacts are expected.

Health Impacts to Workers. Approximately 25 new jobs would be created at SRS. The average exposure to a worker from tritium R&D would be approximately 4.3 mrem, resulting in a total worker dose 0.11 person-rem. Based on a risk estimate of 0.0006 LCFs per person-rem, the likelihood of a LCF to workers would be 6.6×10^{-5} .

Accidents. At SRS, receiving the tritium R&D operations from LANL could produce additional consequences due to accidents that release tritium. Assuming that the same tritium releases could occur at SRS as were analyzed at LANL, consequences to the MEI at SRS would be expected to decrease compared to the MEI at LANL due to a much greater distance to the tritium facilities (at SRS, the MEI would be more than ten times greater distance from the facility than the MEI at LANL). Increasing the distance to the MEI by approximately ten times would decrease the MEI dose by approximately a factor of 100. Consequently, the MEI dose at SRS would be expected to be less than 1 rem (statistically, this means that there would be less than a 1 percent chance that an LCF would result from this accident). For the 50-mile population at SRS (assumed to be 985,980 in the year 2030), it is conservatively assumed⁸ that the population dose at SRS could be approximately twice as large as at LANL. For the 50-mile population surrounding SRS, the highest population dose from an accident would be expected to be less than 380 person-rem, which translates to an LCF risk of 0.22 (statistically, this means that there would be an 22 percent chance that an LCF would result if this accident were to occur).

Socioeconomic Impacts. The addition of 25 new workers at SRS would increase the site workforce by much less than 1 percent and would not be noticeable in the ROI.

Wastes. Wastes at SRS from tritium R&D would increase as follows:

- Mixed Waste: 28 gallons
- High Activity Waste: 330 gallons waste total
- Compactable waste: 2.4 m³
- Non-Compactable, <20mCi/m³: 5 m³
- Mop water (low level liquid waste): 3000 gallons

⁸ The assumption is conservative because the off-site population density within the initial ten mile radius at SRS is less than LANL. Radiological impacts to the 50-mile population are generally the highest within the initial ten miles of a release, as radiological concentrations generally decrease by the inverse of the distance squared.

These wastes would represent less than 1 percent of current wastes generated at SRS and would be inconsequential.

5.14.1.2 Potential Impacts of Phasing Out Operations at LANL

Under this alternative, tritium R&D currently conducted at LLNL and LANL would be phased out. Phasing out tritium R&D operations from the WETF at LANL would reduce tritium emissions, wastes, and exposure to personnel as shown in Table 5.14-1.

Table 5.14-1 — Reductions at LANL from Tritium R&D Phase out

Resource Affected	Amount Reduced
Tritium Emissions	WETF average tritium emissions are approximately 1,000 Ci/year, which includes a spike of 7,600 Ci from a legacy bottle that failed in 2001.
Wastes	Mixed Waste: 28 gallons High Activity Waste: 330 gallons waste total Compactable waste: 84 cubic feet Non-Compactable, <20mCi/m ³ : 176 cubic feet Mop water (low level liquid waste): 3000 gallons
Personnel Exposure	Average dose for 2006 was 4.3 mrem.
Jobs	25 maximum

Source: NNSA 2007.

At LANL, the impacts of these reductions would be as follows:

Tritium Emissions. Tritium emissions at LANL would decrease by approximately 1,000 Curies per year. During 2005, about 2,400 Ci of tritium were released from LANL. Phasing out the tritium R&D at LANL would reduce tritium emissions by approximately 42 percent.

Health Impacts From Tritium Emissions. In 2005, the estimated dose from tritium to the LANL MEI was 0.0036 mrem and the collective 50-mile population dose was estimated at 0.09 person-rem. Decreasing the tritium emissions at LANL by 42 percent would decrease these doses as follows:

- MEI: decrease dose by 0.0015 mrem/year;
- 50-mile population dose: decrease dose by 0.038 person-rem.

Based on a risk estimate of 0.0006 LCFs per person-rem, the decreased likelihood of a LCF for the MEI would be 9.0×10^{-7} and the likelihood of a LCF to the 50-mile population would be decreased by 1.6×10^{-2} .

Health Impacts to Workers. Approximately 25 workers at LANL would be reassigned to new jobs. Assuming these workers would no longer receive a 4.3 mrem dose, total worker dose would decrease by 0.11 person-rem. Based on a risk estimate of 0.0006 LCFs per person-rem, the likelihood of a LCF to workers would decrease by 6.6×10^{-5} .

Accidents. Phasing out LANL R&D operations at the WETF would eliminate the accident consequences associated with those operations. The accidents analyzed for WETF have included

tritium releases from the following initiating events: a facility fire, a site-wide seismic event, and a wildfire (LANL Draft SWEIS 2006). For the maximally exposed individual (MEI) (assumed to be located at a distance of 2,885 feet from the facility), the highest dose from an accident was determined to be 17 rem, which translates to a statistical latent cancer fatality risk of 0.01 (statistically, this means that there would be a 1 percent chance that an LCF would result from this accident). For the 50-mile population (approximately 405,000 people), the highest population dose from an accident was determined to be 190 person-rem, which translates to LCF risk of 0.11 (statistically, this means that there would be an 11 percent chance that an LCF would result if this accident were to occur).

Socioeconomic Impacts. Because the tritium R&D workers would be reassigned to other jobs at LANL, no socioeconomic impacts would result.

Wastes. Wastes at LANL from tritium R&D would decrease as follows:

- Mixed Waste: 28 gallons
- High Activity Waste: 330 gallons waste total
- Compactable waste: 84 cubic feet
- Non-Compactable, <20mCi/m³: 176 cubic feet
- Mop water (low level liquid waste): 3000 gallons

These wastes represent less than 1 percent of current wastes generated at LANL.

Current LLNL tritium R&D (primarily to support gas transfer system development) is very small and is only included here for completeness. Transferring the LLNL tritium R&D (not NIF tritium work) to SRS would basically amount to one glove box system, which could be accommodated in the SRS facilities without any significant changes. Phasing out tritium R&D operations from LLNL would have no significant effects.

5.14.2 Consolidate Tritium R&D at LANL Alternative

Under this alternative, tritium R&D currently conducted at LLNL⁹ would be consolidated at LANL into the WETF. No new construction would be necessary to consolidate these missions. Transferring the LLNL tritium R&D to LANL would basically amount to one glove box system, which could be accommodated in the WETF without any significant changes. LANL already performs same type work within WETF. Phasing out tritium R&D operations from LLNL would have an insignificant effect on tritium emissions, wastes, and exposure to personnel at either LLNL or LANL.

5.14.3 Reduce Tritium R&D In-Place Alternative

Under this alternative, no changes in assigned tritium R&D missions would result. Instead, LLNL, LANL, and SRS would downsize tritium operation in-place. This alternative would result in the least transition impact in the Complex. All three sites would increase efficiencies in

⁹ This does not include NIF target R&D and NIF production target filling. Those operations would remain at LLNL under all alternatives.

tritium operations by increasing emphasis on planning and scheduling. Any reductions in tritium emissions, wastes, and exposure to personnel are expected to be small, as these are a function of requirements rather than planning/scheduling.

5.15 PROJECT-SPECIFIC ANALYSIS OF NNSA FLIGHT TEST OPERATIONS

NNSA Flight Test Operations is a SNL-managed program to assure compatibility of the hardware to interface between NNSA weapons and DoD delivery systems. The actual flight tests are conducted at the Tonopah Test Range, located 140 miles northwest of Las Vegas, Nevada, with one or more denuclearized weapons, called JTAs, which are dropped from DoD aircraft. In some cases, JTAs are not dropped, but simply attached to aircraft and flown. There are five alternatives for Flight Test Operations: (1) the No Action Alternative to continue activities at TTR; (2) an alternative to upgrade operations at TTR; (3) an alternative to operate TTR in a Campaign Mode; (4) an alternative to transfer NNSA Flight Testing to the WSMR in New Mexico; and (5) an alternative to transfer NNSA Flight Testing to the NTS.

The following information and impacts are common to all of the alternatives analyzed in this section.

The Flight Test Program conducts about 10 flight tests in an average year. Compared to the 474,500 commercial flights that take place annually over the U.S., these 10 flights represent about 0.002 percent. These flight tests are conducted using the B-52 and B-2 bomber aircraft and the F-15E and F-16C fighter aircraft. The bomber aircraft originate from the 2nd Bomb Wing, at Barksdale AFB, in Louisiana, the 5th Bomb Wing, at Minot AFB, in North Dakota, or the 509th Bomb Wing, at Whiteman AFB, in Missouri. Fighter aircraft usually deploy from Nellis AFB, in Nevada, or Eglin AFB, in Florida. Flight paths to and from a test range would occur over FAA-controlled routes. Flight test ranges are controlled airspace. Once over the flight test range, flight tests are conducted at varying altitudes, ranging from as low as 200 feet to as high as 50,000 feet.

For each of the alternatives, potential accidents related to flight testing could include an aircraft crash or an inadvertent release of a JTA. These accidents could happen at any of the locations where flight testing might occur and, as discussed below, would have similar consequences. As such, these potential consequences are not expected to represent a meaningful discriminator with respect to selecting a site for flight testing. Nonetheless, for completeness, they are addressed.

With respect to an aircraft crash during flight testing, such an accident has never occurred in the past. Nonetheless, for purposes of this analysis, such an accident is assumed to occur. If an aircraft accident occurred, flight crews and people in the vicinity of the crash site could be killed or seriously injured. Given that the flight test operations would occur over generally low-populated areas (for all three potential locations), the likelihood of anyone on the ground being adversely affected is very small. This conclusion is also supported by a previous study which estimated the probability of a given location being struck by an aircraft to be so low (less than 1×10^{-7}) as to not be considered as a credible accident scenario¹⁰ (DOE 1996g).

With respect to an inadvertent release of a JTA, such an accident could occur due to pilot error, equipment error, or other human error (for example, mistakenly identifying the incorrect target drop location). If such an error occurred, people on the ground could be killed or seriously

¹⁰ For more information, see "Accident Analysis for Aircraft Crash into Hazardous Facilities," DOE Standard DOE-STD-3014-2006, October 1996, Reaffirmation May 2006.

injured. The impacts of such an accident would be less than an aircraft crash. Operating procedures, including equipment safety checks, pre-briefs, radar tracking, controlled flight ranges, and constant communications between the ground and pilots, minimize the potential for such accidents to occur.

5.15.1 No Action Alternative— Continue Operations at TTR

Under the No Action Alternative, NNSA would continue to conduct the Flight Test Mission at TTR. There would be no construction impacts associated with this alternative. However, some minimal one-time investments would be required to maintain the TTR in order to meet mission requirements. These investments would primarily be associated with equipment replacements. The operational requirements are shown in Table 5.15-1. The impacts of the No Action Alternative, which are described in the TTR Affected Environment Section (see Section 4.4), would continue if no changes are made at TTR. Under the No Action Alternative, there would be no change in the workforce currently at TTR. Therefore, there would be no impacts to the ROI employment, income, or labor force.

Table 5.15-1 — TTR No Action Annual Operational Requirements

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595
Peak electrical demand (MWe)	812
Other process gas (N, Ar, etc.)	480 ft ³
Diesel generators	44 (about 20 per test)
Water (Yearly for entire range including AF)	6 million gallons
Range size (square miles)	280
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Maximum inventory of fissile material/throughput	0
Hazardous	
Liquid (gal.)	35
Solid (yds ³)	<1
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds ³)	15

Source: NNSA 2007

Past weapons destruction tests, unrelated to the Flight Test Program, have contaminated soil at TTR in three areas. These sites have been characterized and remediation is ongoing. Additional details on this can be found in Section 4.4.6.2.1, of this document. In addition to these remediation projects there are several structures that must undergo D&D in order to continue ongoing operations at TTR. It is estimated that the soil and structure remediation will be a two year project requiring 80,000 worker hours, and would produce the impacts listed in Table 5.15-2. The soil remediation activities involve only the petroleum-contaminated areas under the

buildings that are scheduled for demolition. The small quantities of LLW and hazardous wastes generated by this effort would be transported to NTS, or a commercial facility, for treatment and disposal. Non-hazardous waste would be disposed of at TTR.

Table 5.15-2 — D&D Associated with TTR Operations—No Action Alternative

D&D Ongoing at TTR	D&D Amounts
Soil D&D (yd ³)	0
LLW generated (yd ³)	20
Non-Hazardous waste (yd ³)	8000
Hazardous waste (yd ³)	3703
Debris/Earth moving equip.(dozers/trucks)	2/3
D&D Related employment	
Peak	20
Total worker hours	80000

Source: NNSA 2007

5.15.2 Upgrade of Tonopah Test Range Alternative

This section describes the impacts associated with upgrading the NNSA Flight Test Operations activities presently being conducted at the TTR. This alternative, referred to as the High-Tech Mobile (HTM) option, would allow for a reduction in the operational costs at TTR through the introduction of newer, more efficient and more technologically advanced equipment. This option would lower manpower test operational needs and keep all test equipment highly reliable and operational between test dates, thereby reducing recalibration and start-up costs. There would be no construction required for this alternative as all new equipment would be in mobile vehicles or trailers. Annual operating requirements would be the same as for the No Action Alternative discussed in Section 5.15.1. Under the HTM Option, the maintenance required to update existing facilities could be conducted by current staff and would result in negligible effects to ROI employment, income, or labor force.

5.15.3 Campaign Mode Operation Alternative

An alternative to relocating flight test operations to another site would be to conduct JTA tests at TTR on a campaign basis from NTS, while doing work for others as time and workload permit. SNL would continue to be the program manager, and National Security Technologies (NSTec) would be the Maintenance and Operations (M&O) contractor. This alternative would reduce the number of full-time employees to the level necessary to maintain facilities and equipment; employees from other facilities would perform the actual tests. The operational requirements for this alternative are shown in Table 5.15-3.

Table 5.15-3 — TTR Annual Operational Requirements—Campaign Mode

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595MWh
Peak electrical demand (MWe)	812MWe
Fuel usage (gal or cubic yd)	
Other process gas (N, Ar, etc.)	480 ft ³
Diesel generators	44
Water (Yearly for entire range including AF)	6 million gallons
Steam (tons)	0
Range size (square miles)	280
Employment (workers)	43
Number of radiation workers	25
Average annual dose	<10 mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Chemical use	0
Waste Category	Volume
Low-Level	
Liquid (gal.)	0
Solid (yds ³)	0
Mixed Low-Level	
Liquid (gal.)	0
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds ³)	15

Source: NNSA 2007

This alternative would result in the loss of 92 full-time jobs at TTR through the downsizing of the permanent workforce from 135 to 43. This level of job reductions is different from the two alternatives that terminate all permanent TTR employment through the transfer of flight test operations to another facility. A discussion of the impacts associated with such a reduction in a community where supporting TTR is the primary employer is detailed in the next section. Other impacts, such as fuel, electricity and water usage and waste generation would remain about the same as the no-action alternative, since there would be no change in the number of tests performed. A reduction in employment of this level would have secondary impacts on the service sector and commercial establishments of the area.

Under this proposed action, the JTA tests would be conducted on a campaign basis at TTR with support from the NTS. The remaining staff at TTR would also perform Work for Others (WFO) as time and workload permits. There would be no construction required as the existing facilities at TTR would be used and upgraded with mobile equipment. The campaign mode operation of TTR would require 43 employees, of which 25 would be higher-paid radiation workers. For the estimated twelve campaign testing periods per year, transient workers would support the local Tonopah economy through spending at existing stores, services, restaurants and entertainment facilities, although this could be minimized if these transient workers spend their non-working hours at the NNSA facilities. This would represent a reduction in workforce at TTR from 135

to 43, a decrease of approximately 68 percent in the total employment at TTR. The loss of 92 jobs would incur impacts similar to but of slightly less severity than those described in Section 5.15.5 for the transfer of operations from TTR. These impacts are discussed in more detail in Section 5.15.5.

5.15.4 Transfer to WSMR Alternative

This alternative would move Flight Test Operations from TTR to WSMR. The WSMR has an extensive network of radar, global positioning system (GPS), telemetry, and optics sites (fixed and mobile), which interface with the Real Time Data Display System located in the Range Control Center and can be provided to remote locations both on and off range via the test support network and Defense Research Engineering Network.

5.15.4.1 Construction and Operations Data

The only construction that would be required to support JTA flight test at the WSMR would be the installation of a circular concrete target. The target would be used to aid in recovery efforts. It would also be used for free-fall test units. The concrete target would be constructed of 4000 psi non-reinforced concrete, 500 feet in diameter with a depth of 12 inches. Tables 5.15-4 and 5.15-5 provide the construction and operational requirements associated with relocating NNSA Flight Test Operations to the WSMR.

Table 5.15-4 — WSMR Construction Requirements

Construction Requirements	Consumption/Use
Peak Electrical Energy Use	40,000 KW-hr
Diesel Generators (Yes or No)	Yes
Concrete (yd ³)	800
Steel (t)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Lay down Area Size	Two 11.5 acre sites
Parking Lots	N/A
Total employment (worker years)	37
Peak employment (workers)	30
Construction period	15 months
Waste Generated	Volume
Hazardous	
Liquid (gal)	0
Solid (yds ³)	0
Non-hazardous (Sanitary)	
Liquid (gal)	0
Solid (yds ³)	6,000
Non-hazardous (Other)	
Liquid (gal)	0
Solid (yds ³)	45

Source: NNSA 2007

Table 5.15-5 — WSMR Operational Requirements

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours)	595MWh
Peak electrical demand (MWe)	812MWe
Fuel usage (gal or yds ³)	32,150 gallons
Other process gas (N, Ar, etc.)	480cu.ft.
Diesel generators	44 (about 20 per test)
Water (Yearly for entire range)	6 million gallons
Steam (tons)	0
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 mrem
Radionuclide emissions and effluents—	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Chemical use	0
Maximum inventory of fissile material/throughput	0
Waste Category	Volume
Hazardous	
Liquid (gal.)	35
Solid (yds ³)	<1
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds ³)	15

Source: NNSA 2007

The required construction is a small project and it is not anticipated that the employment of 30 construction personnel over a 15 month period would have a significant impact on the existing labor pool of the area.

During flight test operations, the primary noise would be generated by aircraft flying over the WSMR drop areas. The noise would be consistent with the existing use of the WSMR, sporadic, and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to those employed by WSMR. They would not likely result in any adverse effect on sensitive wildlife species or their habitats, and would be similar to the effects discussed under the No Action Alternative.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased flights at WSMR as a result of NNSA conducting and additional 10 flights per year. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are remotely located from the flightpath of the aircraft. The public is not allowed on WSMR and noise levels produced by the aircraft are sufficiently reduced at locations where the public would be present to preclude hearing damage. Because no significant off-site health risks are associated with the flight test operations, no environmental justice impacts are expected.

5.15.4.2 *Impacts of Phasing Out TTR Operations*

Relocating NNSA flight test operations to WSMR would entail termination of the NNSA flight test operations activities presently being conducted at the TTR. NNSA would continue the cleanup of its flight test facilities at TTR. About 135 jobs would be lost. Since the flight test operations would be conducted by existing WSMR personnel under this alternative, these jobs would not be transferred to WSMR. This section provides a detailed analysis of socioeconomic characteristics and impacts at TTR as a result of the discontinuance of flight test operations at TTR. The analysis includes a more detailed description of current socioeconomic conditions at TTR and an assessment of impacts to socioeconomic conditions from implementation of the alternatives that would transfer the Flight Test Operations to either WSMR or NTS.

Any removal of capital or employment, such as the transfer of activities from TTR, would impact the existing socioeconomic environment to some degree. The transfer and associated termination NNSA's Flight Test Operations activities at TTR would impact the existing socioeconomic environment of the southern Nevada ROI which includes Clark and Nye counties. The existing economic environment of these counties is discussed in the first part of this section.

5.15.4.2.1 *Socioeconomic Methodology and Impacts*

Socioeconomic impacts consist of both direct and indirect impacts. Direct impacts are those changes that can be directly attributed to the proposed action, such as changes in employment. Indirect impacts to the ROI occur based on the direct impacts from the proposed action.

The direct impacts estimated in the socioeconomic analysis are based on data provided by TTR. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System multipliers developed specifically by the U.S. Bureau of Economic Analysis (BEA) for the southern Nevada ROI, which includes Nye and Clark Counties. These multipliers are developed from national input-output tables maintained by the BEA and adjusted to reflect regional trading patterns and industrial structure. The tables show the distribution of the inputs purchased and the outputs sold for each industry for every county in the U.S. The multipliers are applied to data on initial changes in employment levels and earnings associated with the proposed project to estimate the total (direct and indirect) impact of the project on regional earnings and employment levels. For this analysis, the term *direct jobs*, refers to the employment created by the project and *direct income* refers to project workers' salaries. The term *indirect jobs*, refers to the jobs lost in other employment sectors as an indirect result of direct jobs lost from the transfer of TTR activities and *indirect income* refers to the income lost as a result of the loss of indirect jobs.

This section provides a more detailed description of current socioeconomic conditions at the TTR. A general description of the socioeconomic environment, including population, is presented in Section 4.4.9 of this SPEIS.

Employment and Income

Employment by sector has changed slightly from 2003 to 2005 as shown in Table 5.15-6. The arts, entertainment, recreation, accommodation and food services sector provides the highest percentage of the employment in the ROI, 23 percent in 2005, followed by construction, with 10.7 percent, and the retail trade, with 10.4 percent.

Table 5.15-6 — 2003 and 2005 Employment by Sector (Percent)

Sector	Clark		Nye		ROI	
	2003	2005	2003	2005	2003	2005
Farm employment	0.04	0.03	1.92	1.61	0.07	0.06
Nonfarm employment	99.96	99.97	98.08	98.39	99.93	99.94
Private employment	90.37	90.80	85.92	87.34	90.30	90.75
Forestry, fishing, related activities, and other 3/	0.03	0.03	0.40	0.45	0.04	0.04
Mining	0.14	0.12	6.73	5.88	0.24	0.21
Utilities	0.35	0.32	(D)	(D)	(D)	(D)
Construction	9.12	10.67	6.83	9.45	9.08	10.65
Manufacturing	2.52	2.52	1.15	1.66	2.50	2.50
Wholesale trade	2.50	2.46	1.00	1.05	2.47	2.43
Retail trade	10.76	10.39	11.88	11.76	10.77	10.41
Transportation and warehousing	3.10	3.13	(D)	(D)	(D)	(D)
Information	1.45	1.24	1.01	0.84	1.44	1.24
Finance and insurance	5.11	4.92	2.51	2.52	5.07	4.88
Real estate and rental and leasing	5.49	5.67	6.44	6.86	5.50	5.69
Professional and technical services	5.05	5.04	15.88	14.74	5.22	5.20
Management of companies and enterprises	0.71	0.95	(D)	0.16	(D)	0.94
Administrative and waste services	6.69	7.07	(D)	6.04	(D)	7.06
Educational services	0.53	0.58	(D)	0.39	(D)	0.58
Health care and social assistance	5.94	5.83	(D)	4.13	(D)	5.81
Arts, entertainment, and recreation	3.14	2.85	4.33	4.95	3.16	2.88
Accommodation and food services	23.96	23.32	10.12	9.55	23.75	23.11
Other services, except public administration	3.78	3.69	5.13	4.89	3.80	3.71
Government and government enterprises	9.60	9.16	12.16	11.06	9.64	9.19
Federal, civilian	1.13	1.03	1.15	0.92	1.13	1.03
Military	1.17	1.06	0.53	0.50	1.16	1.05
State and local	7.29	7.07	10.49	9.63	7.34	7.11
State government	1.33	1.33	(D)	0.91	(D)	1.32
Local government	5.96	5.74	(D)	8.72	(D)	5.79

Source: BEA 2007
(D) No Data.

Current TTR Employment. Approximately 67 percent of the workforce at TTR resides in Nye County with over 60 percent residing in Tonopah. Another 20 percent of the workforce resides

within the cities of Henderson (3 percent) and Las Vegas (17 percent) in Clark County, Nevada. The remaining 13 percent of the workforce resides within the cities and counties listed in Table 5.15-7. There are 37 TTR employees (33.6 percent) who do not reside in Tonopah while working but instead reside on site at the Man Camp.

Table 5.15-7 — Summary of Workforce Residence

City	Percent (%)
Tonopah	64.5
Henderson	2.7
Albuquerque	0.9
Santa Clara	0.9
Las Vegas	17.3
Reno	0.9
Deeth	0.9
Boulder City	0.9
Meadview	0.9
Carson City	0.9
Fernley	0.9
Pahrump	0.9
Rio Rancho	0.9
Fallon	1.8
Caliente	1.8
Enterprise	2.7
County	Percent (%)
Nye	67.3
Clark	20.9
Bernalillo	0.9
Washington	1.8
Washoe	0.9
Elko	0.9
Mohave	0.9
Carson City	0.9
Lyon	0.9
Sandoval	0.9
Churchill	1.8
Lincoln	1.8

Source: NNSA 2007.

The average annual salary of a TTR employee is \$78,182. Sandia employees earn an average annual salary of \$105,547, while Westinghouse and U.S. Security employees earn an average annual salary of \$58,000 and \$70,000, respectively (Figure 5.15-1).

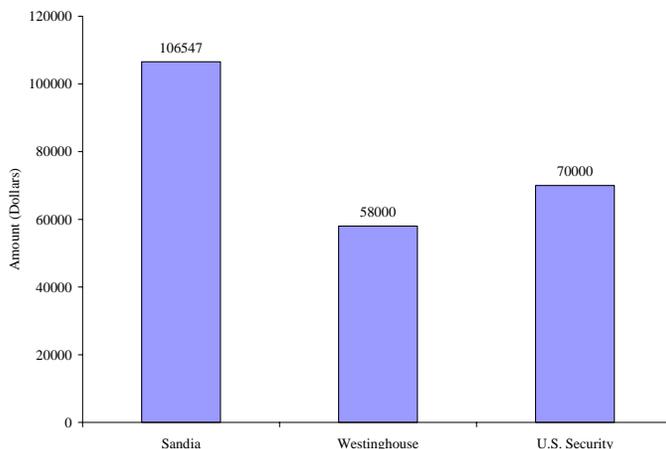


Figure 5.15-1 — Average Annual Salaries of TTR Workforce

Community Services

A large number of TTR employees are also involved in community associations as shown in Table 5.15-8. If operations were discontinued at TTR, it is anticipated that involvement in these reported community activities would decrease.

Table 5.15-8 — Summary of Community Involvement of TTR Employees

Community Activity/Association	Number of TTR Employee Participants
GLVAR	6
Realtors Association	5
Church	11
Outdoor club	5
Business owner	4
Scouts	24
PTA	29
Booster Club	2
Tonopah Little League	7
MSBL Baseball League	1
Elks	14
VFW	3
Beta Sigma Phi	1
HS Basketball Coach	1
4 R Kids	6
Nye County Search & Rescue	32
Central NV Officials Assn (NCOO)	2
HS Wrestling Coach	1
MS Wrestling Coach	1
Tonopah Volunteer Fire Department	19
Trap Shoot Assn	2
Nye County Regional Ambulance Services	3

Source: NNSA 2007.

Educational Systems

There are two schools in Tonopah: Tonopah Elementary/Middle (grades K-8) and Tonopah High school (grades 9-12). As of the 2005-2006 school year, the Tonopah Elementary/Middle school had an enrollment of 212 and the Tonopah High school (grades 9-12) 169 students for a total of 381 students. There are a total of 125 dependents of TTR employees attending school. Of these, 34 (27.2 percent) are in pre-school, 40 (32 percent) in grade school, 23 (21.6 percent) in middle school, 24 (19.2 percent) in high school, and 4 (3.2 percent) in college (see Figure 5.15-2).

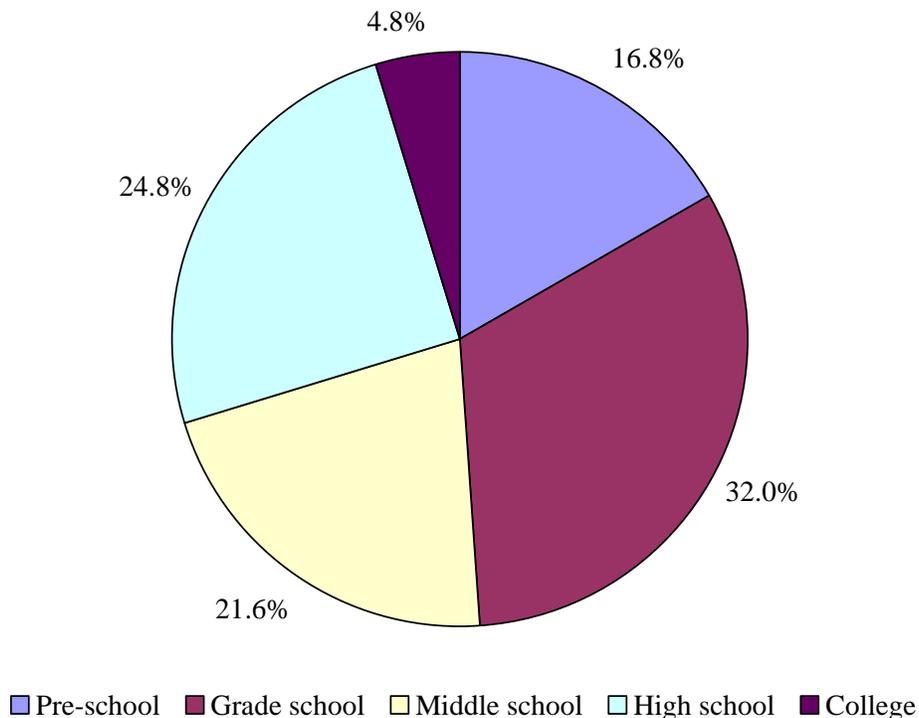


Figure 5.15-2— Percentage of Dependents at Certain Stages of Schooling System

It is assumed that the 87 TTR employee dependents attending grade, middle, and high school all attend either Tonopah Elementary/Middle or Tonopah High school, representing approximately 22.8 percent of the total enrollment for both schools as shown in Table 5.15-9. The student-to-teacher ratio for the Tonopah Elementary/Middle school was 17.1 for the 2005-2006 school year. For the 2005-2006 school year, there were 13 teachers at the Tonopah High School. The average classroom sizes for Tonopah Elementary/Middle and Tonopah High school were 20.75 and 20, respectively (Table 5.15-9).

Table 5.15-9 — School Characteristics in Tonopah

School Characteristics	Tonopah Elementary/Middle	Tonopah High School	Total
Current			
TTR Students	63	24	87
Total Enrollment	212	169	381
Average Classroom Size	21.5	20	20.75
Classroom Teachers	12	13	25
Student to Teacher Ratio	18:1	13:1	16:1
After Transfer			
Total Enrollment	149	145	294
Average Classroom Size	15.1	17.2	16.15
Classroom Teachers	12	13	25
Student to Teacher Ratio	13:1	12:1	12:1

Source: NCES 2007; State of Nevada 2007

Housing Characteristics for TTR Employees

There are approximately 900 occupied housing units in the Tonopah area. Of these, 351 (39 percent) are owner-occupied, while the remaining 549 (61 percent) are renter-occupied as shown in Table 5.15-10 (USCB 2007). According to the Nye County Assessor’s Office (2007), an average of 35 houses were sold annually between the years 2001 and 2006 for an average price of \$65,882 as shown in Table 5.15-11.

Approximately 78 percent of TTR employees own residences, while the remaining 22 percent are renters. Sixty percent of the residences are stick-built, 26 percent are manufactured housing, 6.5 percent are mobile housing units, and 7.5 percent are apartments as shown in Figure 5.15-3.

Table 5.15-10 — Housing Characteristics in Tonopah.

Housing Characteristics	Tonopah Area Total	TTR Employees
Current		
Owner-Occupied	351	86
Renter-Occupied	549	24
Total Occupied Units	900	110

Table 5.15-11 — Home Sales Statistics for Tonopah, 2001-2006 (Nye County Assessor 2007)

Year	Number of Homes Sold	Average Price (\$)
2001	23	65,646
2002	37	56,915
2003	30	63,491
2004	45	61,278
2005	39	72,153
2006	36	75,814
Annual Average	35	65,883

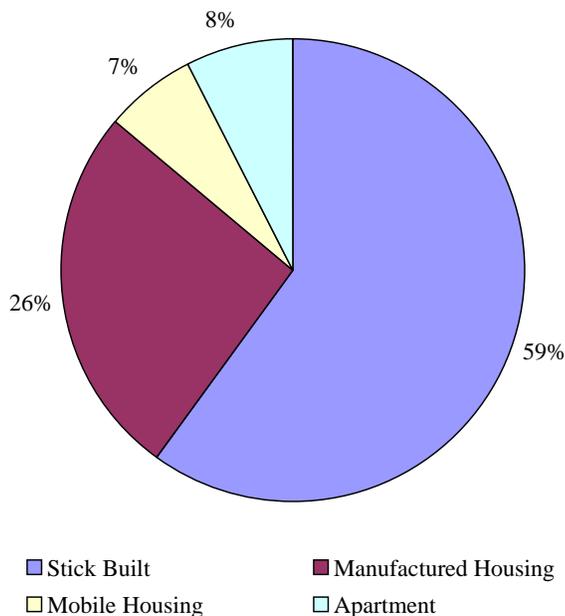


Figure 5.15-3 — Types of TTR Employee Housing

Environmental Impacts

If the NNSA flight test operations were transferred to either WSMR or NTS, approximately 130 direct jobs in the professional, scientific, and technical services industry would be lost at TTR. WSMR would not gain any jobs in the professional, scientific and technical services industry and TTR would lose approximately 92 jobs in the campaign mode during the assignment transfer to the NTS. Indirect effects on employment outside of this industry sector would include a loss of approximately 119 jobs within the Regional Economic Area for a total job loss of about 254.

Based on the ROI average income of \$78,182 for workers employed at TTR, direct ROI income would decrease by approximately \$10.5 million. This would also generate additional indirect income in supporting industries. The total impact to the ROI income from both TTR worker and supporting industry losses would be approximately \$16.2 million (\$10.5 million direct and \$5.7 million indirect).

The population would experience a decrease of approximately 255 persons residing within the ROI at TTR. There could be a population increase of approximately 255 in the WSMR or NTS ROI from discontinued operations at TTR. Community organizations could lose the services of 180 persons involved in community activities at TTR.

As shown in Table 5.15-9, the enrollment at Tonopah Elementary/Middle School would potentially decrease by 63 students, reducing the total enrollment to 149, the average classroom size to 15.1, and, assuming current staffing levels, the student-to-teacher ratio to 12. The Tonopah High School would potentially lose 24 students, reducing the total enrollment to 145

and the average classroom size to 17.2.

It is assumed that the many of the 86 TTR employees who own their houses would place them on the market if the Flight Operations Program were to be transferred, reducing the number of owner-occupied units to a level below 351. Exactly how far below this level is difficult to assess, because if all 86 houses were placed on the market it would amount to more than 20 percent of the houses in a town where a primary employer had stopped operations. As compared to the 35 average annual homes for sale in Tonopah over the past 6 years, the addition of 86 homes for sale would increase this annual statistic by 245 percent, representing a potentially significant impact on the housing market. Housing prices would likely drop and some houses could continue to be occupied by the owners or sit vacant.

Of the 549 renter-occupied residences in the area, it is assumed that the 24 TTR employees who rent their residences would not renew their leases, reducing the number of renter-occupied units to 525 as shown in Table 5.15-10 and Figure 5.15-4. This would represent only 4.4 percent of the total number of units for rent within the Tonopah area, and would not result in a significant impact on the rental market.

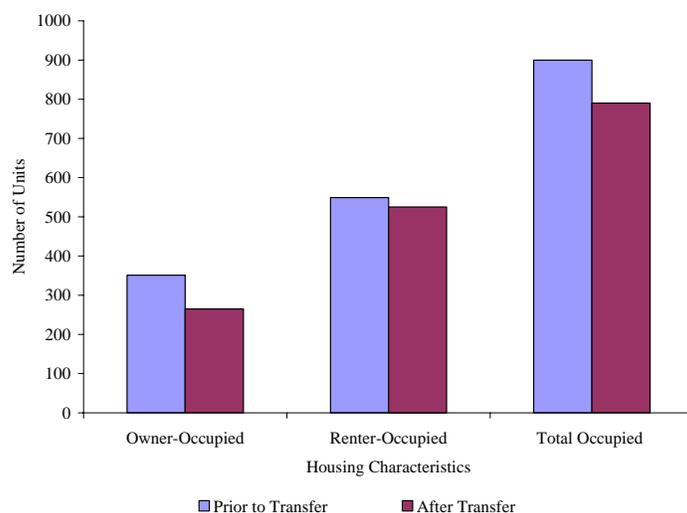


Figure 5.15-4 — Potential Housing Changes with Transfer of Operations from TTR

5.15.4.3 *Potential D&D Requirements*

The TTR contains approximately 105 major buildings, with a total area of 161,505 square feet of space. The TTR facilities also include approximately 90 smaller buildings, including towers and small sheds. These structures encompass an additional 18,000 square feet. If flight testing were transferred to either WSMR or NTS, NNSA would undertake D&D of approximately 180,000 total square feet (structures) and remediation of contaminated soils surrounding these structures. As detailed in Section 4.4.6.2.1, remediation of contamination resulting from former weapons destructions tests is ongoing at TTR and not scheduled to be completed until 2022. If flight testing were transferred, this remediation would already be completed and the required D&D would be limited to the existing structures and some small amount of immediately co-located soils. It is estimated that the D&D required by the closure of TTR would be a two year project

requiring a total of close to 300,000 worker hours to complete, along with the impacts shown on Table 5.15-12. D&D of the facilities and cleanup of the site would have to meet the standards of the Air Force, which is the landlord, and the State of Nevada. Non-hazardous waste generated by this project would be disposed of on-site. LLW and hazardous waste generated by this effort would be transported to NTS or a commercial facility for treatment and disposal.

Table 5.15-12 — D&D Associated with Transfer of Flight Testing from TTR

D&D Required	D&D Amount
Soil D&D (yd ³)	20,000
LLW generated (yd ³)	500
Non-Hazardous waste (yd ³)	45,619
Hazardous waste (yd ³)	7,462
Debris/Earth moving equip.(dozers/trucks)	5/10
D&D Related employment	
Peak	75
Total worker hours	299,300

Source: NNSA 2007.

5.15.5 Transfer to NTS Alternative

This alternative would entail the termination of flight test operations at TTR and the relocation to NTS. Existing communications systems and empty storage and office facilities could easily be adapted to allow for the JTA Flight Test Program.

5.15.5.1 Construction Requirements

As in a transfer to WSMR, a target area would have to be constructed and a few enhancements to Building CP-40 (existing building at NTS) would have to be made. Tables 5.15-13 and 5.15-14 present the requirements for construction and operation of Flight Test Operations at NTS.

Table 5.15-13 — Construction Requirements for NTS

Requirements	Consumption/Use
Peak Electrical Energy (KW-hr)	40,000
Diesel Generators (Yes or No)	Yes
Concrete (yds ³)	800
Steel (tons)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Lay down Area Size	Two 11.5 acre sites
Parking Lots	N/A
Total employment (worker years)	37
Peak employment (workers)	30
Construction period	15 months
Hazardous	
Liquid (gal)	0
Solid (yds ³)	0

Table 5.15-13 — Construction Requirements for NTS (continued)

Requirements	Consumption/Use
Non-hazardous (Sanitary)	
Liquid (gal)	0
Solid (yds ³)	6,000
Non-hazardous (Other)	
Liquid (gal)	0
Solid (yds ³)	45

Source: NNSA 2007.

Table 5.15-14 — Operating Requirements for NTS

Annual Operations	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595MWh
Peak electrical demand (MWe)	812MWe
Fuel usage (gal or cubic yd)	32,150 gallons
Other process gas (N, Ar, etc.)	480cu.ft.
Diesel generators	44 (about 20 per test)
Water (Yearly for entire range including AF)	6 million gallons
Steam (tons)	0
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Chemical use	0
Maximum inventory of fissile material/throughput	0
Waste Generated	
Hazardous	
Liquid (gal.)	35
Solid (yds ³)	<1
Non-hazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Non-hazardous (Other)	
Liquid (gal.)	7000
Solid (yds ³)	15

Source: NNSA 2007.

The required construction is a small project and it is not anticipated that the employment of 30 construction workers over a 15-month period would place any drain on the existing labor pool of the area.

During flight test operations, the primary noise would be generated by aircraft flying over the NTS target drop areas. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to those employed by NTS. These individuals would not likely even be exposed to any high levels of noise as they are remotely located and not in proximity to the actual drop target areas. In addition, these tests are not likely to result in any adverse effect on sensitive wildlife species or their habitats.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased flights at NTS as a result of NNSA conducting flight tests. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are remotely located from the flightpath of the aircraft. The public would not be allowed access to those areas on NTS where flight test operations would occur; in fact, for safety reasons, such areas would be cleared of all personnel and closely monitored so as to exclude any access during such tests. Those areas of NTS where the public is allowed access would be sufficiently remote that the public probably would not perceive the presence of the aircraft, at all. Because no significant off-site health risks are associated with the flight test operations, no environmental justice impacts are expected.

Sensitive wildlife species are unlikely to be adversely affected by the aircraft noise. NTS has conducted large HE test detonations on a regular basis, for a number of years. There has been no apparent, adverse impacts to any species associated with these tests.

5.15.6 Transportation

Due to the proximity of all alternative sites, the transportation requirements are similar for all three action alternatives. All transportation of JTAs is conducted in NNSA Safeguards Transporters operated by the Office of Secure Transportation, based in Albuquerque, New Mexico. Vehicles are state-of-the-art and all personnel associated with such shipments are highly trained both initially and on an ongoing basis. Shipments by such transport have an exemplary safety record. Although routes have been determined and environmental impacts evaluated for such transport, specifics of this information are not available to the public.

5.15.6.1 *Removal of Test Weapon from the Stockpile*

In order to conduct tests at TTR, weapons are removed from the stockpile at various locations across the U.S. and abroad and transported to Pantex. Once the weapon has been inspected, the SNM is removed from the weapon, and instrumentation is added to it, the weapon becomes a JTA. Transportation required to support this activity would be the same as for existing operations and would be the same for all alternatives.

5.15.6.2 *Transport of JTAs to Air Force Installations*

Once the JTAs have been inspected and certified at Pantex, they are transported to U. S. Air Force (USAF) installations on NNSA's fleet of SGT vehicles, and then loaded onto test aircraft. The specific locations of the USAF installations use to support this operation are not relevant for release. Transportation required to support this activity would be the same as for existing operations and would be the same for all alternatives.

5.15.6.3 *Transport of JTAs from Test Site to Pantex*

Once the JTA test has been completed, the JTA is returned to Pantex for post testing analysis and disposition. For fly-over tests, this transportation route would be from the Air Force installation from which the aircraft originated to Pantex. Transportation required to support this activity

would be the same for existing operations as it would be for all alternatives for fly over tests. Dropped JTAs would be transported from the test facility to Pantex. Transportation required to support this activity would be site specific and vary for each alternative site. The No Action Alternative, the TTR Upgrade Alternatives, and the Relocation to NTS would all be similar, since the distances and routes to Pantex are about the same for TTR and NTS. The transportation route from the Relocation to the WSMR Alternative is less than half of the other two alternatives.

5.16 PROJECT-SPECIFIC ANALYSIS OF HYDRODYNAMIC TESTING

Hydrodynamic testing (hydrotesting) is the execution of high-explosive-driven experiments to assess the performance and safety of nuclear weapons. Hydrodynamic tests, except for some underground sub-critical experiments at the NTS, do not normally employ fissile materials, but must not preclude the potential to do so should the stewardship mission require it. The alternatives for meeting the goal of the NHP are explained in the section 3.11. These alternatives are: (1) the No Action Alternative, which would continue operations at the existing facilities of LANL, LLNL, NTS, SNL, and Pantex; (2) an alternative to downsize the number of hydrotesting facilities at LANL, LLNL, NTS, SNL, and Pantex; (3) an alternative to consolidate hydrotesting activities at LANL; and (4) a next generation alternative to consolidate all hydrotesting activities at the NTS.

5.16.1 No Action Alternative

This alternative entails the continued operation of the hydrotesting facilities and missions currently being conducted at five weapons complex sites: LLNL, LANL, NTS, Sandia, and Pantex. Under the No Action Alternative, NNSA would continue to conduct hydrotesting at these facilities and sites. There would be no construction impacts associated with this alternative. The impacts of the No Action Alternative are described in the relevant sections of the Affected Environment Chapter of this SPEIS (Chapter 4). The impacts described in that chapter would continue under the No Action Alternative. Additionally, more details regarding the No Action Alternative for hydrotesting is contained in Section 3.11.1, and in Appendix A. The major No Action Alternative facilities are summarized below.

5.16.1.1 *Hydrotesting Facilities at Lawrence Livermore National Laboratory*

LLNL's Site 300 has been used since 1955 to perform experiments that measure variables important to nuclear weapon safety, conventional ordnance designs, and possible accidents (such as fires) involving explosives. The facilities used for Site 300 firing activities consist of four firing point complexes; the 801, 812, 850, and 851, and several other associated smaller support facilities. Of particular note is the Contained Firing Facility (CFF) located at the 801 complex. There are 30 employees at LLNL's hydrodynamic test facilities. 30 employees are at the 801 complex, of which 10 of these employees are at the CFF.

5.16.1.2 *Hydrotesting Facilities at Los Alamos National Laboratory*

The primary hydrotesting facility at LANL is the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT), which has an intense high-resolution, dual-machine radiographic capability. Some other smaller firing sites at LANL support primarily HE R&D and Work For Others but can also be used for limited classes of hydro-like experiments. LANL hydrodynamic testing has 34 employees of which 29 are at the DARHT.

5.16.1.3 *Hydrotesting Facilities at the Nevada Test Site*

The NTS has several facilities which are utilized for very large explosion-type experiments. The

Big Explosives Experimental Facility (BEEF) is one such facility at NTS which is the only NNSA facility where some experiments, due to the amount of HE utilized, can be conducted. U1a is an underground facility that would continue to conduct HE/Pu tests. NTS has three additional, smaller outdoor facilities. No employees are associated with these facilities.

5.16.1.4 *Hydrotesting Facilities at Sandia National Laboratory and Pantex*

Smaller hydrotesting facilities are located at Pantex, near Amarillo, Texas, and Sandia National Laboratory (SNL or Sandia) in Albuquerque, New Mexico. Both Pantex and Sandia have several outside blasting table facilities which are primarily used for HE R&D activities and can only handle small hydrotesting experiments. No employees are associated with these facilities.

5.16.2 **Reduce-in-Place Alternative**

This option would continue hydrotest activities by, consolidating LLNL activities at Building 801 Complex in the CFF, consolidating LANL activities at the DARHT, closing the smaller facilities at both of these sites, and moving tests requiring larger amounts of HE to the BEEF, at NTS. This alternative would entail the closure of a number of facilities both at LLNL and LANL. It would also entail the closure of all hydrotesting facilities at Pantex and SNL. It should be noted that some of the facilities used for hydrotesting at SNL are shared facilities with the HE R&D Program and that any decisions to close these facilities would require a joint decision on the part of both programs. NTS would close all of its facilities, except for BEEF.

5.16.2.1 *LLNL Impacts*

At LLNL, this would entail the closing of the Building 812 Complex and the Building 850 Complex. The Building 851 Complex would either be closed or turned over to other non-NNSA programs. The associated support facilities would probably not be impacted by this alternative as they are smaller, multi-purpose facilities which could be of use to other program activities. This would entail the D&D and disposal of an estimated 3,200 cubic yards of hardened concrete, steel and other non-hazardous material, and an estimated 9,200 cubic yards of soils which would require D&D. It is estimated that emissions would be reduced by approximately 20 percent, and waste generation reduced by approximately 10 percent. The majority of the reductions in air emissions would be a result of the closing of the smaller outdoor facilities and the increased utilization of the enclosed CFF-like facility. There would be a loss of 26 jobs. These impacts are presented in Table 5.16-1. Buildings 850, and 851A at Site 300 have been determined eligible for listing in the NRHP and would be affected by decommissioning. Prior to D&D activities, these buildings would be recorded and photodocumented to accepted standards. A thorough review would be conducted to assure that there would be no impacts to any cultural or archeological resources.

5.16.2.2 *LANL Impacts*

Under this alternative LANL would close all hydrotesting facilities except for the DARHT, which has an intense high-resolution, dual-machine radiographic capability— and a few of the other smaller firing sites at LANL, which support primarily HE R&D and Work For Others but

can also be used for limited classes of hydro-like experiments. There would be a loss of 5 jobs. This would entail D&D and disposal of an estimated 8,500 cubic yards of hardened concrete, steel and other non-hazardous material and an estimated 17,000 cubic feet of soil which would have to undergo D&D. This alternative would result in reduced air emissions of up to 40 percent and reduce waste generation by approximately 10 percent. These impacts are presented in Table 5.16-1.

5.16.2.3 *Pantex and Sandia Impacts*

At Pantex, at least six outdoor burn areas would be closed. At SNL, at least three outdoor burn areas would be closed. It should be noted that some of the facilities used for hydrotesting at SNL are shared facilities with the HE R&D Program and that any decisions to close these facilities would require a joint decision on the part of both programs. There would be no job loss as there are no employees assigned to these facilities at Pantex and SNL/NM. These are all small facilities and could entail the D&D and disposal of an estimated 2,200 cubic yards of hardened concrete, steel and other non-hazardous materials, and generate an estimated 4,000 cubic feet of contaminated soil which would then have to undergo D&D. Because special nuclear materials were used in past tests, this would entail the generation of small levels of TRU and Low Level wastes. These impacts are presented in Table 5.16-1.

Table 5.16-1 — Impacts of Facility Closures for the Downsize-In-Place Alternative

	LLNL	LANL	Pantex & SNL	NTS	TOTAL
Employment loss	26	5	0	0	31
Soil D&D (yds ³)	9,200	17,000	4,000	2,000	32,200
LLW generated (yds ³)	1,350	28,112	10,000	5,000	44,462
TRU generated (yds ³)	0	0	20	10	30
MLLW generated (yds ³)	0	0	20	10	30
Non-Hazardous waste					
Liquid (gal)	13,165	0	0	10	13,175
Solid (yds ³)	3113	8,487	2,200	1,000	16,246
Hazardous Waste					
Liquid (gal)	220	0	0	0	220
Solid (yds ³)	317	492	80	45	934
Employment					
peak	20	107	20	12	159
total worker-years	45	200	45	23	313

Source: NNSA 2007.

5.16.2.4 *NTS Impacts*

BEEF and U1a would remain open, but NTS would close the smaller outdoor facilities. This would entail the generation, D&D, and disposal of an estimated 1,000 cubic feet of hardened concrete, steel and other non-hazardous material, and the generation of an estimated 2,000 cubic yards of contaminated soil which would require D&D. Because special nuclear materials were used in past tests, it is expected that this D&D would generate small quantities of TRU waste and low level wastes. Reductions in air emissions and waste generation would be small since the facilities eliminated by this alternative are small in comparison to the BEEF and U1a, which would continue to operate. These impacts are presented in Table 5.16-1.

5.16.2.5 *Summary of Impacts for the Reduce-in-Place Alternative*

Closure of close to a dozen facilities would entail a substantial clean-up and D&D effort. Although not heavily contaminated, these facilities all have a substantial amount of reinforced concrete and steel structures designed to withstand sizeable HE explosions. There would be a total job loss of 31 (26 at LLNL and 5 at LANL). It is estimated that at least 10,000 gross square feet of hardened concrete and steel structures and soil immediately surrounding these structures would have to be dismantled, razed, dug up, undergo D&D, and disposed of. Table 5.16-1 presents the cumulative impacts of the Reduce-In-Place Alternative.

After these closures, the Hydrotesting Program would operate the DARHT and a few support facilities at LANL, the CFF and Building Complex 801 at LLNL, and the BEEF and U1a at NTS. The option of using facilities maintained by the HE R&D Program would continue to exist for smaller experiments, under this alternative.

5.16.3 **Consolidation at LANL Alternative**

This alternative would consolidate all large-scale hydrotesting at the single location of LANL. Since LLNL and NTS both have required capabilities not presently at LANL, this alternative would entail maintaining the CFF at the Building 801 Complex and its associated support facilities at LLNL until these capabilities could be established at LANL. In addition, it is not anticipated that it would be possible to transfer the capability to conduct Hydrotesting experiments requiring very large amounts of HE, presently being conducted at the BEEF, at NTS, to LANL. Accordingly, under a consolidation of hydrotest capabilities at LANL, the BEEF would still be required to maintain its operational status at NTS.

This alternative would entail a large amount of clean-up and D&D associated with the closure of all hydrotesting facilities at LLNL, SNL, NTS (except for BEEF and U1a), Pantex, and a substantial number of facilities at LANL. It is estimated that this alternative would entail the closure and clean-up of close to 17,000 square feet of hardened concrete and steel structures designed to withstand very large HE explosions.

5.16.3.1 *LLNL Impacts*

This alternative would entail the closure of all of the LLNL hydrotesting facilities. This would result in the loss of 56 jobs at LLNL. The CFF would remain in operation until a new CFF-like replacement facility could be constructed at LANL. Once this CFF-like replacement facility was operational at LANL, the CFF would be closed and undergo D&D. This would result in the D&D and closure of a substantial number of facilities at LLNL. It is estimated that this would generate 15,700 cubic yards of hardened concrete, steel and other non-hazardous material, and that an estimated 25,500 cubic yards of soil would be required to undergo D&D. In addition, quantities of LLW and hazardous waste would be generated. Because all hydrotesting would cease after a replacement CFF was constructed and in operation at LANL air emissions and waste generation attributable to this activity would decrease to zero. These impacts are presented in Table 5.16-2. Five buildings and two districts at the Livermore Site and Site 300 have been determined eligible for listing in the NRHP and could be affected by

decommissioning. Prior to D&D activities, these buildings would be recorded and photodocumented to accepted standards. A thorough review would be conducted to assure that there would be no impacts to any cultural or archeological resources.

5.16.3.2 *LANL Impacts*

Under this alternative, LANL would close the same facilities as it would for the Downsize-In-Place Alternative, the impacts of which are discussed in Section 5.16.2. As discussed in the LLNL section, above, this alternative could require the construction of a new CFF-like facility at LANL. In this process it would make sense to collocate LANL's distant support facilities (storage, staging and assembly) during the construction of such a new facility. The construction of such a facility would involve a two to three year process resulting in an 8,000 to 12,000 square foot primary structure, with two to three smaller support buildings, situated on a five to seven acre site. There would be an increase of 10 employees associated with the operation of the new CFF-like facility. With the five jobs lost through the closing of the smaller facilities at LANL, this would result in a net gain of 5 jobs. These impacts are presented in Table 5.16-2. The impacts associated with the construction and operation of a CFF-like facility, at LANL, are shown in Table 5.16.3.

5.16.3.3 *Pantex and Sandia Impacts*

The impacts to Pantex and Sandia would be the same as for the Downsize-In-Place Alternative, the impacts of which are detailed in Section 5.16.2.

5.16.3.4 *NTS Impacts*

The impacts to NTS would be the same for this alternative as they would be for the Downsize-In-Place Alternative, the impacts of which are detailed in Section 5.16.2.

5.16.3.5 *Consolidated Impacts*

The Consolidation at LANL Alternative would close all hydrotesting facilities at Pantex, Sandia, and LLNL, and all but the BEEF, at NTS. The CFF would remain open, at LLNL, until a replacement CFF could be constructed and brought on-line at LANL. Table 5.16-2 presents the impacts associated with the closing of facilities required by the Consolidation at LANL Alternative, and Table 5.16-3 presents the impacts associated with the construction of a replacement CFF, at LANL and the operation of facilities resulting from the Consolidation at LANL Alternative.

Table 5.16-2 — Impacts of Facility Closures for the LANL Consolidation Alternative

	LLNL	LANL	Pantex & SNL	NTS	TOTAL
Employment changes	-56	+ 5	0	0	-51
Soil D&D (yds ³)	25,500	17,000	4,000	2,000	48,000
LLW generated					
Liquid (gal)	40,000		10,000	5,000	55,000
Solid (yds ³)	100	0	20	12	130
TRU generated (yds ³)	0	0	20	10	30
MLLW generated (yds ³)	0	0	0	0	0
Non-Hazardous waste					
Liquid (gal)	13,165	0	0	0	13,165
Solid (cubic yards)	15,692	8,487	2,200	1,000	27,379
Hazardous Waste					
Liquid (gal)	517	0	0	0	517
Solid (cubic yards)	15,270	492	80	45	15,887
D&D Related Employment					
peak	120	107	20	12	259
total worker-years	240	200	45	23	508

Source: NNSA 2007.

Table 5.16-3 — Construction and Operation Impacts of a CFF-Like Facility at LANL

Construction	Consumption/Use
Electric use MWh/yr	150
Diesel generators number & size	
Concrete (yds ³)	5,000
Steel (tons)	2,500
Water (gallons)	200,000
Land (acres)	5 to 7
Laydown area (acres)	3
Parking lots (acres)	2
Employment	
Total (worker years)	60
Peak (workers)	50
Construction period	24 months
Waste	
Hazardous (yds ³)	0
Non-hazardous	0
Liquid	22,000
Solid (yds ³)	1,300
Electricity (MWh/yr)	14
Water (gal/yr)	40,000
Footprint Acres	0.12
Employees	10
Explosives	234
Lbs/yr	
DU lbs/yr	207
Beryllium lbs/yr	4
LLW	
Liquid (gal)	9,000

**Table 5.16-3 — Construction and Operation Impacts of a CFF-Like Facility at LANL
 (continued)**

Operation	Consumption/Use
Solid (yd ³)	64
MLLW	
Liquid (gal)	0
Solid (kg/yr)	7,200
TRU Waste	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous Waste	
Liquid (gal)	569,713
Solid (yd ³)	2.8
Non Hazardous Waste	
Liquid (gal)	2,412
Solid (yd ³)	0.1
NOx emissions (tons/yr)	0.0271
CO emissions (tons/yr)	0.0167
SOx emissions (tons/yr)	0.0018

Source: NNSA 2007.

In addition, this alternative could require the construction of a new containment facility at LANL. In this process it may be possible to locate support facilities (storage, staging and assembly) at the facility. The construction of such a facility would involve a two to three year process resulting in a primary containment structure, with possibly two to three smaller support buildings situated at an existing firing site. Options for sites include TA-15-306 and TA-36-12 as well as DARHT. Construction at TA-15-306 would present no conflicts as no experimental program is using that site at this time. Table 5.16-3, which is based on the construction and operation of CFF, gives an idea of what the impacts associated with a new facility capable of performing the experiments presently being conducted at CFF would be. Although the new facility would probably be smaller than the existing CFF, it would accommodate the co-location of LANL facilities presently located at other TA locations.

Construction impacts required for a new CFF like facility would be expected to disturb from 5 to 7 acres at one of two potential sites on TA-15, or at a third potential site on TA-36. No construction would be conducted within a floodplain or a wetland. The construction area would be sited to avoid impacts to prehistoric and Homestead Era cultural resources and to sensitive habitat areas. Should previously unknown cultural resources be discovered during construction, work would cease in that area until LANL’s cultural resources specialists could review the evidence, identify procedures for working in the vicinity of the cultural resources, and initiate any necessary consultations with Federal, state, and tribal entities.

The construction or post-construction landscaping could disturb some potential release sites (PSRs). When possible, PRSs would be avoided. If disturbance of PRSs were necessary, soils from PRSs would be returned to the excavated area after disturbance when feasible or would be characterized and treated or disposed of appropriately. Should a previously unknown or suspect disposal site be disclosed during subsurface construction work, work would cease until LANL’s Project staff could review the site and would identify appropriate procedures for working within that site area.

The new CFF-like facility would be constructed in accordance with seismic criteria in current building codes. This facility would not be constructed over known faults or within 50 feet of known seismic faults active since the beginning of the Holocene (approximately 100,000 years ago). The new facility would be designed according to general design criteria for a new facility (LANL 1999a), with a minimum lifetime expectancy of 30 years of operation.

The newly constructed facility would be designed with safety and security features appropriate to the work to be performed in that building. These features could include air handling and filtration systems, standby emergency generators, alarms, security equipment, monitoring equipment, emergency lighting, and similar kinds of equipment and systems. Onsite utilities (gas, water, sewer, electric, communications, computer networks) at the Two-Mile Mesa Complex are currently being reconfigured and upgraded for efficient distribution to new buildings associated with the DX Consolidation.

LANL is considered a major air emission source under the State of New Mexico Operating Permit program because it emits more than 100 tons per year of certain non-radioactive substances. Specifically, LANL is a major source of nitrogen oxides, emitted primarily from the TA-3 steam plant boilers. Combustion units are the primary point sources of criteria pollutants (nitrogen oxides, sulfur oxides, particulate matter, and carbon monoxide) emitted at LANL. The new building would be located in Los Alamos County, which is in attainment with NAAQS and all NMAAQs. The ambient air quality in and around LANL meets all EPA and DOE standards for protecting the public and workers (LANL 2001a).

Clearing or excavation activities during site construction and during the D&D of the closed facilities would have the potential to generate dust. Dust suppression would be conducted as necessary using BACMs (such as water spraying or use of soil tackifiers) to minimize the generation of dust during construction activities. The application of specific BACMs would be determined on a case-by-case basis. Construction activities would be expected to produce only temporary and localized air emissions and the effects on air quality would also be temporary and localized. There would be no long-term degradation of regional air quality.

Work at both the new facility construction site and the D&D sites would require the use of heavy equipment such as cranes, forklifts, backhoes, cement trucks, and other similar construction equipment. The work would also require the use of a variety of hand tools and equipment. Noise at these sites would be audible primarily to the involved workers. Involved site workers would be required to wear appropriate PPE, including hearing protection. During the construction phase, two acres of temporary parking lots, three acres of laydown yards, and construction access roads would be required. At the completion of the construction process these areas would be reclaimed or used for permanent parking. Additional laydown and temporary storage yards would be required at the D&D sites.

Engineering BMPs would be implemented as part of a construction Storm Water Pollution Prevention Plan required by the NPDES General Permit. These BMPs may include but not be limited to, the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction. After construction, loose soil and debris that was not part of the landscaping design would be removed from the area.

Foot and vehicular traffic would be minimally affected for short periods during delivery of construction materials and by the addition of construction workers in the area. Approximately 50 construction workers would be onsite during the peak construction period, adding an estimated additional 40 personal vehicles to local roadways during the construction period and another 20 construction vehicles (such as dump trucks, bulldozers, drill rigs, cranes, and cement mixer trucks). These vehicles would operate primarily during the daylight hours and could be left onsite over night. Temporary construction lighting would be directed toward the work area. An additional 107 construction workers with an additional 90 personal vehicles would be added to the local roadways for the 24 months of the D&D activities. There would also be an additional 30 to 35 construction vehicles to enable the D&D activities to be conducted.

There would be no effects to sensitive species or their critical habitat due to construction or D&D activities. Small mammals and birds at the construction site or at the temporary storage yards for D&D activities would be temporarily displaced. These would be expected to return to the general area after construction and D&D activities were completed. Game animal migration is not likely to be altered.

The new building or D&D activities would not entail any direct effects on floodplains or wetlands since there are none within the areas proposed for construction or demolition. BMPs would be established so that there would be no indirect effects from construction.

During the construction and D&D period, there would be no increase in the number of LANL employees as a result of this project. The estimated additional 50 peak construction jobs and the 107 D&D jobs would be filled by the existing employees in the regional work force, which includes mostly Los Alamos, Rio Arriba, and Santa Fe Counties. Because these temporary jobs would be filled by existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in Los Alamos or the region. There would be short-term benefits during construction and D&D process in the form of jobs and procurement. Most materials would be purchased in New Mexico.

Construction and D&D activities would not be expected to have any adverse health effects on LANL workers or the public. NNSA and LANL workers would perform site inspections and monitor construction activities during periods of peak activity. Applicable safety and health training and monitoring, PPE, and work-site hazard controls would be required for these workers. The construction is not expected to result in an adverse effect on the health of construction workers. Approximately 157 peak-period (50 construction and 107 D&D) workers. Approximately 60 (20 construction and 40 D&D) of these workers would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and building construction.

An estimate of the potential number of fatalities that might occur from construction-related activities was derived from recent risk rates of occupational fatalities for all industries. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). If the peak construction period lasts for the entire one year construction period, no deaths (0.0049) would be expected for the estimated 157 (50 construction and 107 D&D) onsite workers from construction nor demolition-related activities that include falls, exposure to harmful substances,

fires and explosions, transportation incidents, and being struck by objects, equipment, or projectiles.

The new construction and the D&D of the facilities to be closed would generate non-hazardous solid waste that would be disposed of at the Los Alamos Country Landfill, its replacement facility, or other New Mexico solid waste landfills in accordance with the waste minimization plan. Construction solid waste is estimated at 1,300 cubic yards and the D&D activities is expected to generate 13,165 cubic yards of soil and 15,270 cubic yards of solid waste. No new radioactive or other wastewater or hazardous waste streams would be generated.

Water quality in this area would not be affected by the construction, D&D or the operation of the new facility. The new facility would be designed using pollution prevention processes that lead to minimal waste generation. No new outfalls, wastewater, or hazardous waste streams would be created by implementing the Proposed Action. Water quality would not change as a result of operations of the new facility.

During operations, there would be only a 10 person increase in the number of LANL employees as a result of this project. Compared to the existing workforce at LANL, this project would not have a long-term effect on socioeconomic conditions in north-central New Mexico.

During operations, the primary noise generated by air blast waves and ground vibration impacts associated with high explosives tests, would be minimized by the containment vessel of the new facility. It is not expected that any incremental noise would be detectable outside of the new CFF-like facility. Accordingly, there would not be any adverse effect on non-involved workers, the public, or sensitive wildlife species or their habitats.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased explosions resulting from hydrotesting. Such testing currently occurs at LANL both in the Hydrotesting Program and in the HE R&D Program. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control their entry into explosives firing site detonation points. The public is not allowed within the fenced TAs that have firing sites, and noise levels produced by explosives tests are sufficiently reduced at locations where the public would be present to preclude hearing damage.

Such tests would not be expected to adversely affect offsite sensitive receptors (such as those at Bandelier National Monument or at White Rock). Noises heard at that distance would be similar to thunder in their intensity, and air blast and ground vibrations are not expected to be present outside LANL at intensities great enough to adversely affect real properties. Sensitive wildlife species are unlikely to be adversely affected by “thunder-like” explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average lightning event areas and their continued presence on the LANL site over the past 10 years. In fact, the continued thriving of resident and long-term migratory populations of these sensitive species on the LANL site indicates that the level of noise generated by explosives testing under the No Action Alternative is at least tolerable to these particular species (LANL 2007).

The reasonably foreseeable hydrotest accident scenarios associated with a CFF-like facility, which could produce the greatest potential impacts, are the following:

- Case 1: Accidental detonation of a test of a 60-kg charge of explosives at an outdoor firing table.
- Case 2: Accidental detonation of a 60-kg explosives test which could release up to 20 mg (200 curies) of tritium with dispersal through an unsecured blast door in the CFF or at the new CFF-like facility constructed to replace the CFF.

In each case, the involved workers would probably be fatally injured from blast effects due to peak overpressure and debris, but there would be no injury offsite to members of the general public. No damage to current buildings offsite or in other areas of LANL would be expected from such accidents. Potential impacts from the two accident scenarios are summarized in Table 5.16-4.

Table 5.16-4 — Potential Impacts from Accidents at a CFF-like Facility

Scenario	Involved Worker at 30 meters (rem)	Uninvolved Worker at 50 meters (rem)	Offsite Member of Public at 1,340 meters (mrem)	Excess LCFs, Offsite Member of the Public
Case 1	0	0	0	0
Case 2	0.026	0.015	1.1×10^{-4}	5.5×10^{-8}

Source: DOE 1996d.

These projected radiation doses are lower than DOE guideline limits for workers and for the general public; thus the greatest effects would be fatalities or injuries to workers due to primary blast effects. Because no significant off-site health risks are associated with the operations of a CFF-like facility, no environmental justice impacts are expected.

5.16.4 Consolidation at NTS

Moving hydrodynamic testing to NTS would consolidate the capabilities that currently exist at LANL, LLNL, SNL, Pantex, and NTS to one location and provide the next generation capabilities required to maintain the nuclear deterrent in the 2020 to 2050 timeframe. This potential alternative provides the maximum consolidation with the greatest number of facility closures. However, both DARHT at LANL, and CFF at LLNL, are relatively new facilities that would be expensive to replace in the near term. Consequently, a decision on a next generation hydrotesting facility probably would be premature at this time. However, the alternative is analyzed in this section for completeness.

To the extent the potential environmental impacts of the next generation hydrodynamic test facility can be forecast at this time, a significant part of the public and worker exposures and impacts due to normal operation of the next generation hydrodynamic test facility would be those related to the conduct of hydrodynamic tests and dynamic experiments at the facility. While the impacts are inherently site-dependent, the hydrodynamic tests and dynamic experiments themselves can be anticipated to be similar to such activities as analyzed at DARHT in the DARHT Facility EIS (DOE 1995a); therefore the DARHT Facility impacts are summarized here for reference. Table 5.16-5 presents the construction and operational requirements for such a facility at NTS.

Table 5.16-5 — Construction and Operational Requirements - Consolidation at NTS

Construction	Consumption/Use
Electric use MWh/yr	365
Diesel generators number & size	
Concrete (yds ³)	16,000
Steel (tons)	1,600
Water (gallons)	350,000
Land (acres)	17
Laydown area (acres)	3.5
Parking lots (acres)	2
Employment	
Total (worker years)	175
Peak (workers)	40
Construction period	24 months
Non-hazardous	0
Liquid	22,000
Solid (yds ³)	1,300
Operation	Consumption/Use
Electricity (MWh/yr)	2,520
Water (gal/yr)	100,000
Footprint Acres	17
Employees	29
Avg. Annual dose (rem)	0.097
Maximum worker dose (mrem)	1.84
Explosives (lbs/yr)	3,300
Depleted U (lbs/yr)	720
Lead (lbs/yr)	14
LLW	
Liquid (gal)	0
Solid (yd ³)	12,500
TRU Waste	
Liquid (gal)	0
Solid (tons)	2
Hazardous Waste	
Liquid (gal)	2,500
Solid (yd ³)	310
Non Hazardous Waste	
Liquid (gal)	0
Solid (ft ³)	9,400
NOx emissions (lbs/yr)	31.5
CO emissions (lbs/yr)	93
SOx emissions (lbs/yr)	0.42

Source: NNSA 2007.

Population-based impacts may be expected to be lower at NTS. The normal radiological impacts of the DARHT Facility to the annual collective dose to the population residing within 50 miles would be expected to be 0.57 person-rem. Latent cancer fatalities at this dose would not be expected. The maximum annual dose to any nearby resident would be about 2×10^{-5} rem with a corresponding latent cancer fatality of 1×10^{-8} . The average annual dose to individual workers would probably not exceed 0.02 rem with a corresponding maximum probability of latent cancer fatality of 8×10^{-6} . Routine exposure to chemicals is expected to be low. The likelihood of a

severe facility accident occurring would be very small. The population dose resulting from acute accidental release in the bounding facility accident, accidental uncontained detonation of a plutonium-containing assembly, evaluated on a what-if basis (related DOE safety studies indicate a probability of less than 10^{-6} per year), would be expected to range from 9,000 to 24,000 person-rem in the maximally exposed sector, based on 50th or 95th percentile atmospheric dispersion factors, respectively. Five to twelve latent cancer fatalities would be expected from this dose. Population dose from acute accidental plutonium release from a containment breach was estimated to range from 210 to 560 person-rem, for which no latent cancer fatalities would be expected. For workers, the likelihood of a severe accident occurring and resulting in death would be minimized by a comprehensive training program and an explosives safety program.

Because the concept of this facility has not developed to the point where it is even possible to define the structure size or type, it is not possible to estimate the specific impacts associated with the construction and operation beyond the general emission concepts discussed above. If this alternative were eventually pursued, the appropriate NEPA environmental impact analysis would be performed at the time data to enable such analysis became available.

In addition to the next generation facility which would be constructed for the consolidation at NTS Alternative, an alternative to also construct a new CFF-like facility at NTS in the 2040 timeframe is also being considered. The impacts associated with the construction and operation of this facility would be similar to the impacts detailed in the LANL Consolidation Alternative (see Section 5.16.3).

5.17 PROJECT-SPECIFIC ANALYSIS OF MAJOR ENVIRONMENTAL TEST FACILITIES

5.17.1 Introduction

This section discusses the environmental impacts which could result from actions supporting the following Alternatives for Major ETFs located at LANL, LLNL, SNL, and NTS.

Major ETF Alternatives
<ul style="list-style-type: none">• No Action — Maintain status quo at each site. All facilities must be maintained, or upgraded to meet current safety and security standards.• Downsize-in-Place — No duplication of capability within a given site, but there may be duplication from site to site - phase out aging and unused facilities.• Consolidate ETF Capabilities at One Site (NTS or SNL) — Entails construction of new facilities at consolidation site. This alternative also includes an option to move LLNL Building 334 ETF capabilities to Pantex.

5.17.2 No Action Alternative

ETFs are currently located at three National Laboratories (SNL, LANL and LLNL) and the NTS. Under the No-Action Alternative, DOE/NNSA would continue to operate the existing ETFs at these four sites at the current levels of activity. Only those upgrades and maintenance required to allow for the current activities would take place. There would be no changes to current resource requirements, waste generation, emissions, infrastructure, or employment. A full description of these ETF facilities at these four sites, along with the operational requirements, may be found in Appendix A.

At LLNL, six small structures at the Thermal Test Facility are currently being demolished and surrounding soils will be regraded to the preexisting state. These facilities have not been included in this analysis, as the project has been on-going for a number of years and is expected to be completed prior to any decisions resulting from this SPEIS.

It should be pointed out that the use of Category I/II SNM is an issue that affects the ETF program. SNL/NM is currently removing its Category I/II SNM, and by the end of 2008 should no longer maintain any Category I/II SNM. After that date, any ETF testing requiring such material at SNL/NM would use it in a “campaign mode” only while the test is being conducted. Special security arrangements will be implemented during the test and the material would be removed and returned to the site it came from after the test is completed. For the actions proposed by the ETF Alternatives, use of Category I/II SNM would be dealt with in a similar manner.

5.17.3 Consolidate-in-Place Alternative

The Consolidate-in-Place Alternative entails the elimination of duplicate activities within a given site, and the closing of unused facilities and facilities which require major upgrades to bring them on-line. This Alternative would entail the closure of the following facilities listed in Table 5.17-1.

Table 5.17-1 — ETF Closures for Consolidate-in-Place Alternative

LANL	LLNL	Sandia National Lab
PIXY with Sled Track	Thermal Test Facility (834 Complex)	Outdoor Centrifuge Complex (8 structures)
Thermo-Conditioning Facility (5 structures)	Building 836 Complex (7 structures)	Auxiliary Hot Cell Facility
	SNL/CA Environmental Test Complex* (4 structures)	Low Dose Gamma Irradiation Facility
		Sandia Pulsed Reactor

* A SNL facility, but impacts are considered at LLNL where the facility is physically located. These buildings would not be demolished and undergo D&D, but would be reused for other purposes.

Source: NNSA 2007.

Unless other customers/sponsors are found for these facilities are found, they will be subject to closure and would require the demolition of more than 27 structures, some of which are hardened concrete and steel structures. Some of the structures are merely sheds and of a light construction material type. Some of these facilities have conducted experiments involving radioactive materials for a number of years and would require additional D&D beyond normal demolition activities. Some soils surrounding the structures would be disturbed and some of these soils might prove be contaminated with radioactive materials and/or hazardous wastes. A complete site assessment would be made at and around each of these facilities prior to any demolition activities.

Demolition and D&D would result in the generation of solid, non-hazardous waste, hazardous wastes, low level radioactive wastes, and potentially some mixed wastes. It is not envisioned that there would be any TRU waste generated as a result of the closure and D&D of facilities associated with this alternative.

In the case of the Sandia Pulsed Reactor if no other customer/sponsor is found, its fuel would be removed and taken to NTS and stored for future use. The buildings it occupies will be D&D. The reactor itself will undergo D&D and be disposed of at NTS as LLW.

In addition to the closing of structures, there would be minor job losses at SNL/NM (16), and at LLNL (6). The potential for 6 job losses at LLNL comes from the closure of the SNL/CA facility. The LLNL and the LANL ETF staff would be unaffected by facility closures, as the work and the tests being conducted at these sites would continue at other ETFs. Because the two facilities at NTS would not be affected by this alternative, they would continue operations, and there would be no impacts.

An assessment of the environmental impacts resulting from the closure and D&D (if needed) was made for each structure which would close as a result of this alternative and is summarized in Table 5.17-2.

Table 5.17-2 — Impacts from ETF Closures for Consolidate in Place Alternative

Facility	Soil (yd ³)	LLW (yd ³)	Solid Waste (yd ³)	Hazardous Waste (yd ³)	Peak Employment	Total Worker Hours	Jobs Lost	Floor Space (ft ²)
LANL	2,849	2,741	2,000	2	40	8,518	0	13,040
LLNL*	100	0	6,374	199	85	44,000	6	17,202
SNL	5,100	37	8,700	42	107	48,880	16	26,235

*Impacts of SNL/Environmental Test Complex are attributed to LLNL as this is physically where the impacts would be incurred.
Source: NNSA 2007.

The potential environmental impacts at LANL, LLNL, SNL/NM, and NTS which could result from the Consolidation-In-Place Alternative are presented below:

5.17.3.1 *Consolidate-in-Place Alternative Impacts at LANL*

The Consolidation-in-Place Alternative would entail the closing and the D&D of the Thermo-Conditioning Facility and PIXY with Sled Track. This would reduce the ETF floor space by 13,040 square feet and leave the K Site ETF and the Weapons Component Test Facility in operation. Closure and D&D of the two facilities at LANL is expected to entail 8,518 total worker hours, involve three large earth movers and six large dump-trucks. These trucks would not be anticipated to add to the traffic congestion on or around LANL. These construction vehicles would not be utilized for off-site runs during either the morning or evening rush hours and would remain on site over night. The peak employment would total 40 construction workers with the average work-force being slightly smaller. This would add another 30 vehicles to the normal commuting traffic but is not expected to impact the existing flow of traffic. It is estimated that the total job would take eleven months to complete.

It is expected that 2,849 cubic yards of soil would have to be excavated. None of this soil is expected to be contaminated with hazardous waste or radioactive materials, but a thorough site characterization would be conducted prior to any soil disturbance and soil would be sampled at regular intervals during the demolition process. Uncontaminated soil would be mounded and protected from the environment and erosion by covering the mounds with either vegetation or tarps. Once the demolition process is completed this soil would be used as landscaping grade material. If some of this soil was determined to be contaminated, it would be treated according to applicable regulatory requirements and then taken to TA-54 for final treatment and disposal. It is expected that 2,741 cubic yards of low level waste will be generated. This waste would consist mainly of equipment, glove-boxes and contaminated concrete. This LLW would be sorted, compacted, and packaged on-site and transported directly to Area G, located in TA-54.

The 2 cubic yards of hazardous waste and any asbestos waste would be shipped off site to a commercially licensed facility in accordance with the requirements of RCRA and TSCA. It is not expected, but if any quantities of mixed waste are generated through this process, they would be packaged, on-site, for transport and taken to Area G of TA-54 for treatment and final disposition. An estimated 2,000 cubic yards of non-hazardous, solid waste would be generated by the demolition of these facilities. This waste would consist primarily of concrete, steel reinforcement, and metal scrap. This waste would be transported to the Los Alamos County Landfill for disposal.

LANL is located within the New Mexico Intrastate AQCR 157. None of the area within LANL and its surrounding counties is designated as nonattainment areas with respect to any of the NAAQS (40 CFR 81.332). The only pollutant of concern resulting from this action would be particulate matter, the emissions of which could exceed the 24-hour limits established by the New Mexico Environmental Improvement Board. Dust suppression measures utilizing water and other standard construction practices would be utilized to minimize this temporary emission.

Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers. Because no significant off-site health risks are associated with the ETF operations, no environmental justice impacts are expected.

All OSHA requirements would be followed and monitored closely and all workers would be required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Los Alamos, Santa Fe, Rio Arriba, Taos, Mora and San Miguel, which constitute the ROI are more than sufficient to support such an action without impinging upon other ongoing activities in the area. There would be no loss of jobs attributable to this action as the ETF program would continue at LANL, and the tests would be conducted at other facilities.

5.17.3.2 *Consolidate-in-Place Alternative Impacts on LLNL*

For LLNL, the Consolidation-in-Place Alternative would entail the closing and the D&D of the Thermal Test Facility and the Building 836 Complex, at Site 300, and the SNL/CA Environmental Test Complex near the Main LLNL Site. This action would reduce the ETF floor space by approximately 17,200 square feet by closing all ETF facilities at LLNL Site 300 and the SNL/CA environmental test complex.¹¹ It is expected this would entail 44,000 total worker hours, involve four large earth movers and 12 large dump-trucks. Peak employment would total 85 construction workers with the average daily work-force being smaller. It is estimated that the total job would take thirty-six months. Construction vehicles would be entering and leaving LLNL during the day, at non-rush hours. The construction vehicles would not operate on the

¹¹ The 58,803 square feet of floorspace at the SNL/CA environmental test complex was not included, as this space could be utilized by other programs.

highways during rush hour times. The workforce would add an estimated additional 60 personal vehicles, but work arrival times and departure times could be staggered to minimize impacts on the existing traffic patterns.

It is expected that only 100 cubic yards of soil would need to be excavated. This soil is not expected to be contaminated, but a thorough site characterization of the buildings and surrounding soils would be done prior to any demolition, and soil would be monitored closely for contaminants throughout the demolition process. Uncontaminated soil would be mounded and protected from the environment and erosion by covering with either vegetation or tarps and then used as landscape grade once the demolition process is completed. No LLW is expected to be generated. The expected 199 cubic yards of hazardous waste and any asbestos waste would be shipped off site to a commercial licensed facility in accordance with the requirements of RCRA and TSCA. It is not expected, but if any quantities of mixed waste were to be generated through this process, it would be packaged, on-site, for transport and taken to the Nevada Test Site for treatment and disposal. 6,374 cubic yards of non-hazardous, solid waste would be generated in the demolition of these structures. This waste would consist mainly of concrete, reinforcement steel, metal scrap and wood. This waste would be transported to the nearby Corral Hollow Sanitary Landfill, for disposal.

LLNL is located within the San Francisco BAAQMD and the SJVUAPCD. This area has been designated a nonattainment area for carbon monoxide, ozone, and particulate matter. LLNL could be required to submit a Risk Analysis Study to the State of California prior to commencing any demolition activities. The pollutant of concern would be particulate matter. Dust suppression measures utilizing the spraying of water and other standard construction practices would be utilized to minimize this temporary emission.

Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers. Because no significant off-site health risks are associated with the ETF operations, no environmental justice impacts are expected.

All OSHA requirements would be followed and monitored closely and all workers would be required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Santa Cruz, Santa Clara, Stanislaus, Tuolumne, and Calaveras which constitute the ROI are more than sufficient to support such an action without impinging upon other ongoing activities in the area. Closure of the SNL/CA Environmental Test Complex would lead to the loss of 6 jobs. This number in relation to the total employment of LLNL, or the region, is not significant enough to have measurable impacts for LLNL or within the ROI.

5.17.3.3 *Consolidate-in-Place Alternative Impacts on SNL*

For SNL, the Consolidate-in-Place Alternative would entail the closing and the D&D of 26,235 square feet of floor space by closing the Sandia Pulsed Reactor Facility, the Low Dose Gamma Irradiation Facility, the Auxiliary Hot Cell Facility, and the Outdoor Centrifuge Complex. This is expected to entail 48,880 total worker hours, involve eight large earth movers and twenty large dump-trucks. These trucks would not be anticipated to add to the traffic congestion on or around SNL. These construction vehicles would remain on site over night. The Peak employment would total 107 construction workers with the average work-force being smaller. This would add another 70 personal vehicles to the normal commuting traffic but is not expected to impact the existing flow of traffic. It is estimated that the total job would take twenty months to complete.

It is expected that 5,100 cubic yards of soil would have to be excavated. Small portions of this soil would probably be contaminated with hazardous wastes. A thorough site characterization would be conducted prior to any soil disturbance. Any quantities of contaminated soil would be taken to SNL's Hazardous Waste Management Facility, where it would be packaged for shipment off site to a commercial RCRA permitted facility. Any asbestos material would be handled in accordance with the requirements of TSCA and be shipped off site to a licensed commercial facility for disposal. Non-contaminated soil would be mounded and protected from the environment by vegetation or tarps and used as landscaping grade once the demolition activities would be completed. An estimated 8,700 cubic feet of non-hazardous waste would be generated by the demolition of these structures. This waste would consist of concrete, steel, plastic, wood, and general refuse. This waste would be transported to the nearby Albuquerque Landfill for disposal.

It is expected that 37 cubic yards of low level waste would be generated. This waste would consist mainly of equipment, and a small quantity of contaminated concrete. This LLW would be taken to TECH Area III, where it would be sorted, compacted, and packaged for shipment to NTS. The estimated 8,700 cubic feet of non-hazardous waste, along with any asbestos waste would likewise be taken to Tech Area III, where it would be sorted and packaged for shipment off site to a commercial RCRA permitted facility or TSCA approved facility. It is estimated that this sorting would generate 42 cubic yards of hazardous waste. It is not expected, but if any quantities of mixed waste were to be generated through this process, they would be packaged at Tech Area III and taken to NTS for treatment and disposal.

Bernalillo County has been designated as a maintenance area under the CAA for CO and PM-10. Prior to any demolition activities, SNL would be required to perform a conformity analysis and obtain a pre-construction permit from the State of New Mexico. Required dust suppression

activities would be determined through this process.

Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers. Because no significant off-site health risks are associated with the ETF operations, no environmental justice impacts are expected.

All OSHA requirements would be followed and monitored closely and all workers would be required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Albuquerque, Valencia, Socorro, Torrance, Cibola and Sandoval, which constitute the ROI are more than sufficient to support such an action without impinging upon other ongoing activities in the area. There would a loss of 16 jobs attributable to this action. This number is small in relation to the total employment of SNL, or the region, and is not significant enough to have measurable impacts within SNL or within the ROI.

5.17.4 Consolidate ETF Capabilities at One Site (NTS or SNL) Alternative

There are two options for the Consolidate all ETF Capabilities at One Site Alternative. One would consolidate existing ETF capabilities to the NTS. This option would close all ETF facilities at LANL, LLNL, and SNL and require construction of new facilities at NTS to replace some of the required capabilities lost through facility closings. The two NTS facilities at the DAF and U1a would remain in operation. The Engineered Test Bay (Building 334) at LLNL and three of the facilities at SNL (considered to be capabilities critical to the continuance of the ETF Program) would remain open until the new replacement facilities could be constructed and begin operation.

A second option would consolidate existing large scale ETF capabilities to SNL. This alternative would close all ETF facilities at LANL and LLNL, but would continue operations of the DAF and U1a facilities at NTS. For this option, the operations conducted in the Engineered Test Bay (Building 334) at LLNL would be transferred to NTS (as discussed above), or transferred to Pantex, as discussed in Section 5.17.4.3. The Engineered Test Bay (Building 334) at LLNL would remain open until its new replacement could begin operation.

5.17.4.1 Option 1 – Consolidate ETF Capabilities at NTS

This option would entail the closing of all ETF facilities at LLNL, LANL and SNL and the construction of the following facilities at NTS: (1) an ACRR Facility (to be closed at SNL); (2) an Engineered Test Bay (Building 334-type facility to be closed at LLNL); (3) an Aerial Cable Test Facility (to be closed at SNL); and (4) an Underground Sled Track Complex (sled tracks to be closed at LLNL and SNL). An option to constructing a new Building 334-type facility at NTS would be to move the equipment to Pantex in a planned replacement facility (see Section 5.17.4.3). The facilities listed in Table 5.17-3 would close.

Table 5.17-3 — ETF Closures for the NTS Consolidation Alternative

LANL	LLNL	Sandia National Lab
K Site Environmental Test Facility	Thermal Test Facility (834 Complex) (5 Structures)	Outdoor Centrifuge Complex (8 structures)
Weapons Component Test Facility	Building 836 Complex (7 structures)	Auxiliary Hot Cell Facility
PIXY with Sled Track	Hardened Engineering Test Building (334 in Super Block)	Low Dose Gamma Irradiation Facility
Thermo-Conditioning Facility		Sandia Pulsed Reactor Facility Sandia Pulsed Reactor)
		Simulation Tech Lab (HERMES and RHEPP)
		PBFA (“Z”), Saturn and Sphinx
		Radiation Metrology Lab
		Gamma Irradiation Facility
		25 Foot Centrifuge
		Model Validation and System Cert Test Center
		Complex Wave Test Facility
		Light Initiated HE Test Facility
		10,000 Foot Sled Track
		Aerial Cable Facility and Control Building
		Radiography Building and Nondestructive Test
		Mobile Guns Complex
		Thermal Test Complex
		Vibration Acoustics and Mass Properties Lab
		Engineered Sciences Experimental Facility
		Component Environmental Test & Adv. Diagnostic Facility
		Electromagnetic/Environmental/Light Strategic Defense Facility
		SNL/CA Environmental Test Complex (4 structures)

Source: NNSA 2007.

Closure of the above listed facilities would entail a substantial effort. Some of these facilities have conducted experiments involving radioactive materials for a number of years and would require additional D&D beyond normal demolition activities. Some soils surrounding the structures would be disturbed and some of these soils might prove to be contaminated with radioactive materials and/or hazardous wastes. A complete site assessment would be made at and around each of these facilities prior to any demolition activities. Additional soil sampling would be conducted throughout the demolition process.

Demolition and D&D would result in the generation of solid, non-hazardous waste, hazardous wastes, low level radioactive wastes, and potentially some mixed wastes. It is not envisioned that there would be any TRU waste generated as a result of the closure and D&D of facilities associated with this alternative.

In addition to the closing of structures, there would be minor job losses associated with this Alternative at SNL/NM, LANL, and LLNL. An assessment of the environmental impacts resulting from the closure and D&D (if needed) was made for each structure which would close as a result of this alternative and is summarized in Table 5.17-4, below:

Table 5.17-4 — Environmental Impacts from ETF Consolidation at NTS Alternative

Facility	Soil (yd ³)	LLW (yd ³)	Solid Waste (yd ³)	Hazardous Waste (yd ³)	Peak employment	Total Worker Hours	Jobs lost	Floor Space (ft ²)
LANL	9,849	12,743	503,000	5	110	112,518	29	43,567
LLNL*	300	20	7,174	239	95	100,475	6	89,466*
SNL	5,300	478	119,193	3,654	1,016	456,340	224	404,352

*Impacts of SNL/Environmental Test Complex are attributed to LLNL as this is physically where the impacts will be incurred. These buildings would not be demolished and undergo D&D, but would be reused for other purposes.
Source: NNSA 2007.

5.17.4.1.1 Impacts on LANL from the ETF Consolidation at NTS Alternative

The consolidation alternatives would entail the closing and the D&D of all ETF facilities at LANL. Closure of these facilities would remove 43,567 square feet of floor space and is expected to entail 112,518 total worker hours, involve six large earth movers and twelve large dump-trucks. These trucks would not be anticipated to add to the traffic congestion on or around LANL. These construction vehicles would not be utilized for off-site runs during either the morning or evening rush hours and would remain on site over night. The peak employment would total 110 construction workers with the average work-force being slightly smaller. This would add another 70 vehicles to the normal commuting traffic but is not expected to impact the existing flow of traffic. It is estimated that the total job would take thirty months to complete.

It is expected that 9,849 cubic yards of soil would have to be excavated. None of this soil is expected to be contaminated with hazardous waste or radioactive materials, but a thorough site characterization would be conducted prior to any soil disturbance and soil would be monitored throughout the demolition process. Uncontaminated soil would be mounded and protected from the environment and erosion by covering the mounds with either vegetation or tarps. Once the demolition process is completed this soil would be used as landscaping grade material. If some of this soil was determined to be contaminated, it would be treated according to applicable

regulatory requirements and then taken to TA-54 for final treatment and disposal. It is expected that 12,743 cubic yards of low level waste would be generated. This waste would consist mainly of equipment, glove-boxes and contaminated concrete. This LLW would be sorted, compacted, and packaged on-site and transported directly to Area G, located in TA-54.

Only 5 cubic yards of hazardous waste is expected to be generated. This waste would be shipped off site to a commercial RCRA licensed facility for treatment and disposal. Any asbestos wastes would be handled according to the requirements of TSCA, and shipped off site to a certified facility. It is not expected, but if any quantities of mixed waste were to be generated through this process, it would be packaged, on-site, for transport and taken to Area G of TA-54, for treatment and disposal. An estimated 503,000 cubic yards of non-hazardous waste would be generated by the demolition of these facilities. This waste would consist primarily of concrete, steel reinforcement, and metal scrap. This waste would be transported to the nearby Los Alamos County Landfill for disposal.

LANL is located within the New Mexico Intrastate AQCR 157. None of the area within LANL and its surrounding counties are designated as nonattainment areas with respect to any of the NAAQS (40 CFR 81.332). The only pollutant of concern is particulate matter, the emissions of which could exceed the 24-hour limits established by the New Mexico Environmental Improvement Board. Dust suppression measures utilizing water and other construction practices would be utilized to minimize this temporary emission.

Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers.

All OSHA requirements would be followed and monitored closely and all workers would be required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Los Alamos, Santa Fe, Rio Arriba, Taos, Mora and San Miguel which constitute the ROI are more than sufficient to support such an action without impinging upon other ongoing activities in the area. There would be a loss of 29 jobs attributable to this action at LANL. This amounts to less than 1 percent of the total employment of SNL.

5.17.4.1.2 Impacts on LLNL from the ETF Consolidation at NTS Alternative

For LLNL, the consolidation alternative would entail the closing and the D&D of all of the ETF facilities, with a loss of 89,466 square feet of floor space and would be expected to entail 100,475 total worker hours, involve eight large earth movers and 24 large dump-trucks. SNL/CA ETFs would not be demolished and undergo D&D but would be used for other purposes. Peak employment would total 95 construction workers with the average daily workforce being smaller. It is estimated that the total job would take thirty-six months. Construction vehicles would be entering and leaving LLNL during the day, at non-rush hours. The construction vehicles would not operate on the highways during rush hour times. The workforce would add an estimated additional 78 personal vehicles, but work arrival times and departure times could be staggered to minimize impacts on the existing traffic patterns.

It is expected that only 300 cubic yards of soil would need to be excavated. This soil is not expected to be contaminated, but a thorough site characterization of the buildings and surrounding soils will be done prior to any demolition and continued on a regular basis throughout the demolition process. Uncontaminated soil would be mounded and protected from the environment and erosion by covering with either vegetation or tarps and then used as landscape grade once the demolition process is completed. It is expected that 20 cubic yards of LLW would be generated. This waste would be packaged on site and shipped to NTS for treatment and disposal. The expected 239 cubic yards of hazardous waste and any asbestos waste would be shipped off site to a commercial licensed facility in accordance with the requirements of RCRA and TSCA. It is not expected, but if any quantities of mixed waste were to be generated through this process, they would be packaged, on-site, for transport and taken to the Nevada Test Site for treatment and disposal. 7,174 cubic yards of non-hazardous waste would be generated in the demolition of these structures. This waste would consist mainly of concrete, reinforcement steel, scrap metal and wood. This waste would be transported to the nearby Corral Hollow Sanitary Landfill for disposal.

LLNL is located within the San Francisco Bay Area Air Quality Management District and the San Joaquin Valley Unified Air Pollution Control District. This area has been designated a nonattainment area for carbon monoxide, ozone, and particulate matter. LLNL could be required to submit a Risk Analysis Study to the State of California prior to commencing any demolition activities. The pollutant of concern would be particulate matter. Dust suppression measures utilizing the spraying of water and other standard construction practices would be utilized to minimize this temporary emission.

Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers.

All OSHA requirements would be followed and monitored closely and all workers would be

required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Santa Cruz, Santa Clara, Stanislaus, Tuolumne, and Calaveras, which constitute the ROI, are more than sufficient to support such an action without impinging upon other ongoing activities in the area. Closure of the SNL/CA Environmental Test Complex would lead to the loss of 6 jobs. This number in relation to the total employment of LLNL, or the ROI, is not significant enough to have measurable impacts.

5.17.4.1.3 Impacts on SNL from the ETF Consolidation at NTS Alternative

For SNL, the consolidation alternative would entail the closing and the D&D of all of the ETF facilities. This amounts to 404,352 square feet of floor space. This is expected to entail 456,340 total worker hours, involve sixteen large earth movers and forty large dump-trucks. These trucks would not be anticipated to add to the traffic congestion on or around LANL as they would not operate during peak traffic hours. These construction vehicles would remain on site over night. The peak employment would total more than 1000 construction workers with the average work-force being smaller. This would add another 560 personal vehicles to the normal commuting traffic and has the potential to affect the existing flow of traffic. Arrangements would have to be made to stagger shifts and consider alternative or night time working shifts. It is estimated that the total job would take forty months to complete.

It is expected that 5,300 cubic yards of soil would have to be excavated. Small portions of this soil would probably be contaminated with hazardous wastes. A thorough site characterization would be conducted prior to any soil disturbance and continued throughout the demolition process. Any quantities of contaminated soil would be taken to SNL's Hazardous Waste Management Facility, where it would be packaged for shipment off site to a commercial RCRA permitted facility. Non-contaminated soil would be mounded and protected from the environment by vegetation or tarps and used as landscaping grade once the demolition activities would be completed. An estimated 119,193 cubic feet of non-hazardous waste would be generated by the demolition of these structures. This waste would consist of concrete, steel, plastic, wood, and general refuse. This waste would be transported to the Albuquerque Landfill for disposal.

It is expected that 478 cubic yards of low level waste would be generated. This waste would consist mainly of equipment, and a small quantity of contaminated concrete. This LLW would be taken to TECH Area III, where it would be sorted, compacted, and packaged for shipment to NTS. The estimated 3,654 cubic feet of hazardous waste, along with any asbestos waste would

likewise be taken to Tech Area III, where it would be sorted and packaged for shipment off site to a commercial RCRA permitted facility or TSCA approved facility. It is not expected, but if any quantities of mixed waste are generated through this process, they would be packaged at Tech Area III and taken to NTS for treatment and disposal.

SNL is located within the Albuquerque-Mid Rio Grande New Mexico Intrastate AQR 152. Portions of the ARQU are designated nonattainment for carbon monoxide and total suspended particulate matter. Prior to any demolition activities, SNL would be required to obtain a permit from the State of New Mexico. Required dust suppression activities would be determined through this process. Not all environmental testing involves the detonation of explosives. Some environmental testing, however, does, and during the conduct of such tests, the primary noise would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers.

All OSHA requirements would be followed and monitored closely and all workers would be required to be trained in the OSHA noise requirements as well as other OSHA safety practices. Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased environmental testing detonations of explosives. Such testing currently occurs at this site. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control entry into explosives firing site detonation points. The public is not allowed within the fenced area where such testing is conducted. In fact, neither are workers, during the actual detonations. At areas where the public is allowed, noise levels are sufficiently reduced so as not to create any adverse impacts.

The job markets and construction resources in the surrounding counties of Albuquerque, Valencia, Socorro, Torrance, Cibola and Sandoval, which constitute the ROI are more than sufficient to support such an action without impinging upon other ongoing activities in the area. There would a loss of 224 jobs attributable to this action. This number, in relation to the total employment of SNL of more than 6,000, is less than 4 percent. For the ROI, this is not a significant number.

5.17.4.1.4 Impacts on NTS from the ETF Consolidation at NTS Alternative

The Consolidate ETF Capabilities at NTS Alternative would require the construction of four new facilities at NTS: (1) an ACRR-like facility (replacing capability lost at SNL); (2) an Engineering Test Bay (ETB) (replacing LLNL's Bldg 334, a required capability); (3) an Aerial Cable Test Facility (replacing capability lost at SNL); and (4) a sled track (replacing a required capability lost at LANL and SNL), which could be constructed above or below ground. The ACRR-like facility and the Bldg. 334-like facility could either be located in conjunction with the existing U1a facility (underground) or within the PIDAS and adjacent to the DAF facility. The Aerial Drop facility would be sited at the Area 12 T Tunnel Complex Surface Area.

Annular Core Research Reactor (ACRR)

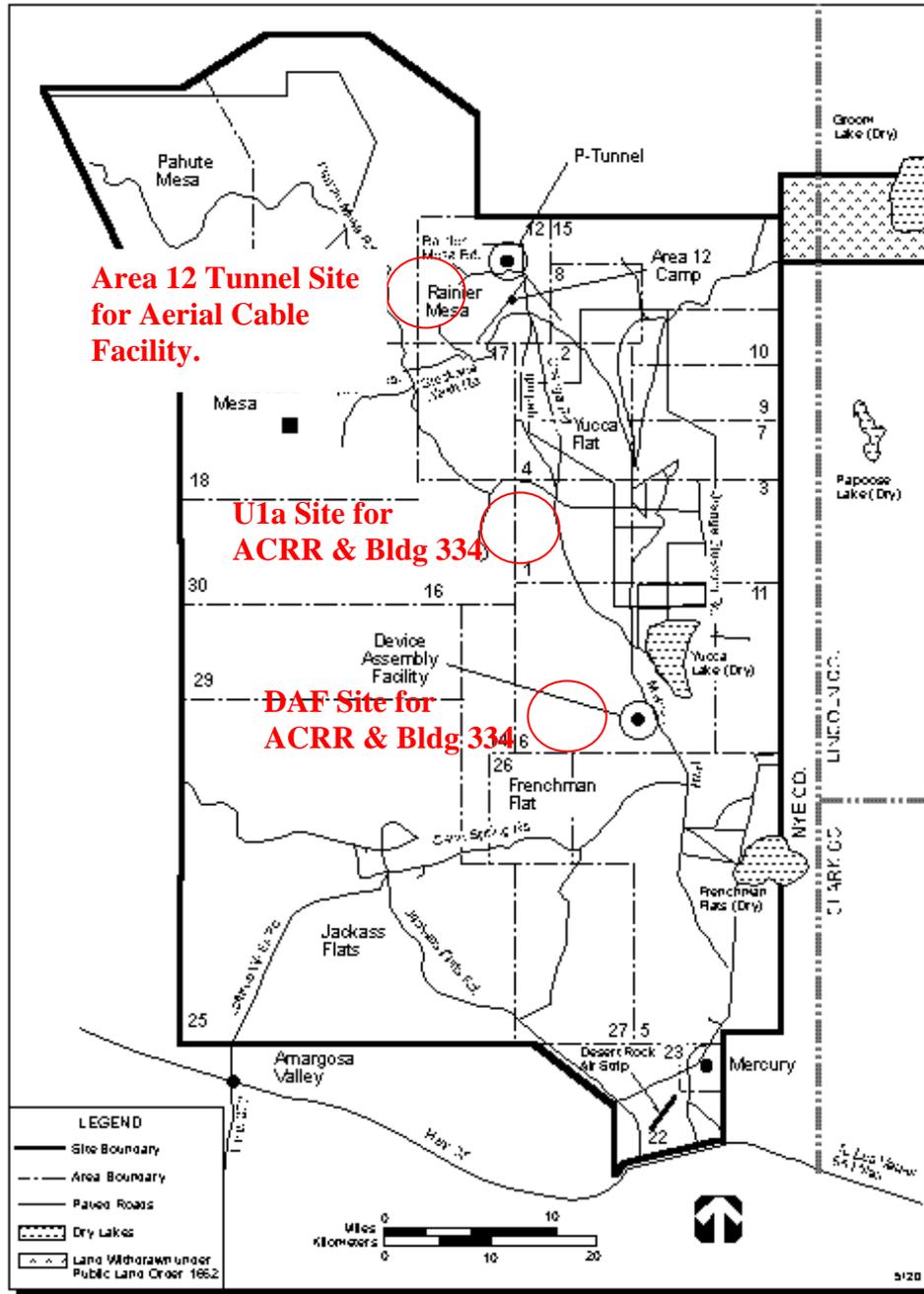
The ACRR is a critical element in the neutron vulnerability and hardness testing and certification of stockpile weapon systems electronic components (e.g., transistors, integrated circuits), subsystems (e.g., fire sets, neutron generators), and systems (e.g., AF&F system). The ACRR is also a critical element in the hostile environment testing of weapon system physics packages (both primary and secondary) at the full-up system level, as well as material sample tests. In addition, ACRR performs neutron radiographic nondestructive examinations of weapons systems components (e.g., neutron generators).

This facility has required capabilities for the Complex which are not found elsewhere and must be maintained. The ETF Consolidation at NTS Alternative would require the construction and operation of such a facility at NTS. There are two proposed sites for this new facility. One would be a stand alone new building within the existing PIDAS of the DAF. The second alternative would be to construct the new ACRR underground at the U1a facility. Tables 5.17-5 and 5.17-6 show the expected requirements for the construction and operation of a new ACRR at each of these two locations.

Table 5.17-5 — Annular Core Research Reactor (ACRR) Sited within the DAF PIDAS

Construction	Consumption/Use
Water Needed for Construction (gal):	1,000,000 gallons
Total Square Footage of New Construction	2800 square feet
Total Land Area Disturbed by Facility Footprint (acres)	3.25 acres
Laydown Area Size (acres)	0.25 acres
Parking Lot (acres) Existing DAF Parking Lot is Adequate	0 acres
Employment	
Total construction employment (worker years)	40 worker years
Peak construction employment (workers)	60 workers
Construction period (years)	3 years
Estimates of Wastes Generated	
Hazardous (yd ³)	0 cubic yards
Nonhazardous (yd ³): Mainly waste concrete with a smaller quantity of packaging materials (cardboard, pallets, etc.)	20 cubic yards
Operation	Consumption/Use
Electrical usage (MWh /yr)	489,787
Water use Gal/year)	13,793 existing ACRR Facility
Employment	
Total	42
Radiation workers	12
Waste Generation	
TRU (yd ³)	.2
Low Level (yd ³)	10
Hazardous (yd ³)	.4
Non-hazardous(gallons)	30,000
Emissions	
NAAQS (tons/year)	NOX .9, CO 1.6., PM 0.1, SOX .03, VOC 0.1
Radionuclide emissions	Argon-41

Source: NNSA 2007.



Source: NNSA 2007.

Figure 5.17-1 — Location of New Facilities for Consolidation at NTS

Table 5.17-6 — Annular Core Research Reactor (ACRR) Sited at NTS U1a Facility

Construction	Consumption/Use
Water Needed for Construction (gal)	400,000 gallons
Land	
Total Square Footage of New Construction	8600 square feet
Total Land Area Disturbed by Facility Footprint (acres) Since this is an underground mine, no surface land area is disturbed by this addition to the existing facility (Existing Surface Infrastructure and Facilities are adequate to support this addition)	0 acres
Laydown Area Size (acres)	.25 acres
Parking Lot (acres) Existing U1a Parking Lot is Adequate	0 acres
Employment	
Total construction employment (worker years)	70 worker years
Peak construction employment (workers)	20 workers
Construction period (years)	4 years
Estimates of Wastes Generated	
Hazardous (yd ³)	0 cubic yards
Nonhazardous (yd ³)	8000 cubic yards
Construction	Consumption/Use
Electrical usage (MWh /yr)	489,787
Water use Gal/year	13,793 existing ACRR Facility
Employment	
Total	42
Radiation workers	12
Waste Generation	
TRU (yd ³)	.2
Low Level (yd ³)	10
Hazardous (yd ³)	.4
Non-hazardous(gallons)	30,000
Emissions	
NAAQS (tons/year)	NOX .9, CO 1.6., PM 0.1, SOX .03, VOC 0.1
Radionuclide emissions (Ci/yr)	Argon-41

Source: NNSA 2007.

If the ACCR operations at SNL were transferred to NTS, the accident risks associated with those operations at SNL would be eliminated. Previously, accidents analyzed for the ACRR have included a target rupture, a fuel handling accident, the rupture of a waterlogged fuel element, and an airplane crash and fire in the reactor room with unirradiated fuel and targets present (SNL/NM SWEIS SA DOE/EIS-0281-SA-04, August 2006). For the bounding accident (an airplane crash and fire with a 6.3×10^{-6} probability of occurring), the increased probability of an LCF for the maximally exposed individual (MEI) would be 1.0×10^{-10} (statistically, this means that there would be much less than a 1 percent chance that an LCF would result if this accident were to occur). This accident would result in 1.6×10^{-6} additional LCFs to the 50-mile population. For the noninvolved worker, this same accident would result in an increased probability of an LCF of 4.9×10^{-8} . Transfer of the ACRR mission to NTS would be expected to result in similarly low risks to the MEI, surrounding population, and non-involved workers. Due to the remoteness of the NTS, the large distance to the MEI (more than 13 miles), and the much smaller surrounding population, risks would be expected to be even lower than those presented above for SNL.

Engineering Test Bay (Bldg 334)

Building 334 is in the Superblock at the LLNL main site and is often referred to as the Hardened Engineering Test Building (HETB). The building is primarily used for environmental testing of SNM. One half of the building is the Radiation Measurement Facility, including the Intrinsic Radiation (INRAD) Bay and the other half is the ETF, consisting of the Engineering Test Bay (ETB). The two bays are separated from each other by a thick concrete wall. With regard to environmental testing, Building 334 is currently the only building within the Complex that can facilitate environmental testing of special nuclear material (SNM) (i.e., pits and secondary assemblies containing SNM). Environmental testing includes vibration, shock, thermal conditioning, or combinations of these environments. This would necessitate the construction and operation of a Building 334-type facility at NTS. Note that only the Engineering Test Bay part of Building 334 is being proposed. Accordingly the Building 334-like facility proposed to be constructed at NTS will be referred to as Engineered Test Bay (slightly smaller than the existing Building 334 at LLNL).

As with the ACRR, the capabilities of Building 334 must be maintained and therefore a Building 334-type facility would have to be constructed at NTS. This facility could be constructed at one of two potential sites; the DAF and U1a. If constructed at the DAF, the facility would be located in two test bays, within the existing DAF structure, thereby not disturbing any new land, benefiting from existing infrastructures, and minimizing environmental impacts. The facility could also be sited underground at the U1a facility. Tables 5.17-7 and 5.17-8 show the construction and operation impacts for such a facility at the two potential locations.

Table 5.17-7 — Engineered Test Bay (Bldg 334 Complex) Sited at NTS DAF Facility

Construction	Consumption/Use
Water Needed for Construction (gal)	100,000 gallons
Land	None disturbed
Total Square Footage of New Construction: Facility would be located in an existing high bay at the DAF (High Bay is approximately 1800 square feet).	0 square feet
Total Land Area Disturbed by Facility Footprint (acres) Since this is a retrofit of an existing facility, no additional surface land area is disturbed by this modification to the existing facility	0 acres
Laydown Area Size (acres)	2 acres
Parking Lot (acres) Existing Facility Parking Lot is Adequate	0 acres
Employment	
Total construction employment (worker years)	20 worker years
Peak construction employment (workers)	15 workers
Construction period (years)	2 years
Estimates of Wastes Generated	
Hazardous (yd3)	0 cubic yards
Nonhazardous (yd3): Dirt and reinforced concrete removed to allow for mounting of shock and vibration equipment to reactive masses in floor providing base isolation.	200 cubic yards
Operation	Consumption/Use
Electrical usage	480 MWh/yr
Water use	2,000 gal / yr
Employment	
Total	2

**Table 5.17-7 — Engineered Test Bay (Bldg 334 Complex) Sited at NTS DAF Facility
(continued)**

Operation	Consumption/Use
Radiation workers	2
Emissions	None
Waste generation	0
TRU	0
LLW	0
Hazardous	0
Non-hazardous (sanitary)	0.006 (yd ³ /yr)

Source: NNSA 2007.

Table 5.17-8 — Engineered Test Bay (Bldg 334 Complex) Sited at NTS U1a Facility

Construction	Consumption/Use
Water Needed for Construction (gal)	500,000 gallons
Land	
Total Square Footage of New Construction	9600 square feet
Total Land Area Disturbed by Facility Footprint (acres) Since this is an underground mine, no surface land area is disturbed by this addition to the existing facility (Existing Surface Infrastructure and Facilities are adequate to support this addition)	0 acres
Laydown Area Size (acres)	2 acres
Parking Lot (acres) Existing Facility Parking Lot is Adequate	0 acres
Employment	
Total construction employment (worker years)	87.5 worker years
Peak construction employment (workers)	20 workers
Construction period (years)	4.5 years
Estimates of Wastes Generated	
Hazardous (yd ³)	0 cubic yards
Nonhazardous (yd ³): Dirt and Rock Mined to Create Space for this facility and removed to the surface.	8000 cubic yards
Operation	Consumption/Use
Electrical usage	480 MWh/yr
Water use	2,000 gal / yr
Employment	
Total	2
Radiation workers	2
Emissions	None
Waste generation	0
TRU	0
LLW	0
Hazardous	0
Non-hazardous (sanitary)	0.006 (yd ³ /yr)

Source: NNSA 2007.

Aerial Cable Test Facility

Located in the Coyote Test Field at SNL, the Aerial Cable Test facility performs gravity drop and accelerated pull-down tests in support of bomb qualification tests and weapons development activities. Gravity drop tests are performed from a cable suspended between two peaks, giving up to a 600-foot vertical distance for acceleration. A rocket-assisted (320-foot sled track) pull-down technique is used to provide higher impact velocities when gravity tests are not adequate.

For the Consolidation of ETF Capabilities at NTS, this facility would have to be constructed at NTS, to replace an existing, required capability which would be lost with the closing of all facilities at SNL. In addition, the proposed replacement site in Nevada would allow for running the rocket sled into an existing (and currently unused) tunnel thereby greatly mitigating fire risks associated with use of the rocket sled in Aerial Cable Test activities. Table 5.17-9 shows the requirements and the impacts associated with the construction and operation of an Aerial Cable Test Facility at the 12T Tunnel complex at NTS.

Table 5.17-9 — Aerial Cable Test Facility Sited at Area 12 T Tunnel Complex Surface Area

Construction	Consumption/Use
Water Needed for Construction (gal): The majority of this water consumption is for dust mitigation at the job site.	1,100,000 gallons
Land	None disturbed
Total Square Footage of New Construction	40,000 square feet
Total Land Area Disturbed by Facility Footprint (acres)	15 acres
Laydown Area Size (acres)	1 acre
Parking Lots (acres) Existing parking area is sufficient.	0 acres
Employment	
Total construction employment (worker years)	130 worker years
Peak construction employment (workers)	50 workers
Construction period (years)	2 years
Estimates of Wastes Generated	
Hazardous (yd ³)	0 cubic yards
Nonhazardous (yd ³) waste concrete, excavated dirt, and small quantities of packaging materials	250 cubic yards
Operation	Consumption/Use
Electrical usage	100MWh/year
Water use	62,720 Gal / year
Employment	
Total	6
Radiation workers	0
Emissions (tons / year)	NOX 3.55, CO 0.06, PM 10.87, VOC 1.67
Waste generation	
TRU	0
LLW	0
Hazardous	2(yd ³)
Non-hazardous (sanitary)	0

Source: NNSA 2007.

Underground Sled Track Complex

Located in TA III, at SNL, the 10,000 foot Sled Track Complex supports weapons system qualification testing and weapons development efforts that must simulate penetration, flight, high-acceleration, and high-shock environments. This environment may be provided through impact, reverse ballistic, or ejection testing. Sled Track capabilities will remain a key requirement for the ETF Program. Under the Consolidation of ETF Capabilities at NTS Alternative, maintenance of this capability would require the construction and operation of a new Sled Track Complex. Construction of a sled track in one of the tunnel complexes at the NTS would have the added benefit of minimizing safety issues. Table 5.17-10 shows the requirements and environmental

impacts associated with the construction and operation of an underground Sled Track Complex in one of the existing tunnel complexes at NTS.

Table 5.17-10 — Underground Sled Track Complex at NTS

Construction	Consumption/Use
Water Needed for Construction (gal)	350,000 gal
Land	
Total Square Footage of New Construction (not including parking areas (see below)	65,400 square feet
Total Land Area Disturbed by Facility Footprint (acres)	5 acres
Laydown Area Size (acres)	1.5 - 2.5
Parking Lots (acres)	0 - 1 acres
Employment	
Total construction employment (worker years)	100 worker years
Peak construction employment (workers)	50 workers
Construction period (years)	2 years
Estimates of Wastes Generated	
Hazardous (yd ³)	0
Nonhazardous (yd ³) waste concrete, excavated dirt, and small quantities of packaging materials	500 cubic yards
Operation	Consumption/Use
Electrical	2,000,000 KW-hr
Water usage (gal)	200,000 gallons
Plant Footprint (square ft.)	110,000 square feet
Employment	
Total	20
Radiation Workers	2
Average Annual Dose	
Waste Generation	
TRU (yd ³)	
Low Level (yd ³)	
Hazardous (yd ³)	0
Non-Hazardous (yd ³)	<20 yd ³
Emissions	
NAAQS Emissions (tons/yr)	NOX 2.92, CO 1.48, PM 17.24, SOX 0.014, VOC 2.33
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	8.75

Source: NNSA 2007.

Construction of these four major facilities with a combined floor space of 117,800 square feet at NTS would be undertaken concurrently so the impacts must be viewed on an additive basis. Since two of these facilities could be constructed either above or below ground with differing construction requirements/impacts, the larger of the two requirements/impacts was used.

The combined construction water requirement would be for 2,950,000 gallons. NTS receives its water from a water system divided into four service areas with 11 groundwater wells for potable water, 2 wells for nonpotable water, approximately 30 usable storage tanks, 13 usable construction water sumps, and 6 water transmission systems. The annual maximum production capacity of site potable water is estimated to be approximately 1.36 billion gallons per year (DOE 2002k). With a current annual water usage of 269 million gallons there is more than

sufficient water resources to support these construction projects, and furnish the 290,000 gallons/yr needed to operate them.

The combined person-years for completion of the project would be 387.5 with a total peak employment of 190. Two projects would last two years and two projects would last 4 and 4.5 years. The Las Vegas area is a rich resource for construction labor and qualified construction firms. There are ample resources in the immediate area to allow for these projects. Noise should only be an issue for workers at the four construction sites. Here the requirements of OSHA, including the training of workers, would be strictly adhered to. Dust suppression would be minimized during construction to the least amount possible.

In the past several years, NTS has been provided power under contracts with the Nevada Power Company and Western Area Power Administration. Electrical capacity at NTS is approximately 176,800 MWh/yr and peak load capacity, approximately 45 MWe. In 2000, NTS electrical usage was approximately 101,000 MWh per year and peak load usage was 27 MWe (DOE2002k). There is more than sufficient capacity to furnish the 495,000 MWh of electricity to operate these four facilities.

None of these facilities would generate measurable levels of wastes, all of which can be managed on site. NTS has an extensive waste management system, and can manage treatment and disposal of all wastes on site, except for the disposal of TRU waste. The proposed ACRR Facility is expected to generate 0.2 cubic yards of TRU waste on annual basis. This waste would be taken to the Transuranic Pad Cover Building at Area 5 of NTS. Here the waste would be stored until it could be characterized, visually examined, and packaged at the Waste Examination Facility, also in Area 5. Once this is done the waste would be packaged for shipment and disposal at WIPP, in accordance with the WIPP Waste Acceptance Criteria requirements.

The proposed sites for all four facilities are located in developed areas. Accordingly, it is not likely that archaeological, prehistoric cultural, historic, or Native American resources would be disturbed. The Consolidated Group of Tribes and Organizations has identified several sites at NTS that are important to Native American people, including storied rocks, rock shelters, wooden lodges, rock rings, springs and certain other archeological sites. None of the proposed construction sites infringe upon these areas.

The desert tortoise inhabits the southern one-third of NTS. Although these proposed sites are not in that portion of NTS, NTS would take every effort possible to assure that activities would not jeopardize the continued existence of the Mojave population of the species and that no critical habitat would be destroyed or adversely modified. There are no wetlands or aquatic resources in the vicinity of the proposed construction sites.

Geologically, NTS is a tectonically active area. This has been factored into the design process for the proposed facilities. The most recent volcanic activity in the immediate area was 3.7 million years ago and the likelihood for renewed activity in the next 10,000 years is slight. Additional information on the affected environment of NTS can be found in Chapter four of this SPEIS, in Section 4.3.

The noise from this construction would be limited to the remote areas of NTS where it would take place and as such only be an issue with associated workers. These workers would be trained in OSHA requirements and be required to work in accordance with those requirements. The noise associated with the construction would not interfere with sensitive habitats or indigenous wildlife species.

5.17.4.2 Option 2: Consolidate ETF Capabilities at SNL

This option would entail the closing of all ETF facilities at LLNL, LANL and constructing a new Bldg 334-like facility at SNL. This alternative would maintain the operation of the two NTS ETF facilities (at DAF and the U1a) and allow for construction of an underground rocket sled track facility at NTS. The same facilities that would close at SNL for the Consolidation-In-Place Alternatives (see Table 5.17-1 in Section 5.17.3, above) would also close for this alternative. Table 5.17-11 lists the facilities that would close for this alternative.

Table 5.17-11 — Facilities to Close for ETF Consolidation at SNL Alternative

LANL	LLNL	Sandia National Lab
K Site Environmental Test Facility	Engineered Test Bay (834 Complex) (5 Structures)	Sandia Pulsed Reactor Facility (part of the Sandia Pulsed Reactor)
Weapons Component Test Facility	Building 836 Complex (7 structures)	Low Dose Gamma Irradiation Facility
PIXY with Sled Track	Hardened Engineering Test Building (334 in Super Block)	Auxiliary Hot Cell Facility
Thermo-Conditioning Facility		Outdoor Centrifuge Complex
		SNL/CA Environmental Test Complex (4 structures) ^a

^a SNL/CA Environmental Test Complex is a Sandia National Laboratoryrun program near LLNL in California. For environmental impacts, SNL/CA facilities are included in LLNL analysis since this is where the majority of the impacts are incurred. Source: NNSA 2007.

Closure of the above listed LANL and LLNL facilities are the same as for the Consolidate ETF Capabilities at NTS Alternative which has already been described in Sections 5.17.4.1.1 and 5.17.4.1.2. For SNL, the facilities that would close are the same as for the Consolidation-In-Place Alternative already described in Section 5.17.3.3. A summary of the impacts incurred as a result of the closures required by the Consolidation of ETF Capabilities at SNL Alternative are shown in Table 5.17-12.

Table 5.17-12 — Closure Impacts Resulting from ETF Consolidation at SNL Alternative

Facility	Soil (yd ³)	LLW (yd ³)	Solid Waste (yd ³)	Hazardous Waste (yd ³)	Peak employment	Total Worker Hours	Jobs lost	Floor Space (ft ²)
LANL	9,849	12,743	503,000	5	110	112,518	29	43,567
LLNL*	300	20	7,174	239	95	100,475	6	89,466*
SNL	5,100	37	8,700	42	107	48,880	16	26,235

*Impacts of SNL/Environmental Test Complex are attributed to LLNL as this is physically where the impacts will be incurred.

5.17.4.2.1 Impacts on LANL from the ETF Consolidation at SNL Alternative

The ETF Consolidation at SNL Alternative impacts on LANL are the same as those discussed in Section 5.17.4.1.1, and as summarized in Table 5.17-12.

5.17.4.2.2 Impacts on LLNL from the ETF Consolidation at SNL Alternative

The ETF Consolidation at SNL Alternative impacts on LLNL are the same as those discussed in Section 5.17.4.1.2, and as summarized in Table 5.17-12.

5.17.4.2.3 Impacts on SNL from the ETF Consolidation at SNL Alternative

Under the ETF Consolidation at SNL Alternative, the SNL facilities identified in Table 5.17-11 would close. These facility impacts would be the same as discussed in Section 5.17.4.1.3 and as summarized in Table 5.17-12. Closing all ETF Facilities at both LLNL and LANL, and consolidating ETF capabilities at SNL, would not require the construction of a new Building 334-type facility at SNL, as that mission would be transferred to NTS (as previously discussed in Section 5.17.4.1.4) or to Pantex (see Section 5.17.4.3 below).

5.17.4.3 *ETF Pantex Option*

Should the Alternative to Consolidate ETF Capabilities at One Site (NTS or SNL) be selected, all ETF activities at LLNL would cease. Activities being conducted at Building 334 at LLNL, in Superblock, are critical to the Complex and would have to be relocated. An alternative to constructing a new Building 334-like facility at NTS would be to move the equipment and activities presently being conducted at Building 334 to an existing building at Pantex. The existing building at Pantex has bays used for similar testing, but not with SNM. This Pantex facility (or the Weapons Surveillance Facility, presently being pursued as a replacement) could accommodate these activities with minimal refitting and no new construction. This Section assesses the environmental impacts of the option for moving the LLNL Building 334 activities and equipment to Pantex.

Pantex conducts ETF-like work on a regular basis as a function of production certification and quality assurance. The existing facility at Pantex is a two story 3,000 square foot block and cement structure, with a concrete slab floor. Because this facility is used on an intermittent basis, it could easily share space with another program. Moving the activities and equipment from LLNL to Pantex would only require minor modifications.

The nature of the work presently being conducted in Building 334 at LLNL is to test classified test objects made from SNM, and as such needs to be located in a secure PIDAS (Perimeter Intrusion Detection and Assessment System) area similar to what is found at the LLNL Superblock. Any other location for this work would need to be a Category II Nuclear Facility and as have the facility infrastructure to support this hazard level of work.

Existing free workspace at Pantex would be sufficient to accommodate these additional activities, and has sufficient security, power, and water requirements. The only modifications to the Pantex facility would be the digging of a pit and the addition of a roof extension to allow for the installation of the measurement tower. This would require breaking-up the existing concrete floor, excavating a pit (12 feet by 12 feet by 14 feet deep), the addition of a roof extension (8 feet), and the pouring of concrete to line the pit. All modifications to the existing building would be done without an increase in the building footprint. The following is a list of the equipment at Building 334 which would be relocated to Pantex:

1. **Measurement Tower** – Expanded aluminum metal tower with a minimum footprint of 25' by 25' with a minimum load limit of 6,000 pounds with a 2,500 pound point load. This tower needs to be a minimum of 15 feet above the concrete floor. This height is required to again minimize the signal received by the detectors related to the building composition.
2. **Sealed Source Storage Pit** – A sub floor pit for the storage of Class 1-4 sealed sources used in measurement activities. This would also require source cells be designed using lead shielding to aid in attenuation of any signal from the sources while in their storage locations.
3. **5-Ton Bridge Crane** – Due to the size and weight of many of the test assemblies, as well as the necessary fixturing, an overhead bridge crane is needed to lift and position the objects within the test facility.

The existing crane, spin test equipment, and aerial measurement tower equipment would be shipped, via commercial transport, from LLNL to Pantex. This is estimated to require 3 standard container sized truckloads.

Fugitive dust emissions and noise resulting from modifications at Pantex would be minimized due to the enclosed environment. The 22 yards of concrete and dirt to be removed to allow for the measurement tower could easily be managed on-site, at one of Pantex's existing landfills. Noise emanating from this site would be limited to the involved site workers. Involved site workers would be required to wear the appropriate personal protective equipment, including hearing protection. The construction modifications would require four workers, a backhoe, and one dump truck. The building modifications are estimated to entail a total of about 2600 worker hours and last a period of about four months. The modification to the building would involve excavation, the pouring of steel reinforced concrete, the laying of block and brick, the repairing of the roof and the adding of a new roof structure, the transport of equipment from LLNL, the installation of LLNL equipment, and the wiring for the new equipment.

Transfer of this activity to Pantex would result in the addition of two new jobs, once modifications were completed and the new equipment installed. The four construction jobs and

the two full time operational jobs are insignificant compared to the total employment in the ROI and at Pantex. Once operational, these activities would not be expected to create additional waste other than normal office refuse, occasional use of solvents and cleaning fluids, and would not use additional water other than the sanitary and personal usage for the two new employees. The increased electrical demand would be minimal and the new activities would not add to the current emissions.

An accident involving an aircraft impact into a Building 334-type facility (which would be similar to an assembly cell) at either Pantex or NTS would have the greatest potential to cause environmental impacts. Such an accident has previously been postulated and analyzed for an assembly cell (DOE 1996c). Although considered to be credible but an extremely unlikely event with an estimated probability in the range of 1×10^{-7} to 5×10^{-6} per year, this accident scenario is presented because it could cause sufficient damage to release SNM. The MEI and offsite impacts from the previous analysis are considered to be bounding because the material at risk for the ETF mission would be significantly less. For the noninvolved worker, the analysis estimates that a worker at 100 meters (328 ft) would not survive the aircraft crash effects. The accident consequences to the MEI are estimated to be a dose 23 rem; this corresponds to an LCF risk of 0.01 (a risk of an LCF approximately once every 72 years). The 50-mile population dose at Pantex would be approximately 2.8×10^3 person-rem; this would correspond to 1.7 LCFs. At NTS, these consequences would be significantly lower due to the greater distance to the MEI and the lower 50-mile population.

5.18 Project-Specific Analysis of Sandia National Laboratories, California (SNL/CA) Weapons Support Functions

The SNL/CA Weapons Support mission has evolved over the past several decades into a robust weapons design and R&D activity. Conducting operations out of seven major facilities consisting of 29 buildings, this activity is a required and integral part of the Nuclear Weapons Complex. Additional information about the activities conducted by this formation is presented in Section 3.13.

There are two alternatives for the SNL/CA Weapons Support Functions: (1) the No Action Alternative to continue activities at SNL/CA; (2) an alternative to consolidate these functions with similar activities presently being conducted at SNL/NM.

5.18.1 No Action Alternative

Under the No Action Alternative, NNSA would continue to conduct the existing weapons non-nuclear component design and engineering work at the SNL/CA facilities. There would be no construction impacts associated with this alternative. However, some minimal investments could be required to maintain the facilities through the year 2030 in order to meet mission requirements. These investments would primarily be associated with general building maintenance, wear and tear, and equipment replacements. Under the No Action Alternative, there would be no change in the workforce currently at SNL/CA. Therefore, there would be no impacts to the ROI employment, income, or labor force.

5.18.2 Consolidate SNL/CA Weapons Support Functions to SNL/NM

This alternative would entail moving the weapons non-nuclear component design and engineering work at the SNL/CA facilities to SNL/NM, and transferring the positions and equipment associated with these functions to SNL/NM. Because the facilities to be vacated are in good repair and have no contamination issues, they could be utilized by other ongoing programs.

Moving some of the SNL/CA weapons support functions would impact a maximum of 500 jobs at SNL/CA. This number is not significant in relation to the total employment of LLNL of about 8,000, or the civilian labor force of 1,777,645 for the ROI. In addition, these changes could be more than offset by work separate from the weapons program. Acceptance of these activities at SNL/NM would be accommodated in existing facilities. The addition of 500 jobs is not significant enough to have measurable impacts either on the ROI, or SNL/NM. There would be no change in effluents, emissions, or wastes associated with the transfer of this mission.

aircraft crash could have the potential for more serious impacts to workers and the public. DOE estimated the impacts of the potential release of the most hazardous chemical used at the CUC. Chemical accident consequences were obtained from review of the Y-12 chemical accident scenarios reported in previous NEPA documents. Appendix C provides a listing of the Y-12 documents reviewed in performing this comparison. The chemical analyzed for release was nitric acid.

The impacts of a nitric acid release are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations. Table 5.5.12-6 shows the consequences of the dominant loss of containment accident scenario.

Table 5.5.12-6 — CUC Chemical Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^a	
Nitric acid	10,500	6	0.85	4.49	0.48	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles.
Source: Tetra Tech 2007

5.5.12.3.3 Involved Worker Impacts

For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Prediction of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the receptor decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

5.5.12.4 Assembly/Disassembly/High Explosives

Accidents associated with the A/D/HE Center, which are included under the No Action Alternative, are presented in Tables 5.5.12-7 through 5.5.12-9 below.

Chapter 6
CUMULATIVE IMPACTS

Chapter 6 CUMULATIVE IMPACTS

This chapter considers past, present, and reasonably foreseeable actions that could, along with the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) alternatives, result in cumulative impacts to the environment. It considers other ongoing operations at the potentially-affected sites, reasonably foreseeable future actions at the sites, and reasonably foreseeable actions that are ongoing or planned within the Region of Influence of each site.

6.1 METHODOLOGY AND ANALYTICAL BASELINE

The Council on Environmental Quality (CEQ) regulations that implement the procedural provisions of the *National Environmental Policy Act* (NEPA) define cumulative impact as the “impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR Part 1500-1508). Thus the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity is taking the actions. The cumulative impact analysis in this chapter is based on continued operations at the potentially affected sites, reasonably foreseeable future actions at the sites, and reasonably foreseeable actions that are ongoing or planned within the Region of Influence of each site.

A cumulative impact analysis is only conducted for those resource areas with the greatest potential for cumulative impacts. Based on an analysis of the impacts presented in Chapter 5 of this SPEIS, these resource areas were considered to be land use, infrastructure (electricity availability), water use, transportation, socioeconomics, waste management, accidents, and health and safety. The analysis has been conducted in accordance with CEQ NEPA regulations and the CEQ handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997a), on the preparation of cumulative impact assessments.

Cumulative impact assessment is based on both geographic (spatial) and time (temporal) considerations. Historical impacts at the potentially affected sites are captured in the existing No Action Alternative. Future impacts will be analyzed for the same timeframe as the alternatives analyzed in the Complex Transformation SPEIS— with any construction occurring in the future, and operations for approximately 40 years. Geographic boundaries vary by resource, depending on the time an effect remains in the environment, the extent to which the effect can migrate, and the magnitude of the potential impact.

6.2 POTENTIALLY CUMULATIVE ACTIONS

In addition to alternatives evaluated in this SPEIS, actions that may contribute to cumulative impacts include on- and off-site projects conducted by Federal, state, and local governments, private sector, or individuals that are within the ROIs of the actions considered in this SPEIS. Information on present and future actions was obtained from a review of site-specific actions and

NEPA documents to determine if current or proposed projects could affect the cumulative impact analysis at the potentially affected sites. For those actions that are speculative, not yet well defined, or are expected to have a negligible contribution to cumulative impacts, the actions are described but not included in the cumulative effects. The potentially cumulative actions discussed below are the major DOE projects that may contribute to cumulative impacts on or in the vicinity of the potentially affected sites.

6.2.1 Global Nuclear Energy Partnership (GNEP)

DOE is preparing a Programmatic Environmental Impact Statement (PEIS) for GNEP (DOE/EIS-0396). One alternative being evaluated is the construction and operation of an advanced fuel cycle facility (AFCF) at a DOE site. Three of the sites being evaluated for this facility are relevant to this SPEIS: Oak Ridge National Laboratory adjacent to the Y-12 National Security Complex (Y-12), Savannah River Site (SRS), and Los Alamos National Laboratory (LANL). The environmental impacts associated with these facilities are being addressed in the GNEP PEIS. Preliminary data for the GNEP facilities is available and has been used in this cumulative impact assessment. This cumulative impact assessment will be updated if better information becomes available for the GNEP facilities.

6.2.2 Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems

DOE is currently preparing the *Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems EIS* (hereafter, the “Pu-238 Consolidation EIS”) to assess alternatives to consolidate these radioisotope power systems (RPS) operations, which involve plutonium 238 (Pu-238) (DOE 2005e). RPSs provide electrical power to space and other systems through the conversion of heat (thermal energy) generated by the decay of plutonium-238 to electricity. For the past 4 decades, DOE has supplied RPSs, including plutonium-238 fueled radioisotope thermoelectric generators (RTGs) and plutonium-238-fueled light-weight radioisotope heater units (RHUs), as the source of electric power and heat for National Aeronautics and Space Administration (NASA) and national security missions. The nuclear infrastructure required to produce an RPS comprises three major components: (1) the production of plutonium-238; (2) the extraction, purification, and encapsulation of plutonium-238 into a usable fuel form; and (3) the assembly, testing, and delivery of RPSs to Federal users. Currently, DOE RPS production operations exist, are planned, or proposed to exist, at three separate sites: Oak Ridge National Laboratory (ORNL), Tennessee; LANL, New Mexico; and Idaho National Laboratory (INL).

The Pu-238 Consolidation EIS evaluates the environmental impacts of two action alternatives (Consolidation) and a No Action Alternative. Under the No Action Alternative, Pu-238 would be produced in accordance with previous NEPA documents, which, for purposes of the Complex Transformation SPEIS cumulative impact analysis, would mean that Pu-238 operations would continue at both LANL and ORNL. Under the Consolidation Alternatives, RPS nuclear operations currently assigned to facilities at ORNL and LANL would be consolidated at INL. As such, the actions in the Pu-238 Consolidation EIS could create cumulative impacts at both LANL and Y-12.

6.2.3 Yucca Mountain Repository

DOE announced the availability of two draft NEPA documents, related to Yucca Mountain in the *Federal Register* on October 12, 2007 (72 FR 58071):

1. *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-SID) (hereafter, Repository SEIS) (DOE 2007a); and,
2. *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor (Part 1)* (DOE/EIS-0250F-S2); and *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada (Part 2)* (DOE/EIS-0369D) (hereafter, Nevada Rail Corridor SEIS and Rail Alignment EIS) (DOE 2007b).

These two documents address the transportation and disposal of SNF and DOE high level wastes (HLW). The Yucca Mountain Supplemental EIS updates the analysis of the environmental effects associated with the proposed action to construct, operate, and monitor, and eventually to close, a geologic repository for the disposal of 70,000 metric ton of heavy metal (MTHM) of spent nuclear fuel (SNF) and HLW at Yucca Mountain. DOE anticipates starting construction of the Yucca Mountain repository in 2011, with initial operations beginning in 2017. The Rail Alignment Supplemental EIS assesses the construction and operation of a rail line to connect the repository site at Yucca Mountain to a new or existing rail line in the State of Nevada for the shipment of SNF and HLW, in the event that the Nuclear Regulatory Commission (NRC) authorizes construction of the repository and receipt and possession of these materials at Yucca Mountain. Actions associated with Yucca Mountain have the potential to cause cumulative impacts related to the transformation of the nuclear weapons complex (Complex) both locally at the NTS and nationally due to the transportation of nuclear materials.

6.2.4 Plutonium Disposition

The end of the Cold War created a legacy of surplus weapons-usable fissile materials in both the United States (U.S.) and Russia. The U.S. and Russia have been working together to reduce the threat of nuclear weapons proliferation worldwide by implementing programs for dispositioning surplus plutonium in a safe, secure, environmentally acceptable, and timely manner. Russia and the U.S. have issued numerous statements and agreements to this effect since the mid-1990's. The most recent agreement, signed in September 2000, provides that the U.S. and Russia will each dispose of 34 tons of "weapons-grade" plutonium, and allows for disposition either by immobilization, or by mixed-oxide (MOX) fuel fabrication and subsequent irradiation.

NNSA has evaluated its ability to continue implementing two disposition approaches and has determined that in order to make progress with available funds, only one approach can be supported. DOE is of the view that if only one disposition approach is to be pursued, the MOX approach rather than the immobilization approach is the preferable one. Accordingly, it

cancelled the immobilization portion of the dual disposition strategies announced in previous Records of Decision (RODs) for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE/EIS-0229, December 1996) (Storage and Disposition PEIS) and the *Surplus Plutonium Disposition Environmental Impact Statement* (DOE/EIS-0283, November 1999) (SPD EIS) (see Supplemental Analysis and Amended Record of Decision, Changes to the Surplus Plutonium Disposition Program. (DOE/EIS-0283-SA1, April 2003)).

In response to a statutory directive, DOE/NNSA has submitted to Congress a report on a strategy for the disposal of surplus plutonium currently located at, or to be shipped to Savannah River Site (SRS). That strategy involves converting this plutonium to a MOX fuel and irradiating it in commercial power reactors. DOE/NNSA is currently evaluating the changes to the MOX fuel portion of the surplus plutonium disposition program necessitated by this strategy, including the need for additional environmental reviews pursuant to the NEPA. No final decisions regarding the MOX portion of the program will be made until these reviews are completed. DOE/NNSA's current disposition strategy involves a MOX-only approach, under which DOE/NNSA would dispose of up to 34 tons of surplus plutonium by converting it to MOX fuel and irradiating it in commercial power reactors.

The actions associated with plutonium disposition could produce local cumulative impacts at SRS, where the MOX fuel fabrication activities would occur, and nationally due to the transportation of plutonium from Pantex, where the bulk of U.S. surplus plutonium is stored, to SRS. A MOX Fuel Fabrication Facility is currently under construction at SRS (scheduled to commence operation in 2017) and a Pit Disassembly Facility is scheduled to be constructed at SRS. The Pit Disassembly Facility will disassemble surplus pits and provide the plutonium to the MOX facility.

6.3 CUMULATIVE IMPACTS BY RELEVANT SITE

The following Complex Transformation sites could be potentially affected by the projects identified and described above: LANL, Nevada Test Site (NTS), Pantex Plant (Pantex), SRS, and Y-12. Because these five sites are also the same sites that could be affected by the programmatic alternatives in the Complex Transformation SPEIS, this cumulative impact analysis focuses on these five sites. While this SPEIS acknowledges that other projects could create cumulative impacts at the other Complex Transformation sites (Lawrence Livermore National Laboratory [LLNL], Sandia National Laboratories, New Mexico [SNL/NM], Tonopah Test Range [TTR], and the Department of Defense's White Sands Missile Range [WSMR]), the impacts from Complex Transformation would be relatively minor at those sites. This cumulative analysis also presents a summary of the impacts associated with the following project: Transformation of Facilities and Infrastructure for the Non-Nuclear Production Activities Conducted at the NNSA Kansas City Plant (KCP).

6.3.1 Cumulative Impacts at LANL

LANL could be affected by decisions resulting from the GNEP PEIS and the Pu-238 Consolidation EIS. The potential cumulative impacts associated with the GNEP PEIS are addressed first, followed by the Pu-238 Consolidation EIS.

6.3.1.1 *GNEP Cumulative Impacts*

The GNEP PEIS is considering LANL (TA-36) as a site location for the AFCF. The AFCF would provide the venue for development and advancement of several of these technologies, including those needed for: (a) separation and recovery of usable materials from SNF; and (b) fabrication of proliferation-resistant, recycled fuels. The AFCF would be a large (approximately 550,000 square feet) shielded facility with remotely maintained areas, known as hot cells to validate, demonstrate, and improve fuel cycle technologies such as fully integrated spent fuel processing and fuel fabrication. The majority of the process facilities of the AFCF would be located within a Perimeter Intrusion, Detection and Assessment System (PIDAS) to protect the nuclear material from diversion or sabotage. The site area within the PIDAS would be approximately 62 acres. The total site area required, within a property protection fence, would be approximately 144 acres.

TA-36 is one of the sites that conducts high explosives (HE) testing. TA-36 is in a remotely located area in the eastern portion of LANL that is fenced and patrolled. It has four active firing sites that support explosives testing. The sites are used for a wide variety of non-nuclear ordnance tests pertaining to warhead designs, armor and armor-defeating mechanisms, explosives vulnerability to projectile and shaped-charge attack, warhead lethality, and determining the effects of shock waves on explosives and propellants.

Most of TA-36 is undeveloped, and largely consists of Pinyon-Juniper woodlands. Northern portions of TA-36 were burned by the Cerro Grande fire in May 2000. The only actions in the Complex Transformation SPEIS that could affect directly TA-36 would be HE alternatives that would transfer HE research and development (R&D) experimentation and fabrication activities from LANL to another site or some of these similar activities transferred from other sites to LANL. The HE R&D activities at TA-36 would not produce any cumulative impacts if an AFCF were located at TA-36. The HE R&D missions are located on small areas of TA-36 and would not produce significant impacts beyond the local areas at TA-36. Because the HE R&D missions do not involve radioactive materials, they do not contribute to cumulative radiological impacts (e.g., radiation doses to workers or the public, or the generation of radioactive wastes). Thus, these HE R&D facilities, coupled with an AFCF at TA-36, would not produce cumulative radiological impacts.

On a broader site-wide scale, locating an AFCF at LANL would produce cumulative impacts as follows:

6.3.1.1.1 Construction

During construction, the most significant potential cumulative impact would involve socioeconomics. According to preliminary plans for GNEP facilities, construction of the AFCF would begin in approximately 2014, peak in 2017 and last about 5 years. Full operations would begin in approximately 2020. During construction, the AFCF is estimated to involve a peak workforce of approximately 2,250 workers. Such construction could occur at the same time as construction for a Consolidated Uranium Complex (CUC) (construction period: 2011- 2016, with a peak workforce of 1,300) and a Consolidated Plutonium Center (CPC) (construction period 2016 – 2019 [Upgrade], with a peak workforce of 300, or 2016-2022 [Greenfield], with a peak workforce of 850). If one were to assume a bounding approach in which the peak workforce of the AFCF occurred at the same time as the peak workforce of a CUC and a CPC, the total peak construction of all three facilities would be 4,320. In addition to the direct jobs created by the construction of these three facilities, additional jobs would be created in other supporting industries. It is estimated that approximately 4,660 indirect jobs would be created, for a total of approximately 8,900 jobs. This represents approximately 5.95 percent of the total ROI labor force. It is estimated that many of the direct jobs would be filled by workers migrating into the ROI, at least temporarily during the construction period. Nonetheless, a 5.9 percent increase in ROI employment would create a large demand on housing and community services that would stress the ROI. In 2000, there were only approximately 8,600 vacant housing units in the ROI. For the current ROI workforce (approximately 106,000) there are approximately 24,000 students enrolled in school, which equates to approximately 0.24 students per ROI worker. Assuming a similar percentage for new workers, the addition of 8,900 new workers in the ROI could add 2,136 students to the ROI school systems, an increase of approximately 9 percent. This would result in either increased class sizes, the need for additional teachers per classroom, or additional classrooms and teachers to account for all of the potential scenarios.

6.3.1.1.2 Operations

Once operational, the AFCF would create impacts similar to many of the existing operations at LANL. The facility would:

- use a peak load of approximately 35.5 megawatts electric (MWe) of electricity;
- use approximately 117 million gallons of water annually;
- employ approximately 1,350 workers;
- result in a total radiation dose to workers of 17.1 person-rem (855 radiation workers receiving an average dose of 20 millirem (mrem) per year)
- create annually 90 cubic yards of high-level wastes, 10 cubic yards low-level waste, and 18 cubic yards of mixed-low level waste (LLW).

6.3.1.2 Electricity

Cumulatively, this bounding analysis assumes that a Consolidated Nuclear Production Center (CNPC) would be located at LANL along with the AFCF. The current power pool total electric energy capacity is 1,138,800 megawatt-hours (MWh) (based on a nominal peak load of approximately 130 MWe). The most recent data shows a peak load of approximately 69.5 MWe

from LANL and 18.3 MWe from the county for a total peak load of 87.8 MWe (LANL 2006a). The addition of 35 MWe from the AFCF would result in an electrical load below the 130 MWe peak load.

However, if both the CNPC (peak power load: 41 MWe [18 MWe for Consolidated Uranium Center (CUC), 11 MWe for CPC, and 12 MWe from Assembly/Disassembly/High Explosives [A/D/HE]) and the AFCF were located at LANL, the resultant peak load of 163 MWe (87 MWe + 35 MWe + 41 MWe) would exceed the peak power pool total electric energy availability of 130 MWe. In such a situation, LANL would need to procure additional power and upgrade the on-site electrical distribution network beyond current plans.¹

6.3.1.3 *Water Use*

LANL has water rights to 542 million gallons. In 2005, approximately 359.3 million gallons of water were used at LANL. If the CNPC were located at LANL, water use would increase by approximately 395 million gallons to approximately 754 million gallons per year. If the AFCF were also located at LANL, water use would increase by approximately 117 million gallons to approximately 871 million gallons per year. This would mean the total water used at LANL would exceed the current water rights by approximately 60 percent.

6.3.1.4 *Socioeconomics*

LANL currently employs approximately 13,500 people and there are approximately 150,000 people employed in the ROI. If LANL's employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011. If the CNPC were located at LANL, operational employment would increase by approximately 4,500 at LANL. If the AFCF were located at LANL, operational employment would increase by approximately 1,350 at LANL. The total increase in LANL employees (5,850) would increase the LANL workforce expected in 2011 by 38 percent (15,400/5,850). In the ROI, in addition to the direct jobs created (5,850), approximately 6,200 indirect jobs would be created, for a total of 12,050 new jobs, an increase of approximately 8 percent in the ROI. The impacts at LANL would be similar to the impacts discussed for construction.

¹ The 1999 *LANL SWEIS* documented the limitations of the electric transmission lines that deliver electric power to the Los Alamos power pool, as well as the need to upgrade the aging onsite electrical distribution system (LANL 1999b). Specifically, projects to improve the reliability of electric power transmission to the power pool have been undertaken. To address such situations, a new transmission line was proposed that would be constructed in two segments: (1) from the Norton Substation to a new substation (Southern TA) that is being constructed near White Rock, and (2) from the new Southern TA Substation to the Western TA Substation. The first segment will be constructed at 345 kilovolts (KV) but operated in the short term at 115 kilovolts, as large pulse power loads at LANL will need the higher voltage in the future. The second segment will be constructed and operated at 115 KV (LANL 2006a). Construction of the portion of the new transmission line from the Southern TA 3911 Substation to the Western TA Substation was completed in February 2006, and construction of the new Southern TA switchyard was finished in March 2006. The project to uncross the two existing transmission lines and to refurbish the existing Eastern TA Substation is still ongoing with completion now expected by August 2007. The construction of the portion of the line from the Norton Substation to the Southern TA Substation is in the design phase (LANL 2006).

6.3.1.5 *Human Health*

The worker population at LANL currently receives approximately 155.4 person-rem of radiation dose from normal operations. If the CNPC were located at LANL, the cumulative operational dose to workers would increase by approximately 386 person-rem. If the AFCF were located at LANL, the cumulative operational dose to workers would increase by approximately 17.1 person-rem. The resultant total dose to the LANL workforce would be 558.5 person-rem. Statistically, an annual dose of 558.5 person-rem would result in 0.33 latent cancer fatalities (LCF) to the LANL workforce, meaning that 1 additional LCF could be expected to occur for every 3 years of LANL operation.

6.3.1.6 *Waste Management*

LANL currently does not generate any high level waste (HLW), so any HLW created by the AFCF would not add any cumulative impacts. The AFCF would include facilities to manage such wastes until ultimate disposal in a geologic repository. The 10 cubic yards of low level waste (LLW) would be less than 1 percent of LLW generated by existing site operations. The 18 cubic yards of mixed LLW would add approximately 20 percent to the mixed LLW generated by existing site operations.

6.3.1.7 *Pu-238 Cumulative Impacts*

With respect to LANL, the Pu-238 Consolidation EIS assesses the alternative that would transfer the Pu-238 operations to the INL, in addition to the No Action Alternative that would maintain Pu-238 operations at LANL TA-55. Maintaining the Pu-238 operations at LANL is included as part of the No Action Alternative for LANL in the Complex Transformation SPEIS. As such, potential cumulative impacts focus on the transfer of Pu-238 operations.

The cumulative impacts of transferring Pu-238 operations from LANL to INL would tend to mitigate any added impacts from the Complex Transformation SPEIS alternatives that would add missions to LANL. Conversely, the cumulative impacts of transferring Pu-238 operations from LANL to INL would tend to exacerbate any impacts from the Complex Transformation SPEIS alternatives that would subtract missions from Los Alamos. For example, if LANL were selected as the site for a CPC (either a Greenfield CPC or one of the Upgrade Alternatives), or a CNPC, the transfer of the Pu-238 operations would mitigate the impacts of these additional impacts beyond the analysis in the Complex Transformation SPEIS (which assumes no change in Pu-238 operations at LANL). Alternatively, if Los Alamos were not selected as the site for a CPC or a CNPC, the transfer of the plutonium missions from LANL to the CPC/CNPC, coupled with the transfer of Pu-238 operations to INL, would create greater impacts than the analysis in the Complex Transformation SPEIS.

As discussed in the Pu-238 Consolidation EIS, the impacts of Pu-238 operations at LANL are not a significant contributor to impacts at LANL. For example, Pu-238 operations require minimal infrastructure support (less than 1 percent of LANL electricity, fuels, and water use). Pu-238 operations also produce small doses (less than 1 person-rem) to the maximally-exposed individual (MEI) and the 50-mile population surrounding LANL. With respect to workers, doses

from Pu-238 operations result in approximately 240 millirem (mrem) per year to the average worker. For the approximately 80 people working on Pu-238 operations at LANL, the resultant dose (19 person-rem) would create a latent cancer fatality (LCF) risk of 0.011 (or the potential for one cancer every 87 years of operation). With respect to accidents, the bounding consequences associated with Pu-238 accidents would result in 1.1 LCFs to the 50-mile population surrounding LANL. With respect to wastes, Pu-238 operations at LANL create less than 3 percent of any waste type (DOE 2005e). Thus, transfer of Pu-238 operations from LANL to INL would mitigate any added Complex Transformation SPEIS impacts by the amounts shown above.

The more significant cumulative impact would result from the transfer of Pu-238 operations from LANL to INL, coupled with the transfer of LANL Pu missions to a CPC/CNPC if a site other than Los Alamos were chosen for the CPC/CNPC. In this case, the impacts from both missions would be additive. Relative to each other, the most significant contributor to these cumulative impacts would be impacts associated with the LANL pit production and plutonium R&D missions, which are presented in Section 5.12 of this SPEIS. The cumulative impacts of transferring Pu-238 operations from LANL would add incremental impacts as described above.

6.3.2 Cumulative Impacts at NTS

Decisions related to the Yucca Mountain Repository could cause cumulative impacts in the NTS ROI and nationally (from transportation activities associated with a geologic repository). The potential cumulative impacts in the NTS ROI are discussed below, followed by potential cumulative impacts from transportation.

As discussed in Section 6.2.3, DOE is currently preparing two EISs related to the Yucca Mountain repository: the Yucca Mountain Supplemental EIS and the Rail Alignment Supplemental EIS. Although these two projects could affect the *implementation* of a national repository for the disposal of SNF and DOE HLW, they would not affect the prior decision to use Yucca Mountain as a geologic repository for the disposal of 70,000 metric tons of heavy metal (MTHM) of SNF and HLW at Yucca Mountain. As such, the impacts of disposing of 70,000 MTHM of SNF and HLW at Yucca Mountain, including transportation, are included in this cumulative impact assessment for the Complex Transformation SPEIS. The environmental impacts associated with Yucca Mountain are being addressed in the two EISs currently being prepared and recently released as Draft EISs (see Section 6.2.3). This cumulative impact section uses data from these Draft EISs.

Based on the best available information available, DOE anticipates starting construction of the Yucca Mountain repository in 2011, with initial operations beginning in 2017. The cumulative impacts associated with Yucca Mountain and Complex Transformation are discussed below.

6.3.2.1 Socioeconomics

During construction activities for the repository, short-term socioeconomic impacts would occur in the Yucca Mountain region. There would be nearly 2,600 new jobs in the two county area around Yucca Mountain (Clark, and Nye Counties). Repository construction could occur at the

same time as construction for a CUC, with a peak workforce of 1,300, and a CPC, with a peak workforce of 850. Assuming a bounding approach (peak workforce of the repository, CUC, and a CPC at the same time), the total peak construction of all three facilities would be 4,750. In addition to the direct jobs created by the construction of the facility, additional jobs would be created in other supporting industries. It is estimated that approximately 4,615 indirect jobs would be created, for a total of 9,365 jobs. This represents approximately 1 percent of the total ROI labor force. As such, no significant impacts to employment, housing or community services would be expected from construction activities.

6.3.2.2 *Human Health*

Construction and operation of the repository would result in about 8 LCFs and 2 to 3 non-radiological fatalities, depending on the repository operating mode. The maximum annual dose to the MEI would be about 6.8 mrem per year. Greater than 99.99 percent of the annual dose would be from radon-222 and radon decay products. The pre-closure Public Health and Environmental Standard found in 10 CFR 63.204 is 15 mrem per year to a member of the public. Maximum annual doses from repository activities would be less than one-half of this standard. The average individual in the United States receives 200 mrem per year from exposure to naturally occurring radon and its decay products, so Yucca Mountain releases would be expected to add less than 4 percent to the natural background dose from radon.

The MEI would have an increase in the probability of incurring a LCF of 2.9×10^{-4} from exposure to radionuclides released from repository facilities over a 70-year lifetime, or about 1 in 3500. The long-term performance of the proposed repository over 10,000 years would result in a mean peak annual dose of 0.02 mrem to a MEI hypothetically located 11 miles from the repository. The analysis of a human intrusion event occurring at 30,000 years indicated a mean peak annual dose of 0.002 mrem to the reasonably maximally exposed individual at the same location. The potential long-term (postclosure to 10,000 years) environmental impacts would also be small. There would be virtually no LCFs (much less than 1) over 10,000 years. In addition, there would be a potential for very small impacts to vegetation and animals over the repository area as soil surface temperatures increased. Small impacts to other resources (for example, socioeconomics, biological resources, utilities and services) would occur.

For Complex Transformation, a maximum of 4.1 non-radiological fatalities would be associated with the construction of a CNPC, and less than 1 non-radiological fatality would be associated with operations. During operations, the maximum MEI dose would be 0.2 mrem per from NNSA activities at NTS. Cumulatively, the maximum dose to the MEI from NNSA operations and Yucca Mountain operations would be 1.5 mrem per year. Statistically, this would equate to a LCF risk of 9.0×10^{-7} , meaning that the MEI would have a risk of developing a LCF every 1.1 million years of operation. For Complex Transformation workers, approximately 386 person-rem would result annually from operations. Over 40 years of operations, this would equate to 15,440 person-rem. Based on a dose-to-risk factor of 0.0006 LCFs per person-rem, approximately 9.3 LCFs could be statistically expected to the workforce over 40 years of operation.

6.3.2.3 Transportation

With respect to cumulative impacts of transportation, impacts of transporting SNF and HLW from the commercial and DOE sites to the Yucca Mountain site could be additive to the transportation impacts associated with Complex Transformation activities. For DOE’s preferred transportation mode (mostly rail), Table 6.3.2-1 depicts these transportation impacts.

For Complex Transformation, as shown in Section 5.10, the maximum transportation impacts would result in less than one fatality from both radiological impacts and non-radiological impacts. As such, the cumulative transportation impacts would be essentially the same as the results presented in Table 6.3.2-1.

Table 6.3.2-1 — Yucca Mountain Transportation Impacts (for 50 year shipping period)

Impact	Mostly legal-weight truck scenario	Mostly rail scenario
Incident-free latent cancer fatalities		
Involved worker	0.53	2.8
Public ^a	0.21	0.48
Latent cancer fatalities from accidents		
Public	0.000041	.0025
Traffic Fatalities ^b	0 .59	2.2

^a These latent cancer fatalities would result from very low doses to a very large population.

^b Does not include 44-46 fatalities that could occur from repository workers commuting and transporting construction material to the repository.

Source: DOE 2007a.

Complex Transformation alternatives would contribute approximately 4.1 worker fatalities from construction of a CNPC, less than 1 traffic fatality from CNPC construction and operation, approximately 9.3 LCFs to Complex Transformation workers over 40-years of operations, and essentially no LCFs to the public from Complex Transformation operations, including transportation of radiological materials.

6.3.3 Cumulative Impacts at Pantex

Cumulative impacts at Pantex could result from Complex Transformation activities and the plutonium disposition activities. The maximum cumulative impacts would be associated with transportation of plutonium from Pantex to SRS. Under the plutonium disposition program, up to 34 tons of surplus plutonium would be transported from Pantex to SRS for conversion to MOX fuel. Under the Complex Transformation CNPC alternative, up to 60 metric tons of plutonium could be shipped from Pantex to SRS. Based on the analysis in Section 5.10, the impacts of transporting up to 60 metric tons of plutonium from Pantex to SRS would be as shown in Table 6.3.3-1.

Table 6.3.3-1 — Radiological Transportation Impacts Associated with the Transportation of Pits from Pantex to the CNPC Site

CNPC Site	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
SRS	Pits	3.46×10 ⁻⁹	0.0584	0.0584

Source: Dimsha 2007.

Assumptions:

- All materials in metal form
- ES-3100 or similar container used
- Shipments of Pu from Pantex to the CNPC would require 10 shipments for every ton of plutonium
- Release and aerosol fractions based on *West Valley Demonstration Project EIS (WVDP EIS)* values

Using these same assumptions, the impacts of transporting an additional 34 tons would be as shown in Table 6.3.3-2.

Table 6.3.3-2 — Radiological Transportation Impacts Associated with the One-Time Transportation of 34 Tons of Plutonium from Pantex to SRS

MOX Site	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
SRS	Pits	2.50×10^{-9}	0.0422	0.0422

Source: Dimsha 2007.

Using the same assumptions as discussed above, the cumulative impacts of transporting up to 94 metric tons would be as shown in Table 6.3.3-3.

Table 6.3.3-3 — Radiological Transportation Impacts Associated with the One-Time Transportation of up to 94 Metric Tons of Plutonium from Pantex to SRS

MOX Site	Transportation Segment	Estimated Health Impacts (LCFs)		
		Accident	Incident-Free	Total
SRS	Pits	5.96×10^{-9}	0.101	0.101

Source: Dimsha 2007.

The cumulative impacts associated with the transfer of Category I/II SNM from Zone 4 to Zone 12 would not cause any significant impacts at Pantex (less than 1 LCF due to handling operations). As such, this alternative would not contribute to any significant cumulative impacts.

6.3.4 Cumulative Impacts at SRS

SRS is a potential site for the GNEP AFCF. The SRS and the Barnwell site adjacent to SRS have also been proposed as sites for a nuclear fuel recycling center and an advanced recycling reactor. However, because DOE only intends to make a siting decision for the AFCF as a result of the GNEP PEIS, it would be premature to assess the cumulative impacts of a nuclear fuel recycling center and an advanced recycling reactor. As such, this cumulative impact assessment focuses on the AFCF only for GNEP facilities. Additionally, as discussed in Section 6.2.4, SRS could be affected by plutonium disposition activities, including the transportation of surplus plutonium (see Section 6.3.3), and the operation of PDCF and a MOX fuel fabrication facility. Based on current plans, PDCF would start construction in late 2010 and begin operations in 2019. PDCF operations would last approximately 8 years. The MOX Fuel Fabrication Facility started construction in August, 2007 and is expected to begin operations in 2016. Operations would last approximately 13 years. As such, for purposes of this cumulative impact assessment,

the bounding assumption is: peak construction of the PDCF and MOX Fuel Fabrication Facility occurs at approximately the same time as the peak construction of the CUC and CPC. Operationally, the bounding assumption is: SRS operates the PDCF, MOX Fuel Fabrication Facility, and CNPC simultaneously.

Based on these assumptions, the potential cumulative impacts at SRS would be as follows.

6.3.4.1 *Construction*

The AFCF would be a large (approximately 550,000 square feet) shielded facility with remotely maintained areas, known as hot cells to validate, demonstrate, and improve fuel cycle technologies such as fully integrated spent fuel processing and fuel fabrication. The majority of the process facilities of the AFCF would be located within a PIDAS to protect the nuclear material from diversion or sabotage. The site area within the PIDAS would be approximately 50 acres. The total site area required, within a property protection fence, would be approximately 170 acres.

If the CNPC were located at SRS, approximately 545 acres could be affected. The PDCF and MOX Fuel Fabrication Facility are expected to disturb approximately 77 acres (DOE 1999). Together, the AFCF, CNPC, PDCF, and MOX Fuel Fabrication Facility would disturb approximately 800 acres. On a site as large as SRS (approximately 198,400 acres, of which 90 percent [191,000 acres] are undeveloped), the disturbance of 800 acres would be less than 1 percent of the available land.

During construction, the most significant potential cumulative impact would involve socioeconomics. The PDCF and MOX Fuel Fabrication Facility are estimated to need a peak construction workforce of 1,968, with an additional 1,580 indirect jobs created (DOE 1999). According to preliminary plans for GNEP facilities, construction of the AFCF would begin in approximately 2014, peak in 2017 and last about 5 years. Full operations would begin in approximately 2020. During construction, the AFCF is estimated to involve a peak workforce of approximately 2,250 workers. Such construction could occur at the same time as construction for a CUC, with a peak workforce of 1,300, and a CPC, with a peak workforce of 770. If one were to assume a bounding approach in which the peak workforce of the PDCF, MOX Fuel Fabrication Facility, and the AFCF occurred at the same time as the peak workforce of a CUC and a CPC, the total peak construction of all three facilities would be 6,288. In addition to the direct jobs created by the construction of these three facilities, additional jobs would be created in other supporting industries.

It is estimated that approximately 4,690 indirect jobs would be created, for a total of approximately 10,978. This represents approximately 3.7 percent of the total ROI labor force. It is estimated that many of the direct jobs would be filled by workers migrating into the ROI, at least temporarily during the construction period. A 3.7 percent increase in ROI employment would not significantly stress housing and community services in the ROI. In 2000, there were approximately 18,000 vacant housing units in the ROI.

6.3.4.2 *Operations*

Once operational, the AFCF would create impacts similar to many of the existing operations at SRS. The facility would:

- use a peak load of approximately 35.5 megawatts electric (MWe) of electricity;
- use approximately 117 million gallons of water annually;
- employ approximately 1,350 workers;
- result in a total radiation dose to workers of 17.1 person-rem (855 radiation workers receiving an average dose of 20 millirem (mrem) peryr)
- create annually 90 cubic yards of high-level wastes, 10 cubic yards low-level waste, and 18 cubic yards of mixed-low level waste (LLW).

The potential cumulative impacts are addressed below.

6.3.4.3 *Electricity*

Cumulatively, this bounding analysis assumes that a CNPC would be located at SRS along with the AFCF. The most recent data shows a peak load of approximately 70 MWe from SRS operations, compared to a site capacity of 330 MWe. The addition of 35.5 MWe from the AFCF and 41 MWe from a CNPC would be well within the site electrical capacity.

6.3.4.4 *Water Use*

SRS has absolute ownership of the groundwater resource underlying SRS land and has no restrictions on the amount of groundwater withdrawn annually. In 2005, SRS used approximately 3.5 billion gallons of water. If the CNPC were located at SRS, water use would increase by approximately 395 million gallons to approximately 3.90 billion gallons per year. If the AFCF were located at SRS, water use would increase by approximately 117 million gallons to approximately 4.1 billion gallons per year.

6.3.4.5 *Socioeconomics*

SRS currently employs approximately 15,100 people and there are approximately 294,000 people employed in the ROI. If the CNPC were located at SRS, operational employment would increase by approximately 4,500 at SRS. If the AFCF were located at SRS, operational employment would increase by approximately 1,350 at SRS. The total increase in SRS employees (5,850) would increase the current SRS workforce by 39 percent. In the ROI, in addition to the direct jobs created (5,850), approximately 2,700 indirect jobs would be created, for a total of 8,550 new jobs, an increase of approximately 2.9 percent in the ROI. This increase would be less than the bounding increase discussed for construction, but would create many of the same similar impacts. When added to the approximately 1,120 new employees that would be required to operate the PDCF and MOX Fuel Fabrication Facility (and 515 additional indirect workers), the total jobs created would be 10,185, an increase of approximately 3.5 percent in the ROI.

6.3.4.6 Human Health

Workers at SRS currently receive approximately 121.3 person-rem of radiation dose from normal operations. If the CNPC were located at SRS, the cumulative operational dose to workers would increase by approximately 386 person-rem. If the AFCF were located at SRS, the operational dose to workers would increase by approximately 17.1 person-rem. The resultant cumulative dose to the SRS workforce would be 524.3 person-rem. Statistically, an annual dose of 524.3 person-rem would result in 0.31 LCFs to the SRS workforce, meaning that 1 additional LCF could be expected to occur for every 3.2 years of SRS operation. When added to the approximately 456 person-rem to workers at the PDCF and MOX Fuel Fabrication Facility, the total worker dose would be 980.3 person-rem. Statistically, this would result in 0.59 LCFs to the SRS workforce, meaning that 1 additional LCF could be expected to occur for every 1.7 years of SRS operation.

With respect to the public, PDCF and MOX Fuel Fabrication operations would produce small doses to the public (less than 7.4×10^{-3} mrem to the MEI and approximately 1.8 person-rem to the 50-mile population surrounding SRS) (DOE 1999). The CNPC would also produce small doses to the public (3.39×10^{-3} mrem to the MEI and approximately 0.429 person-rem to the 50-mile population surrounding SRS). The total dose to the population from PDCF, MOX Fuel Fabrication, and CNPC would be: 1.08×10^{-2} mrem to the MEI and approximately 2.2 person-rem to the 50-mile population surrounding SRS.

6.3.4.7 Waste Management

SRS currently does not generate any HLW, but still has substantial quantities of HLW from former operations. Any HLW created by the AFCF would not add significant quantities of HLW being managed at SRS. The AFCF would include facilities to manage its HLW until ultimate disposal in a geologic repository. The 10 cubic yards of LLW would be less than 1 percent of LLW generated by existing site operations. The 18 cubic yards of mixed LLW would add approximately double the mixed LLW generated by existing site operations. The CNPC would add 955 cubic yards of TRU, an increase of nearly 10 times the amount generated at SRS in 2004. The CNPC would also double the LLW currently generated, and increase mixed LLW by approximately four times the current amount generated. With respect to a PDCF and a MOX Fuel Fabrication Facility, those 2 facilities could generate approximately 500 cubic yards of TRU, 270 cubic yards of LLW, and 6.5 cubic yards of mixed LLW. As such, the total wastes at SRS would increase by the amounts shown in Table 6.3.4-1.

Table 6.3.4-1 — Cumulative Waste Generation at SRS

Waste type	Current	CNPC	GNEP	PDCF and MOX	Total
High-level, cubic yards	0	0	225	0	225
Transuranic, cubic yards	88	955	0	500	1,543
Low-level, cubic yards	4,900	12,964 ^a	10	270	18,144 ^a
Mixed, cubic yards	20	306	18	6.5	350.5

^a approximately 9,000 gallons of liquid LLW would be generated and would need to be solidified

6.3.5 Cumulative Impacts at Oak Ridge Reservation (Y-12 Location)

The Oak Ridge Reservation (ORR), of which Y-12 and the ORNL are two of the principal facilities, could be affected by the Pu-238 Consolidation EIS and the GNEP PEIS. The potential cumulative impacts associated with the Pu-238 Consolidation EIS are addressed first.

6.3.5.1 Pu-238 Cumulative Impacts

DOE analyzed the need for reestablishment of plutonium-238 production capability in the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (NI PEIS), issued in December 2000 (DOE 2000b). On the basis of the analysis in the NI PEIS, DOE issued a ROD on January 26, 2001 (66 FR 7877), to reestablish plutonium-238 production capability at ORNL using the Radiochemical Engineering Development Center (REDC) for the fabrication of neptunium-237 targets and extraction of plutonium-238 from the irradiated targets.

With respect to ORR, the Pu-238 Consolidation EIS assesses the alternative that would transfer the Pu-238 operations to INL, in addition to the No Action Alternative that would maintain Pu-238 operations at ORNL. The cumulative impacts of transferring Pu-238 operations from ORNL to INL would tend to mitigate any added impacts from the Complex Transformation SPEIS alternatives that would add missions to Y-12. For example, if Y-12 were selected as the site for a CPC or a CNPC, the transfer of the Pu-238 operations would mitigate the impacts of these additional impacts beyond the analysis in the Complex Transformation SPEIS (which assumes no change in Pu-238 operations at ORNL). On the flip side, if Y-12 were not selected as the site for a CNPC, the transfer of the HEU missions from Y-12, coupled with the transfer of Pu-238 operations to INL, would create greater impacts beyond the analysis in the Complex Transformation SPEIS.

As discussed in the Pu-238 Consolidation EIS, the impacts of Pu-238 operations at ORNL are not a significant contributor to impacts at ORR. For example, Pu-238 operations require minimal infrastructure support (less than 1 percent of ORR electricity, fuels, and water use). Water use (0.76 million gallons) per year at REDC is well within the capacity of the ORNL water supply system, which can deliver 2.6 billion gallons annually. Electrical use is inconsequential.

Target fabrication and post-irradiation processing of neptunium-237 targets at REDC requires about 41 workers (DOE 2000). These jobs represent less than 0.1 percent of the ORNL workforce and have no noticeable impact on socioeconomic conditions in the ORNL ROI.

Pu-238 operations produce small doses to the public (less than 4.5×10^{-6} mrem to the MEI and less than 1.5×10^{-4} person-rem the 50-mile population surrounding ORR). With respect to workers, doses from Pu-238 operations result in approximately 170 mrem per year to the average worker, resulting in a total worker dose of less than 12 person-rem. This creates a LCF risk of 7.2×10^{-3} (or the potential for one cancer every 581 years of operation). With respect to accidents, for REDC target fabrication and processing accidents, the annual increased risk of an

LCF to the offsite MEI and a noninvolved worker was estimated to be 1.6×10^{-6} and 1.0×10^{-5} , respectively. The annual accident risk in terms of the increased number of LCFs in the surrounding population was estimated to be 4.5×10^{-3} . With respect to wastes, Pu-238 operations at ORNL create less than 1 percent of any waste type. Thus, transfer of Pu-238 operations from ORNL to INL would mitigate any Complex Transformation SPEIS added impacts by the amounts shown above.

6.3.5.2 *GNEP Cumulative Impacts*

ORNL is a potential site for the GNEP AFCF. The potential cumulative impacts at ORR would be as follows.

6.3.5.2.1 **Construction**

The AFCF would be a large (approximately 550,000 square feet) shielded facility with remotely maintained areas, known as hot cells to validate, demonstrate, and improve fuel cycle technologies such as fully integrated spent fuel processing and fuel fabrication. The majority of the process facilities of the AFCF would be located within a PIDAS to protect the nuclear material from diversion or sabotage. The site area within the PIDAS would be approximately 50 acres. The total site area required, within a property protection fence, would be approximately 170 acres.

If the CNPC were located at Y-12, approximately 518 acres could be affected. Together, the AFCF and the CNPC would disturb approximately 770 acres. On a site as large as ORR (approximately 34,000 acres), the disturbance of 688 acres would be approximately 2 percent of the site land.

During construction, the most significant potential cumulative impact would involve socioeconomics. According to preliminary plans for GNEP facilities, construction of the AFCF would begin in approximately 2014, peak in 2017 and last about 5 years. Full operations would begin in approximately 2020. During construction, the AFCF is estimated to involve a peak workforce of approximately 2,250 workers. Such construction could occur at the same time as construction for a Uranium Processing Facility (UPF), with a peak workforce of 900, and a CPC with a peak workforce of 850. If one were to assume a bounding approach in which the peak workforce of the AFCF occurred at the same time as the peak workforce of a UPF and a CPC, the total peak construction of all three facilities would be 4,000. In addition to the direct jobs created by the construction of these three facilities, additional jobs would be created in other supporting industries.

It is estimated that approximately 16,800 indirect jobs would be created, for a total of approximately 20,800. This represents approximately 10 percent of the total ROI labor force. It is estimated that many of the direct jobs would be filled by workers migrating into the ROI, at least temporarily during the construction period. Nonetheless, a 10 percent increase in ROI employment would create a large demand on housing and community services that would stress the ROI. In 2000, there were only approximately 19,000 vacant housing units in the ROI. For the current ROI workforce (approximately 210,000) there are approximately 81,000 students

enrolled in school, which equates to approximately 0.38 students per ROI worker. Assuming a similar percentage for new workers, the addition of 20,800 new workers in the ROI could add approximately 8,000 new students to the ROI school systems, an increase of approximately 10. This would result in either increased class sizes or the need for additional teachers/classrooms.

6.3.5.2.2 Operations

Once operational, the AFCF would create impacts similar to many of the existing operations at Y-12. The facility would:

- use a peak load of approximately 35.5 megawatts electric (MWe) of electricity;
- use approximately 117 million gallons of water annually;
- employ approximately 1,350 workers;
- result in a total radiation dose to workers of 17.1 person-rem (855 radiation workers receiving an average dose of 20 millirem (mrem) peryr)
- create annually 90 cubic yards of high-level wastes, 10 cubic yards low-level waste, and 18 cubic yards of mixed-low level waste (LLW).

The potential cumulative impacts are addressed below.

6.3.5.3 Electricity

Cumulatively, this bounding analysis assumes that a CNPC would be located at Y-12, along with the AFCF at ORNL. ORR has significant excess capacity for available electrical power. The addition of 35.5 MWe from the AFCF and 41 MWe from a CNPC would be well within the site electrical capacity.

6.3.5.4 Water Use

ORR has significant quantities of excess water capacity and has no restrictions on water use. As such, if the CNPC were located at Y-12, water use would increase by approximately 395 million gallons. If the AFCF were located at ORNL, water use would increase by approximately 117 million gallons. These increases (512 million gallons annually) would be approximately a 25 percent increase compared to existing operations.

6.3.5.5 Socioeconomics

ORR currently employs approximately 13,000 people and there are approximately 210,000 people employed in the ROI. If the CNPC were located at Y-12, operational employment would increase by approximately 4,165 at Y-12. If the AFCF were located at ORNL, operational employment would increase by approximately 1,350. The total increase in ORR employees (5,515) would increase the current ORR workforce by 40 percent. In the ROI, in addition to the direct jobs created (5,515), approximately 23,163 indirect jobs would be created, for a total of 28,678 new jobs, an increase of approximately 13.6 percent in the ROI. This increase would be larger than the 10 percent increase discussed for construction, but would create many of the same similar impacts.

6.3.5.6 *Human Health*

Workers at ORNL and Y-12 currently receive approximately 166 person-rem of radiation dose from normal operations. If the CNPC were located at Y-12, the cumulative operational dose to workers would increase by approximately 386 person-rem. If the AFCF were located at ORNL, operational dose to workers would increase by approximately 17.1 person-rem. The resultant cumulative dose to the ORR workforce would be 569.1 person-rem. Statistically, an annual dose of 569.1 person-rem would result in 0.34 LCFs to the ORR workforce, meaning that 1 additional LCF could be expected to occur for every 3 years of ORR operation.

6.3.5.7 *Waste Management*

Y-12 currently does not generate any HLW, so any HLW created by the AFCF would not add any cumulative impacts. The AFCF would include facilities to manage such wastes until ultimate disposal in a geologic repository. The 10 cubic yards of LLW would be less than 1 percent of LLW generated by existing site operations. The 18 cubic yards of mixed LLW would add approximately double the mixed LLW generated by existing site operations. The CNPC would also double the LLW currently generated, and increase mixed LLW by approximately four times the current amount generated.

Chapter 7
UNAVOIDABLE ADVERSE IMPACTS

Chapter 7

UNAVOIDABLE ADVERSE IMPACTS

This chapter presents the unavoidable adverse environmental impacts associated with the major programmatic actions that could result from decisions based on this document. As a result of such actions, the siting, construction, and/or operation of facilities located at Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee; Savannah River Site (SRS) in Aiken, South Carolina; Pantex Plant (Pantex) in Amarillo, Texas; Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico, Sandia National Laboratories in Albuquerque, New Mexico; Nevada Test Site (NTS) in Las Vegas, New Mexico; Tonopah Test Range (TTR) in Tonopah, Nevada; Lawrence Livermore National Laboratory (LLNL) in Livermore, California; and White Sands Missile Range (WSMR) in Las Cruces, New Mexico could result in adverse environmental impacts.

The analysis presented in this document has identified potential adverse impacts. In addition, mitigative measures that could be taken to either avoid or minimize these impacts have been identified. The residual adverse impacts of actions remaining after mitigation are considered to be unavoidable and the bounding case impacts of all potential alternatives are discussed below. The largest impacts for each of these facilities, except for LLNL, TTR, and WSMR, would come from the construction and operation of a Consolidated Nuclear Production Center (CNPC).

Construction of a CNPC at Y-12, the SRS, Pantex, NTS, or LANL would disturb approximately 600 acres. This land requirement represents two thirds of the 800 acres at Y-12. For SRS, this 600 acres site represents less than one percent of the total 198,420 acre site. For Pantex, 600 acres represents about 3.75 percent of the 15,977 acre site. For NTS, 600 acres is an insignificant portion of the 879,990 acre site. For LANL, 600 acres represents a little less than four percent of the 15,600 acre site. Although construction of a CNPC would change the existing land use, the proposed CNPC would be compatible and consistent with the land use plans of all of the potential sites and would be compatible with the current land use designations.

The proposed reference location at each of the candidate sites, except for LANL, is located in a highly developed and previously disturbed area; therefore, there would be no loss of habitat or impacts to biological, cultural or archaeological resources. At LANL, construction of a CNPC would take place at a site located within TA-16, some of which is developed. Wildlife and vegetation present at TA-16 are characteristic of species adapted to built environments with open settings, i.e., non-forested. Vegetation is comprised primarily of grasses, weeds, and plants used for landscaping. Wildlife is common to the region and is comprised primarily of small mammals, lizards, and birds. In addition to the impacts associated with the Consolidated Plutonium Center (CPC) and Consolidated Uranium Center (CUC), approximately 300 acres of low value vegetation and habitat would be affected during construction of the Assembly/Disassembly/High Explosive (A/D/HE) Center. These collectively make up the CNPC impacts. During site clearing activities, highly mobile wildlife species, such as other small mammals and birds, would be able to relocate to adjacent, less developed areas. However, successful relocation may not occur due to competition for resources to support the increased population and the carrying capacity limitations of areas outside the proposed development. For less mobile species (reptiles and other small mammals), direct mortality could occur during the actual construction event or

ultimately result from stress related to habitat alteration. Potential hunting habitat for raptors and other predators would be lost as acreage is used for development.

Construction impacts for all potential sites would be minor and the appropriate soil and erosion mitigation measures would minimize any adverse impacts. No Federal- and state-threatened and endangered species and other species of special interest are known to occur or may occur at any of the potential CNPC sites. However, TA-16, the candidate site at LANL, does contain core and buffer Areas of Environmental Interest for the Mexican spotted owl (*strix occidentalis lucida*), a federally listed threatened species, and other special interest avian species may use the habitat for foraging and hunting. The proposed CNPC at LANL would have minimal effect on the core and buffer area for the Mexican spotted owl as it is proposed for construction in a partially developed environment.

For each of the candidate sites, use of water is unavoidable. It is estimated that 145 million gallons per year of groundwater would be required to operate a CNPC at SRS, Y-12 NTS or LANL. This amount of water is not an issue for any of the candidate sites just noted. However, at Pantex 15,427,000 gallons of groundwater per year would be required for operation. This would amount to a 12 percent increase in groundwater usage for Pantex.

For NTS, there would be a significant impact to site electrical power requirements. Electrical energy requirements would exceed available site electrical energy capacity by approximately 42 percent. Available peak electrical load would be exceeded by approximately 33 percent. NTS would have to procure additional power. Currently, NTS does not use natural gas or coal which are necessary for the production of steam for heating. Coal would have to be transported to the site or a natural gas pipeline installed, to serve as fuel sources for the generation of steam. Impacts to liquid fuel and process gases would be negligible. Likewise at Pantex, there would be a significant impact to site electrical power requirements. Electrical energy requirements at Pantex would be approximately 53 percent of the site capacity. Available peak electrical load would be approximately 89 percent. It is expected that additional electrical capacity could be procured from the electric power provider to support the increased requirements. Impacts to fuel and process gases would be negligible for all candidate sites.

During construction there would be no in-migration at any CNPC candidate site. However, for operation of a CNPC there would be in-migration to all candidate sites to fill the 1,785 new jobs required to operate the CNPC. In most cases, vacancies in the existing housing stock would be sufficient. An increase in vehicle traffic associated with construction and operation would affect the roads and transportation network surrounding the alternative sites. The resulting impacts in traffic, congestion, and road accidents resulting from socioeconomic growth is unavoidable, but could be eased through upgrades to existing road systems.

During normal operations, a minimal amount of radioactive material and activation products would be released to the environment. However, any radiation dose received by a member of the public from emissions from the construction and operation of a CNPC would be too small to distinguish from naturally occurring background radiation. During normal operation, even with a strong as-low-as-reasonably-achievable (ALARA) program, workers would be exposed to an increased risk of cancer as a result of occupational exposure to radiation over an extended period.

Details about occupational exposure can be found in Chapter 5 in the Health and Safety Section for each candidate site.

In addition, because hazardous and toxic chemicals would be routinely handled at the various facilities, some worker exposure to these chemicals would be unavoidable. However, no onsite chemical concentrations would exceed the Occupational Exposure Limit guidelines. Analysis has shown that chemical pollutant emissions would be of minimal consequence and would not pose a danger to the public.

Operations at the facilities would generate a variety of wastes (including radioactive, hazardous, mixed, and sanitary) as an unavoidable result of normal operations. Although these sites use pollution prevention and waste avoidance measures, generation of chemical and radioactive wastes would be unavoidable. The sites would continue to further reduce hazards and potential exposures through the continued success of pollution prevention and waste avoidance measures. Details regarding waste generation, as well as other environmental impacts, are presented in Chapter 5.

If a site other than LANL is selected as the candidate site for a CNPC, plutonium operations at LANL's TA-55 would be phased out with a resulting job loss of 610 persons, and Category I/II special nuclear material (SNM) moved to the CNPC. This would reduce the radiation dose to workers by 220 person-roentgen equivalent in man (rem). It would also reduce waste generation at LANL by approximately 11 percent for low level waste (LLW), 14 percent for mixed LLW, and 80 percent for transuranic (TRU) waste.

If TTR were to be closed, there would be major socioeconomic impacts for the town of Tonopah, Nevada. A loss of 120 jobs would pose a problem for the local economy, the existing school system, and the local housing market. If flight test operations were to be transferred to WSMR, there would be an increase in employment, although not the 120 lost from TTR, as existing staff at WSMR would be utilized. Additional information is discussed in Chapter 5.

Chapter 8
RELATIONSHIP BETWEEN
SHORT-TERM AND LONG-TERM USES

Chapter 8

RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM USES

In accordance with the *National Environmental Policy Act* (NEPA) (42 *United States Code* §4321 et seq.) requirements, this section discusses the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. It also examines long-term adverse cumulative impacts, with a focus on impacts that may narrow the range of options for future use. Potential impacts of the alternatives at the candidate sites are discussed in Chapter 5, and cumulative impacts are identified in Chapter 6. The use of land on any of the candidate sites for new programmatic-decision facilities would not affect the long-term productivity adversely since these facilities would all be constructed on disturbed land. In fact, since the new facilities would be technologically more advanced, they would be less polluting and generate less waste, thereby reducing the future need for use of additional land for the disposal of radiological and hazardous materials. At the same time, such facilities represent long-term research and development (R&D) and production functions compatible with historic nuclear weapons support.

Of concern are several of the project-specific alternatives requiring the construction of new facilities at Nevada Test Site (NTS). These proposed facilities could compromise long-term habitat productivity. The range of the endangered desert tortoise lies in the southern third of NTS. Construction and operation of facilities associated with Flight Test Operations or Environmental Test Facilities have the potential to impact the habitat of the Federal-listed threatened desert tortoise. Measures designed to avoid impacts to the desert tortoise from previous projects at NTS have been implemented with mitigation measures developed in consultation with U.S. Fish and Wildlife Service (USFWS). These measures have proven to be effective. In addition, long-term effects are especially delicate at facilities located in the western United States such as Sandia National Laboratories (SNL), Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and NTS, where biological communities recover very slowly from disturbances and are particularly susceptible to soil erosion.

Losses of other terrestrial and aquatic habitat from natural productivity to accommodate new facilities and temporary disturbances required during construction are possible. Land clearing and construction activities resulting in large numbers of personnel and equipment moving about an area would disperse wildlife and temporarily eliminate habitat. Although some destruction would be inevitable during and after construction, these losses would be minimized by selection and through environmental reviews at the site-specific level. In addition, short-term disturbances of previously undisturbed biological habitat from the construction of new facilities could cause long-term reductions in the biological productivity of an area.

Potential termination of nuclear weapons activities at the Tonopah Test Range (TTR), Pantex Plant (Pantex) or Y-12 National Security Complex (Y-12) as well as reduced operations at other sites offer the possibility of restoring existing facilities at these sites to other purposes.

Environmental restoration activities could have minor or short-term impacts similar to those normally associated with construction activities such as habitat disturbance and soil erosion. If contaminated structures were removed and site areas restored to a natural state, these areas could provide improved but not pristine conditions for the long-term.

Chapter 9
IRREVERSIBLE AND
IRRETRIEVABLE RESOURCES

Chapter 9

IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

Operations at the alternative candidate site would require an irreversible and irretrievable commitment of resources. A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. For example, as a landfill receives waste, the primary impact is a limit on waste capacity. The secondary impact is a limit on future land use options. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. This section discusses four major resources: land, energy, material, and water that have the potential to be committed irreversibly or irretrievably under the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) alternatives.

9.1 LAND

The land requirements in support of Complex Transformation construction would be modest in relation to the existing nuclear weapons facilities and would represent an irreversible commitment of the land. Most of the larger facilities would be constructed on disturbed land. For the aboveground construction alternatives, the land would not be restored to its original condition and the land would not be available or suitable for other uses. The same is true of associated access roads. Once these facilities end their useful life, they could be returned to open space uses if the buildings, roads and other structures were removed, areas cleaned up, and the land revegetated. Alternatively, the facilities could be modified for use in other nuclear programs. Therefore, the commitment of this land is not completely irreversible.

However, land rendered unfit for other purposes, such as that set aside for radiological and hazardous chemical waste disposal facilities, or facilities which have experienced leaks or other such unplanned releases, represent an irreversible commitment because wastes and other radioactive or hazardous chemical substances in below-ground settings or disposal areas may not be completely removed at the end of the project's useful life. It is possible that the land could not be restored to its original condition or even to minimum cleanup standards, nor could the site feasibly be used for any other purposes following closure of the disposal facility. This land could be permanently unusable because the substrata would not be available for other potential intrusive uses such as mining, utility infrastructure, or foundations for other buildings. However, the surface area appearance and biological habitat lost during construction and operation of the facilities could be restored to a large extent.

9.2 ENERGY

The irretrievable commitment of resources during construction and operation of the facilities would include the consumption of fossil fuels used to generate heat and electricity for the sites. Energy would also be expended in the form of diesel fuel, gasoline, and oil for construction equipment and transportation vehicles. The amounts of irretrievable energy required to construct and operate new or modified facilities are estimated in Chapter 3. Resource requirements for the larger construction alternatives are shown in Table 9.2-1 and Table 9.2-2.

Table 9.2-1 — Irreversible and Irretrievable Construction Commitments

Requirement	Stand-alone CPC at SRS, Y-12, Pantex, NTS	CPC at LANL	LANL Upgrade TA-55/PF4	UPF at Y-12	CUC	AD/HE
Electrical Energy (MWh)	6,600	6,000	.3/1.5	26.4	30	277
Concrete (cubic yards)	308,000	280,000	3,715/32,750	200,000	230,000	324,500
Steel (tons)	44,000	40,000	401/3,850	27,500	29,500	18,050
Liquid Fuels (million gals)	4.8	4.4	0/0	.25	.325	21.35
Gases (cubic yards)	19,800	18,000	0/450	NA	NA	NA
Water (million gals)	20.9	20.9	2.1/.55	4	5.2	2.35
Total (worker years)	2900	2,650	1100/430	2,900	4000	6,800
Peak (workers)	850	770	300/190	900	1300	3,800

NA – Not Applicable

Table 9.2-2 — Irreversible and Irretrievable Operation Commitments

Resources	CPC at LANL [200 pits per year (ppy) (surge)]	CPC at SRS, Y-12, Pantex, NTS [200 ppy (surge) plus R&D]	LANL Upgrade	UPF at Y-12	CUC	AD/HE
Electrical Consumption (MWh)	48,000	48,000	44,000	168,000	168,000	52,000
Peak Electrical (MWe)	22.0	24.0	10	18.4	18.4	11.9
Diesel Fuel (gallons)	21,000	23,000	NA	NA	NA	367
Nitrogen ^c (yd ³)	81,000	89,000	NA	NA	NA	NA
Argon ^c (yd ³)	2,000	2,200	NA	NA	NA	NA
Domestic Water (million gals)	14	15.5	10	.105	.105	130
Total workers	1,173	1,780	680	600	935	1,785
Radiation workers	675	1,150	458	315	490	400

NA – Not Applicable

9.3 MATERIAL

The irreversible and irretrievable commitment of material resources during the entire lifecycle of the existing or proposed facilities for Complex Transformation includes construction materials that cannot be recovered or recycled, materials that are rendered radioactive but cannot be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. Where construction is necessary, materials required include wood, concrete, sand, gravel, plastics, steel, aluminum, and other metals. At this time, no unusual construction material requirements have been identified either as to type or quantity. The construction resources, except for those that can be recovered and recycled with present technology, would be irretrievably lost. However, none of these identified construction resources is in short supply and all are readily available in the vicinity of the locations being considered for new construction. The commitment of materials to be manufactured into new equipment that cannot be recycled at the end of the project's useful lifetime is irretrievable. Consumption of operating supplies, miscellaneous chemicals, and gases,

while irretrievable, would not constitute a permanent drain on local sources or involve any material in critically short supply in the United States as a whole. Materials consumed or reduced to unrecoverable forms of waste, such as uranium, are also irretrievably lost. However, strategic and critical materials, or resources having small natural reserves, are of such value that economics promotes recycling. Plans to recover and recycle as much of these valuable, depletable resources as is practical would depend upon need. Each item would be considered individually at the time a recovery decision is required. Some of the larger material needs for construction and operation of the major proposed facilities are shown in Table 9.2-1 and Table 9.2-2.

9.4 WATER

Water is a scarce resource in many parts of the United States, and must not be taken for granted. Many of the Complex Transformation new construction alternatives have large water requirements, even though they have used all existing conservation technology available and designed product fabrication practices to minimize water needs. To the extent water is recoverable it has been designed into the facility planning process. None of the water requirements for any of the new construction alternatives and alternative siting locations pose any issues. Water requirements for construction and operation of the larger alternative new construction facilities are shown in Table 9.2-1 and Table 9.2-2.

Chapter 10
COMPLIANCE, REGULATORY
REQUIREMENT, PERMITS

Chapter 10

COMPLIANCE, REGULATORY REQUIREMENT, PERMITS

This chapter provides information concerning the environmental standards that regulate or guide proposed plans presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS). This section presents primary environmental compliance requirements that would result from implementation of the proposed action or alternatives. These requirements are found in Federal and state statutes, regulations, permits, approvals, and consultations, and in Executive and U.S. Department of Energy (DOE) Orders, consent orders, and a Federal Facility Agreement. These citations identify the standards to be used for evaluating the ability of the alternative actions to meet the environmental, safety, and health requirements and for obtaining required Federal and state permits and licenses.

10.0 INTRODUCTION

As mandated by the *National Environmental Policy Act (NEPA)*, the *Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS)* must assess whether the proposed action and alternatives would result in a violation of a Federal, state, or local law or requirement (40 Code of Federal Regulations [CFR] Part 1500-1508), or necessitate a permit, license, or other entitlement (40 CFR Part 1500-1508). This chapter provides a baseline summary assessment of the environmental, safety and health (ES&H) requirements that apply to the proposed action and alternatives, to the extent necessary to assist in making programmatic-level decisions. These requirements include Federal and state statutes, regulations, permits, approvals, and consultations, as well as Executive Orders and DOE Orders, Consent Orders, Federal Facility Agreements, Federal Facility Compliance Agreements (FFCA), and Agreements in Principle that identify the standards against which the proposed action and alternatives will be evaluated to ensure compliance with all applicable ES&H requirements, and to obtain the required Federal, state, and local permits, licenses, and approvals.

The remainder of this chapter explains the concept of shared Federal and state enforcement, provides historical background on environmental protection at nuclear weapons production facilities, and summarizes the ES&H requirements associated with the proposed action and alternatives.

10.1 PURPOSE

Federal and state governments mandate ES&H requirements for operations at current DOE facilities and newly constructed or proposed facilities. These requirements originate with the U.S. Congress, Federal agencies, Executive Orders, state legislatures, state agencies, and local governments. In general, Federal statutes establish national policies, create broad legal requirements, and authorize Federal agencies to create regulations that conform to statutes. These statutes are delegated to various Federal agencies including the DOE, Environmental Protection Agency (EPA), and the Department of Transportation (DOT), which promulgate implementing

regulations. Executive Orders are issued by the President and establish policies and requirements for Federal agencies, but do not have the force of law of regulations. State legislatures issue their own statutes to authorize and mandate promulgation of state regulations. State statutes, like Federal statutes, establish broad legal requirements. State regulations are then promulgated by state agencies to enforce state statutes.

The *Federal Facility Compliance Act* of 1992 (FFCA) waives sovereign immunity from enforcement of the *Resource Conservation and Recovery Act* (RCRA) at Federal facilities and thereby gives states the authority to assess fines and penalties under certain conditions. It further requires DOE to develop plans and enter into agreements with states as to specific management actions for particular mixed waste streams. Such agreements could have a direct effect on the wastes generated as a result of the implementation of the proposed action and alternatives, yet such an effect cannot be determined until such time as these agreements are approved according to the terms of the FFCA.

Some environmental regulatory programs are enforced through review, approval, and permitting requirements that attempt to minimize the negative impacts from releases of pollutants to the environment by limiting activities to established standards. Federal and state agencies share environmental regulatory authority over DOE facility operations when Federal legislation delegates permitting or review authority to qualifying states. Some examples are the following: National Emission Standards for Hazardous Air Pollutants (NESHAP) and the Prevention of Significant Deterioration under the *Clean Air Act* (CAA); the Water Quality Standards and the National Pollutant Discharge Elimination System (NPDES) under the *Clean Water Act* (CWA); the Hazardous Waste Programs under RCRA; and the Drinking Water and Underground Injection Control Programs under the *Safe Drinking Water Act* (SDWA). When Federal legislation allows delegation of enforcement authority, states must set standards equal to or more stringent than those required by Federal law to obtain such authority. Where the Federal regulatory agency has delegated its authority, the state or local regulations set the governing standards; however, when Federal legislation does not provide for delegation of enforcement authority to the states (e.g., the *Toxic Substances Control Act* [TSCA]), the standards are administered and enforced solely by the Federal government.

The health and safety of all workers associated with the proposed action and alternatives is a primary consideration in the programmatic decision resulting from this Supplemental PEIS. A comprehensive nuclear and occupational safety and health initiative was announced by the Secretary of Energy on May 5, 1993, entailing closer consultation with the Occupational Safety and Health Administration (OSHA) regarding regulation of worker safety and health at DOE contractor-operated facilities. Regulation of worker health and safety at DOE contractor-operated facilities will gradually shift from DOE to OSHA. The Occupational Safety and Health Act of 1970 (Public Law 91-596) establishes Federal requirements for ensuring occupational safety and health protection for employees. DOE facilities also comply with the Emergency Planning and Community Right-To-Know Act (EPCRA)(42 USC §11001), which requires facilities to report the release of extremely hazardous substances and other specified chemicals; to provide material safety data sheets or lists thereof; and to provide estimates of the amounts of hazardous chemicals onsite. The reporting and emergency preparedness requirements are designed to protect both individuals and communities.

10.2 BACKGROUND

Since a large number of the facilities in the nation's Nuclear Weapons Complex (Complex) were constructed in the 1940s and 1950s, before the advent of most ES&H requirements, national security requirements played a dominant role in the design and operation of those facilities. However, with the emerging awareness of environmental and health-related issues, and the enactment of environmental and worker safety and health programs, DOE began shifting its resources into programs designed to achieve compliance with all applicable Federal, state, and local ES&H requirements. Today, many government agencies at the Federal, state, and local levels have regulatory authority over DOE facility operations. DOE has entered into enforceable compliance agreements with the regulators at most of its facilities. These agreements detail specific programs, funding levels, and schedules for achieving compliance with applicable ES&H statutory and regulatory requirements.

10.3 FEDERAL ENVIRONMENTAL, SAFETY & HEALTH STATUTES, REGULATIONS, ORDERS, AND AGREEMENTS

The *Atomic Energy Act* of 1954, as amended, directs DOE to protect public health and minimize dangers to life or property with respect to activities under its jurisdiction. The EPA, under authority of the *Atomic Energy Act*, has set radiation protection standards for workers and the public. EPA has also promulgated Federal environmental regulations and implemented statutes to protect the environment and to control the generation, handling, treatment, storage, and disposal of hazardous materials and waste substances.

Because of their length, and for ease of reading, the tables in this chapter are presented consecutively at the end of the text. Table 10.4-1 lists the applicable Federal environmental statutes, regulations, and Executive Orders, and also identifies the associated permits, approvals, and consultations generally required to site, construct, or operate stockpile stewardship and management facilities. Except for limited presidential exemptions, Federal agencies must comply with all applicable provisions of Federal environmental statutes and regulations, in addition to all applicable state and local requirements. Table 10.4-2 lists selected DOE ES&H orders that apply to all sites, but which may affect each site differently.

DOE has entered into agreements with regulatory agencies on behalf of all of DOE facilities being considered in this Supplemental Programmatic Environmental Impact Statement (SPEIS). These agreements normally establish a schedule for achieving full compliance at these DOE facilities. Table 10.4-3 lists those environmental agreements and consent orders that DOE has with Federal and state regulatory agencies. These agreements and consent orders are generally available from the regulatory agency that is a party to the agreement, normally the state environmental department or EPA region, and also from the local DOE information resource center or reading room.

10.4 STATE ENVIRONMENTAL, SAFETY & HEALTH REQUIREMENTS

Table 10.4-4 lists the potential requirements imposed by the major state environmental statutes and regulations applicable to the proposed action and alternatives. These requirements apply to

Federal activities within the jurisdiction of the enforcing authority. Just as Table 10.4-3 identifies requirements based on Federal laws, Table 10.4-4 identifies the permits, approvals, and consultations generally required to site, construct, or operate DOE facilities in accordance with state statutes and regulations.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Air and Noise	<i>Clean Air Act</i> of 1970, as amended	42 USC §§7401 et seq.	EPA	Requires sources to meet standards and obtain permits to satisfy; National Ambient Air Quality Standards, State Implementation Plans, Standards of Performance for New Stationary Sources, National Emission Standards for Hazardous Air Pollutants, and Prevention of Significant Deterioration.
	National Ambient Air Quality Standards/State Implementation Plans	42 USC §§7409 et seq.	EPA	Requires compliance with primary and secondary ambient air quality standards governing sulfur dioxide, nitrogen oxide, carbon monoxide, ozone, lead, and particulate matter and emission limits/reduction measures as designated in each state's implementation plan.
	Standards of Performance for New Stationary Sources	42 USC §7411	EPA	Establishes emission standards and recordkeeping requirements for new or modified sources specifically addressed by a standard.
	National Emissions Standards for Hazardous Air Pollutants	42 USC §7412	EPA	Requires sources to comply with emission levels of carcinogenic or mutagenic pollutants; may require a preconstruction approval depending on the process being considered and the level of emissions that will result from the new or modified source.
	Prevention of Significant Deterioration	42 USC §§7470 et seq.	EPA	Applies to areas that are in compliance with National Ambient Air Quality Standards. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 tons/year) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible state agency setting forth emission limitations to protect the Prevention of Significant Deterioration increment.
	<i>Noise Control Act</i> of 1972, as amended	42 USC §§4901 et seq.	EPA	Requires facilities to maintain noise levels that do not jeopardize public health and safety.
Water	<i>Clean Water Act</i> , as amended	33 USC §§1251 et seq.	EPA	Requires EPA or state-issued permits and compliance with provisions of permits regarding discharge of effluents (pollutants) o surface waters.
	National Pollutant Discharge Elimination System (section 402 of the CWA)	33 USC §1342	EPA	Requires permit to discharge effluents and storm waters to surface waters; permit modifications are required if discharge effluents are altered.
	Dredged or Fill Material (section 404 of the CWA), <i>Rivers and Harbors Appropriations Act</i> of 1899	33 USC §1344/ 33 USC §§401 et seq.	U.S. Army Corps of Engineers (USACE)	Requires permits to authorize the discharge of dredged or fill material into navigable waters or wetlands and to authorize certain work in or structures affecting navigable waters.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders (continued)

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Water (cont'd)	<i>Wild and Scenic Rivers Act</i> of 1968	16 USC §§1271 et seq.	U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), U.S. Forest Service (USFS), National Park Service (NPS)	Consultation required before construction of any new Federal project associated with a river designated as wild and scenic or under study in order to minimize and mitigate any adverse effects on the physical and biological properties of the river.
	<i>Safe Drinking Water Act</i> of 1974, as amended	42 USC §§300f et seq.	EPA	Requires permits for construction/operation of underground injection wells and subsequent discharging of effluents to ground aquifers.
	Executive Order 11988: Floodplain Management	3 CFR, 1977 Comp., p. 117	Water Resources Council, Federal Emergency Management Agency (FEMA), Council on Environmental Quality (CEQ)	Requires consultation if project impacts a floodplain.
	Executive Order 11990: Protection of Wetlands	3 CFR, 1977 Comp., p. 121	USACE, USFWS	Requires Federal agencies to avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands.
	Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR 1022	DOE	Requires the Department of Energy to comply with all applicable floodplain/wetlands environmental review requirements.
Hazardous Wastes and Soils	Resource Conservation and Recovery Act/Hazardous and Solid Waste Amendments of 1984	42 USC §§6901 et seq./PL 98-616	EPA	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities; changes to site hazardous waste operations could require amendments to hazardous waste permits.
	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i> of 1980/Superfund Amendments and Reauthorization Act of 1986	42 USC §§9601 et seq./PL 99-499	EPA	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires the Department of Energy to enter into Interagency Agreements with the Environmental Protection Agency and state to control the cleanup of each Department of Energy site on the National Priorities List.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders (continued)

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Hazardous Wastes and Soils (cont'd)	Executive Order 12580: Superfund Implementation	3 CFR, 1987 Compilation., p. 193	EPA	The Department of Energy shall comply with the National Contingency Plan in addition to the other requirements of the order, as amended.
	<i>Community Environmental Response Facilitation Act</i> of 1992	PL 102-426	EPA	Amends the <i>Comprehensive Environmental Response, Compensation, and Liability Act</i> to establish a process for identifying, prior to the termination of Federal activities, property that does not contain contamination. Requires prompt identification of parcels that will not require remediation to facilitate the transfer of such property for economic redevelopment purposes.
	<i>Farmland Protection Policy Act</i> of 1981	7 USC §§4201 et seq.	Soil Conservation Service	The Department of Energy shall avoid any adverse effects to prime and unique farmlands.
	<i>Federal Facility Compliance Act</i> of 1992	42 USC §6961	States	Waives sovereign immunity for Federal facilities under the <i>Resource Conservation and Recovery Act</i> and requires the Department of Energy to develop plans and enter into agreements with states as to specific management actions for specific mixed waste streams.
Biotic	<i>Fish and Wildlife Coordination Act</i> of 1934	16 USC §§661 et seq.	USFWS	Requires consultation on the possible effects on wildlife if there is construction, modification, or control of bodies of water in excess of 10 acres (4 hectares) surface area.
	<i>Bald and Golden Eagle Protection Act</i> of 1973, as amended	16 USC §§668 et seq.	USFWS	Consultations should be conducted to determine if any protected birds are found to inhabit the area. If so, the Department of Energy must obtain a permit prior to moving any nests due to construction or operation of project facilities.
	<i>Migratory Bird Treaty Act</i> of 1918, as amended	16 USC §§703 et seq.	USFWS	Requires consultation to determine if there are any impacts on migrating bird populations due to construction or operation of project facilities. If so, the Department of Energy will develop mitigation measures to avoid adverse effects.
	Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds	66 FR 3853	USFWS	The Department of Energy shall take measures to develop and implement a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service that shall promote the conservation of migratory bird populations.
	<i>Wilderness Act</i> of 1964	16 USC §§1131 et seq.	Department of Commerce (DOC), Department of Interior (DOI)	The Department of Energy shall consult with the Department of Commerce and Department of the Interior and minimize impacts.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders (continued)

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
Biotic (cont'd)	<i>Wild Free-Roaming Horses and Burros Act</i> of 1971	16 USC §§1331 et seq.	DOI	The Department of Energy shall consult with the Department of the Interior and minimize impacts.
	<i>Endangered Species Act</i> of 1973	16 USC §§1531 et seq.	USFWS, National Marine Fisheries Service (NMFS)	Requires consultation to identify endangered or threatened species and their habitats, assess Department of Energy impacts thereon, obtain necessary biological opinions, and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operations.
Cultural	<i>National Historic Preservation Act</i> of 1966, as amended	16 USC §§470 et seq.	President's Advisory Council on Historic Preservation	The Department of Energy shall consult with the State Historic Preservation Office prior to construction to ensure that no historical properties will be affected.
	Executive Order 13007: Indian Sacred Sites	61 FR 26771	DOE	The Department of Energy shall accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.
	Executive Order 13175: Consultation and Coordination With Indian Tribal Governments	65 FR 67249	DOE	The Department of Energy shall establish regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies with tribal implications, strengthen U.S. government to government relations with Indian tribes, and reduce imposition of unfunded mandates upon Indian tribes.
	<i>Archaeological and Historical Preservation Act</i> of 1974	16 USC §§469 et seq.	DOI	The Department of Energy shall obtain authorization for any disturbance of archaeological resources.
	<i>Archaeological Resources Protection Act</i> of 1979	16 USC §§470aa et seq.	DOI	The Department of Energy shall obtain authorization for any excavation or removal of archaeological resources.
	<i>Antiquities Act</i> of 1906	16 USC §§431-33	DOI	The Department of Energy shall comply with all applicable sections of the act.
	<i>American Indian Religious Freedom Act</i> of 1978	42 USC §1996	DOI	The Department of Energy shall consult with local Native American Indian tribes prior to construction to ensure that their religious customs, traditions, and freedoms are preserved.
	<i>Native American Graves Protection and Repatriation Act</i> of 1990	25 USC §3001	DOI	The Department of Energy shall consult with local Native American Indian tribes prior to construction to guarantee that no Native American graves are disturbed.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders (continued)

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	Executive Order 11593: Protection and Enhancement of the Cultural Environment	3 CFR 154, 1971-1975 Compilation, p. 559	DOI	The Department of Energy shall aid in the preservation of historic and archaeological data that may be lost during construction activities.
Worker Safety and Health	<i>Occupational Safety and Health Act of 1970</i>	5 USC §651	Occupational Safety and Health Administration	The Department of Energy shall comply with all applicable worker safety and health legislation (including guidelines of 29 CFR 1960) and prepare, or have available in the workplace, Material Safety Data Sheets.
	Hazard Communication Standard	29 CFR 1910.1200	OSHA	The Department of Energy shall ensure that workers are informed of, and trained to handle, all chemical hazards in the DOE workplace.
Other	<i>Atomic Energy Act of 1954, as amended</i>	42 USC §2011	EPA and DOE	The Department of Energy shall follow its own standards and procedures to ensure the safe operation of its facilities.
	<i>National Environmental Policy Act of 1969, as amended</i>	Under the authority of 42 USC §§4321 et seq. and in accordance with 10 CFR 1021	CEQ and DOE	The Department of Energy shall comply with NEPA implementing procedures.
	<i>Uranium Mill Tailings Radiation Control Act of 1978</i>	42 USC §§7901 et seq.	EPA	The Department of Energy shall enforce and implement health and environmental standards and acquire licenses when required.
	<i>Toxic Substances Control Act of 1976</i>	15 USC §§2601 et seq.	EPA	The Department of Energy shall comply with inventory reporting requirements and chemical control provisions of TSCA to protect the public from the risks of exposure to chemicals; TSCA imposes strict limitations on use and disposal of polychlorinated biphenyl-contaminated equipment.
	<i>Hazardous Materials Transportation Act of 1975, as amended</i>	49 USC §§1801 et seq.	DOT	The Department of Energy shall comply with the requirements governing hazardous materials and waste transportation.
	<i>Hazardous Materials Transportation Uniform Safety Act of 1990</i>	49 USC §1801	DOT	Restricts shippers of highway route-controlled quantities of radioactive materials to use-only permitted carriers.
	<i>Emergency Planning and Community Right-To-Know Act of 1986</i>	42 USC §§11001 et seq.	EPA	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency releases, and imposes right-to-know reporting requirements covering storage and use of chemicals which are reported in toxic chemical release forms.

Table 10.4-1 — Federal Environmental, Safety & Health Statutes, Regulations, and Orders (continued)

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	Potential Applicability
	<i>Pollution Prevention Act of 1990 under the provision of the Superfund Amendments and Reauthorization Act (SARA).</i>	42 USC 13101 and section 313 of SARA	EPA	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under section 313 of SARA .
Other (cont'd)	Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations as amended by Executive Order 12948	3 CFR, 1994, Compilation, p. 859 February 11, 1994 amended January 30, 1995	EPA	Requires Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
	Executive Order 12088: Federal Compliance with Pollution Control Standards, as amended by Executive Order 12580: Superfund Implementation" to the end of Executive Order 12088	3 CFR, 1978 Compilation, p. 243	Office of Management and Budget	Requires Federal agencies landlords to submit to Office of Management and Budget an annual plan for the control of environmental pollution and to consult with Environmental Protection Agency and state agencies regarding the best techniques and methods.
	Executive Order 11514: Protection and Enhancement of Environmental Quality	3 CFR, 1966-1970 Compilation., p. 902	CEQ	Requires Federal agencies to demonstrate leadership in achieving the environmental quality goals of NEPA; provides for DOE consultation with appropriate Federal, state, and local agencies in carrying out their activities as they affect the environment.
	<i>Nuclear Waste Policy Act of 1982</i>	Under the authority of 42 USC 108 §§10101 et seq. and in accordance with 40 CFR 191	EPA	The Department of Energy shall dispose of radioactive waste.
	<i>Low-Level Radioactive Waste Policy Act of 1954</i>	42 USC §§2021b-2021d	DOE	The Department of Energy shall dispose of low-level radioactive wastes in accordance with the states in which it operates.

Table 10.4-2 — Selected Department of Energy Orders

DOE Order	Title
5400.5	Radiation Protection of the Public and Environment
5480.4	Environmental Protection, Safety, and Health Protection Standards
5480.19	Conduct of Operations Requirements for DOE Facilities
O 231.1	Environmental Safety and Health Reporting
O 414.1C	Quality Assurance
O 420.1B	Facility Safety
O 430.1B	Real Property Asset Management
O 435.1	Radioactive Waste Management
O 440.1A	Worker Protection Management for DOE Federal and Contractor Employees
O 450.1	Environmental Protection Program
O 451.1B	National Environmental Policy Act Compliance Program
O 460.1B	Packaging and Transportation Safety
O 460.2	Departmental Materials Transportation and Packaging Management
O 461.1	Packaging and Transfer or Transportation of Materials of National Security Interest
O 470.4A	Safeguards and Security Program

Table 10.4-3 — Agreements with Federal and State Environmental Regulatory Agencies

DOE Facility	Resource Category	Parties	Scope of Agreement	Effective Date
LANL	Water	DOE/EPA	CWA-NPDES compliance agreement	1991
	Water/Soil	DOE/NMED	The Compliance Order on Consent pertains to waste site investigations, corrective actions, and monitoring. IV.A.5 of the Order relates to Firing Sites, specifically deferring investigation or corrective action at active firing sites.	2005
LLNL, SNL/CA	Water	DOE/EPA/CA-RWQCB, CA-Dept. Health Svcs	Federal Facility Agreement-Regulates groundwater cleanup activities at LLNL under CERCLA/SARA Section 120	1988
	Water/Soil	DOE/EPA/CAEPA Department of Toxic Substances Control/RWQCB	CERCLA-Federal Facility Agreement describes the groundwater and soil investigations to be conducted at Site 300 and specifies reporting dates.	1992
	Air/Soil	DOE/EPA/CAEPA Department of Toxic Substances Control	Hazardous Waste Compliance Agreement 92/93-031 governing open burning of explosives wastes at Site 300.	1992
SNL/NM	Soil	DOE/NM	RCRA-Groundwater monitoring at chemical waste landfill	1989
SRS	Air	DOE/EPA	CAA-Federal Facility Compliance Agreement, Radionuclide NESHAP	1991
	Soil	DOE/SC	RCRA-Settlement Agreement 87-52-SW with amendment, Part B application deficiencies; groundwater monitoring	1987, 1991
	Soil	DOE/EPA	RCRA-Federal Facility Compliance Agreement for land disposal restrictions, with amendment 1, Docket No. 91-01-FFR	1991, 1992
	Soil	DOE/EPA/SC	CERCLA/RCRA-Federal Facility Agreement	1993
	Cultural	DOE/SHPO ACHP	Programmatic Memorandum of Agreement-Management of Archaeological Sites	1990

**Table 10.4-3 — Agreements with Federal and State Environmental Regulatory Agencies
(continued)**

DOE Facility	Resource Category	Parties	Scope of Agreement	Effective Date
ORR, Y-12	Air	DOE/EPA	CAA-Federal Facility Compliance Agreement, Radionuclide NESHAP	1992
	Soil	DOE/EPA/TN	CERCLA-Federal Facility Agreement	1992
	Soil	DOE/EPA	RCRA-Federal Facility Compliance Agreement for storage of mixed waste subject to land disposal restrictions	1992
	Soil	DOE/EPA/TN	Federal Facility Compliance Act Commissioners Order ORR Site-Specific Treatment Plan for Mixed Waste	1995
	All except Radiological	DOE/TN Dept. of Environment and Conservation	Oversight of environmental monitoring programs	1991
	Cultural	DOE/TN	DOE commitment to prepare a cultural resource management plan for ORR and to conduct a survey to identify significant historical properties located within the ORR; interim programmatic exclusions from Section 106 review	1994
NTS	Air/Water	DOE/NV	Agreement in Principle for DOE to provide funding to Nevada for oversight of environmental, safety and health activities	1990
	Soil	DOE/NV	RCRA-Settlement Agreement-TRU mixed waste	1992
	Cultural	DOE/NV	Programmatic Agreement-Archaeological and Historic Preservation activities	1993
	Water/Soil	DOE/NV/DoD	Federal Facility Agreement and Consent Order outlines a schedule for cleanup and monitoring commitments	1996
Pantex Plant	Soil	DOE/EPA	RCRA-Section 3008 (h) Administrative Order on Consent	1990
TTR	Soil	DOE/NV/DoD	Federal Facility Compliance Agreement	1996
WSMR	Cultural	DOE/NM	As per an agreement between WSMR and the State Historic Preservation Office (SHPO) construction of new permanent structures is not permitted within the boundaries of the Trinity National Historic Landmark.	
	Biotic	U.S. Army/National Parks Service/U.S. Fish and Wildlife Service/New Mexico Department of Game and Fish	Cooperative agreement for protection and maintenance of the White Sands pupfish	1994

Table 10.4-4 — State Environmental, Safety & Health Requirements

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
<i>New Mexico (LANL, SNL, WSMR)</i>				
Air	<i>New Mexico Air Quality Control Act</i>	NM Stat., Title 74, Article 2	NM Environment Department	Permit required prior to the construction or modification of an air contaminant source.
	New Mexico Air Quality Standards and Regulations	NM Air Quality Control Regulations, §100	NM Environment Department	Permit required prior to the construction or modification of an air contaminant source.
Water	<i>New Mexico Water Quality Act</i>	NM Stat., Title 74, Article 6	NM Water Quality Control Commission	Permit required prior to the construction or modification of a water discharge source.
	New Mexico Water Quality Regulations	NM Water Regulations	NM Water Quality Control Commission	Permit required prior to the construction or modification of a water discharge source.
Hazardous Wastes and Soils	<i>New Mexico Solid Waste Act</i>	NM Stat., Chap. 74, Article 8	NM Environment Department	Permit required prior to the construction or modification of a solid waste disposal facility.
	New Mexico Solid Waste Management Regulations	NM Solid Waste Mgmt. Regulations	NM Environment Department	Permit required prior to the construction or modification of a solid waste disposal facility.
	New Mexico Hazardous Waste Management Regulations	NM Hazardous Waste Mgmt. Regulations	NM Environment Department	Permit required prior to the construction or modification of a hazardous waste disposal facility.
	New Mexico Underground Storage Tank Regulations	NM Underground Storage Tank Regulations	NM Environment Department	Permit required to comply with tank requirements prior to the construction or modification of an underground storage tank.
Biotic	<i>New Mexico Wildlife Conservation Act</i>	NM State Act 1978, Sections 17-2-37 through 17-2-46	NM Department of Game and Fish	Permit and coordination required if a project may disturb habitat or otherwise affect threatened or endangered species.
	<i>New Mexico Endangered Plant Species Act</i>	NM State Act 1978, Sections 75-6-1	NM State Forestry Department	Coordination with the department required.
Cultural	<i>New Mexico Cultural Properties Act</i>	NM State Act 1978, Sections 18-6-1 through 18-6-23	NM State Historic Preservation Office	Established State Historic Preservation Office and requirements to prepare an archaeological and historic survey and consult with the State Historic Preservation Office.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
<i>California (LLNL)</i>				
Air	<i>California Clean Air Act</i>	CA Health and Safety Code, Sections 39000 et seq.	CA Environmental Protection Agency, Air Resources Board and local districts	Permit required prior to construction or modification of an air contaminant source.
	<i>Air Toxics "Hot Spots" Information and Assessments Act</i>	CA Health and Safety Code, Sections 44300 et seq.	CA Environmental Protection Agency, Air Resources Board and local districts	Screening Risk Assessment required to estimate human health impacts to a resident living near the boundary of the site.
Water	<i>California Porter-Cologne Water Quality Act</i>	Water Code, Sections 13000 et seq.	CA Environmental Protection Agency, Water Resources Control Board and Regional Water Quality Control Boards	Permit required prior to construction or modification of water discharges sources.
Hazardous Wastes and Soils	<i>California Hazardous Waste Control Act</i>	CA Health and Safety Code, Sections 25100 et seq.	CA Environmental Protection Agency, Department of Toxic Substances Control	Permit required prior to construction or modification of hazardous waste management facility.
	<i>The Hazardous Waste Source Reduction and Management Review Act of 1989</i>	CA Health and Safety Code, Sections 25244.12 et seq.	CA Environmental Protection Agency, Department of Toxic Substances Control	Requires reports and plans describing how mandatory percentage reductions in waste streams will be achieved.
	"Hazardous Materials" Department of the California Highway Patrol	13 C.C.R, Chapter 6	CA Highway Patrol	Defines routes, stopping places, and rules of the road for transportation of hazardous materials.
	<i>California Environmental Quality Act</i>	CA Public Resources Code, section 21081.6	CA Environmental Protection Agency	Requires evaluation of environmental impacts associated with Department of Toxic Substances Control permitting decisions.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
Biotic	<i>California Endangered Species Act</i>	CA Fish and Game Code, Sections 2050-2098	CA Department of Fish and Game	States that agencies should not approve projects that would jeopardize the continued existence of threatened or endangered species or result in destruction or adverse modification of habitat essential to the continued existence of those species if conservation alternatives are reasonable and prudent.
Cultural	<i>California Environmental Quality Act</i>	CA Public Resources Code, Section 21083.2	CA Office of Planning and Research	Requires consideration of the effects of a project on prehistoric and historic cultural resources.
South Carolina and Georgia (SRS)				
Air	South Carolina Pollution Control Act/South Carolina Air Pollution Control Regulations and Standards	SC Code, Title 48, Chapter 1	SC Dept. of Health and Environmental Control (SCDHEC)	Permit required prior to construction or modification of an air contaminant source.
	Augusta-Aiken Air Quality Control Region	40 CFR 81.114	SC and GA	Requires SRS and surrounding communities in the 2-state region to attain National Ambient Air Quality Standards (NAAQS).
	<i>South Carolina Atomic Energy & Radiation Control Act</i>	SC Code, Title 13, Chapter 7	SCDHEC	Establishes standards for radioactive air emissions.
Water	<i>South Carolina Pollution Control Act</i>	SC Code, Title 48, Chapter 1	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	South Carolina Water Quality Standards	SC Code, Title 61, Chapter 68	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	<i>South Carolina Safe Drinking Water Act</i>	SC Code, Title 44, Chapter 55	SCDHEC	Establishes drinking water standards.
Hazardous Wastes and Soils	<i>South Carolina Underground Storage Tanks Act</i>	SC Code, Title 44, Chapter 2	SCDHEC	Permit required prior to construction or modification of an underground storage tank.
	South Carolina Solid Waste Regulations	SC Code, Title 61, Chapter 60	SCDHEC	Permit required to store, collect, dispose, or transport solid wastes.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
Hazardous Wastes and Soils	South Carolina Industrial Solid Waste Disposal Site Regulations	SC Code, Title 61, Chapter 66	SC Pollution Control Authority	Permit required for industrial solid waste disposal systems.
	<i>South Carolina Hazardous Waste Management Act</i>	SC Code, Title 44, Chapter 56	SCDHEC	Permit required to operate, construct, or modify a hazardous waste treatment, storage, or disposal facility.
	South Carolina Solid Waste Management Act	SC Code, Title 44, Chapter 96	SCDHEC	Establishes standards to treat, store, or dispose of solid waste.
Biotic	<i>South Carolina Nongame and Endangered Species Conservation Act</i>	SC Code, Title 50, Chapter 15	SC Department of Natural Resources	Consult with SC Wildlife and Marine Resources Department and minimize impact.
Cultural	South Carolina Institute of Archaeology and Anthropology	SC Code, Title 60, Chapter 13-210	SC State Historic Preservation Office	Consult with SC State Historic Preservation Office and minimize impact.
Tennessee (Y-12)				
Air	Tennessee Air Pollution Control Regulations	TN Rules, Division of Air Pollution	TN Air Pollution Control Board	Permit required to construct, modify, or operate an air contaminant source; sets fugitive dust requirements.
Water	<i>Tennessee Water Quality Control Act</i>	TN Code, Title 69, Chapter 3	TN Water Quality Control Board	Authority to issue new or modify existing NPDES permits required for a water discharge source.
Hazardous Wastes and Soils	Tennessee Underground Storage Tank Program Regulations	TN Rules, Chapter 1200-1-15	TN Division of UST Programs	Permit required prior to construction or modification of an underground storage tank.
	<i>Tennessee Hazardous Waste Management Act</i>	TN Code, Title 68, Chapter 46	TN Division of Solid Waste Management	Permit required to construct, modify, or operate a hazardous waste treatment, storage, or disposal facility.
	Tennessee Solid Waste Processing and Disposal Regulations	TN Rules, Chapter 1200-1-7	TN Division of Solid Waste Management	Permit required to construct or operate a solid waste processing or disposal facility.
Biotic	Tennessee State Executive Order on Wetlands	TN State Executive Order	TN Division of Water Quality Control	Consultation with responsible agency.
	<i>Tennessee Threatened Wildlife Species Conservation Act of 1974</i>	TN Code, Title 70, Chapter 8	TN Wildlife Resources Agency	Consultation with responsible agency.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
	<i>Tennessee Rare Plant Protection and Conservation Act of 1985</i>	TN Code, Title 70, Chapter 8-301 et seq.	TN Wildlife Resources Agency	Consultation with responsible agency.
	<i>Tennessee Water Quality Control Act</i>	TN Code, Title 69, Chapter 3	TN Division of Water Quality Control	Permit required prior to alteration of a wetland.
Cultural	Tennessee Desecration of Venerated Objects	TN Code, Title 39, Chapter 17-311	TN Historical Commission	Forbids a person to offend or intentionally desecrate venerated objects including a place of worship or burial.
	Tennessee Abuse of Corpse	TN Code, Title 39, Chapter 17-312	TN Historical Commission	Forbids a person from disinterring a corpse that has been buried or otherwise interred.
	Native American Indian Cemetery Removal and Reburial	TN Comp. Rules and Regulations, Chapter 400-9-1	TN Historical Commission	Requires notification if Native American Indian remains are uncovered.
	Tennessee Protective Easements	TN Code, Title 11, Chapter 15-101	TN State Government	Grants power to the state to restrict construction on land deemed as a "protective" easement.
<i>Nevada (NTS, TTR)</i>				
Air	Nevada Air Pollution Control Law	NV Statutes, Title 40	NV State Environmental Commission	Permit required prior to construction or modification of an air contaminant source.
	Nevada Air Quality Regulations	NV Admin. Code, Chapter 445	NV State Environmental Commission	Permit required prior to construction or modification of an air contaminant source.
Water	Nevada Water Pollution Control Law	NV Statutes, Title 40, Chapter 445	NV Division of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
	Nevada Water Pollution Control Regulations	NV Admin. Code, Chapter 445	NV Division of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
Hazardous Wastes and Soils	Nevada Underground Storage Tank Rules	NV Admin. Code, Chapter 459	NV Division of Environmental Protection	Permit required prior to construction or modification of an underground storage tank.
Hazardous Wastes and Soils (cont'd)	Nevada Solid Waste Disposal Law	NV Statutes, Title 40, Chapter 444	NV Division of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
	Nevada Solid Waste Disposal Regulations	NV Admin. Code, Chapter 44	NV Division of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility; permit for septage hauling may be required.
	Nevada Hazardous Waste Disposal Law	NV Statutes, Title 40, Chapter 459	NV Division of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
	Nevada Hazardous Waste Facility Regulations	NV Admin. Code, Chapter 444	NV Division of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
Biotic	<i>Nevada Non-Game Species Act</i>	NV Admin. Code, Title 45, Chapter 503	NV Department of Wildlife	Consult with NV Department of Wildlife and minimize impact.
Cultural	Historic Preservation and Archaeology Regulations	NV Statutes, Title 26, Chapters 381-383	NV Advisory Board for Historic Preservation and Archaeology	Permit required prior to the investigation, exploration, or excavation of a historic or prehistoric site.
<i>Texas (Pantex)</i>				
Air	Texas Air Pollution Control Regulations	TX Admin. Code, Title 30, Chapter 101-125, 305	TX Natural Resource Conservation Commission	Permit required prior to construction or modification of an air contaminant source.
Water	Texas Water Quality Standards	TX Admin. Code, Title 30, Chapter 305, 308-325	TX Natural Resource Conservation Commission	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.
	Texas Consolidated Permit Rules	TX Admin. Code, Title 30	TX Natural Resource Conservation Commission	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.
Hazardous Wastes and Soils (cont'd)	<i>Texas Water Quality Acts</i>	TX Code, Title 30, Chapter 290	TX Natural Resource Conservation Commission	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.

Table 10.4-4 — State Environmental, Safety & Health Requirements (continued)

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability
	Texas Underground Storage Tanks Rules	TX Admin. Code, Title 30, Chapter 334	TX Natural Resource Conservation Commission	Permit required prior to construction or modification of an underground storage tank.
	Texas Solid Waste Management Regulations	TX Admin. Code, Title 30, Chapter 305, 335	TX Natural Resource Conservation Commission	Permit required prior to construction or modification of a solid waste disposal facility.
	<i>Texas Solid Waste Disposal Act</i>	TX Admin. Code, Title 30, Chapter 305, 334, and 335	TX Natural Resource Conservation Commission	Permit required prior to construction or modification of a solid waste disposal facility.
Biotic	Texas Parks and Wildlife Regulations	TX Parks and Wildlife Code, Chapter 67, 68, and 88	TX Parks and Wildlife Department	Permit required by anyone who possesses, takes, or transports endangered, threatened, or protected plants or animals.
Cultural	Antiquities Code of Texas	TX Statutes, Volume 17, Article 6145	TX State Historical Survey Committee	Permit required for the examination or excavation of sites and the collection or removal of objects of antiquity.

10.5 ALTERNATIVE-SPECIFIC INFORMATION

10.5.1 Additional Requirements

Under any alternative, new or modified permits would be needed prior to construction or operation of the proposed facilities. These permits regulate many aspects of facility construction and operations, such as treatment and storage of hazardous waste and discharges of airborne or liquid effluents to the environment. Permits would be obtained through the appropriate Federal, state, or local agencies. As with consultations, a more detailed analysis of the required permits and/or approvals would occur as part of the second tiered SPEIS that DOE will prepare after a decision is made based on the siting alternatives evaluated in this SPEIS. In addition to permitting, the following sections discuss site-specific requirements that would apply to construction and operation of the proposed facilities.

10.5.1.1 *Los Alamos Site Alternative*

Hazardous Waste Facility Permit

The New Mexico Environment Department (NMED) issued the original Resource Conservation and Recovery Act (RCRA) permit for Los Alamos National Laboratory's (LANL's) waste management operations at Technical Areas (TA)-50, -54, and -16 on November 8, 1989, for a term of 10 years. On January 15, 1999, LANL submitted an application for a permit renewal for TA-54. That application also covered the hazardous waste container storage areas at TA-3 and TA-16, and at TA-54's Area G, Area L, and TA-54 west; hazardous waste treatment by solidification, cementation, and vitrification at TA-55; and hazardous waste treatment by burning and detonation at TA-14 and burning at TA-16. It includes general statements that corrective action will be conducted for releases of hazardous wastes and hazardous constituents at these areas. The original permit expired after 10 years, but was administratively continued pending the NMED review of LANL's permit renewal application. LANL continues to work on the application process to renew its Hazardous Waste Facility Permit and to respond to information requests from NMED about the history of hazardous waste generation and management at LANL.

LANL is not listed on EPA's National Priorities List but it follows some *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) guidelines for remediating sites that contain hazardous substances not covered by RCRA and/or that may not be included in Module VIII of the Hazardous Waste Facility Permit.

Resource Conservation and Recovery Act Corrective Action

On November 26, 2002, NMED issued a final order to DOE and the University of California pursuant to New Mexico Statutes Annotated 1978 Sections 74-4-10.1 and 74-4-13 of the *New Mexico Hazardous Waste Act* and the New Mexico Hazardous Waste Management Regulations 20.4 New Mexico Administrative Code. The order contains investigation and cleanup requirements and a schedule for implementation of cleanup measures at LANL. In the draft order issued on May 2, 2002, NMED made a determination that the past or present handling, storage, treatment, and/or disposal of solid or hazardous wastes at the LANL may present an imminent and substantial endangerment to health and the environment. LANL challenged that determination. LANL also commented that the Endangerment Determination and order seek to regulate source, special nuclear, and byproduct material, as defined in the *Atomic Energy Act* of 1954, which are exempt from regulation under RCRA and the *New Mexico Hazardous Waste Act*. DOE is pursuing legal challenges to the endangerment finding and regulatory authority issue.

The proposed facilities would not be expected to impact ongoing LANL remediation activities.

Site Treatment Plan

In October 1995, the State of New Mexico issued a Federal Facility Compliance Order to LANL requiring compliance with a Site Treatment Plan. The LANL Site Treatment Plan, which is

updated annually, provides overall schedules for achieving compliance with RCRA land disposal restriction (LDR) storage and treatment requirements for mixed waste at LANL.

If LANL were selected as the site for a CPC, DOE would include mixed transuranic TRU waste and mixed low level waste (LLW) associated with proposed facilities operations in a future update to the LANL Site Treatment Plan.

10.5.2 Nevada Test Site Alternative

NTS is subject to several formal compliance agreements with various regulatory agencies. Agreements with the State of Nevada include a Memorandum of Understanding covering releases of radioactivity; a Federal Facility Agreement and Consent Order, an Agreement in Principle covering environment, safety, and health activities; a Settlement Agreement to manage mixed TRU waste; and a Mutual Consent Agreement on management of mixed LDR wastes, among others. A brief description of these agreements and their relationship to the proposed facilities follows.

Settlement Agreement

The Settlement Agreement, which was signed by DOE and the Nevada Department of Environmental Protection in June 1992, authorizes the temporary storage of only NTS's current inventory of mixed TRU waste. The storage of additional mixed TRU waste would require a permit. Mixed TRU waste is not normally generated at Nevada Test Site (NTS); the majority of mixed TRU waste stored at NTS was generated offsite.

DOE would be required to seek a permit for storage of TRU waste associated with proposed facilities operations.

Federal Facility Agreement and Consent Order

The agreement is a tri-party agreement with DOE, the State of Nevada, and the Department of Defense. The agreement, effective in May 1996, addresses environmental restoration of inactive contaminated sites at NTS and other sites in Nevada. The Parties agreed to negotiate to address needed environmental restoration. The Order outlines a process for identifying, prioritizing, investigating, and remediating contaminated sites. It also establishes a technical strategy for cleanup activities, maximizes the opportunity to complete multiple corrective actions, and provides a mechanism for public involvement.

The proposed facilities would not be expected to impact NTS remediation activities under the Federal Facility Agreement and Consent Order.

Federal Facility Compliance Act-Consent Order

The State of Nevada and DOE approved the Order and its associated NTS Site Treatment Plan in March 1996. The Order and Plan address treatment of legacy mixed waste streams at NTS. Under a June 1998 revision to the Order, new milestones and deadlines for mixed waste treatment must be proposed through annual updates to the Site Treatment Plan.

If NTS were selected as the site for the proposed facilities, DOE would include mixed TRU waste and mixed LLW associated with proposed facilities operations in a future update to the NTS Site Treatment Plan.

Mutual Consent Agreement

The Mutual Consent Agreement was signed by Nevada Operations Office and the State of Nevada in January 1994 and modified in June 1995 and 1998. The Mutual Consent Agreement authorizes the storage of newly identified mixed waste at the NTS Area 5. State of Nevada approval of a Treatment and Disposal Plan is required for mixed waste stored for greater than 9 months.

DOE would manage mixed LLW generated from proposed facilities operations in accordance with the Mutual Consent Agreement. A Treatment and Disposal Plan would be prepared if storage of this waste for greater than 9 months were required.

Agreement in Principle

This agreement includes commitments with regard to DOE technical and financial support to the State of Nevada for environmental, safety, and health oversight and associated monitoring activities. The DOE Nevada Operations Office/State of Nevada Joint LLW Oversight Agreement was incorporated as an appendix to the Agreement in Principle. This appendix is a cooperative oversight arrangement between DOE and the State of Nevada and grants the state an increased role in monitoring the management of LLW generated at the NTS, as well as LLW generated elsewhere and disposed at NTS. By entering into the agreement, DOE and the State of Nevada agree to share information concerning waste types and quantities, in addition to general information that allows the state to conduct detailed oversight of NTS waste disposal operations.

Under this Agreement, the State of Nevada would oversee the disposal of LLW associated with proposed facilities operations. This would occur under the NTS alternative, where LLW is generated and disposed of at NTS, as well as alternatives where LLW resulting from the operation of the proposed facilities is shipped to NTS for disposal (e.g., Pantex, WIPP [Waste Isolation Pilot Plant]).

10.5.3 Pantex Site Alternative

Site Treatment Plan

DOE has prepared a Site Treatment Plan (known as the Compliance Plan) for mixed waste at Pantex, which identifies how DOE proposes to obtain commercial treatment or develop technologies for the site's mixed LLW. The Compliance Plan provides overall schedules for achieving compliance with LDR requirements for mixed wastes at Pantex and is enforceable under an Agreed Order issued by the Texas Natural Resource Conservation Commission (Texas Natural Resource Conservation Commission TNRCC, now called the Texas Commission on Environmental Quality [TCEQ]). DOE provides annual updates to the Compliance Plan to the state for review and comment.

If Pantex were selected as the site for the proposed facilities, DOE would include mixed TRU waste and mixed LLW associated with operation of the proposed facilities in a future update to the Pantex Site Treatment Plan.

Hazardous Waste Permit

Pantex was included on the National Priorities List in 1994. Corrective action requirements for environmental restoration at Pantex are included in the RCRA Hazardous Waste Operating Permit (HW-50284) administered jointly by EPA and the TCEQ. Pantex has identified 249 release sites within 144 Solid Waste Management Units (SWMUs) for investigation and remediation activities. RCRA Facility Investigations have been completed for all SWMU groupings. Remediation activities are performed to reduce contamination of soils and groundwater sufficiently to achieve a No Further Action designation under the Texas Risk Reduction Standards Guidance. The state has approved 93 release sites as requiring no further action.

Under the current baseline, DOE would complete environmental restoration and decontamination activities and turn over the Pantex facilities for long-term stewardship by FY2014. DOE recently proposed to accelerate these activities to completion by the end of FY2008 (DOE 2002j). Under this accelerated schedule, these activities would be completed prior to the start of the construction of the proposed facilities. Under either schedule, the proposed facilities would not be expected to impact ongoing Pantex remediation activities.

10.5.4 Savannah River Site (SRS) Alternative

Federal Facility Agreement

SRS was placed on the National Priorities List in 1989. In August 1993, SRS entered into the Federal Facility Agreement with EPA Region IV and the South Carolina Department of Health and Environmental Control (SCDHEC). The Federal Facility Agreement addresses RCRA corrective action and CERCLA requirements applicable to cleanup at SRS. The Agreement governs the corrective/remedial action process from site investigation through site remediation. It also describes procedures for setting annual work priorities, including schedules and deadlines, for that process.

The proposed facilities would not be expected to impact SRS remediation activities under the Federal Facility Agreement.

Site Treatment Plan

On September 20, 1995, SCDHEC approved the Site Treatment Plan for SRS. SCDHEC issued a consent order, signed by DOE, requiring compliance with the plan on September 29, 1995. The Site Treatment Plan provides overall schedules for achieving compliance with RCRA LDR storage and treatment requirements for mixed waste at SRS. DOE provides SCDHEC with annual updates to the information in the SRS Site Treatment Plan.

If SRS were selected as the site for the proposed facilities, DOE would include mixed TRU waste and mixed LLW associated with operation of the proposed facilities in a future update to the SRS Site Treatment Plan.

10.5.5 Current Capacity Limitations at WIPP

The total disposal capacity at WIPP is limited to 6,180,000 ft³ under the *WIPP Land Withdrawal Act*. (Of this total, DOE Consultation and Cooperation Agreement with the State of New Mexico limits the volume of remote-handled TRU waste to 250,000 ft³). The Preferred Alternative in DOE's 1997 *WIPP Supplemental EIS II* (WIPP SEIS II) estimated a Basic Inventory of 6,004,000 ft³ of TRU waste that would be disposed of at WIPP over a 35-year operating period. This alternative formed the basis for DOE's 1998 Record of Decision to open WIPP (63 FR 3624).

Nevertheless, the WIPP SEIS II acknowledged, and DOE continues to recognize, that the amount of TRU waste to be disposed of could exceed the volumes identified in the WIPP SEIS II preferred alternative. This could occur in the future for a number of reasons. For example, DOE sites continue to improve the accuracy of their inventories, the nature of sites' missions may change over time, waste processing decisions being made for existing waste forms can generate additional TRU waste, and several sites have missions expected to extend beyond WIPP's currently planned operating period. The proposed facilities would fall into this latter category, in that it would be fully operational in 2020 and for a subsequent period of 50 years.

If additional disposal capacity were needed but not readily available post-treatment, storage of waste would be needed until that additional capacity became available. The WIPP SEIS II analyses under Action Alternative 1 examined the impacts of storage and disposal of 11,018,000 ft³ of TRU waste. This alternative included lag storage for a period of up to 160 years at all of the sites being considered for the proposed facilities. The analyses under WIPP SEIS II Alternative 1 indicated that potential impacts to the public, involved workers, and non-involved workers from lag storage would be small. The LCFs would be one or less than one, and no cancers from potential exposure to hazardous chemicals would be expected.

In the future, if inventory projects show a need for additional disposal capacity for TRU waste, DOE would initiate the development of strategies for expanding such capacity at an appropriate time. However, because DOE has made no plans to date regarding the location or design of a waste disposal facility for TRU waste beyond WIPP's current capacity, this SPEIS assumed WIPP as the disposal location for TRU waste generated under each alternative, for the purposes of transportation analysis only.

10.6 COMPLIANCE HISTORY

The following sections describe recent compliance activities at each of the alternative sites. This information was taken from the 2006 Annual Site Environmental Report, for each of the sites. These reports have a substantial amount of detail concerning environmental problems, permits and remediation activities. The following website is a good reference for obtaining these reports, on-line:

www.hss.energy.gov/nuclearsafety/nsea/oepa/reports/aser/aserlinks

10.6.1 Los Alamos Site Alternative

Clean Water Act and Safe Drinking Water Act

In 2005, LANL was in compliance with its NPDES permit liquid discharge requirements in 100 percent of the samples from its sanitary effluent outfalls and in 99.9 percent of the samples from its industrial effluent outfalls. DOE reported one exceedance of the water quality parameters for industrial outfalls. Corrective actions were taken to address this permit noncompliances. Concentrations of chemical, microbiological, and radioactive constituents in the. LANL obtains its drinking water under an arrangement with Los Alamos County and in 2005, LANL's drinking water system was within Federal and state drinking water standards.

Clean Air Act

In 1994, Concerned Citizens for Nuclear Safety filed a lawsuit against DOE and the Director of LANL alleging violations of the radionuclide NESHAP (40 CFR 61, Subpart H) provisions of the CAA. The parties settled the lawsuit out of court on January 25, 1997. DOE and LANL entered into a Consent Decree and a Settlement Agreement to resolve the lawsuit. Under the settlement provisions of the Consent Decree, up to four comprehensive independent audits of LANL's radioactive air emissions compliance program will be performed to verify whether LANL is in full compliance with the CAA (40 CFR 61, Subpart H).

The first audit assessed LANL's compliance for 1996 and concluded that LANL meets the dose standard for radioactive air emissions but does not meet several technical requirements of 40 CFR 61, Subpart H. LANL implemented most of the technical recommendations contained in the assessment report. The second audit determined that LANL was in compliance with the Federal regulations governing radioactive air emissions for the year 1999. The third audit confirmed that LANL's radioactive air emissions in 2001 were less than one fifth of what is allowed by the CAA and that LANL's air-monitoring processes will ensure future compliance with the law. In 2005, in compliance with its operating permit, submitted an Annual Compliance Certification Report in which it demonstrated full compliance with the permits terms, conditions and reporting requirement deadlines (LANL 2006b).

Resource Conservation and Recovery Act

LANL staff frequently interact with regulatory personnel on RCRA and *New Mexico Hazardous Waste Act* requirements and compliance activities. NMED conducted an annual hazardous waste compliance inspection at LANL from February 23 to March 28, 2005, NMED issued a Notice of Violation to the University of California and DOE as a result of that inspection. The Notice of Violations identified 4 alleged violations.. The types of issues described ranged from waste determinations, generator's control of waste, exceeding waste storage time, incompatible chemical storage, training, emergency response, waste manifesting, mixed waste management under the Site Treatment Plan, waste piles, and prevention of releases. The University of California and DOE responded to the Notice of Violation.

LANL met all of its Site Treatment Plan deadlines and milestones during 2005 (LANL 2006b).

Price-Anderson Amendments Act

Since 1996, LANL has been the subject of five enforcement actions under the DOE Price-Anderson Enforcement Program. Most recently, in February 2007, National Nuclear Security Administration (NNSA) issued a preliminary notice of violation asserting that LANL had violated nuclear safety rules in the areas of work planning and control, adequacy of procedures, training, quality improvement, assessment programs, safety basis, and radiological and contamination controls. The violations involve improper waste handling procedures resulting in small intakes of radioactive materials by workers.

10.6.2 Lawrence Livermore National Laboratory

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Ongoing groundwater investigations and remedial actions at LLNL fall under the jurisdiction of CERCLA, Title I of the Superfund Amendment and Reauthorization Act (SARA). CERCLA is commonly referred to as the Superfund law.

The Livermore site became a CERCLA sit in 1987 when it was placed on the National Priorities List. The Livermore Site Ground Water Project (GWP) complies with provisions specified in a Federal Facility Agreement entered into by EPA, DOE, and the State of California's Department of Toxic Substance Control (DTSC) and the San Francisco Bay Regional Water Quality Control Board.

Significant GWP restoration activities began in 2006 including the installation of 7 dual (groundwater and soil vapor) extraction wells, 2 groundwater extraction wells, 2 groundwater monitoring wells, 11 soil vapor wells and 1 anode well; decommissioning 3 wells; and conducting 2 hydraulic tests, 3 soil vapor extraction tests, and 4 dual extraction tests. LLNL met all regulatory and DOE milestones on schedule by constructing or upgrading treatment facilities and beginning remediation at Treatment Facility D East Traffic Circle North Source Area, Building 419 Source Area, Treatment Facility C Hotspot, Buildings 511/514 Source Area, and Treatment Facility 5475 South. LLNL completed 87 of the milestones specified in the Remedial Action Implementation Plan.

In 2006, LLNL operated 27 groundwater treatment facilities. The 92 groundwater extraction wells and 34 dual extraction wells produced nearly 1.1 billion liters of groundwater and removed approximately 78 kilograms of Volatile Organic Compounds (VOCs).

Investigations and remedial activities are ongoing at Site 300, which became a CERCLA site in 1990 when it was placed on the National Priorities List. Common VOCs (primarily TCE) are the main contaminants at Site 300. High explosives, tritium, depleted uranium, organosilicate oil, nitrate, and perchlorate are also found in the groundwater. During 2006, 19 treatment facilities, at Site 300, were in operation. At these facilities, 40 groundwater extraction wells and 18 dual phase extraction wells extracted about 116 million liters of groundwater in 2006. The 18 dual phase extraction wells and 2 soil vapor extraction wells together removed 2.25 million cubic meters of soil vapor.

In 2006, 20 boreholes ere drilled at Site 300 – 5 were drilled to collect soil and rock for chemical analysis, 4 were completed as guard wells to monitor downgradient of contaminant plumes, an 8 were completed as monitoring wells for tracking of groundwater contaminant plumes.

Resource Conservation and Recovery Act (RCRA) and Related State Laws

RCRA provides the framework at the federal level for regulating the generation, storage, treatment, and management of solid wastes, including wastes designated as hazardous. Subtitle C of RCRA controls all aspects of the management of hazardous waste, from the point of generation to its ultimate disposal. Hazardous waste generators must follow specific requirements for handling these wastes. In addition, owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain permits that include a plan for the long-term postclosure care of the facility. The California Hazardous Waste Control Act (HWCA) and the Title 22 of *the California Code of Regulations* set requirements for managing hazardous wastes and implementing RCRA in California. RCRA and HWCA also regulate permit requirements.

The hazardous waste management facilities at the Livermore site consist of permitted units in Area 612, and Buildings 693, 695 and 696, of the Decontamination and Waste Treatment Facility (DWTF). Permitted waste management units include container storage, tank storage, an various treatment processes. During 2005/2006, LLNL also submitted several Class 1, Class 1* and Class 2 permit modification requests to DTSC.

A final closure plan for Building 419 Interim Status Facility was submitted to DTSC in February 2001. DTSC is continuing its review of this closure plan. LLNL has provided additional information requested by DTSC, including responding to Building 419 Notices of Deficiency that DTSC issued in November 2004.

The hazardous waste management facilities at Site 300 consist of three operational RCRA-permitted facilities. The Explosives Waste Storage Facility and Explosives Waste Treatment Facility are permitted respectively to store and treat explosives waste, only. The Building 883 Container Storage Area is permitted to store routine, facility-generated waste, such as spent acids, bases, contaminated oil, and spent solvents.

Clean Air Act

Air permits are obtained from the Bay Area Air Quality Management District (BAAQMD) for the Livermore Site and from the San Joaquin Valley Air Pollution Control District (SJVAPCD) and BAAQMD for Site 300. Both agencies are overseen by the California Air Resources Board.

In 2006, LLNL operated 1182 permitted air emission sources at the Livermore site and 43 permitted air emission sources at Site 300. During the year BAAQMD performed two Livermore site source inspections and 44 emission sources and the SJVAPCD performed one Site 300 source inspection of one emission source. Both the BAAQMD and the SJVAPCD found all inspected sources to be in compliance with the applicable air emission regulations and permit conditions.

In 2006, several potentially significant air pollutant emission sources at the Livermore site were eliminated to reduce overall pollutant emissions. In addition, LLNL obtained approvals to construct and alternative fuel dispensing facility at the Livermore site.

National Emission Standards for Hazardous Air Pollutants, Radionuclides (NESHAPs)

To demonstrate compliance with 40 CFR Part 61, Subpart H (NESHAPs for radiological emissions from DOE Facilities), LLNL is required to monitor certain air release points and evaluate the maximum possible dose to the public. In 2006, LLNL continuously monitored radionuclide emissions from the Tritium Facility, the Plutonium Facility, and portions of five other facilities. Using ambient air monitoring, LLNL also continuously monitored releases of depleted uranium used in explosives testing at Site 300. There was one unplanned incident at the Livermore site in 2006 that had the potential to result in a small release of tritium to air. However, because LLNL personnel with the most exposure did not receive any measurable dose attributable to the incident, any potential dose to a member of the public would have been negligible. There were no unplanned atmospheric releases at Site 300 in 2006.

Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) establishes permit requirements for discharges into waters of the United States. In addition, the State of California, under the Porter-Cologne Water Control Act, requires permits, known as Waste Discharge Requirements (RWQCBs) and the State Water Resources Control Board. Several other State and local government entities also require discharge permits. The Safe Drinking Water Act requires registration with EPOA and management of injection wells to protect underground sources of drinking water.

At Site 300, LLNL completed the construction of two culverts at Round Valley and Oasis. A habitat pool built at Round Valley served in part to compensate for the loss of habitat that was a result of two drainage improvement projects. These projects were authorized under nationwide permits and certified by the Central Valley RWQCB. To satisfy a concern that the cooling tower blowdown from Building 801 at Site 300 might reach a surface water tributary during winter storms, LLNL constructed a new percolation pit and registered it as a Class V injection well with the U.S. EPA. The new system was put into service on October 9, 2006.

10.6.3 Nevada Test Site Alternative

NTS continues to fulfill its requirements of the agreements discussed in Section 10.5.2. Compliance issues related to specific programs are noted in the following paragraphs.

Clean Water Act

There are no NPDES permits for NTS because there are no wastewater discharges directly to onsite or offsite surface waters. However, discharges to sewage lagoons and ponds are regulated by the State of Nevada under a state general permit. NTS has maintained compliance with permit requirements. However, downsizing of NTS operations has resulted in low flow

conditions at several sewage lagoon systems, which has reduced the efficiency of the lagoons to properly treat effluents. DOE plans to install septic tank systems in these areas (NTS 2007).

Safe Drinking Water Act

During 2006, the four public drinking water systems at NTS were in compliance with regulatory limits. Onsite water wells and select offsite wells are monitored in accordance with Federal and state SDWA regulations (NTS 2007).

Resource Conservation and Recovery Act

No non-compliance incidents were reported in 2006. Violations were cited during those inspections (NTS 2007).

Clean Air Act

Criteria air pollutants emitted at NTS include particulates from construction, aggregate production, surface disturbances, and fugitive dust from vehicles traveling on unpaved roads; various pollutants from fuel-burning equipment, incineration, and open burning and volatile organics from fuel storage facilities. Emissions of hazardous air pollutants from current NTS sources are below regulatory requirements. During 2006, three pieces of equipment failed their performance emissions test and were shut down (NTS 2007).

Ambient air quality at NTS is not currently monitored for criteria pollutants or hazardous air pollutants, with the exception of radionuclides. As with all previous years that the NESHAP report was produced, the estimated annual dose to the public from radiological emissions during 2005 was well below the 10 mrem dose/year limit (40 CFR 61.92) (NTS 2007).

Comprehensive Environmental Response, Compensation, and Liability Act

Other than reporting requirements, there is no formal CERCLA program at NTS (NTS 2007).

Price-Anderson Amendments Act

NTS has not been subject to any enforcement actions under the DOE Price-Anderson Enforcement Program.

10.6.4 Tonopah Test Range

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List (NPL) for cleanup (EPA 222007). There are no NPL or “Superfund” sites located at the Tonopah Test Range (TTR).

The Superfund Amendments and Reauthorization Act (SARA) Title III amended CERCLA requirements for reportable quantity releases and chemical inventory reporting. Sandia at TTR was in full compliance with CERCLA/SARA in 2006. SARA also requires reporting for chemical releases exceeding certain thresholds. The TTR Firing Range released approximately 5,832 lbs. of non-recovered lead in 2006. This amount exceeds the reporting limit and will be reported in the 2007 report.

Resource Conservation and Recovery Act (RCRA) and Related State Laws

RCRA provides the framework at the federal level for regulating the generation, storage, treatment, and management of solid wastes, including wastes designated as hazardous. Subtitle C of RCRA controls all aspects of the management of hazardous waste, from the point of generation to its ultimate disposal. Hazardous waste generators must follow specific requirements for handling these wastes. In addition, owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain permits that include a plan for the long-term postclosure care of the facility.

Under the RCRA Hazardous Waste Permit Program (40 CFR 270), TTR is permitted as a “small quantity generator”. Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA permitted facility. Sanitary solid waste, also regulated by RCRA, is disposed of at landfills on-site. There is one Class II sanitary landfill in operation at TTR operated by the U.S. Air Force Operations and Maintenance contractor.

The last of five Underground Storage Tanks, two gas and two diesel tanks from a former gas station in Area 3, and one diesel tank from area 9, were removed in 1995. There are no Above Ground Storage Tanks that require registration with the State of Nevada, at TTR.

Clean Air Act and Clean Air Act Amendments of 1990

The clean Air Act requirements are regulated by the State of Nevada air quality regulations. Air emissions from non-radionuclide sources, such as a screening plant or a portable screen, are permitted under a Class II Air Quality Permit. SNL tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia met all air quality permit conditions in 2006.

National Emission Standards for Hazardous Air Pollutants, Radionuclides (NESHAPs)

To demonstrate compliance with 40 CFR Part 61, Subpart H (NESHAPs for radiological emissions from DOE Facilities), TTR is required to monitor certain air release points and evaluate the maximum possible dose to the public. The EPA retains compliance authority for all radionuclide air releases. The Clean Slate sites, former nuclear material test sites, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual. The result of 0.024 mrem/year was below the threshold of 0.1 mrem/year, for which continuous air monitoring would be required, and approximately 400 times less than the EPA standard of 10 mrem/year.

Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) establishes permit requirements for discharges into waters of the United States. Wastewater effluents and potable water supplies are regulated under the Clean Water Act and the State of Nevada water pollution and sanitary waste systems regulations. The State of Nevada, Bureau of Health Protection Services and the Nevada Department of Environmental Protection administer regulations relevant to wastewater discharges. At TTR, wastewater is discharged to the sewer system that is connected to the U.S. Air Force sewage lagoon and to six separate septic tank systems. There were no excursions or other permit violations in 2006 with respect to wastewater discharges.

10.6.5 Pantex Site Alternative

The TCEQ (formerly TNRCC) routinely conducts RCRA, *Clean Air Act*, and drinking water compliance inspections. Overall, Pantex is in compliance with the applicable environmental laws and regulations. However, since this facility existed prior to the promulgation of many current environmental laws and regulations, both EPA and the State of Texas have allowed DOE to continue operations while taking actions to achieve full compliance with all applicable environmental regulatory requirements. Pantex has reported minor noncompliances pursuant to its State of Texas and EPA permits, but no cases of noncompliance that could have impacted human health or the environment have occurred.

Compliance Agreements and Orders

In 1994, Pantex was placed on the National Priorities List based on the presence of contamination due to past practices. DOE, TNRCC, and EPA Region 6 developed a Federal Facility Compliance Agreement to address CERCLA issues at Pantex.

EPA has issued two Administrative Orders to address prior noncompliance with Pantex's NPDES permit. DOE also entered into a Federal Facility Compliance Agreement (No. VI-98-1210) with EPA Region 6 relating to the same issues. As of the end of 2000, all corrective actions contained in the Administrative Orders and the Federal Facility Compliance Agreement were on schedule.

Groundwater Protection

Pantex conducts soil and groundwater monitoring in accordance with the corrective action provisions (CP-50284) of its Hazardous Waste Permit No. HW-50284. Non-radiological contamination was found in the perched groundwater beneath the Zone 12 operations area (metals, explosives, and organic solvents), in the soil near operations areas (traces of metals and explosives), and in the ditches and playas that form Pantex's drainage system (metals and explosives). Some contaminants were also found in the perched aquifer on properties neighboring Pantex to the south and southeast.

Trichloroethene was detected with results above the drinking water standard in an Ogallala Aquifer monitoring well sample taken in May 1999. This aquifer is the primary source of drinking water for the surrounding landowners and the cities of Amarillo and Panhandle. A study concluded that an improperly constructed monitoring well was allowing trichloroethene to migrate from the upper vadose, into the well, and down into the Ogallala Aquifer. Corrective measures eliminating the contaminant pathway into the Ogallala Aquifer have been completed. Antimony, cadmium, chromium, manganese, and thallium were also detected in a small number of samples in a few selected Ogallala Aquifer monitoring wells at levels that exceeded drinking water standards. These exceedances may be attributed to corrosion of the stainless steel well screens, casings, and pumps. It is Pantex's intent to plug wells that have become badly corroded. Monitoring for these constituents will continue.

Price-Anderson Amendments Act

Since 1996, Pantex has been the subject of four enforcement actions under the DOE Price-Anderson Enforcement Program. Most recently, in May 2005, DOE issued a preliminary notice of violation asserting that Pantex had failed to maintain and control the operation of safety equipment in its nuclear facilities. The notice included violation of facility safety basis requirements, work process and training procedures, and quality improvement requirements that contributed to the unplanned high explosive (HE) cracking during the disassembly of a retired nuclear weapon.

10.6.6 Sandia National Laboratory

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Ongoing groundwater investigations and remedial actions at SML fall under the jurisdiction of CERCLA, Title I of the Superfund Amendment and Reauthorization Act (SARA). CERCLA is commonly referred to as the Superfund law. A Preliminary Assessment/Site Inspection was performed at SL/NM, in 1988. This inspection confirmed that SNL/NM does not own any sites that would qualify for the National Priorities List. Therefore, with respect to inactive hazardous waste sites, SNL has no CERCLA reporting requirements. Amendments under SARA require additional reporting in the event of a reportable quantity release of certain substances. SNL was in full compliance with CERCLA/SARA in 2006.

Resource Conservation and Recovery Act (RCRA) and Related State Laws

RCRA provides the framework at the federal level for regulating the generation, storage, treatment, and management of solid wastes, including wastes designated as hazardous. Subtitle C of RCRA controls all aspects of the management of hazardous waste, from the point of generation to its ultimate disposal. Hazardous waste generators must follow specific requirements for handling these wastes. In addition, owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain permits that include a plan for the long-term postclosure care of the facility. The RCRA program was delegated to the State of New Mexico. SNL has RCRA permits for the Hazardous Waste Management Facility, the Thermal Treatment Facility, the High Bay Waste Storage Facility, and the Radioactive Mixed

Waste Management Facility. A new application to include the Auxiliary Hot Cell has been made. During 2006, SNL requested minor modifications to the existing permits for the Hazardous Waste Management Facility to reflect changes in personnel and operations. These modifications were approved, along with modifications requested in 2005.

Clean Air Act

The objectives of the Clean Air Act and the Clean Air Act Amendments of 1990 are to protect and enhance the nation's air quality. EPA is responsible for describing and regulating air pollutants from stationary and mobile sources and for setting ambient air quality standards. In 2006, SNL was in compliance with all Clean Air Act Requirements.

National Emission Standards for Hazardous Air Pollutants, Radionuclides (NESHAPs)

To demonstrate compliance with 40 CFR Part 61, Subpart H (NESHAPs for radiological emissions from DOE Facilities), SNL is required to monitor certain air release points and evaluate the maximum possible dose to the public. As required by the regulations, SNL calculates an annual dose from actual or calculated emissions to potentially exposed members of the public. In 2006, the maximally exposed individual was located at the Kirkland Storage Site. The dose at this location was 0.0016 mrem/year; the result, primarily, of releases of argon-41 from the Annular Core Research Reactor and the Sandia Pulsed Reactor, both located in Technical Area V. The off-site maximally exposed individual was located at the Eubank Gate Area. The dose at this location was 0.00079 mrem/year; the result, primarily, of releases of tritium from the Neutron Generator Facility located in Tech Area I. Both doses are well below the EPA standard of less than 10 mrem/year.

Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) establishes permit requirements for discharges into waters of the United States. At SNL/NM the Clean Water Act applies to sanitary and septic system effluents, storm water runoff, and surface water discharges. The Clean Water Act is implemented and administered by state, local and federal entities. Surface discharges made to the ground or to containment areas must be monitored and evaluated for compliance with New Mexico State regulations. Additionally, two evaporation lagoons in Tech Area IV are permitted by the state. All permit and monitoring requirements were met in 2006. In 2006, there were seven reportable surface releases that met State reporting requirements and were reviewed by the Surface Discharge Program.

10.6.7 Savannah River Site Alternative

Notices of Violation

No Notices of Violation were issued for SRS in 2006 under RCRA or the SDWA. No Notices of Violation were issued under the CAA.

Under the CWA, SRS's NPDES compliance rate was 99.9 percent. DOE reported 3 exceedances. Corrective actions were taken to address each of these permit non-compliances. Two Notices of Violation were received under NPDES. from SCDHEC.

During 2006, SCDHEC conducted CAA compliance inspections at SRS. As a result of the annual compliance inspections, SRS achieved a compliance rate of 100 percent and received no Notice of Violation under the CAA (SRS 2006c).

Consent Orders

In October 1999, SCDHEC issued a consent order addressing compliance with water quality parameters set forth in the site's NPDES permit at outfall A-01. During 2000, a wetland treatment system was constructed to address these problems. The wetland system was operating and had achieved compliance with permit parameters by the end of 2001.

Price-Anderson Amendments Act

Since 1996, SRS has been the subject of six enforcement actions under the DOE Price-Anderson Enforcement Program. Most recently, in April 2004, DOE issued a preliminary notice of violation describing numerous violations of nuclear safety requirements related to SRS operations at the FB-line, seven of which were classified as Severity Level II violations. These violations included work processes, as low as reasonably achievable (ALARA) practices, quality improvement, and management assessment.

10.6.8 Y-12 Complex

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

CERCLA, also known as Superfund, was passed in 1980 and was amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Oak Ridge Reservation, which Y-12 is a part of, was listed on the National Priorities List, as a Superfund site, on November 21, 1989. An interagency agreement under Section 120© of CERCLA, known as the ORR Federal Facility Agreement, was effective in 1992 among EPA, the Tennessee Department of Environmental Control (TDEC), and DOE. The agreement establishes the procedural framework and schedule for developing, implementing. A monitoring remedial actions on ORR (and Y-12) in accordance with CERCLA. The Agreement lists all of the sites/areas that will be investigated, and possibly undergo remediation, under CERCLA.

The progress toward achieving these goals is described in the *2006 Remediation Effectiveness Report for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge Tennessee* (DOE 22007a). This report describes the individual remedial actions and provides an overview of some of the monitoring conducted to evaluate the efficacy of those actions.

Resource Conservation and Recovery Act (RCRA)

RCRA provides the framework at the federal level for regulating the generation, storage,

treatment, and management of solid wastes, including wastes designated as hazardous. Subtitle C of RCRA controls all aspects of the management of hazardous waste, from the point of generation to its ultimate disposal. Hazardous waste generators must follow specific requirements for handling these wastes. In addition, owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain permits that include a plan for the long-term postclosure care of the facility.

At the end of 2006, Y-12 had 102 generator accumulation areas for hazardous or mixed waste. The Y-12 Complex is registered as a large-quantity generator under EPA identification Number TN389090001 and is permitted to perform hazardous waste treatment and storage. During 2006, nine units operated as permitted units. The RCRA treatment units at Y-12 operate under two RDRA permits.

At the Y-12 Complex, 37 RCRA units have been closed since the mid-1980s. TDEC accepted the certification of final closure to the East Chestnut Ridge Waste Pile on January 5, 2006. Located within the boundary of the Y-12 Complex are two Class II operating industrial solid waste disposal landfills and one operating Class IV construction demolition landfill. These facilities are permitted by TDEC and accept solid waste from DOE operations on the Oak Ridge Reservation. A second Class IV construction demolition landfill has been certified closed and the permit terminated on March 15, 2007. In addition one Class IV is overfilled by 11,700 cubic yards and has been the subject of a CERCLA remedial investigation/feasibility study.

The Y-12 Underground Storage Tank (UST) Program includes four active petroleum USTs that meet all current regulatory compliance requirements. All legacy petroleum UST sites at the Y-12 Complex have either been granted final closure by TDEC or have been deferred to the CERCLA process for further action.

Clean Air Act

Authority for implementation and enforcement of the Clean Air Act has been delegated to the state of Tennessee by EPA as described in the State Implementation Plan. Air pollution control rules are developed and administered by the TDEC. The Y-12 Complex has two permits issued by the TDEC. One, a Title V Permit, includes 35 air emission sources and more than 100 air emission points. During 2006, a significant permit modification to this Title V Permit was issued to identify new requirements and compliance methodologies for the Y-12 steam plant maintenance project. The new requirements will be effective upon completion of the project, and requires use of Maximum Achievable Control Technology.

National Emission Standards for Hazardous Air Pollutants, Radionuclides (NESHAPs)

To demonstrate compliance with 40 CFR Part 61, Subpart H (NESHAPs for radiological emissions from DOE Facilities), the Y-12 Complex is required to monitor certain air release points and evaluate the maximum possible dose to the public. On June 10, 1996, EPA delegated authority for regulation of airborne radionuclide emissions to the TDEC. TDEC adopted the federal rules. In 2006, the Y-12 Complex operated in compliance with the Radionuclide NESHAPs dose limits of 10 mrem/year to the most exposed member of the public. Based on

modeling of radionuclide emissions from all sources, the effective dose equivalent in 2006 to the most exposed member of the public was 0.8 mrem/year.

Y-12 has numerous buildings and equipment that contain asbestos-containing materials. The regulation of the program to control asbestos during demolition and renovation is regulated by TDEC (the Toxic Substances Control Act regulates the management and disposal of this material). No releases of reportable quantities of asbestos were reported at the Y-12 Complex in 2006.

Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) establishes permit requirements for discharges into waters of the United States. The NPDES program has been delegated, by EPA, to the State of Tennessee. The Y-12 Complex operates under Permit TN0002968, issued in 1995, and reissued on May 1, 2006. Presently about 60 active point-source discharges or in-stream monitoring locations are monitored for compliance with the permit. In 2006 there was one NPDES noncompliance (chlorine at outfall #201, on February 7, 2006).

The Clean Water Act includes pretreatment regulations for publicly owned treatment works. Sanitary wastewater from the Y-12 Complex is discharged to the city of Oak Ridge treatment works under an industrial and commercial wastewater discharge permit. The permit establishes discharge limits for total suspended solids, biochemical oxygen demand, total nitrogen, and various metals and requires monitoring and reporting of uranium, gross alpha and beta radiation, and several organic compounds.

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Chapter 13
GLOSSARY

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above mean sea level (AMSL)—The elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum.

absorbed dose—For ionizing radiation, the energy imparted to matter by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue). The units of absorbed dose are the rad and the gray. (See *rad* and *gray*.)

accident sequence—In regard to nuclear facilities, an initiating event followed by system failures or operator errors, which can result in significant core damage, confinement system failure, and/or radionuclide releases.

actinide—Any member of the group of elements with atomic numbers from 89 (actinium) to 103 (lawrencium) including uranium and plutonium. All members of this group are radioactive.

activation products—Nuclei, usually radioactive, formed by bombardment and absorption in material with neutrons, protons, or other nuclear particles.

active fault—A fault that is likely to have another earthquake sometime in the future. Faults are commonly considered to be active if they have moved one or more times in the last 10,000 years.

acute exposure—The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. For convenience, the period of acute exposure is normally assumed to end one week after the inception of a radiological accident.

administrative control level—A dose level that is established well below the regulatory limit to administratively control and help reduce individual and collective radiation doses. Facility management should establish an annual facility administrative control level that should, to the extent feasible, be more restrictive than the more general administrative control level.

air pollutant—Generally, an airborne substance that could, in high-enough concentrations, harm living things or cause damage to materials. From a regulatory perspective, an air pollutant is a substance for which emissions or atmospheric concentrations are regulated or for which maximum guideline levels have been established due to potential harmful effects on human health and welfare.

air quality control region—An interstate or intrastate area designated by the U.S. Environmental Protection Agency for the attainment and maintenance of National Ambient Air Quality Standards.

air quality standards—The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

alluvium (alluvial)—Unconsolidated, poorly sorted detrital sediments ranging from clay to gravel sizes deposited by streams.

alpha activity—The emission of alpha particles by radioactive materials.

alpha particle—A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). (See *alpha radiation*.)

alpha radiation—A strongly ionizing, but weakly penetrating, form of radiation consisting of positively charged alpha particles emitted spontaneously from the nuclei of certain elements during radioactive decay. Alpha radiation is the least penetrating of the three common types of ionizing radiation (alpha, beta, and gamma). Even the most energetic alpha particle generally fails to penetrate the dead layers of cells covering the skin and can be easily stopped by a sheet of paper. Alpha radiation is most hazardous when an alpha-emitting source resides inside an organism. (See *alpha particle*.)

alpha wastes—Wastes containing radioactive isotopes which decay by producing alpha particles.

ambient—Surrounding.

ambient air—The surrounding atmosphere as it exists around people, plants, and structures.

ambient air quality standards—The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

aquatic—Living or growing in, on, or near water.

aquifer—An underground geologic formation, group of formations, or part of a formation capable of yielding a significant amount of water to wells or springs.

aquitard—A less-permeable geologic unit that inhibits the flow of water.

archaeological sites (resources)—Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

argon-41—A radioactive isotope of the noble gas argon with a half-life of 1.83 hours that emits beta particles and gamma radiation. It is formed by the activation, by neutron absorption, of argon-40, a stable argon isotope present in small quantities in air.

artifact—An object produced or shaped by human workmanship of archaeological or historical interest.

as low as is reasonably achievable (ALARA)—An approach to radiation protection to manage and control worker and public exposures (both individual and collective) and releases of

radioactive material to the environment to as far below applicable limits as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit but a process for minimizing doses to as far below limits as is practicable.

atmospheric dispersion—The process of air pollutants being dispersed in the atmosphere. This occurs by wind that carries the pollutants away from their source, by turbulent air motion that results from solar heating of the Earth's surface, and by air movement over rough terrain and surfaces.

Atomic Energy Act of 1954—This Act was originally enacted in 1946 and amended in 1954. For the purpose of this Programmatic Environmental Impact Statement "...a program for Government control of the possession, use, and production of atomic energy and special nuclear material whether owned by the Government or others, so directed as to make the maximum contribution to the common defense and security and the national welfare, and to provide continued assurance of the Government's ability to enter into and enforce agreements with nations or groups of nations for the control of special nuclear materials and atomic weapons..." (Section 3(c)).

Atomic Energy Commission—A five-member commission, established by the *Atomic Energy Act* of 1946, to supervise nuclear weapons design, development, manufacturing, maintenance, modification, and dismantlement. In 1974, the Atomic Energy Commission was abolished, and all functions were transferred to the U.S. Nuclear Regulatory Commission and the Administrator of the Energy Research and Development Administration. The Energy Research and Development Administration was later terminated, and functions vested by law in the Administrator were transferred to the Secretary of Energy.

atomic number—The number of positively charged protons in the nucleus of an atom or the number of electrons on an electrically neutral atom.

attainment area—An area that the U.S. Environmental Protection Agency has designated as being in compliance with one or more of the National Ambient Air Quality Standards for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants but not for others. (See *National Ambient Air Quality Standards*, *non-attainment area*, and *particulate matter*.)

attractiveness level—A categorization of nuclear material types and compositions that reflects the relative ease of processing and handling required to convert that material to a nuclear explosive device.

background radiation—Radiation from (1) cosmic sources; (2) naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material); (3) global fallout as it exists in the environment (e.g., from the testing of nuclear explosive devices); (4) air travel; (5) consumer and industrial products; and (6) diagnostic x-rays and nuclear medicine.

badged worker —A worker equipped with an individual dosimeter who has the potential to be exposed to radiation.

barrier—Any material or structure that prevents or substantially delays movement of radionuclides toward the accessible environment.

basalt—The most common volcanic rock, dark gray to black in color, high in iron and magnesium, and low in silica. It is typically found in lava flows.

baseline—The existing environmental conditions against which impacts of the proposed action and its alternatives can be compared. For this EIS, the environmental baseline is the site environmental conditions as they exist or are estimated to exist in the absence of the proposed action.

becquerel—A unit of radioactivity equal to one disintegration per second. Thirty-seven billion becquerels equal 1 curie.

BEIR V—Biological Effects of Ionizing Radiation; referring to the fifth in a series of committee reports from the National Research Council.

benthic—Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

beryllium—An extremely lightweight element with the atomic number 4. It is metallic and is used in reactors as a neutron reflector.

best available control technology (BACT)—A term used in the Federal *Clean Air Act* that means the most stringent level of air pollutant control considering economics for a specific type of source based on demonstrated technology.

beta emitter—A radioactive substance that decays by releasing a beta particle.

beta particle—A particle emitted in the radioactive decay of many radionuclides. A beta particle is identical to an electron. It has a short range in air and a small ability to penetrate other materials.

beyond-design-basis accident—An accident postulated for the purpose of generating large consequences by exceeding the functional and performance requirements for safety structures, systems, and components. (See *design-basis accident*.)

beyond-design-basis events—Postulated disturbances in process variables due to external events or multiple component or system failures that can potentially lead to beyond-design-basis accidents. (See *design-basis events*.)

biota (biotic)—The plant and animal life of a region (pertaining to biota).

block—U.S. Bureau of the Census term describing small areas bounded on all sides by visible features or political boundaries; used in tabulation of census data.

bounded—Producing the greatest consequences of any assessment of impacts associated with normal or abnormal operations.

burial ground—In regard to radioactive waste, a place for burying unwanted radioactive materials in which the earth acts as a receptacle to prevent the escape of radiation and the dispersion of waste into the environment.

Cambrian—The earliest geologic time period of the Paleozoic era, spanning between about 570 and 505 million years ago.

cancer—The name given to a group of diseases characterized by uncontrolled cellular growth, with cells having invasive characteristics such that the disease can transfer from one organ to another.

canister—A general term for a container, usually cylindrical, used in handling, storage, transportation, or disposal of waste.

canned subassembly – The component of a nuclear weapon which contains the secondary uranium and lithium elements.

capability-based deterrence—Deterrence based on the capability to respond to stockpile reliability and safety problems and to meet new requirements.

capable fault—A fault that has exhibited one or more of the following characteristics: (1) movement at or near the ground surface at least once within the past 35,000 years, or movement of a recurring nature within the past 500,000 years; (2) macroseismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault; (3) a structural relationship to a capable fault according to characteristic (1) or (2) above, such that movement on one could reasonably be expected to be accompanied by movement on the other.

capacity factor—The ratio of the annual average power production of a power plant to its rated capacity.

carbon adsorption—A unit physiochemical process in which organic and certain inorganic compounds in a liquid stream are absorbed on a bed of activated carbon; used in water or waste purification and chemical processing.

carbon dioxide—A colorless, odorless gas that is a normal component of ambient air; it results from fossil fuel combustion and is an expiration product.

carbon monoxide—A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

carcinogen—An agent that may cause cancer. Ionizing radiations are physical carcinogens; there are also chemical and biological carcinogens and biological carcinogens may be external (e.g.,

viruses) or internal (genetic defects).

carolina bay—Ovate, intermittently flooded depression of a type occurring on the Coastal Plain from New Jersey to Florida.

cask—A heavily shielded container used to store or ship radioactive materials.

categories of special nuclear material (Categories I, II, III, and IV)—A designation, consistent with DOE Manual 470.4–6 Nuclear Material Control and Accountability, determined by the quantity and type of special nuclear material or a designation of a special nuclear material location based on the type and form of the material and the amount of nuclear material present. A designation of the significance of special nuclear material based upon the material type, the form of the material, and the amount of material present in an item, grouping of items, or in a location.

cation—A positively charged ion.

cell—See *hot cell*.

chain reaction—A reaction that initiates its own repetition. In nuclear fission, a chain reaction occurs when a neutron induces a nucleus to fission and the fissioning nucleus releases one or more neutrons, which induce other nuclei to fission.

chemical oxygen demand—A measure of the quantity of chemically oxidizable components present in water.

chronic exposure—Low-level radiation exposure incurred over a long period of time.

cladding—The outer metal jacket of a nuclear fuel element or target. It prevents fuel corrosion and retains fission products during reactor operation and subsequent storage, as well as providing structural support. Zirconium alloys, stainless steel, and aluminum are common cladding materials. In general, a metal coating bonded onto another metal.

Class I areas—A specifically designated area where the degradation of air quality is stringently restricted (e.g., many national parks and wilderness areas). (See *Prevention of Significant Deterioration*.)

Class II areas—Most of the country not designated as Class I is designated as Class II. Class II areas are generally cleaner than air quality standards require, and moderate increases in new pollution are allowed after a regulatory-mandated impacts review. (See *Prevention of Significant Deterioration*.)

classified information—Information that is classified as Restricted Data or Formerly Restricted Data under the *Atomic Energy Act* of 1954, as amended, or information determined to require protection against unauthorized disclosure under Executive Order 12958 or prior Executive Orders, which is identified as National Security Information.

clastic—Refers to rock or sediment made up primarily of broken fragments of pre-existing rocks or minerals.

Clean Air Act of 1990—This Act mandates and enforces air pollutant emissions standards for stationary sources and motor vehicles.

Clean Water Act 1972, 1987—This Act regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit as well as regulates discharges to or dredging of wetlands.

climatology—The science that deals with climates and investigates their phenomena and causes.

Code of Federal Regulations—The codification of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the Federal Government. It is divided into 50 titles that represent broad areas subject to Federal regulation.

collective dose—The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation. Collective dose is expressed in units of person-rem or person-sieverts.

colluvium (colluvial)—A loose deposit of rock debris accumulated at the base of a cliff or slope.

combined impact—Depending on the scope of the program concerned, a Programmatic Environmental Impact Statement may address more than one “Purpose and Need,” each with its own set of alternatives. These several actions, however, may have common environments. The sum of these impacts with respect to the site concerned are combined impacts, as opposed to cumulative impacts, which incorporate the site-specific impacts of activities not otherwise related to the actions and alternatives in question.

committed dose equivalent—The dose equivalent to organs or tissues that will be received by an individual during the 50-year period following the intake of radioactive material. It does not include contributions from external radiation sources. Committed dose equivalent is expressed in units of rem or sieverts.

committed effective dose equivalent—The dose value obtained by (1) multiplying the committed dose equivalents for the organs or tissues that are irradiated and the weighting factors applicable to those organs or tissues, and (2) summing all the resulting products. Committed effective dose equivalent is expressed in units of rem or sieverts. (See *committed dose equivalent* and *weighting factor*.)

community (biotic)—All plants and animals occupying a specific area under relatively similar conditions.

community (environmental justice)—A group of people or a site within a spatial scope exposed to risks that potentially threaten health, ecology, or land values or are exposed to industry that stimulates unwanted noise, smell, industrial traffic, particulate matter, or other non-aesthetic impacts.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

(Superfund)—This Act provides regulatory framework for remediation of past contamination from hazardous waste. If a site meets the Act’s requirements for designation, it is ranked along with other “Superfund” sites and is listed on the National Priorities List. This ranking is the Environmental Protection Agency’s way of determining which sites have the highest priority for cleanup.

Comprehensive Test Ban Treaty (CTBT)—A proposed treaty prohibiting nuclear tests of all magnitudes.

computational modeling—Use of a computer to develop a mathematical model of a complex system or process and to provide conditions for testing it.

conformity—Conformity is defined in the *Clean Air Act* as the action's compliance with an implementation plan’s purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards, expeditious attainment of such standards, and that such activities will not: (1) cause or contribute to any new violation of any standard in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely attainment of any standard, required interim emission reduction, or other milestones in any area.

consumptive water use—The difference in the volume of water withdrawn from a body of water and the amount released back into the body of water.

contact-handled waste—Radioactive waste or waste packages whose external dose rate is low enough to permit contact handling by humans during normal waste management activities (e.g., waste with a surface dose rate not greater than 200 millirem per hour). (See *remote-handled waste*.)

container—In regard to radioactive waste, the metal envelope in the waste package that provides the primary containment function of the waste package, which is designed to meet the containment requirements of 10 CFR 60.

contamination—The deposition of undesirable radioactive material on the surfaces of structures, areas, objects, or personnel.

conventional weapon—A weapon that is neither nuclear, biological, nor chemical.

cooperating agency—Any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment (40 CFR 1508.5). A state, local, or tribal government also may agree to be a cooperating agency.

credible accident—An accident that has a probability of occurrence greater than or equal to once in a 1-million-year timeframe.

Cretaceous—The final geologic time period of the Mesozoic era, spanning between about 144 and 66 million years ago. The end of this period also marks the end of dinosaur life on Earth.

criteria pollutants—Six air pollutants for which the National Ambient Air Quality Standards are established by the U.S. Environmental Protection Agency under Title I of the Federal *Clean Air Act*: sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, lead, and two size classes of particulate matter, less than or equal to 10 micrometers (0.0004 inch) in diameter, and less than or equal to 2.5 micrometers (0.0001 inch) in diameter. New pollutants may be added to, or removed from, the list of criteria pollutants as more information becomes available.

critical assembly—A critical assembly is a system of fissile material (uranium-233, uranium-235, or plutonium-239) with or without a moderator in a specific proportion and shape. The critical assembly can be gradually built up by adding additional fissile material and/or moderator until this system achieves the dimensions necessary for a criticality condition. A continuous neutron source is placed at the center of this assembly to measure the fission rate of the critical assembly as it approaches and reaches criticality.

critical habitat—Defined in the *Endangered Species Act* of 1973 as “specific areas within the geographical area occupied by [an endangered or threatened] species..., essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species...that are essential for the conservation of the species.”

critical mass—The smallest mass of fissionable material that will support a self-sustaining nuclear fission chain reaction.

criticality—The condition in which a system is capable of sustaining a nuclear fission chain reaction.

cultural resources—Archaeological sites, historical sites, architectural features, traditional use areas, and Native American sacred sites.

cumulative impacts—The impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

curie—A unit of radioactivity equal to 37 billion disintegrations per second (i.e., 37 billion becquerels); also a quantity of any radionuclide or mixture of radionuclides having 1 curie of radioactivity.

day-night average sound level—The 24-hour, A-weighted equivalent sound level expressed in decibels. A 10-decibel penalty is added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during night hours.

decay (radioactive)—The decrease in the amount of any radioactive material with the passage of time, due to spontaneous nuclear disintegration (i.e., emission from atomic nuclei of charged particles, photons, or both).

decibel (dB)—A unit for expressing the relative intensity of sounds on a logarithmic scale where 0 is below human perception and 130 is above the threshold of pain to humans. For traffic and industrial noise measurements, the A-weighted decibel, a frequency-weighted noise unit, is widely used. The A-weighted decibel scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.

decibel, A-weighted (dBA)—A unit of frequency-weighted sound pressure level, measured by the use of a metering characteristic and the “A” weighting specified by the American National Standards Institution (ANSI S1.4-1983 [R1594]) that accounts for the frequency response of the human ear.

decommissioning—Retirement of a facility, including any necessary decontamination and/or dismantlement.

decontamination—The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

defense-in-depth—The use of multiple, independent protection elements combined in a layered manner so that the system capabilities do not depend on a single component to maintain effective protection against defined threats.

°C (degrees Celsius)—A unit for measuring temperature using the centigrade scale in which the freezing point of water is 0 degrees and the boiling point is 100 degrees.

°F (degrees Fahrenheit)—A unit for measuring temperature using the Fahrenheit scale in which the freezing point of water is 32 degrees and the boiling point is 212 degrees.

delayed critical devices—A critical assembly designed to reach the condition of delayed supercriticality. Delayed criticality is the nuclear physics supercriticality condition, where the neutron multiplication factor of the assembly is between 1 (critical) and 1 plus the delayed neutron fraction. (See *multiplication factor* and *delayed neutrons*.)

delayed neutrons—Neutrons emitted from fission products by beta decay following fission by intervals of seconds to minutes. Delayed neutrons account for approximately 0.2 to 0.7 percent of all fission neutrons. For uranium-235, the delayed neutron fraction is about 0.007; for plutonium-239, it is about 0.002.

depleted uranium—Uranium whose content of the fissile isotope uranium-235 is less than the 0.7 percent (by weight) found in natural uranium, so that it contains more uranium-238 than natural uranium.

deposition—In geology, the laying down of potential rock-forming materials; sedimentation. In

atmospheric transport, the settling out on ground and building surfaces of atmospheric aerosols and particles (“dry deposition”), or their removal from the air to the ground by precipitation (“wet deposition” or “rainout”).

design basis—For nuclear facilities, information that identifies the specific functions to be performed by a structure, system, or component, and the specific values (or ranges of values) chosen for controlling parameters for reference bounds for design. These values may be: (1) restraints derived from generally accepted state-of-the-art practices for achieving functional goals; (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals; or (3) requirements derived from Federal safety objectives, principles, goals, or requirements.

design-basis accident—An accident postulated for the purpose of establishing functional and performance requirements for safety structures, systems, and components.

design-basis events—Postulated disturbances in process variables that can potentially lead to design-basis accidents.

design-basis threat—The elements of a threat postulated for the purpose of establishing requirements for safeguards and security programs, systems, components, equipment, information. (See *threat*.)

dewatering—The removal of water. Saturated soils are “dewatered” to make construction of building foundations easier.

deuterium—A nonradioactive isotope of the element hydrogen with one neutron and one proton in the atomic nucleus.

direct economic effects—The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct Effect Multiplier—The total change in regional earnings and employment in all related industries as a result of a one-dollar change in earnings and a one-job change in a given industry.

direct jobs—The number of workers required at a site to implement an alternative.

disposition—The ultimate “fate” or end use of a surplus Department of Energy facility following the transfer of the facility to the Office of the Assistant Secretary for Environmental Waste Management.

diversion—The unauthorized removal of nuclear material from its approved use or authorized location.

Dolomite—Calcium magnesium carbonate, a limestone-like mineral.

Dolostone—A carbonate rock made up predominately of the mineral dolomite, $\text{CaMg}(\text{CO}_3)_2$.

dose—A generic term that means absorbed dose, effective dose equivalent, committed effective

dose equivalent, or total effective dose equivalent, as defined elsewhere in this glossary. It is a measure of the energy imparted to matter by ionizing radiation. The unit of dose is the rem or rad.

dose equivalent—A measure of radiological dose that correlates with biological effect on a common scale for all types of ionizing radiation. Defined as a quantity equal to the absorbed dose in tissue multiplied by a quality factor (the biological effectiveness of a given type of radiation) and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert.

dose rate—The radiation dose delivered per unit of time (e.g., rem per year).

dosimeter—A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., a film badge or ionization chamber).

drainage basin—An aboveground area that supplies the water to a particular stream.

drawdown—The height difference between the natural water level in a formation and the reduced water level in the formation caused by the withdrawal of groundwater.

drinking water standards—The level of constituents or characteristics in a drinking water supply specified in regulations under the *Safe Drinking Water Act* as the maximum permissible.

ecology—A branch of science dealing with the interrelationships of living organisms with one another and with their nonliving environment.

ecosystem—A community of organisms and their physical environment interacting as an ecological unit.

effective dose equivalent—The dose value obtained by multiplying the dose equivalents received by specified tissues or organs of the body by the appropriate weighting factors applicable to the tissues or organs irradiated, and then summing all of the resulting products. It includes the dose from internal and external radiation sources. The effective dose equivalent is expressed in units of rem or sieverts. (See *committed dose equivalent* and *committed effective dose equivalent*.)

effluent—A gas or fluid discharged into the environment.

electron—An elementary particle with a mass of 9.107×10^{-23} gram (or 1/1,836 of a proton) and a negative charge. Electrons surround the positively charged nucleus and determine the chemical properties of the atom.

Emergency Response Planning Guideline (ERPG)-1—is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG-2—is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health

effects or symptoms that could impair their abilities to take protective action.

ERPG-3—is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

emission—A material discharged into the atmosphere from a source operation or activity.

emission standards—Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

endangered species—Defined in the *Endangered Species Act* of 1973 as “any species which is in danger of extinction throughout all or a significant portion of its range.”

Endangered Species Act of 1973—This Act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

engineered safety features—For a nuclear facility, features that prevent, limit, or mitigate the release of radioactive material from its primary containment.

enriched uranium—Uranium whose content of the fissile isotope uranium-235 is greater than the 0.7 percent (by weight) found in natural uranium. (See *uranium*, and *natural uranium*.)

Environment, Safety, and Health Program—In the context of DOE, encompasses those requirements, activities, and functions in the conduct of all DOE and DOE-controlled operations that are concerned with: impacts on the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both the operating personnel and the general public; and protecting property against accidental loss and damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, process and facility safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

environmental assessment—A written environmental analysis that is prepared pursuant to the *National Environmental Policy Act* to determine whether a Federal action would significantly affect the environment and thus require the preparation of a more detailed environmental impact statement. If the action would not significantly affect the environment, then a finding of no significant impact is prepared.

environmental impact statement—The detailed written statement required by Section 102(2)(C) of the *National Environmental Policy Act* for a proposed major Federal action significantly affecting the quality of the human environment. A DOE EIS is prepared in accordance with applicable requirements of the Council on Environmental Quality *National Environmental Policy Act* regulations in 40 CFR 1500-1508 and the DOE *National Environmental Policy Act* regulations in 10 CFR 1021. The statement includes, among other information, discussions of the environmental impacts of the proposed action and all reasonable alternatives; adverse environmental effects that cannot be avoided should the proposal be implemented; the

relationship between short-term uses of the human environment and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources.

environmental justice—The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, state, local, and tribal programs and policies. Executive Order 12898 directs Federal agencies to make achieving environmental justice part of their missions by identifying and addressing disproportionately high and adverse effects of agency programs, policies, and activities on minority and low-income populations.

environmental survey—A documented, multidisciplinary assessment (with sampling and analysis) of a facility to determine environmental conditions and to identify environmental problems requiring corrective action.

Eocene—A geologic epoch early in the Cenozoic Era, dating from approximately 54 to 38 million years ago.

ephemeral stream—A stream that flows only after a period of heavy precipitation.

epicenter—The point on the Earth's surface directly above the focus of an earthquake.

epidemiology—Study of the occurrence, causes, and distribution of disease or other health-related states and events in human populations, often as related to age, sex, occupation, ethnic, and economic status, to identify and alleviate health problems and promote better health.

exposure limit—The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur. *Reference dose* is the chronic-exposure dose (milligrams or kilograms per day) for a given hazardous chemical at which or below which adverse human noncancer health effects are not expected to occur.

Reference concentration is the chronic exposure concentration (milligrams per cubic meter) for a given hazardous chemical at which or below which adverse human noncancer health effects are not expected to occur.

fault—A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Finding of No Significant Impact—A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and will not require an environmental impact statement.

fissile materials—An isotope that readily fissions after absorbing a neutron of any energy. Fissile materials are uranium-233, uranium-235, plutonium-239, and plutonium-241. Uranium-235 is the only naturally occurring fissile isotope.

fission—The splitting of the nucleus of a heavy atom into two lighter nuclei. It is accompanied by the release of neutrons, gamma rays, and kinetic energy of fission products.

fission products—Nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclides formed by the fission fragments' radioactive decay.

fissure—A long and narrow crack in the earth.

floodplain—The lowlands and relatively flat areas adjoining inland and coastal waters and the flood-prone areas of offshore islands. Floodplains include, at a minimum, that area with at least a 1.0 percent chance of being inundated by a flood in any given year.

The *base floodplain* is defined as the area which has a 1.0 percent or greater chance of being flooded in any given year. Such a flood is known as a 100-year flood.

The *critical action floodplain* is defined as the area which has at least a 0.2 percent chance of being flooded in any given year. Such a flood is known as a 500-year flood. Any activity for which even a slight chance of flooding would be too great (e.g., the storage of highly volatile, toxic, or water-reactive materials) should not occur in the critical action floodplain.

The *probable maximum flood* is the hypothetical flood considered to be the most severe reasonably possible flood, based on the comprehensive hydrometeorological application of maximum precipitation and other hydrological factors favorable for maximum flood runoff (e.g., sequential storms and snowmelts). It is usually several times larger than the maximum recorded flood.

flux—Rate of flow through a unit area; in reactor operation, the apparent flow of neutrons in a defined energy range. (See *neutron flux*.)

formation—In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

fossil—Impression or trace of an animal or plant of past geological ages that has been preserved in the earth's crust.

fossiliferous—Containing a relatively large number of fossils.

fugitive emissions—(1) Emissions that do not pass through a stack, vent, chimney, or similar opening where they could be captured by a control device, or (2) any air pollutant emitted to the atmosphere other than from a stack. Sources of fugitive emissions include pumps; valves; flanges; seals; area sources such as ponds, lagoons, landfills, piles of stored material (e.g., coal); and road construction areas or other areas where earthwork is occurring.

fusion—Nuclear reaction in which light nuclei are fused together to form a heavier nucleus, accompanied by the release of immense amounts of energy and fast neutrons.

gamma radiation—High-energy, short wavelength, electromagnetic radiation emitted from the nucleus of an atom during radioactive decay. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded by dense materials, such as lead or depleted uranium. Gamma rays are similar to, but are usually more energetic than, x-rays.

Gaussian plume—The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

genetic effects—Inheritable changes (chiefly mutations) produced by exposure of the parts of cells that control biological reproduction and inheritance to ionizing radiation or other chemical or physical agents.

GENII—A computer code used to predict the radiological impacts on individuals and populations associated with the release of radioactive material into the environment during normal operations and postulated accidents.

geology—The science that deals with the Earth: the materials, processes, environments, and history of the planet, including rocks and their formation and structure.

glovebox—A large enclosure that separates workers from equipment used to process hazardous material while allowing the workers to be in physical contact with the equipment; normally constructed of stainless steel, with large acrylic/lead glass windows. Workers have access to equipment through the use of heavy-duty, lead-impregnated rubber gloves, the cuffs of which are sealed in portholes in the glovebox windows.

gray—The International System of Units (SI) unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (1 gray is equal to 100 rad). (The joule is the SI unit of energy.) (See *absorbed dose*.)

groundwater—Water below the ground surface in a zone of saturation.

habitat—The environment occupied by individuals of a particular species, population, or community.

half-life—The time in which one-half of the atoms of a particular radioactive isotope disintegrate to another nuclear form. Half-lives vary from millionths of a second to billions of years.

Hazard Index—A summation of the Hazard Quotients for all chemicals being used at a site and

those proposed to be added to yield cumulative levels for a site. A Hazard Index value of 1.0 or less means that no adverse human health effects (noncancer) are expected to occur.

Hazard Quotient—The value used as an assessment of non-cancer-associated toxic effects of chemicals, e.g., kidney or liver dysfunction. It is a ratio of the estimated exposure to that exposure at which it would be expected that adverse health effects would begin to be produced. It is independent of cancer risk, which is calculated only for those chemicals identified as carcinogens.

hazards classification—The process of identifying the potential threat to human health of a chemical substance.

hazardous air pollutants—Air pollutants not covered by National Ambient Air Quality Standards but which may present a threat of adverse human health or environmental effects. Those specifically listed in 40 CFR 61.01 are asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. More broadly, hazardous air pollutants are any of the 188 pollutants to be regulated or renewed under Section 112(b) of the *Clean Air Act*. Very generally, hazardous air pollutants are any air pollutants that may realistically be expected to pose a threat to human health or welfare.

hazardous chemical—Under 29 CFR 1910, Subpart Z, hazardous chemicals are defined as “any chemical which is a physical hazard or a health hazard.” Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

hazardous material—A material, including a hazardous substance, as defined by 49 CFR 171.8, which poses a risk to health, safety, and property when transported or handled.

hazardous substance—Any substance subject to the reporting and possible response provisions of the *Clean Water Act* and the *Comprehensive Environmental Response, Compensation, and Liability Act*.

hazardous waste—A category of waste regulated under the *Resource Conservation and Recovery Act*. To be considered hazardous, a waste must be a solid waste under the *Resource Conservation and Recovery Act* and must exhibit at least one of four characteristics described in 40 CFR 261.20 through 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity) or be specifically listed by the U.S. Environmental Protection Agency in 40 CFR 261.31 through 261.33.

heavy metals—Metallic or semimetallic elements of high molecular weight, such as mercury, chromium, cadmium, lead, and arsenic, that are toxic to plants and animals at known concentrations.

high-efficiency particulate air filter—An air filter capable of removing at least 99.97 percent of particles 0.3 micrometers (about 0.00001 inches) in diameter. These filters generally include a pleated fibrous medium, typically fiberglass, capable of capturing very small particles.

high-level radioactive waste—High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.

high-multiplication devices—A critical assembly for producing nondestructive superprompt critical nuclear excursions. These types of devices are sometimes called prompt burst devices. (See *prompt critical device* and *nuclear excursion*.)

highly enriched uranium—Uranium in which the abundance of the isotope uranium-235 is increased well above normal (naturally occurring) levels.

HIGHWAY—A computer code used for predicting routes for transporting radioactive material in the United States and calculating route-specific population density statistics.

historic resources—Physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later.

Holocene—The current epoch of geologic time, which began approximately 10,000 years ago.

hot cell—A shielded facility that requires the use of remote manipulators for handling radioactive materials.

hydrology—The science dealing with the properties, distribution, and circulation of natural water systems.

hydrodynamic test—High-explosive nonnuclear experiment to investigate hydrodynamic aspects of primary function up to mid to late stages of pit implosion.

hydrodynamics—The study of the motion of a fluid and of the interactions of the fluid with its boundaries, especially in the case of an incompressible inviscid fluid.

Hydrology—The science dealing with the properties, distribution, and circulation of natural water systems.

impingement—The process by which aquatic organisms too large to pass through the screens of a water intake structure become caught on the screens and are unable to escape.

incident-free risk—The radiological or chemical impacts resulting from emissions during normal operations and packages aboard vehicles in normal transport. This includes the radiation

or hazardous chemical exposure of specific population groups such as crew, passengers, and bystanders.

indirect economic effects—Indirect effects result from the need to supply industries experiencing direct economic effects with additional outputs to allow them to increase their production. The additional output from each directly affected industry requires inputs from other industries within a region (i.e., purchases of goods and services). This results in a multiplier effect to show the change in total economic activity resulting from a new activity in a region.

indirect jobs—Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

induced economic effects—The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.

injection well—A well that takes water from the surface into the ground, either through gravity or by mechanical means.

ion—An atom that has too many or too few electrons, causing it to be electrically charged.

ionizing radiation—Alpha particles, beta particles, gamma rays, high-speed electrons, high-speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.

irradiated—Exposure to ionizing radiation. The condition of reactor fuel elements and other materials in which atoms bombarded with nuclear particles have undergone nuclear changes.

isotope—An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.

joint test assembly—A nonnuclear test configuration with diagnostic instrumentation of a warhead or bomb.

joule—A metric unit of energy, work, or heat, equivalent to 1 watt-second, 0.737 foot-pounds, or 0.239 calories.

lacustrine wetland—Lakes, ponds, and other enclosed open water at least 8 ha (20 acres) in extent and not dominated by trees, shrubs, and emergent vegetation.

latent cancer fatalities—Deaths from cancer occurring some time after, and postulated to be due to, exposure to ionizing radiation or other carcinogens.

lithic—Pertaining to stone or a stone tool.

limestone—A sedimentary rock composed mostly of the mineral calcite, CaCO₃.

loam—A soil composed of a mixture of clay, silt, sand, and organic matter.

long-lived radionuclides—Radioactive isotopes with half-lives greater than 30 years.

low-income population—Low-income populations, defined in terms of U.S. Bureau of the Census annual statistical poverty levels (*Current Population Reports*, Series P-60 on Income and Poverty), may consist of groups or individuals who live in geographic proximity to one another or who are geographically dispersed or transient (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. (See *environmental justice* and *minority population*.)

low-level radioactive waste—Waste that contains radioactivity but is not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined by Section 11e (2) of the *Atomic Energy Act* of 1954, as amended. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level radioactive waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram.

magnitude—A number that reflects the relative strength or size of an earthquake. Magnitude is based on the logarithmic measurement of the maximum motion recorded by a seismograph. An increase of one unit of magnitude (for example, from 4.6 to 5.6) represents a 10-fold increase in wave amplitude on a seismograph recording or approximately a 30-fold increase in the energy released. Several scales have been defined, but the most commonly used are (1) local magnitude (ML), commonly referred to as "Richter magnitude," (2) surface-wave magnitude (Ms), (3) body-wave magnitude (Mb), and (4) moment magnitude (Mw). Each is valid for a particular type of seismic signal varying by such factors as frequency and distance. These magnitude scales will yield approximately the same value for any given earthquake within each scale's respective range of validity.

material access area—A type of security area that is authorized to contain a security Category I quantity of special nuclear material and which has specifically defined physical barriers, is located within a Protected Area, and is subject to specific access controls.

material control and accountability—The part of safeguards that detects or deters theft or diversion of nuclear materials and provides assurance that all nuclear materials are accounted for appropriately.

maximally exposed individual—A hypothetical offsite member of the public whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposures (e.g., inhalation, ingestion, direct exposure).

maximum contaminant level—The designation for U.S. Environmental Protection Agency standards for drinking water quality under the *Safe Drinking Water Act*. The maximum contaminant level for a given substance is the maximum permissible concentration of that

substance in water delivered by a public water system. The primary maximum contaminant levels (40 CFR 141) are intended to protect public health and are federally enforceable. They are based on health factors, but are also required by law to reflect the technological and economic feasibility of removing the contaminant from the water supply. Secondary maximum contaminant levels (40 CFR 143) are set by the U.S. Environmental Protection Agency to protect the public welfare. The secondary drinking water regulations control substances in drinking water that primarily affect aesthetic qualities (such as taste, odor, and color) relating to the public acceptance of water. These regulations are not federally enforceable, but are intended as guidelines for the states.

megajoule—A unit of heat, work, or energy equal to 1 million joules. See “joule”.

megawatt—A unit of power equal to 1 million watts. Megawatt-thermal is commonly used to define heat produced, while megawatt-electric defines electricity produced.

meteorology—The science dealing with the atmosphere and its phenomena, especially as relating to weather.

micron—One-millionth of 1 meter.

migration—The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Migratory Bird Treaty Act—This act states that it is unlawful to pursue, take, attempt to take, capture, possess, or kill any migratory bird, or any part, nest, or egg of any such bird other than permitted activities.

million electron volts (MeV)—A unit used to quantify energy. In this EIS, it describes a particle’s kinetic energy, which is an indicator of particle speed.

millirem—One-thousandth of 1 rem.

minority population —Minority populations exist where either: (a) the minority population of the affected area exceeds 50 percent, or (b) the minority population percentage of the affected area is meaningfully greater than in the general population or other appropriate unit of geographic analysis (such as a governing body's jurisdiction, a neighborhood, census tract, or other similar unit). “Minority” refers to individuals who are members of the following population groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. “Minority populations” include either a single minority group or the total of all minority persons in the affected area. They may consist of groups of individuals living in geographic proximity to one another or a geographically dispersed/transient set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. (See *environmental justice* and *low-income population*.)

Miocene—An epoch of the upper Tertiary Period, spanning between about 24 and 5 million years ago.

mitigate—Mitigation includes: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action; or (5) compensating for an impact by replacing or providing substitute resources or environments.

mixed waste—Waste that contains both nonradioactive hazardous waste and radioactive waste, as defined in this glossary.

Modified Mercalli Intensity—A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground shaking with 12 divisions, from I (not felt by people) to XII (nearly total damage). It is a unitless expression of observed effects.

National Ambient Air Quality Standards—Air quality standards established by the Clean Air Act, as amended. The primary National Ambient Air Quality Standards are intended to protect the public health with an adequate margin of safety, and the secondary National Ambient Air Quality Standards are intended to protect the public welfare from any known or anticipated adverse effect of a pollutant.

National Emission Standards for Hazardous Air Pollutants—Standards set by the U.S. Environmental Protection Agency for air pollutants which are not covered by National Ambient Air Quality Standards and which may, at sufficiently high levels, cause increased fatalities, irreversible health effects, or incapacitating illness. These standards are given in 40 CFR 61 and 63. National Emission Standards for Hazardous Air Pollutants are given for many specific categories of sources (e.g., equipment leaks, industrial process cooling towers, dry-cleaning facilities, petroleum refineries). (See *hazardous air pollutants*.)

National Environmental Policy Act of 1969—This Act is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

National Environmental Research Park—An outdoor laboratory set aside for ecological research to study the environmental impacts of energy developments. National environmental research parks were established by the Department of Energy to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development and use.

National Historic Preservation Act of 1966, as amended—This Act provides that property resources with significant national historic value be placed on the National Register of Historic

Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System—A provision of the *Clean Water Act* which prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the U.S. Environmental Protection Agency, a state, or, where delegated, a tribal government. The National Pollutant Discharge Elimination System permit lists either permissible discharges, the level of cleanup technology required for wastewater, or both.

National Register of Historic Places—The official list of the Nation's cultural resources that are worthy of preservation. The National Park Service maintains the list under direction of the Secretary of the Interior. Buildings, structures, objects, sites, and districts are included in the National Register for their importance in American history, architecture, archaeology, culture, or engineering. Properties included on the National Register range from large-scale, monumentally proportioned buildings to smaller-scale, regionally distinctive buildings. The listed properties are not just of nationwide importance; most are significant primarily at the state or local level. Procedures for listing properties on the National Register are found in 36 CFR 60.

natural uranium—Uranium with the naturally occurring distribution of uranium isotopes (approximately 0.7-weight percent uranium-235 with the remainder essentially uranium-238). (See *uranium*, *depleted uranium*, and *enriched uranium*.)

neutron—An uncharged elementary particle with a mass slightly greater than that of the proton. Neutrons are found in the nucleus of every atom heavier than hydrogen-1.

neutron flux—The product of neutron number density and velocity (energy), giving an apparent number of neutrons flowing through a unit area per unit time.

nitrogen—A natural element with the atomic number 7. It is diatomic in nature and is a colorless and odorless gas that constitutes about four-fifths of the volume of the atmosphere.

nitrogen oxides—Refers to the oxides of nitrogen, primarily nitrogen oxide and nitrogen dioxide. These are produced in the combustion of fossil fuels and can constitute an air pollution problem. Nitrogen dioxide emissions contribute to acid deposition and the formation of atmospheric ozone.

noise—Undesirable sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities (e.g., hearing, sleep), damage hearing, or diminish the quality of the environment.

non-attainment area—An area that the U.S. Environmental Protection Agency has designated as not meeting (i.e., not being in attainment of) one or more of the National Ambient Air Quality Standards for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants, but not for others.

nonproliferation—Preventing the spread of nuclear weapons, nuclear weapon materials, and

nuclear weapon technology.

Nuclear Nonproliferation Treaty—A treaty with the aim of controlling the spread of nuclear weapons technologies, limiting the number of nuclear weapons states and pursuing, in good faith, effective measures relating to the cessation for the nuclear arms race.

normal operations—All normal (incident-free) conditions and those abnormal conditions that frequency estimation techniques indicate occur with a frequency greater than 0.1 events per year.

Notice of Intent—Announces an agency's intent to prepare an EIS and describes the proposed action and possible alternatives and the scoping process. The scoping process includes holding at least one public meeting and requesting written comments on issues and environmental concerns that an EIS should address.

nuclear assembly—Collective term for the primary, secondary, and radiation case.

nuclear component—A part of a nuclear weapon that contains fissionable or fusionable material.

nuclear criticality—See *criticality*.

nuclear excursion—A very short time period (in milliseconds) during which the fission rate of a supercritical system increases, peaks, and then decreases to a low value.

nuclear explosive—Any assembly containing fissionable and/or fusionable materials and main-charge high-explosive parts or propellants capable of producing a nuclear detonation.

nuclear facility—A facility subject to requirements intended to control potential nuclear hazards. Defined in DOE directives as any nuclear reactor or any other facility whose operations involve radioactive materials in such form and quantity that a significant nuclear hazard potentially exists to the employees or the general public.

nuclear grade—Material of a quality adequate for use in a nuclear application.

nuclear material—Composite term applied to: (1) special nuclear material; (2) source material such as uranium, thorium, or ores containing uranium or thorium; and (3) byproduct material, which is any radioactive material that is made radioactive by exposure to the radiation incident or to the process of producing or using special nuclear material.

Nuclear Posture Review—A report, led by the Department of Defense, which addresses possible changes in U.S. nuclear policy.

nuclear production—Production operations for components of nuclear weapons that are fabricated from nuclear materials, including plutonium and uranium.

nuclear radiation—Particles (alpha, beta, neutrons) or photons (gamma) emitted from the nucleus of unstable radioactive atoms as a result of radioactive decay.

Nuclear Regulatory Commission—The Federal agency that regulates the civilian nuclear power industry in the United States.

nuclear warhead—A warhead that contains fissionable and fusionable material, the nuclear assembly, and nonnuclear components packaged as a deliverable weapon.

nuclear weapon—The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.

Nuclear Weapons Complex—The sites supporting the research, development, design, manufacture, testing, assessment, certification, and maintenance of the Nation's nuclear weapons and the subsequent dismantlement of retired weapons.

nuclide—A species of atom characterized by the constitution of its nucleus and hence by the number of protons, the number of neutrons, and the energy content.

Occupational Safety and Health Administration—The U.S. Federal Government agency which oversees and regulates workplace health and safety; created by the *Occupational Safety and Health Act* of 1970.

offsite—The term denotes a location, facility, or activity occurring outside of the boundary of a DOE Complex site.

onsite—The term denotes a location or activity occurring within the boundary of a DOE Complex site.

onsite population—Department of Energy and contractor employees who are on duty, and badged onsite visitors.

outfall—The discharge point of a drain, sewer, or pipe as it empties into a body of water.

ozone—The triatomic form of oxygen; in the stratosphere, ozone protects Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere, ozone is considered an air pollutant.

package—For radioactive materials, the packaging, together with its radioactive contents, as presented for transport (the packaging plus the radioactive contents equals the package).

packaging—The assembly of components necessary to ensure compliance with Federal regulations. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle tie-down system and auxiliary equipment may be designated as part of the packaging.

paleontological resources—The physical remains, impressions, or traces of plants or animals from a former geologic age; may be sources of information on ancient environments and the evolutionary development of plants and animals.

Paleozoic—Geologic time dating from 50 million to 245 million years ago when seed-bearing plants, amphibians, and reptiles first appeared.

palustrine wetland—Nontidal wetlands dominated by trees, shrubs, and emergent vegetation.

particulate matter (PM)—Any finely divided solid or liquid material, other than uncombined (i.e., pure) water. A subscript denotes the upper limit of the diameter of particles included. Thus, P₁₀ includes only those particles equal to or less than 10 micrometers (0.0004 inches) in diameter; P_{2.5} includes only those particles equal to or less than 2.5 micrometers (0.0001 inches) in diameter.

peak ground acceleration—A measure of the maximum horizontal acceleration (as a percentage of the acceleration due to the Earth's gravity) experienced by a particle on the surface of the earth during the course of earthquake motion.

Pennsylvanian—A geologic time period of the Paleozoic era, spanning between about 320 and 286 million years ago.

perched aquifer/groundwater—A body of groundwater of small lateral dimensions separated from an underlying body of groundwater by an unsaturated zone.

perchlorate—Perchlorate originates as a contaminant in the environment from the solid salts of ammonium, potassium, or sodium perchlorate. It can persist for many decades under typical groundwater and surface water conditions. Ammonium perchlorate is manufactured for use as the oxidizer component and primary ingredient in solid propellant for rockets, missiles, and fireworks. Other uses of perchlorate salts include their use in nuclear reactors and electronic tubes, as additives in lubricating oils, and in aluminum refining.

Permian—The final geologic time period of the Paleozoic Era, spanning between about 286 and 245 million years ago.

permeability—In geology, the ability of rock or soil to transmit a fluid.

perennial stream—A stream that flows throughout the year.

person-rem—The unit of collective radiation dose commitment to a given population; the sum of the individual doses received by a population segment.

Perimeter Intrusion Detection and Assessment System (PIDAS)—A mutually supporting combination of barriers, clear zones, lighting, and electronic intrusion detection, assessment, and access control systems constituting the perimeter of the Protected Area and designed to detect, impede, control, or deny access to the Protected Area.

pit—The central core of a nuclear weapon containing plutonium-239 and/or highly enriched uranium that undergoes fission when compressed by high explosives. The pit and the high explosive are known as the primary of a nuclear weapon.

placer—A surficial mineral deposit formed by mechanical concentration of valuable minerals from weathered debris, usually through the action of stream currents or waves.

playa—A dry lake bed in a desert basin or a closed depression that contains water on a seasonal basis.

Pleistocene—The geologic time period of the earliest epoch of the Quaternary Period, spanning between about 1.6 million years ago and the beginning of the Holocene epoch at 10,000 years ago. It is characterized by the succession of northern glaciations and also called the “Ice Age.”

plume—The elongated pattern of contaminated air or water originating at a source, such as a smokestack or a hazardous waste disposal site.

plutonium—A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially by neutron bombardment of uranium. Plutonium has 15 isotopes with atomic masses ranging from 232 to 246 and half-lives from 20 minutes to 76 million years.

plutonium-239—An isotope of plutonium with a half-life of 24,110 years which is the primary radionuclide in weapons-grade plutonium. When plutonium-239 decays, it emits alpha particles.

population dose—See *collective dose*.

Precambrian—All geologic time before the beginning of the Paleozoic era. This includes about 90 percent of all geologic time and spans the time from the beginning of the Earth, about 4.5 billion years ago, to about 570 million years ago.

prehistoric resources—The physical remains of human activities that predate written records; they generally consist of artifacts that may alone or collectively yield otherwise inaccessible information about the past.

Prevention of Significant Deterioration—Regulations required by the 1977 *Clean Air Act* amendments to limit increases in criteria air pollutant concentrations above baseline in areas that already meet the National Ambient Air Quality Standards. Cumulative increases in pollutant levels after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (e.g., national parks, wilderness areas) where the preservation of clean air is particularly important. All areas not designated as Class I are currently designated as Class II. Maximum increments in pollutant levels are also given in 40 CFR 51.166 for Class III areas, if any such areas should be so designated by the U.S. Environmental Protection Agency. Class III increments are less stringent than those for Class I or Class II areas. (See *National Ambient Air Quality Standards*.)

prime farmland—Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oil seed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, without intolerable soil erosion, as determined by the Secretary of Agriculture (*Farmland Protection Act* of 1981, 7 CFR 7, paragraph 658).

probable maximum flood—Flood levels predicted for a scenario having hydrological conditions that maximize the flow of surface waters.

probabilistic risk assessment—A comprehensive, logical, and structured methodology that accounts for population dynamics and human activity patterns at various levels of sophistication, considering time-space distributions and sensitive subpopulations. The probabilistic method results in a more complete characterization of the exposure information available, which is defined by probability distribution functions. This approach offers the possibility of an associated quantitative measure of the uncertainty around the value of interest.

process—Any method or technique designed to change the physical or chemical character of the product.

proliferation—The spread of nuclear weapons and the materials and technologies used to produce them.

prompt critical device—A critical assembly designed to reach the condition of prompt criticality. Prompt criticality is the nuclear physics supercriticality condition, due to neutrons released immediately during the fission process, in which a mass and geometric configuration of fissile material (uranium-233, uranium-235, plutonium-239, or plutonium-241) results in an extremely rapid increase in the number of fissions from one neutron generation to the next. Prompt criticality does not rely on the releases of delayed neutrons, which are not released immediately, but rather over a period of about one minute after fission. Prompt criticality describes the condition in which the nuclear fission reaction is not only self-sustaining, but also increasing at a very rapid rate.

protected Area—A type of security area defined by physical barriers (i.e., walls or fences), to which access is controlled, used for protection of security Category II special nuclear materials and classified matter and/or to provide a concentric security zone surrounding a Material Access Area (security Category I nuclear materials) or a Vital Area.

proton—An elementary nuclear particle with a positive charge equal in magnitude to the negative charge of the electron; it is a constituent of all atomic nuclei, and the atomic number of an element indicates the number of protons in the nucleus of each atom of that element.

pulsed assemblies—A critical assembly designed to produce a brief emission of neutrons and gamma radiation associated with a critical condition which lasts a fraction of a second.

Quaternary—The second geologic time period of the Cenozoic era, dating from about 1.6 million years ago to the present. It contains two epochs: the Pleistocene and the Holocene. It is characterized by the first appearance of human beings on Earth.

rad—The English unit of absorbed dose, a rad is 0.01 joule of energy deposited per kilogram of absorbing material. A joule is a very small amount of energy. For example, a 60-watt light bulb on for about 0.02 seconds would use 1 joule of energy. It is historically derived from “radiation absorbed dose.”

radiation (ionizing)—See “*ionizing radiation*.”

radioactive waste—In general, waste that is managed for its radioactive content. Waste material that contains source, special nuclear, or byproduct material is subject to regulation as radioactive waste under the *Atomic Energy Act*. Also, waste material that contains accelerator-produced radioactive material or a high concentration of naturally occurring radioactive material may be considered radioactive waste.

radioactivity—*Defined as a process*: The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing radiation.

Defined as a property: The property of unstable nuclei in certain atoms to spontaneously emit ionizing radiation during nuclear transformations.

radioisotope or radionuclide—An unstable isotope that undergoes spontaneous transformation, emitting radiation. (See *isotopes*.)

radon—A radioactive noble gas with the atomic number 86, resulting from the radioactive decay of radium. Radon occurs naturally in the environment and can collect in unventilated enclosed areas, such as basements. Large concentrations of radon can result in the accumulation of radioactive radon progeny which can cause lung cancer in humans.

RADTRAN—A computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.

Reasonably Available Control Technology (RACT)—The lowest emissions limit that a particular source is capable of meeting by the application of control technology that is reasonably available as well as technologically and economically feasible.

receiving waters—Rivers, lakes, oceans, or other bodies of water into which wastewaters are discharged.

recharge—Replenishment of water to an aquifer.

Record of Decision—A document prepared in accordance with the requirements of 40 CFR 1505.2 and 10 CFR 1021.315 that provides a concise public record of DOE’s decision on a proposed action for which an EIS was prepared. A Record of Decision identifies the alternatives considered in reaching the decision; the environmentally preferable alternative; factors balanced by DOE in making the decision, and whether all practicable means to avoid or minimize environmental harm have been adopted, and, if not, the reasons they were not.

reference concentration—An estimate of a toxic chemical daily inhalation of the human population (including sensitive subgroups) likely to be without an appreciable risk of harmful effects during a lifetime. Those effects are both to the respiratory system (portal-of-entry) and the peripheral to the respiratory system (extra-respiratory effects). It is expressed in units of

micrograms per cubic meter.

region of influence—A site-specific geographic area in which the principal direct and indirect effects of actions are likely to occur and are expected to be of consequence for local jurisdictions.

regional economic area—A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. Each regional economic area is defined by the U.S. Bureau of Economic Analysis.

regulated substances—A general term used to refer to materials other than radionuclides that may be regulated by other applicable Federal, state, or local requirements.

reliability—The ability of a nuclear weapon, weapon system, or weapon component to perform its required function under stated conditions for a specified period of time. (Essentially equivalent to performance.)

rem—The English unit of dose equivalent. The dose equivalent in rem equals the absorbed dose in rad in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Historically derived from “roentgen equivalent man,” referring to the dosage of ionizing radiation that will cause the same biological effect as 1 roentgen of x-ray or gamma ray exposure. (See *absorbed dose* and *dose equivalent*.)

remediation—The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

remote-handled waste—In general, refers to radioactive waste that must be handled at a distance to protect workers from unnecessary exposure (e.g., waste with a dose rate of 200 millirem per hour or more at the surface of the waste package). (See *contact-handled waste*.)

Replacement Pit Fabrication—This function includes the fabrication, surveillance, and storage of the primary high explosive and plutonium core of a nuclear weapon.

Resource Conservation and Recovery Act — This Act gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous wastes.

retrofit—To furnish (e.g., a weapon) with new parts, equipment, or features not available at the time of manufacture.

rhyolite—A fine-grained silica-rich igneous rock, the extrusive equivalent of granite.

riparian—Of, on, or relating to the banks of a natural course of water.

risk—The probability of a detrimental effect from exposure to a hazard. Risk is often expressed

quantitatively as the probability of an adverse event occurring multiplied by the consequence of that event (i.e., the product of these two factors).

risk assessment (chemical or radiological)—The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

roentgen—A unit of exposure to ionizing x-ray or gamma radiation equal to or producing one electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.

runoff—The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

Safe Drinking Water Act, as amended—This Act protects the quality of public water supplies, water supply and distribution systems, and all sources of drinking water.

safe secure trailer—A specially modified semitrailer, pulled by an armored tractor truck, which DOE uses to transport nuclear weapons, nuclear weapons components, or special nuclear material over public highways.

safeguards—An integrated system of physical protection, material accounting, and material control measures designed to deter, prevent, detect, and respond to unauthorized access, possession, use, or sabotage of nuclear materials.

safety analysis report—A report that systematically identifies potential hazards within a nuclear facility, describes and analyzes the adequacy of measures to eliminate or control identified hazards, and analyzes potential accidents and their associated risks. Safety analysis reports are used to ensure that a nuclear facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable laws and regulations. Safety analysis reports are required for DOE nuclear facilities and as a part of applications for U.S. Nuclear Regulatory Commission licenses. The U.S. Nuclear Regulatory Commission regulations or DOE orders and technical standards that apply to the facility type provide specific requirements for the content of safety analysis reports. (See *nuclear facility*.)

sandstone—A sedimentary rock composed mostly of sand-size particles cemented usually by calcite, silica, or iron oxide.

sanitary waste—Waste generated by normal housekeeping activities, liquid or solid (includes sludge), which is not hazardous or radioactive.

sanitization—An irreversible modification or destruction of a component or part of a component to the extent required to prevent revealing classified or otherwise controlled information.

scope—In a document prepared pursuant to the *National Environmental Policy Act* of 1969, the range of actions, alternatives, and impacts to be considered.

scoping—An early and open process for determining the scope of issues to be addressed in an

EIS and for identifying the significant issues related to a Proposed Action. The scoping period begins after publication in the *Federal Register* of a Notice of Intent to prepare an EIS. The public scoping process is that portion of the process where the public is invited to participate. DOE also conducts an early internal scoping process for environmental assessments or EISs. For EISs, this internal scoping process precedes the public scoping process. DOE's scoping procedures are found in 10 CFR 1021.311.

scrubber—An air pollution control device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

sealed pit—A nuclear weapon pit that is hermetically closed to protect nuclear material from the environment.

secondary—See “weapon secondary”.

security—An integrated system of activities, systems, programs, facilities, and policies for the protection of restricted data and other classified information or matter, nuclear materials, nuclear weapons and nuclear weapons components, and/or DOE contractor facilities, property, and equipment.

sedimentation—The settling out of soil and mineral solids from suspension in water.

seismic—Earth vibration caused by an earthquake or an explosion.

seismicity—The relative frequency and distribution of earthquakes.

severe accident—An accident with a frequency of less than 10^{-6} per year that would have more severe consequences than a design-basis accident in terms of damage to the facility, offsite consequences, or both.

sewage—The total organic waste and wastewater generated by an industrial establishment or a community.

shielding—In regard to radiation, any material of obstruction (e.g., bulkheads, walls, or other construction) that absorbs radiation to protect personnel or equipment.

short-lived activation products—An element formed from neutron interaction that has a relatively short half-life that is not produced from the fission reaction (e.g., a cobalt isotope formed from impurities in the metal of the reactor piping).

short-lived nuclides—Radioactive isotopes with half-lives no greater than about 30 years.

Shrink-well potential—Refers to the potential for soils to contract while drying and expand after wetting.

sievert—The International System of Units (SI) unit of radiation dose equivalent. The dose equivalent in sieverts equals the absorbed dose in grays multiplied by the appropriate quality

factor (1 sievert is equal to 100 rem). (See *gray*.)

silica gel—An amorphous, highly adsorbent form of silicon dioxide.

silt—A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

siltstone—A sedimentary rock composed of fine textured materials.

soils—All unconsolidated materials above bedrock. Natural earthy materials on the Earth's surface, in places modified or even made by human activity, containing living matter, and supporting or capable of supporting plants out of doors.

somatic effect—Any effect that may manifest in the body of the exposed individual over his or her lifetime.

source material—Depleted uranium, normal uranium, thorium, or any other nuclear material determined, pursuant to Section 61 of the *Atomic Energy Act* of 1954, as amended, to be source material, or ores containing one or more of the foregoing materials in such concentration as may be determined by regulation.

source term—The amount of a specific pollutant (e.g., chemical, radionuclide) emitted or discharged to a particular environmental medium (e.g., air, water) from a source or group of sources. It is usually expressed as a rate (i.e., amount per unit time).

special nuclear materials—As defined in Section 11 of the *Atomic Energy Act* of 1954, special nuclear material means: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material; or (2) any material artificially enriched by any of the above.

spectral (response) acceleration—An approximate measure of the acceleration (as a percentage of the acceleration due to Earth's gravity) experienced by a building, as modeled by a particle on a massless vertical rod having the same natural period of vibration as the building.

spectral characteristics—The natural property of a structure as it relates to the multidimensional temporal accelerations.

staging—The process of using two layers to achieve a combined effect greater than that of one layer.

START I and II—Terms which refer to negotiations between the United States and Russia (formerly the Soviet Union) during Strategic Arms Reduction Treaty (START) I negotiations aimed at limiting and reducing nuclear arms. START I discussions began in 1982 and eventually led to a ratified treaty in 1988. START II protocol, which has not been fully ratified, will attempt to further reduce the acceptable levels of nuclear weapons ratified in START I.

steppe—A semi-arid, grass-covered, and generally treeless plain.

stockpile—The inventory of active nuclear weapons for the strategic defense of the United States.

stockpile stewardship program—A program that ensures the operational readiness (i.e., safety and reliability) of the U.S. nuclear weapons stockpile by the appropriate balance of surveillance, experiments, and simulations.

Stockpile surveillance—Routine and periodic examination, evaluation, and testing of stockpile weapons and weapon components to ensure that they conform to performance specifications and to identify and evaluate the effect of unexpected or age-related requirements.

strategic reserve—That quantity of plutonium and highly enriched uranium reserved for future weapons use. For the purposes of this SPEIS, strategic reserves of plutonium will be in the form of pits, and strategic reserves of highly enriched uranium will be in the form of canned secondary assemblies. Strategic reserves also include limited quantities of plutonium and highly enriched uranium metal maintained as working inventory at DOE laboratories.

stratigraphy—Division of geology dealing with the definition and description of rocks and soils, especially sedimentary rocks.

sulfur oxides—Common air pollutants, primarily sulfur dioxide, a heavy, pungent, colorless gas (formed in the combustion of fossil fuels, considered a major air pollutant), and sulfur trioxide. Sulfur dioxide is involved in the formation of acid rain. It can also irritate the upper respiratory tract and cause lung damage.

Superfund Amendments and Reauthorization Act of 1986 Public Law 99-499 which amends the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) of 1980. SARA more stringently defines hazardous waste cleanup standards and emphasizes remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes. Title III of SARA, the *Emergency Planning and Community Right-to-Know Act*, mandates establishment of community emergency planning programs, emergency notification, reporting of chemicals, and emission inventories.

surface water—All bodies of water on the surface of the earth and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, and estuaries.

Tertiary—The first geologic time period of the Cenozoic era (after the Mesozoic era and before the Quaternary Period), spanning between about 66 and 1.6 million years ago. During this period, mammals became the dominant life form on Earth.

thermonuclear—The process by which very high temperatures are used to bring about the fusion of light nuclei, such as deuterium and tritium, with the accompanying release of energy.

Third Third wastes—The Environmental Protection Agency proposed the Third Thirds Rule, as required by the Hazardous and Solid Waste Amendments of 1984, to establish treatment standards and effective dates for all wastes (including characteristic wastes) for which treatment

standards had not yet been promulgated (40 CFR 268.12), including derived-from wastes (i.e., multi-storage leachage), and for mixed radioactive/hazardous wastes.

threat—(1) A person, group, or movement with intentions to use extant or attainable capabilities to undertake malevolent actions against DOE interests; (2) the capability of an adversary coupled with his intentions to undertake any actions detrimental to the success of program activities or operation.

threatened species—Any plants or animals likely to become endangered species within the foreseeable future throughout all or a significant portion of their ranges and which have been listed as threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures set in the *Endangered Species Act* and its implementing regulations (50 CFR 424). (See *endangered species*.)

threshold limit values—The recommended highest concentrations of contaminants to which workers may be exposed according to the American Conference of Governmental Industrial Hygienists.

total effective dose equivalent—The sum of the effective dose equivalent from external exposures and the committed effective dose equivalent from internal exposures.

Toxic Substances Control Act of 1976—This Act authorizes the Environmental Protection Agency to secure information on all new existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

transuranic—Refers to any element whose atomic number is higher than that of uranium (atomic number 92), including neptunium, plutonium, americium, and curium. All transuranic elements are produced artificially and are radioactive.

transuranic waste—Radioactive waste not classified as high-level radioactive waste and that contains more than 100 nanocuries (3,700 becquerels) per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years.

tritium—A radioactive isotope of the element hydrogen with two neutrons and one proton. Common symbols for the isotope are H-3 and T.

Transuranic Package Transporter Model 2 (TRUPACT 2) — Type of Type B transportation container (see *Type B packaging*) used for transporting transuranic waste. It is a stainless steel, approximately eight feet in diameter, 10 feet high, and constructed with leaktight inner and outer containment vessels. TRUPACT 2 can hold up to 14 55 gallon waste drums, two standard waste boxes, or one 10-drum overpack (a container designed to provide additional protection for older, deteriorating drums).

tuff—A fine-grained rock composed of ash or other material formed by volcanic explosion or aerial expulsion from a volcanic vent.

Type B packaging—A regulatory category of packaging for transportation of radioactive material. The U.S. Department of Transportation and U.S. Nuclear Regulatory Commission require Type B packaging for shipping highly radioactive material. Type B packages must be designed and demonstrated to retain their containment and shielding integrity under severe accident conditions, as well as under the normal conditions of transport. The current U.S. Nuclear Regulatory Commission testing criteria for Type B package designs (10 CFR 71) are intended to simulate severe accident conditions, including impact, puncture, fire, and immersion in water. The most widely recognized Type B packages are the massive casks used for transporting spent nuclear fuel. Large-capacity cranes and mechanical lifting equipment are usually needed to handle Type B packages.

Type B shipping cask—A U.S. Nuclear Regulatory Commission-certified cask with a protective covering that contains and shields radioactive materials, dissipates heat, prevents damage to the contents, and prevents criticality during normal shipment and accident conditions. It is used for transport of highly radioactive materials and is tested under severe, hypothetical accident conditions that demonstrate resistance to impact, puncture, fire, and submersion in water.

unconfined aquifer—A permeable geological unit having the following properties: a water-filled pore space (saturated), the capability to transmit significant quantities of water under ordinary differences in pressure, and an upper water boundary that is at atmospheric pressure.

unsaturated zone (vadose)—A region in a porous medium in which the pore space is not filled with water.

uranium—A radioactive, metallic element with the atomic number 92; one of the heaviest naturally occurring elements. Uranium has 14 known isotopes, of which uranium-238 is the most abundant in nature. Uranium-235 is commonly used as a fuel for nuclear fission. (See *natural uranium*, *enriched uranium*, and *depleted uranium*.)

vault (special nuclear material)—A penetration-resistant, windowless enclosure having an intrusion alarm system activated by opening the door and which also has: (1) walls, floor, and ceiling substantially constructed of materials which afford forced-penetration resistance at least equivalent to that of 20.32-centimeter (8-inch) thick reinforced concrete; (2) a built-in combination-locked steel door which, for existing structures, is at least 2.54-centimeter (1-inch) thick exclusive of bolt work and locking devices and which, for new structures, meets standards set forth in Federal specifications and standards.

viewshed—The extent of an area that may be viewed from a particular location. Viewsheds are generally bounded by topographic features such as hills or mountains.

vital area—A type of DOE security area that is located within the Protected Area and that has a separate perimeter and access controls to afford layered protection, including intrusion detection, for vital equipment.

vitrification—A waste treatment process that uses glass (e.g., borosilicate glass) to encapsulate or immobilize radioactive wastes to prevent them from reacting with the surroundings in disposal

sites.

Visual Resource Management Class—Any of the classifications of visual resources established through application of the Visual Resources Management process of the Bureau of Land Management. Four classifications are employed to describe different degrees of modification to landscape elements: Class I-areas where the natural landscape is preserved, including national wilderness areas and the wild sections of national wild and scenic rivers; Class II-areas with very limited land development activity, resulting in visual contrasts that are seen but do not attract attention; Class III-areas in which development may attract attention, but the natural landscape still dominates; and Class IV-areas in which development activities may dominate the view and may be the major focus in the landscape.

volatile organic compounds—A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol. In regard to air pollution, any organic compound that participates in atmospheric photochemical reaction, except for those designated by the U.S. Environmental Protection Agency administrator as having negligible photochemical reactivity.

warhead—Collective term for the package of nuclear assembly and nonnuclear components that can be mated with a delivery vehicle or carrier to produce a deliverable nuclear weapon.

waste classification—Waste is classified according to DOE Order 435.1, *Radioactive Waste Management* and includes high-level radioactive, transuranic, and low-level radioactive waste.

Waste Isolation Pilot Plant—A facility in southeastern New Mexico developed as the disposal site for transuranic waste, not yet in operation.

waste management—The planning, coordination, and direction of those functions related to the generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

waste minimization and pollution prevention—An action that economically avoids or reduces the generation of waste and pollution by source reduction, reducing the toxicity of hazardous waste and pollution, improving energy use, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

water table—Water under the surface of the ground occurs in two zones, an upper unsaturated zone and the deeper saturated zone. The boundary between the two zones is the water table.

watt —A unit of power equal to 1 joule per second. (See *joule*.)

weapon primary—The crucial subsystem for weapon reliability and safety; the primary contains the main high explosive and the plutonium that comprise the principal safety concerns. Without proper primary-stage function, the secondary will not work.

weapon secondary—Provides additional explosive energy release; composed of lithium

deuterium and other materials. As the secondary implodes, the lithium in the isotopy form lithium-6. is converted to tritium by neutron interactions, and the tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.

weapons-grade—Fissionable material in which the abundance of fissionable isotopes is high enough that the material is suitable for use in thermonuclear weapons.

weapons assembly/disassembly—Assembly operations assembles piece parts into subassemblies using joining techniques such as welding, adhesive bonding, and mechanical joining. Disassembly takes retired weapons apart and recycles all materials of value.

weighting factor—Generally, a method of attaching different importance values to different items or characteristics. In the context of radiation protection, the proportion of the risk of effects resulting from irradiation of a particular organ or tissue to the total risk of effects when the whole body is irradiated uniformly (e.g., the organ dose weighting factor for the lung is 0.12, compared to 1.0 for the whole body). Weighting factors are used for calculating the effective dose equivalent.

wetland—Wetlands are “... those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3).

whole-body dose—In regard to radiation, dose resulting from the uniform exposure of all organs and tissues in a human body. (See *effective dose equivalent*.)

wind rose—A circular diagram showing, for a specific location, the percentage of the time the wind is from each compass direction. A wind rose for use in assessing consequences of airborne releases also shows the frequency of different wind speeds for each compass direction.

worker year—Measurement of labor requirement equal to 1 full time worker employed for 1 year.

X/Q (Chi/Q)—The relative calculated air concentration due to a specific air release; units are seconds per cubic meter (sec/m³).

yield—The force in tons of TNT of a nuclear or thermonuclear explosion.

zero-based stockpile—A nuclear weapons stockpile with zero nuclear weapons and therefore requiring no stockpile management effort.

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Chapter 15
DISTRIBUTION LIST

Chapter 15 DISTRIBUTION LIST

The U.S. Department of Energy provided copies of the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* (SPEIS) or the Summary to Federal, state and local elected and appointed government officials and agencies; Native American representatives; national, state, and local environmental and public interest groups; and other organizations and individuals listed in this chapter. Copies will be provided to others upon request. Approximately **TBD** copies of the Draft Complex Transformation SPEIS and TBD copies of the Summary of the SPEIS were sent to interested parties. Copies will be provided to others upon request.

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Tennessee Valley Authority	
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U.S. Department of Homeland Security	
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Sharon Sanders Brooks
John A. Sharp

Nevada

Nye County Chair Person

Gary Hollis

Nye County Board of County Commissioners

Roberta Carver
Andrew "Butch" Borasky

Joni Eastley
Peter Liakopoulos

Nye County

Lorina Dellinger

Town of Tonopah

James T. Eason

New Mexico

Mayors

Martin Chavez, Albuquerque
David Coss, Santa Fe

Richard Lucero, Española

County Officials

Galen Buller, City Manager, Santa Fe
Max Baker, Los Alamos County Administrator
Anthony Mortillaro, Los Alamos County, Assistant Administrator
Rick Bohn, Los Alamos County, Director, Community Development
Lorenzo Valdez, Rio Arriba County Manager

South Carolina

Mayors

Fred Cavanaugh, City of Aiken
W. Ken Durham, Town of Edgefield

Lark W. Jones, North Augusta
Thomas Rivers, Town of Williston

Council Members

Ronnie Young, Aiken County Council
J. W. Wall, County of Allendale
Richard Huggins, Barnwell County Council
Monroe Kneece, Edgefield County Council
James M. Adams, North Augusta City Council
Carolyn C. Baggott, North Augusta City Council
Pat C. Carpenter, North Augusta City Council

Kenneth J. McDowell, North Augusta City Council
Arthur Shealy, North Augusta City Council
Jason Whinghter, North Augusta City Council

County and City Officials

Timothy Simmons, Aiken County Commission for Higher Education
Van Smith, Aiken Downtown Development Association
Robert Thomas, Allendale County Development Board
Isaia Odom, Bamberg County
Marshall Martin, Barnwell County Economic Commission
Vernon Dunbar, City of New Ellenton

Lower Savannah Council of Governments

F. Wayne Rogers

Chambers of Commerce

J. David Jameson, President, Aiken Chamber
Augusta Metro Chamber

Tennessee

Oak Ridge Mayor

Tom Beehan

Oak Ridge City Council

Tom Beehan

Tom Hayes

D. Jane Miller

Ellen Smith

Willie Golden

Charlie Hensley

David Mosby

Environmental Quality Advisory Board

Amy Fitzgerald, Government and Public Affairs Coordinator

Chambers of Commerce

Hayes Ledford, Chattanooga Area Chamber

Clyde Craven, Oak Ridge Chamber

Parker Hardy, Oak Ridge Chamber

Tatia M. Harris, Knoxville Area Chamber Partnership

Terry Payne, Roane County Chamber

Oak Ridge Economic Partnership

Texas

Amarillo Mayor

Debra McCartt

Amarillo Commissioners

Ronald Boyd

Brian J. Eades

Madison Scott

Jim Simms

Amarillo Economic Development Corporation

Buzz David

Native American Tribes and Organizations

All Indian Pueblo Council	Pueblo of Laguna
Five Sandoval Indian Pueblos	Pueblo of Nambe
Eight Northern Indian Pueblos Council	Pueblo of Picuris
Jicarilla Apache Nation	Pueblo of Pojoaque
Mescalero Apache Tribe	Pueblo of Sandia
National Congress of American Indians	Pueblo of San Ildefonso
National Environmental Coalition of Native Americans	Pueblo of San Felipe
National Tribal Environmental Council	Pueblo of Santa Ana
Navajo Nation	Pueblo of Santa Clara
Navajo Nation Council	Pueblo of Santo Domingo
Pueblo of Acoma	Pueblo of Taos
Pueblo of Cohiti	Pueblo of Tesuque
Pueblo of Isleta	Pueblo of Zia
Pueblo of Jemez	Pueblo of Zuni

Public Interest Groups

Winston Butler, 100 Black Men
Joanne Steele, Action for a Clean Environment
Susan Winsor, Aiken Technical College
Anita Amstutz, Albuquerque Mennonite Church
Susan Gordon, Alliance for Nuclear Accountability
Schwartz Sandra, American Friends Service Committee
Joseph Gerson, American Friends Service Committee
Bruce A. Anderson, Anderson, Reeves & Herbert, P.A.
Sperry Raphael, Architects Designers Planners for Social Responsibility
Terry Elam, Augusta Technical College
Dorothy Jean Baker, Benedictine Sisters
Benedictine Sisters
Leroy Matthieson, Catholic Diocese of Amarillo
Leonor Tomero, Center for Arms Control and Non-Proliferation
Janet Greenwald, Citizens for Alternatives to Radioactive Dumping
Susan Wood and J.M. McKibben, Citizens for Nuclear Technology Awareness
James Hendrix, Community Reuse Organization
Joni Arends, Sadaf Cameron, Kalliroi Matsakis, Concerned Citizens for Nuclear Safety
Roberta Brich, Congregation of the Humility of Mary
Mary George Senderak, Convent of St. Elizabeth
Valerie Heinonen, Dominican Sisters of Hope, Mercy Investment Program, Sisters of Mercy
Regional Community of Detroit, and the Ursuline Sisters of Tildonk - U.S. Province
Stella Goodpasture, Dominican Sisters of Mission San Jose

Beth Murphy, Dominican Sisters of Springfield, Illinois
Mary Beth Binder, East Bay Animal Advocates
Alice Q. Murphy, East Tennessee Environmental Business Association
Fred Humes, Economic Development Partnership
Sheri Kotowski, Embudo Valley Environmental Monitoring Group
Janet Brysch, Felician Franciscan Sister
Amanda Hendler-Voss, First Congregational United Church of Christ
Pamela Gilchrist, First Presbyterian Church
Regina Holtz, Franciscan Sisters of Peace
David Culp, Friends Committee on National Legislation
Devin Helfrich, Friends Committee on National Legislation
Elizabeth Bagen, Grey Nuns of the Sacred Heart
Loretta Theresa , Handmaids of Mary
Travis Sharp, Herbert Scoville Jr. Peace Fellow
Rosemary Davis, IHM Congregation
Bonnie Carroll, Information International Associates
Gary Marshall, Innovation and Commercialization Center
Lois Chalmers, Institute for Energy and Environmental Research
Arjun Makhijani, Institute for Energy and Environmental Research
Tully Widner, International Chemical Workers Union, Local 252C
Allegany Convento, Irmas Franciscans de Allegany
Bob and Carrol Pearson, Las Vegas Committee for Peace and Justice
David E. Rivers, Medical University of South Carolina
Jan McNally, Methodist Medical Center
Suzanne Koehler, Methodist Medical Center of Oak Ridge
Debra Atkinson, Midland Valley Area Chamber of Commerce
Monastery of St. Gertrude
Paul Stephens, Montana Green Bulletin
Sister Ramona, Mother of God Monastery - Benedictine Sisters
David, Barrett, Mount Rogers Planning District Commission
Dorothy Urban, Mount Saint Joseph Convent
Bob Hanson, Mt. Diablo Peace and Justice Center
Christopher E. Paine, Natural Resources Defense Council
Susana Navarro, Navarro Research and Engineering, Inc.
Sarah Harling, Nevada Desert Experience
Jay Coghlan, Nuclear Watch New Mexico
Mary Elizabeth Imler, Order of Saint Francis; Franciscan Sisters of the Sacred Heart
John McKittrick, ORN Federal Credit Union
Sister Mary Frances, Our Lady of Sorrow Convent
Shirley Lewis, Paine College
Doris and Phillip Smith, Panhandle Area Neighbors and Landowners
Laurian Lasha, Pax Christi Northwest Minnesota
Peggy Prince, Peace Action New Mexico
Griffin Rebecca, Peace Action West
Carol E. O'Farrell, Pellissippi State Technical Community College
Curtiss DuRand, Physicians for Social Responsibility

Harry Wang, Physicians for Social Responsibility, Sacramento
Martin D. Fleck, Physicians for Social Responsibility, Washington
Greg Kaufman, Pueblo of Jemez - DRP
Brenda Walsh, Racine Dominican
Honora Nicholson, Religious Sisters of Mercy
Mary Ann Schimscheiner, Religious Sisters of Mercy
Jeanette Brooks, Savannah River Site Chapter of the National Management Association
Nichola Kuehn, Savannah River Site Retiree Association
School Sisters of Notre Dame, St. Louis Province
Sister McCarthy, School Sisters of St. Francis
Margaret Fitzgibbon, Sisters of Charity
Sister Barbara Hagedora, Nancy Bromloge, Georgia Kitt, Maureen Heverin, Trish M., Michele Fischer, Sisters of Charity of Cincinnati
Louise O'Reilly, Sisters of Notre Dame de Namur
Denise Nikensen, Marsha Speth, Jane Marie Osterholt, Nancy Reynolds, Marie McCarthy, Paula Damiano, Sisters of Providence
Teresina Terex Joo, Illona Homoki-Szabo and Elizabeth Kovacs, Sisters of Social Service of Buffalo, New York
Lenore Paschke, Sisters of St. Benedict
Edith Wyss, Sisters of St. Francis
Janice Cebula, Sisters of St. Francis
Sister Anna Kessen, Sisters of St. Joseph
Diana Oleskevich, Sisters of St. Joseph of Carondelet
Judy Mannix, Sisters of the Good Shepherd
Carol Tobler, Sisters of the Incarnate Word and Blessed Sacrament
Joy Peterson, Sisters of the Presentation
Nancy McLaughlin, Sisters of the Presentation
Sister Frances O'Neil, Sisters of the Presentation
Virginia Wilkinson, Sisters of the Presentation
Andrew Hugine, South Carolina State University
Carl Gooding, Southern Carolina Regional Development Alliance
Beverly Gattis, STAND
Peter Fessenden, Stanford University
The Provincial Leadership Team
The Roy Process
The Sisters of Charity of Saint Elizabeth
Norah Nash, The Sisters of St. Francis of Philadelphia
Colin Covington, Three Rivers Solid Waste Authority
Marylia Kelley, Tri-Valley CAREs
Loulena Miles, Tri-Valley CAREs
Mary Perner, Tri-Valley CAREs
Arnold Troeh, Tsinoonk Nation
United for Peace and Justice, Bay Area
Susan McGovern, United Nations Association
Dee Stanford, United Way of Aiken County
P.A. Brodie, University Health Care Foundation

Lezlie Moriniere, University of Arizona
Richard Schultz, University of Chicago
Joanne LaFramenta, University of Florida
Paul Bertsch, University of Georgia
Patrick Ciez, University of South Carolina
Thomas L. Hallman, University of South Carolina
Homer S. Fisher, University of Tennessee
John W. Schaerer, University of Tennessee at Chattanooga
Donna Frey, Ursuline Convent of the Sacred Heart
Tracy Moore, Western Shoshone Defense Project
Jacqueline Cabasso, Western States Legal Foundation
Sally Blakemore, Wildmaker Art & Music School
Anita Thompson, Xavier Center
Glenn Bell, Y-12 Beryllium Support Group

Public Reading Rooms

California

Lawrence Livermore National Laboratory

NNSA/LSO Public Reading Room, LLNL Discovery Center (Visitors Center),
Building 6525
East Gate Entrance, Greenville Road
Livermore, CA 94550
Phone: (925) 424-4026

Livermore Public Library

1000 So. Livermore Avenue
Livermore, CA 94550
Phone: (925) 373-5500

Tracy Public Library

20 East Eaton Avenue
Tracy, CA 95376
Phone: (209) 831-4250

Georgia

Southeastern Power Administration

Southeastern Power Administration
1166 Athens Tech Road, Elberton, GA 30635-6711
Phone: (706) 213-3813

East-Central Georgia Regional Library

902 Greene Street
Augusta, GA 30901
Phone: (706) 821-2600

Missouri

Central Library

14 West 10th Street
Kansas City, MO 64105
Phone: (816) 701-3400

North-East Branch

6000 Wilson Road
Kansas City, MO 64123
Phone: (816) 701-3485

Nevada

NNSA Nevada Site Office

NNSA Nevada Site Office
755 E. Flamingo Road, PO Box 98521, M/S 400
Las Vegas, NV 89193-8521
Phone: (702) 784-5121

Office of Repository Development

Bechtel SAIC Company LLC
Reading Room
Science Center
4101 B Meadows Lane
Las Vegas, NV 89107
Phone: (702) 295-1312

Las Vegas Library

833 Las Vegas Boulevard North
Las Vegas, NV 89101
Phone: (702) 507-3500

Indian Springs Library

715 Gretta Lane
Indian Springs, NV 89018
Phone: (702) 879-3845

Beatty Community Library

400 North 4th Street
Beatty, NV 89003
Phone: (775) 553-2257

New Mexico

Los Alamos National Laboratory

Research Library
TA-3-207
Los Alamos, NM 87545
Phone: (505) 667-0216

NNSA Albuquerque

National Nuclear Security Administration Service Center
DOE FOIA Reading Room, Government Information/Zimmerman Library, MSC05 3020, 1
University of New Mexico
Albuquerque, NM 87131-0001
Phone: (505) 277-5441

Mesa Public Library

2400 Central Avenue
Los Alamos, NM 87544
Phone: (505) 662-8240

Santa Fe Main Library

145 Washington Avenue
Santa Fe, NM 87501
Phone: (505) 955-6780

South Carolina

Savannah River Operations Office

University of South Carolina-Aiken
171 University Parkway

Aiken, SC 29801
Phone: (803) 641-3320

Aiken County Public Library
314 Chesterfield St. SW
Aiken, SC 29801
Phone: (803) 642-2020

Barnwell County Public Library
40 Burr Street
Barnwell, SC 29812
Phone: (803) 259-3612

Tennessee

Oak Ridge Office
DOE Information Center, 475 Oak Ridge Turnpike
Oak Ridge, TN 37830
Phone: (865) 241-4780 or 1-800-328-6938, Option 6

Oak Ridge Public Library
Civic Center
1401 Oak Ridge Turnpike
Oak Ridge, TN 37830
Phone: (865) 425-3457

Kingston Public Library
1004 Bradford Way
Kingston, TN 37763
Phone: (865) 376-9905

Texas

Central Library
413 E 4th
Amarillo, TX 79101
Phone: (806) 378-3054

North Branch
1500 NE 24th
Amarillo, TX 79107
Phone: (806) 381-7931

U.S. Department of Energy Headquarters, Washington, DC

Freedom of Information Reading Room
U.S. Department of Energy
Public Reading Room
1000 Independence Avenue, SW
Washington, DC 20585
Phone: (202) 586-3142

Individuals

Mary Ellen Andrisin
Richard Barnhart
John Agnes Barone
Jim Bartman
Maya Be
Larry Beans
Marylin Bechtel
Jaime Becker
Dean Beddow
Genevieve Behal
Era Behrens
Mary Loretta Beier
Glenn Bell

Jim Bell
Ruth Benjamin
Rachel Benjoyo
Cheryl Benson
Sonya Benson
Joanie Berdel
Emily Berger
Kim Bergier
Fred Bergmann
Bruce Berlin
Robert Berman
Lois Bernbeck
Maurita Bernet

Bernice Fischer
Scott Bernstein
Jean Berringer
Sammy Berris
Dottie Berry
Florence K. Bert
Anne Berven
Bobbe Besold
Beverly Hobson
Beverly King
Juliette Bidon
Jed Bierhaus
Philip Bifulco

David and Alexandra Biggs	Ann and Dayton Brandon Tocha Brandon	Jackie Burns Shawn Burroughs
Margaret Bigler	Marcia Brenden	Erin Burtch
Susan Billings	Sherman Brennan	Linda A. Butler
Lee Billips	Carl Bretz	Thomas Butler
Beth Bingman	Krista Brewer	Janice Button-Shafer
Joan Birch	Rick Brewer	Mary Byers
David Birdbaum	Samuel Brient	Jacqueline Cabasso
Darryl Birkenfeld	John Bright	Scott Cady
Nancy Birmingham	Tom Brill	Larry Caldwell
Chad Bisk	Marie Brillan	Craig Caleb
Fay Bisno	Nancy Bringhurst	Jim Campbell
Anne Bjornson	Gert Brixius	Jane Campos Johnson
Tom Blandy	Beth Brockman	Marlene Candell
David Blank	Eleanor Brockman	Marge Cantu
Joseph Blazewicz	Harold Brokaw	J. Capozzeli
Karen Blomquist	Gail Bromer	Carolanne M. Carawan
Cindy Blount	Jim Bronke	Mona Cardell
John Bluth Gill	Richard Brooks	Jerome Cardens
Becky Bodonyi	Stephen Brooks	Enrique Cardiel
Joel Boland	Ashley Brough	Eugene Cardona
Alan Boltuch	Charles Brown	Ann Cardwell
Gary Bomhoff	Edmund Brown	S. Caristi
Kendell Bond	Elizabeth Brown	Terry Carpenter
Ken Bondo	Katherine Brown	Barbara Carr
Earle Boner	Patricia Brown	Christina Carr
Arne Bonilla	Shawnee Brown	Frank Carrasco
Jean Bonnyman	Wayne Brown	Glenn Carroll
Dolores Boogdaian	Kathry Browning	Bill and Mary Carry
Elaine Booth	Dolores Broyles	Harold Cartlidge
Bud Boothe	Marie Noel Bruch	Clark Case
Elden Boothe	Joel Bryan	J. Caseber
Sharon Borgstrom	John Bryant	Karen Cassidy
David Borzenski	Katherine Bryski	Tim Cassidy
Jasmine Boss	John Buck	Nicholas Castro
Bill Boteler	Ted Bucklin	Phillip Cates
Mary Botkin	John Buckridge	Robert Cathey
Mary Ellen Bowen	Norman Budow	Julie Cato
Margaret Bowman	Jeanette Buehler	B. Cauthorne
Ruth Bowman	Amy V. Bunting	Maureen Cawley
Elizabeth Boyd	Darlene Bunting	Duane and Fran Cawthorn
Richard Boyden	Shelley Buonaiuto	D.C. Cawthorne
Nancy Bracewell	Frank Burger	R. M. Cecchini
Mildred Brady	Janet A. Burgos-Corredor	Ester Ceja
Peggy Brahdan	Maya Burien	Patricia Chaffee
Gina Brandolino	Esther Burnham	Brittney Chamber

Stephanie Chappell	Barbara Conroy	Andrew Davis
Addis Charless, Jr.	Carlos Contreras	Ellen Davis
Jamie Chase	Linda N. Cook	George Davis
Margaret Chase	Eva Coombs	Jayne Davis
Erlinda J. Chavez	Arlene Cooper	Shirley Davis
Michelle L. Childers	Gaywyn Cooper	Susanna de Falla
Charles Chiusano	Roberto Cooper	Virginia de Rochemont
Elisabeth Choi	Mary Corbelt	Fred Dearing
Linda Chorez	Kim Corle	Eric DeBode
Sersen Christ	Elise Corwin	Barb Decker
Kelly Christian	Christine Cory	Sarah Deeby
Rebecca Christman	Demelza Costa	Teresa del Castillo
Dora Christopulos	Ann Cottrell	Thomasina Delauro Nolan
Joseph Cidelio	Richard Craig	Maria Luisa Deitering
D.K. and F.L. Cinquemani	Susan Crane	Bill Denneen
Urs Cipolad	Audrey Crawford	J.D. Depelchin
Benni Clark	Teresa Crawford	Anita DeSalvo
Bob Clark	Edwin Crayton	Donna Detweiler
Clayton Clark	Pearl Garrett Crayton	Thomas Deveny
Kathy Clark	A.J. Cregan	Jean DeVinney
Penni Clark	Ruby A. Cribbin	Stanley Dewey
Robert Clark	Carter Criffin	Sharon Deyo
Beezie Clarke	Peggy Cross	Joan Digan
John Clarke	Arthur Crow	Mark Dilg
Rebecca M. Clay	Kay Cumbow	Betsy Dinger
Valentina Clayton	Joseph Cunneen	Florence Ditlow
Catherine Cleary	Tim Curry	Jim Ditton
Elaine and Charles Cleland	Shirley Cuthbertson	Jo Dodson-Boyle
John Strauz Clement	John Cutler	John Doe
Tom Clements	Megan Cutler	MC Domandi
Jill Cliburn	Samuel Cutter	Nick Dombrowski
Charlene Cocke	Karen Dabrusin	Mark Donham
Sharon Cody	Ron C. Dale	Lisa Douglas
Alexandra Cohen	Juliana D'Amato	Spivey S. Douglass
Eleanor Cohen	Dixie Damm	Tom Douglass
Portia P. Cohen	Kendrick Daniel	Lloyd Downs
John Coiley	Mark Dankert	Marlene Dragonlair
Frieda Coleman	Rosemary Darney	Bruce Drago
Rita Collins	Arron Daugherty	Joseph Driessen
Lori Colt	Terry Ann Daugherty	Martha Drogovich
Adele W. Combs	Margaret Davenport	Catherine Drury
Bruce Combs	David Payton	Kiva Duckworth
Dorothy Compinsky	Bernadette Davidson	Paulina Dudek
Jean M. Conger	Bonnie Davidson	Amy Duffy
Kate Connell	Gillian Davies-Nippel	Joan Dukes
Zigmund Connell	M. Davies	Judith Duvall

Ted Dyman	Lawrence Feinberg	L. Douglas Franklin
John Dziak	Thomas Fetter	Fred Norman
Elena Dzuro	Craig Fiels	Lawrence Freedman
Carol Eagen	David Filipelli	Janet Freehling
Christina Eavyn Warner	Morgan Fillion	Maria Cecilia Freeman
Laurence H. Ebersole	Edie Fink	Suzanne Freeman
Terry Ebersole	Mary Lou Finley	Lawrence Freinberg
John Edgerton	John Fishburn	Evan Freirich
Chris Edsey	Rita Fisher	Christiane French
Frances Edwards	Michele F. Fisk	Travis Fretter
Kirsten Edwards	Martha Ann Fitzpatrick	Chris Fretz
Rem and Louise Edwards	Margaret A. Flanagan	Thomas Friche
Tom Egan	Michael M. Fleenor	David Friedman
Anita Eisenbeis	Eileen Fleming	Judi Friedman
Tim Eisenbeis	Charles B. Fletcher	Mark Friesen
Nicole Eisenberg	Sally Flick	John Frink
Mark Ekarán	Mary Theresa Floer Shelm	Mary Froemming
Raymond Elaine	Marie Flom	Vicki Frost
Matthew Eldredge	Lyn Flynn	Phil Fry
Jarel Eldrege	Mary Rachel Flynn	Virginia and Gene Frye
Valerie Elkins	Adrienne Fong	Cynthia Fugman
Freda Elliot	Margaret Yearwood	Glenn Fuller
Robert Elliot	Fontenot	Marigrace Furby
Lois Ellis	Felicity Fonseca	Marilyn Furlano
Jacinta Elmendorf	Joshua Force	Sam Furrow
Mary Lou Eltgroth	Ian Ford	Laurie Furumoto
Maura L. Emerine	Kenneth Ford	Janet A. Gabriel
Karla Eoff	Robbin Ford	Carol Gaeke
Steve Erickson	Eleanor Forfang-	Mary Ann Gaido
Cheryl Evans	Brockman	George Gamble
Dinda Evans	Emma Forman	Sage Gang-Halvorson
Chrysse Everhart	Joan Forman	Anthony Garcia
Karl Eysenback	D'Anna Fortunato	Kevin Garcia
Niki Fagin	Daryn Foss	Keith Gardner
Martin Fahrney	Lenny Foster	Percyne Gardner
Eric Fairfield	Nancy Foster	Cathy Garger
Cassandra Falix	Shannon Fouts	Christina Garofano
Sister Mary Fallon	Leslie Fowler	Jo Anne Garrett
Don B. Fanning	Pat Fowler	Shane Garrity
Michele Faraon	Doug Fox	Linda Gartzman
Eileen Farley	Tressia Fox	B. Geary
Sam Faulmer	Bonnie Foz	Richard Gedes
Barbara Favor	Sandy Franck	Piraino Genevie
Carol Fay	Adam Frank	Don Gentry
Marvin Fedman	B. Frank	Frederick Georges
Marie and Bob Fehribach	Esther Franklin	Adam Gerhardstein

Jack Gerritsen	Lynne Gray	Emile Hamilton
Gerilyn Gess-Healey	Patricia Gray	Tom Hamilton
Karen Ghin	Trish Gray	Laura Han
Harland Gibson	Venita Gray	Don Hancock
Cheryl Gilbes	Audley Green	Jack Handey
Chad Gilchrist	Carol E. Green	Timothy Handley
Karen Giles	Hope Green	Hanish Thompson
John Bluth Gill	Karen Green	Kelly Hankedo
Che Gilliland	Matthew Green	Helen Hanna
Gerald Giovacchini	Paul Green	Jane Hanna
Josephine Girardin	Phyllis Greenleaf	Hildegarde Hannum
Ellen Glaccum	Aaron Greenward	Art Hanson
Bonnie Glasgow	Robert Greenwood	Beverly Hanson
David Glasgow	Jan Gregorcich	Kristi Hanson
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David N. Goff	DeeAnn Grimes	Pat Harms
Joshua Goldberg	Amie Grubb	Shelby Harne
Helen Goldenberg	John Grula	Louise Harper
Steven Goldfarb	Martine Gubernat	Frank Harrell
Bobbi Goldin	Lena and Paul Gubiotti	Brian Harrison
Jane Goldthwait	Eric Guinn	Allan Hart
Suzanne Golembieski	Jenny Gumpertz	Susan Hart
Michael Gomel	Kristine Gutierrez	Margeret Hartman
Stella Gomezdelcampo	Sally Gutkowski	Joe Harty
Joe Goob	Ian S. Guy	Elise Harvey
Albert Good	Steve H.	Lisa Harvey
Linda Goodman	Judy Haaksma	Mary Ellen Harvley
Rachel Goodwin	Holly Haas	Jan Harwood
Michael Gootee	Anne Hablas	Jimmy Haslam
Christopher Gordin	Lance Haddix	Jeannette Hassberg
Cortney Gordon	L. Hagen	Carla Hastings
David Gordon	Jacob Hagerty	Ted Hatzivramidis
Jessie Gordon	Gail Haggard	Hallie Hayden
Sandra Gordon	Mariam Hail	William Hayes
Janet A. Gorges	Ann & Dave Hake	John Haynes
Janice Gori	Elizabeth J. Hakel	Nancy Hazen
Jacob Gotwals	Dr. James Hales	Ruth and John Hazleton
Joan Govedare	James W. Hall	Jack Heacock
Kathleen Grace	William Hallerberg	Gess Healey
Anne Grady	Mary Halligan	Donna M. Hebert
Linda Grant	Lynn Halpen	Thomas Heck
Chris Grapentine	Nicholas Richard Hambel	Edmund Hefferman
Bill Gray	Donna Hamer	Michael Hefferon

Harriet Hehr	Pauline Houzard	Rose Johnson
Ulrich Heinz	Beatrice Howard	T.J. Johnson
Laura Helbig	Carlton H. Howard	Val Johnson
Homans Helenty	Barbara Hoying	Cathleen Johnston
Bernadette Helfert	Audre Hrasen	Margarete Johnston
Rosella M. Helm	Sister Larine Huelshamp	Mary Dea Johnston
Dolores Helman	Kimberley Hughes	Tom Johnston
Kendall Hendley	Michael Hunt	J.T. Jolley
Ann Hendrie	Edna Hunthausen	Jo Ann Jolley
Jimmy Henley	Lisa Huntington	Evan Jones
RP Henley	Ed Iaccarino	Hope Jones
Ross Hennesy	Martha Iancu	I.L. Jones
Patricia Henron	Jack Igel	James Jones
Charles Hernandez	Harry Iltonen	Jessica Jones
Joan Heron	Hayat Imam	Leslie Jones
Caroline Herzenberg	Joan Intrator	Virginia McClurkin Jones
Chet and Judy Heyberger	C.K. Chaparral Ireland	Debora Jordan
Linda Hibbs	Blaize Ison	Patricia Jordan
Virginia Hildebrandt	Carolyn Israel	Russell Jorgensen
Patricia Hiles	Karen Iverson	Ruth Joslin
Amalie Hill	Heidi Jackson	Helene Joy
Gail Hintz	Ron Jackson	Mary Joyce
Adrienne Hirl	Ruth Jamieson	Joyce Rupp
Steve Hixson	S. Norma Janssen	John Judson
Maira Hoaglund	Karen Jaques	Martha Julins
Harold Hodes	Phyllis Jardine	Evy Justesen
Kathryn Hodge	Marilyn Jasper	Ranowul Jzar
Lynn Hodge	Alison Jayne	Frederick Kackley
Jay Hodges	Audrey Jean	Linda Kaehler
Wylyn Hodnett	Abbie Jenks	Liz Kaercher
Wilbur Hoff	George Jennings	Marianne Kakstis
S. Frances Hoffman	Mary Jenny	Marie Kalb
Rosemary Hogan	Louis Jensen	Cathy Kama
Corina Holiday	Mona Jhaveri	Cindy Kaminski
Dorothy Holland	Abigail Johnson	Kevin Kamps
Ruth Hollenback	Audrey Johnson	Virginia Kampwenth
Karen Holligan	Beverly Johnson	Betty Kane
Pam Hollings McConnell	Bonnie Johnson	Solomon Kaplaus
Jo Ann Holmes	Charlene Johnson	Ann Karp
Rebecca Holsinger	Chris Johnson	Leah R. Karpen
Jeannie Honicker	Elaine Johnson	Liz Kassan
Chris Horger	Joshua Johnson	Fern Katz
Sharon Horne	Loy Johnson	Kimberley Kauffman
Pamela Hosler	Mina F. Johnson	Cynthia Kaul
Gwen Hoss	Richard Johnson	Alyssa Kay
Shahram Hosseinion	Robert W. Johnson	Roberta Kaye

Margarete Kearns	Alicia Knoblock	Donald Larson
Julia Keegan	Kristie Knoll	Mark Larson
Meghan Keegan	Eunice Koch	Naidine Adams Larson
Andrea Keisler	Wendy Kochis-Flippo	Thomas Larson
Joanne Kellar	Jody Butler Koehl	Susan Latham
Grayce Keller	Selena Kohel	Jolie Laut
Allen Kelly	Bruce Kohler	Marie Laux
J.A. Kelly	Ellen Koivisto	Anina Lavee
Mary Kelly	Victoria Kokoras	Nancy Lavix
Marylia Kelly	Lucas James Xavier Kolasa	Virgine Lawinger
Michele Kelly	G. Konecky	Donald Lawn
Daniel Kendrick	DC Konrad	Clara Lawrence
Rachel Kennedy	Helen Kopp	Lory Lazarus
Gaby Ketterle	Jeanette Korrect	Katherine Leahy
Christopher Key	Peter Kovatis	Linda Lee
Diana Keyes	Lawrence Krauss	Jacqueline Leech
Mha Atma Khalsa	Richard Kravath	Christian Leiva
Santokh Khalsa	Janet Kreber	Rhonda Leland
Shanti Kaur Khalsa	Danin Krehn	Arnold Lelis
John Kiefer	Liz Kreml	Sadnah Lemba
Laverne Kilbren	Claire Kugelman-Kropp	Joe Lenhard
Cheryl Kilcollins	Florence Kuhn	Pat Lent
Bob Kimzey	Richard Kujawa	Barbara Leonard
Brenda King	Christopher Kundel	Gorgana Leonard
Donald King	Alice Kunkel	Karen Leonard
Jim King	Della Kurtz	Cody LePow
Joan King	Adele Kushner	Michelle Lerman
Karen King	Breanna Kyle	Jim Lertola
Marilyn King	Korina Kyriakou	Monika Lesch
Nancy King	Madeline Labriola	Ken Lesem
Kathryn Kinnard	David Lafond	Bret Leslie
Diane Kinney	John LaForge	Algrias M. Leskys
Robert Kinsey	Tri'shonne LaFreniere	Leon and Alita Letwin
Ray Kircher	Randy Lagro	Kathy Leupp
Keith Kirchesler	Leslie Lakind	Donald Levering
Steve Kirkland	Carolyn P. Lamb	Judy Lewis
Tom Kirkpatrick	Marguerite Lambert	Julia Lewis
Mary Anne Kirsch	Mary Lambert	Kathy Lewis
Seth Kirshenberg	Rick Lamont	N. Lewis
Carolyn Kisen	Jonathan E. Lan	O. Lewis
Beverly Kissy	Charles Lane	Pete Lewis
Bob Kitznan	Amanda Lang	R.B. Lewis
Judith Kleinheider	Edward Langley	Suzanne Licht
Keith Kline	Peter Lapolla	Alan Liddel
Rachel Klingberg	Don Larkin	Alien Liddel
Rebecca Knight	Cullen Larson	Barbara Likens

Magdalene Liles	Andy Mahler	Robert McFarland
Jennifer Lincoln-Lewis	Jackson Mammele	Liz McGeachy
Karen Lind	Stacey Manburg	Chris McGee
Mark Lind	Dianne Mancini	Kathleen McGinn
Katherine Lindahn	Rebecca Mandel	Patricia McGornick
Francine Lindberg	Dan Manis	Simon McGuinness
Carl Lindor	Kathleen Manscill	Sara McIntosh
Homer Liney	Katherine N. Mareck	Sebastian McIntyre
Lorraine Lipani	Seymour Marion	Brian McKee
Heather Little	Krzysztof Markowski	Thomas M. McLernon
Greg Livingston	Emily Marler	Ada S. McMillan
Natasha Lloyd	Lersch Marlies	Mimi McMillen
Joyce and John Locke	Thomas Marshall	Oreandra McNally
Marguerite Loddengaard	Andrea Martinez	Randy McNally
Jane Loebel	Joel Martinez	Kathryn McNeill
Judy Loest	Tommy Martinez	Donna McNiel
Robert Loest	Susan Maslar	Katherine McNiel
Priscilla Logan	Michele Mason	Jones Mealy
Yvonne Logan	David Matteson	Barbara Medina
Diane Lohr	Dustan J. Mattingly	Elizabeth Medina
Alfred Long	Laurie Mattingly	Diane Mee
Johnny Long	Carroll Maxine	Alison Mejia
Ted Long	Dorothy Maxwell	Paleidia Melanson
Jan Marie Lonsway	Liz Maxwell	Asper Meleski
Charles Lord	Stan Maxwell	Greg Mello
Loretta Schmitz	Janet May	Sister Tiziana Merletti
Richard Low	Margaret Mayce	Victoria Merson
Patsy Lowe	Paul Mayhew	Verlina Mescher
Rosemary Lowe	Kathy Mayo	Charles Metheny
Eduardo Lozano	Dominique Mazeaud	Catherine Methot
Rosaire Lucassen	Jean K. McAmis	Judith and James Metzger
Jim and Louise Lund	Shirin McArthur	Aloise Meurer
Evelyn Lundstrom	Martin McBride	Shirley Meyer
Jean Lusardi	Eileen McCabe	John and Kate Meyers
Terese Lux	Daniel McCall	Terri Middleton
Mary Eamon Lyng	Joan McClellan	Mideral Fallx
Ann Elizabeth Lyon	Marsheine McClurg	Del Miles
Richard Lyons	John McConnell	Elizabeth Millard
Gary Mabrey	Jerry McCoy	Catherine Miller
Donald R. Machen	Joan McCoy	Cheryl P. Miller
Meredith Machen	Sue McCrery	Dick Miller
Patrick Mack	Bryan McCulloch	Gabrielle Miller
Sally Mack	Mark McDaniel	Jean Miller
Wales Madden	Carol McDonald	Phyllis Miller
Tonia Madenford	Henry McDonald	Rex Miller
Virginia Maguire	Jeffrey McDonough	Richard Miller

Stan Miller	Wolf Naegeli	J.C. Oday
Suzanne Miller	Marian Naranjo	E. O'Donnell
Tim Miller	Rick D. Nason	Emma Ogley
Jane Milliken	Carroll Nast	Sam Okrina
Cynthia Mills	Johianna Natosi	Jonathan Oldfather
Debra Mills	Marina Nazir-Sampaio	Jerry O'Leary
Mike Mirzamani	Dirk Neighart	Diana Oleskevich
Stefani Mistretta	Nancy Neiman-Hoffman	Beata Olesniewicz
Herbert Mitson	David Nellis	Phillis Olin
James Moffat	James Nelson	William Olin
G. Mojtabai	Paul Nelson	Stephen Olsick
Patricia Monaghan	Suzanne Nelson	Mary Olson
Alex Money	Dale Nesbitt	Steven O'Neil
John Montalbano	Renze Nesbitt	Susan Opotow
Ted Montgomery	Susan Nesbitt	Robin Ordelheide
Ann Moody	Iesha Neslon	Florence O'Rourke
Rosemary Moon	Barbara Nester	Donald Orth
Aaron Moore	Larry Neumark	Amy Osborne
Ellen Moore	Patsy Newman	Wren Osborne
Jill Moore	Dirk Neyhart	Wendy Oser
Nan Moore	Shel Neywark	Doug Osmond
Tricia Moore	Jean Nichols	Shayne Osterberg
Diane Morgan	Rosemary Nichols	Carolyn Ostrander
Judith Morita	Pat Nicholson	Magdala Oswald
April Morris	Wes Nicholson	Jeff Otterbein
Halle R. Morrison	Judy Niday	Harold P.
Frank Morrow	Agatha Niebrugge	Christina Pace
Susan Mosely	Jan Nielsen	Wayne E. Packwood
Juliette Moser	Sheryl Sooter	Jane Padberg
Brian Moss	James Noble	Jessey Padberg
Ruth Mota	Cheryl Noel	Kasi Pagel
Abby Mouer	Susan Noel	Suzanne Palembo
Milton Mozen	Kathleen Nolan	Jospeh Palen
Agnes Muehlenfeld	Michael Nolan	Marjorie Palmer
Gretchen Muller	Andrea Norouzi	Gene Palsgrove
Joanna Muller	Brian Northrup	Robert Pancner
Zae Munn	P.I. Norton	Brigid Panter
James Murphy	Neal Nossaman	Tracey Papiernik
Jean Murray	Andy Nowak	William C. Pappano, Jr.
Laura Murrill	Tony Nuspl	La Mount Parker
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Stephen A. Myers	Sara Oaklander	Michael Pascale
William Myers	Violet Oaklander	Therese Pasquesi
Mary Martha Naber	Harold A. Oberlander	Shayla Pasternack
Bob Nace	Vaudeth Oberlander	Ida Mae Patteson
Margaret Nadey	Mara O'Connor	Nancy Patterson

Sara Patterson	Peter Ponzetti	Paula Riccobono
Sarah Pattison	Freddie Porter	Craig Rice
Connie Patton	Richard Porter	Hugh Richards
David Patton	Eve L. Posada	John Richards
Mr. & Mrs. Paul	Donna G. Powers	Don Richardson
Erick Paulk	Daniel R. Prentice	Ron Richardson
Terrence Paupp	Marty Prentice	Mark Richert
R. Paxter	Victor Preston	Robert Ricigliano
Laura Paz	Thomas Pretlow	Elizabeth Riedel
Robert E. Pearson	Marjorie Price	Rosalie G. Riegle
Eileen Pech	Norma Price	Bernice Rieland
Christine Pedlar	M. S. Pryor	Richard Riggs
Robert W. Peelle	Bill Puett	Ben Riley
Petra Peham	Cynthia Purcell	Caroline E. Rivard
Daniel Penberton	Penelope G. Purtzer	Pat Roach
Kathie Pendered	Sasha Pyle	Wayne Robe
Pat Penner	Qiana Quartararo	Deborah Roberts
Jane Perless	Betty Quick	Stan Roberts
Mary Perner	Susan Quickel	Bill Robertson
Linda Perrone	Lynn Quilicot	Kathryn Robertson
Mary Anne Perrone	Alby Quinlan	Kyle Robinette
Nicole Perrot	Christine Rack	Christina Robinson
Carol Perry	Lois Racz	Diane Robinson
Susan Perz	Mike Ragsdale	Jane Robinson
Madeleine Pestiaux	Nancy Ramsden	Jim Robinson
Mary Pete	K. Randall	Mark Robinson
Amanda Peters	Caryn Randon	Hawley Roddick
Melody Peters	Bill Rankin	Cheryl Rodriguez
Arlo Peterson	Jill Ransom	Dolores Rodriguez
Marjorie Peterson	James Ranson	Terry Rogers
Susan Peterson	Margaret Ray	Rita M. Rogier
Bill Petry	Marilyn Read	Gerard Rohlf
Johanna Pettit	Marilynn Rebman	Greg Rohloff
Orlando Pettus	Marguerite Rece	Cynthia Rohrbach
Connie Pich	Elizabeth Redding	Jolene Rohrbacher
Marlie Pickett	M. M. Redmond	J. M. Rojas
Marc Pilisuk	Pat Redner	Catherine Romancik
M.L. Pinkard	Pete Redyk	Michael Romba
Marci Pinkard	Stuart Reed	Matt Romero
Lamar Pittman	Matt Reedy	Chad Rondeau
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Jennifer Poland	LaNoka O. Rhodes	Amy Rosenberg
Kara Pomeroy	Mary Rhodes	Pamela Rosenberg
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Carolyn and Richard Rosenstein	John Sayre	Patricia Shipley
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Linda Roth	Peter Scheffler	Steven Shuecraft
Julia Rouvier	Claudette Schiratti	Graeme and Mildred Sieber
Catherine Rowan	Wolfgang Schlupp-Hauck	Alex Silberstein
Aaron Rowe	Joan Schnabel	Carolyn B. Silvey
Kevin Rowlands	Edith Schneider	Maia Simon
Ana Rudolph	Michelle Schneider	Aaron Simpson
Rosalie Ruesewald	Mikel Schoeler	Aimee Sinclair
Barbara Rugg	Robert W. Schoenecker	Rosalind Singer
Jim Rugh	Andrew Schoerke	Bani Singh
Bob and Helen Rundle	Pam Schoessling	Suki Singh
Steve Rundle	Craig Schollenberger	Jai Hari Singh Khalsa
Susan Runyan	Donald Scholten	Bernice Sipson
James Russell	Nicole Schrank	Erik Sjodin
Lisa J. Russell	Judy Schreck	Elliot Skinner
Marie Russo	Marjorie Schubring	Rives Skotnicki
Rachel V. Ruth	Stephen Schuck	John Slatauski
Jenny Saar	Dini Schut	Lorrie Slonsky
Timothy Sable	Anil L. Schwartz	Barbara Sloss
Stephanie Sabro	B. Schwartz	Patricia Slurly
Joy Sacks	Liz Schwartz	David Smith
Lourdes Sadanaga	Shana Schwartzberg	Elizabeth Smith
Miriam A. Sagan	Brayton	Etta Smith
Marilyn Salas	Amy Scott	Judy Smith
Morgen Salas	Barbara Scott	Linda Smith
Robert Salas	David Seaborg	Lindsey Smith
Edwin Salpeter	Richard and Barbara Searles	Phillipe Smith
Linda Sammataro	Paula Seaton	Roger Smith
Jean Sammon	William Seavey	Rose M. Smith
Cindy Sanchez	Paul Seely	Keith Snider
Izilde Sanchez	Joan Seeman	Kath Snow
Jasmin Sanders	Tim Seitz	Denise Snyder
Cynthia Sandness	Linda Seligman	Judith L. Snyder
Mary Sandri	Mary Beth Seminario	Shannyn Sollitt
Karin Sandvik	Ellen Sesmundo	Curtis Sollohub
Valerie Sanfilippo	Danika Setaro	Phyllis Solomon
Brandon Santos	Myrna Seto	Sally Sorbello
Merry Santos	Dahn Shaulis	Dawn Sorem
David Saperia	Dick Sheid	Barbara Sorensen
Sarah Satzman	Anna Shenk	Theo Spaeth
Elizabeth Savage	Alice Shillock	Margaret Sparks

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Abbott Spencer	Valerie Sweeney	Lawrence Touth
Jeff Spicer	Bradley Sykes	Dan Toussant
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Dennis Spjut	Maria Tamb	Emily Traverse
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Lisa Starbuck	Carole Tashel	Judy Treichel
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Marla Stark	Carolyn Taylor	Calvin Tribby
Melodie Starkey	Debra Taylor	Ethel Trimmer
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Steven Starr	F. Taylor	Tiffany Trip
Mark Staudte	Georgia Taylor	Jorge E. Tristan
Mary Ann Stecbling	Ed Templeton	Philip H. Troxer
Ann Steffy	Mary E. Terrell	Ruth Tuft
Malcolm Steinberg	Jean Teschner	Janet Tunick
Martin Steiz	Malcolm Theisen	Sister Margarete Turk
Kimberly Stenley	Nancy Thierheim	Barbara Turner
Janice Stevens	Bonnie Thomas	Carol Turner
Shirley Stevens	Carolyn Thomas	Guy Turner
Shirley Stevenson	Dennis Thomas	Jeff Turner
Arnold Stieber	Elle Thomas	Kim Turner
David Stieber	Ellen Thomas	Anne Ullman
Pamela Stiles	Heather Thomas	Dick Ullrich
Debra Stoleroff	James P. Thomas	Kris Unger
Crystal Stone	Robert Thomas	Douglas Uptain
Kim Stone	Steve R. Thomas	Carl Urner
Don Strachan	Tina L. Thomas	Carol Urner
Rick Strassman	Anne Thompson	John Utter
Grace Strauber	Greg Thompson	James Valvoda
Doris Marie Strom	Inga Thompson	Rose van Buren
Anna Stryker	James Thompson	Marvin van Dilla
Amelie Sturby	Jan Thompson	Mary van Dilla
Kimberly Sturtevant	Judith Thompson	Norma van Dyke
Sue Wallinger	June Thompson	Jane van Tamelen
Susan Sugarman	Kevin Thompson	Carolyn P. van Zandt
Edward Sullivan	M. Thompson	Phil Vandeman
Joseph P. Sullivan	Sally Thompson	Robert Vangaught
Dot Sulock	Deborah Thurmond	Carol Vanhoff
Rebecca Summer	Rick Tilman	Dashelle Vaxter
Judy Sumner	Ethel Tobach	Sylvia Vergara
Steven Sutherland	James W. Tonjes	Sister Mary Veronica
Jacqueline Suttle	Nelda Toon	Gerald Vertrees
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John Viktora
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Dan Vogelgesang
Mary S. Vogt
Kent Vollmar
Susan Volpe
Christa Von Blanckensee
Aaus Von Briessen
Jeremy Voss
Lillian Wade
Jessica Wade-Murphy
Joan Wageman
Kay Wagner
Sue Wagner Fields
Vicki Waldner
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David Walker
Joseph Walker
Christopher Wapniarski
Ms. Ward
Debra Lee Ware
Patrice Warrender
Isabel Anne Washburn
David Wass
Sister Helen Watkins, PHJC
Mila Watson
April Wayland
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Sheila Weaver
Julie Webb
John Weber
Robert C. Weber
Richard Weckert
Bruce Wedda
Renee Weeks
Dennis Weeter
Sister Nola Weiner, PHJC
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Sharon Richards Weiser
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Russ Wellen
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James Wenzel
Valerie Wenzel
Kelly Werenko
Susan Werner
John Martin West
Susan West
Wendy Westerbeke
Julie Weston
Wanda Wetli
Terrell Wexler
Patricia Whalen
Melissa Wheeler
Joe Whetstone
Alan White
Danielle White
Joseph B. Whiteman
Mary Whitley
Susan Whitlow
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Jean Wightman
Chrysa Wikstrom
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Jim Wilkins
Paul Wilkins
Stefani Wilkins
Robert Wilkinson
W.H. Wilkinson
Laurie Willets
Sharon William
Eva Williams
Henry Williams
Jenna Williams
Kathleen Williams
Sally Alice Williams
Vanessa Williams
Marianne Williamson
Shari Willinston
Howard Wilshire
Beth Wilson
Charles and Margaret

Wilson
Doyle Wilson
Gerrard Wilson
Laura Wilson
Olive Wilson
Stephen Wingeier
Carol Winger
Jim Winkins
Leslie Winston
Angela Wise
Nan Withington
Evelyn M. Witt
Jo Ann Witt
Patrice Woepffel
Pam and Al Wohlpart
Steve Wold
Maxine D. Wolf
Sylvia Wolf
Lincoln Wolfenstein
Larry Wolpert
Connie Wood
Mary Woodman
Nancy Woodward
John F. Worrell, Jr.
Lynn Wozniak
Xoletta Wrasman
Nancy Wrenn
Elizabeth Wright
Johanna Wright
Selma Wuebbels
Michele Wuensch
Horace Wyatt
Chris Wylie
Mary H. Wyse
Leah Yankee
Linda Yates
Richard Yates
Mary Geraldine Yelich
Glenn Yokum
Scott Yundt
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Appendix A
ALTERNATIVES

Appendix A

ALTERNATIVES

A.1 CONSOLIDATED PLUTONIUM CENTER (CPC)

CPC Requirements

- A CPC would consolidate all Category I/II security and hazard class defense programs mission activities requiring the use and handling of plutonium material. It would provide the facilities and equipment to perform pit manufacturing, pit surveillance, plutonium research and development, manufacturing process development, manufacture of parts for pit certification testing, and training of manufacturing and research and development personnel. A CPC would also consolidate and store all plutonium metal and other materials and parts required in support of these activities, and have supporting analytical chemistry and metallurgical capability.
- Stockpile requirements are based on national security requirements directed by the President based upon strategy and agreements between DOE and Department of Defense (DoD). CPC capacity and production output would be designed to meet the Reliable Replacement Warhead (RRW) requirements. Legacy pits would be supported as required through the use of contingency floor space, additions of required specific pit equipment, and development of specific procedures in handling required material. The facility would not be designed specifically to support all legacy pit types, but would accommodate any requirement for legacy pits as an adjustment to the equipment and facility capability designed for RRW pits with the use of contingency floor space and module flexibility.
- A CPC would provide the facilities and equipment to perform pit manufacturing, pit surveillance, and plutonium research and development.
- Stockpile requirements are based on national security requirements directed by the President and the Congress based on joint recommendations from DOE and DoD. CPC capacity and production output would be designed to meet national security requirements, which could include production of new pits for maintenance of the legacy stockpile or replacement weapons (e.g., Reliable Replacement Warheads [RRW]).
- As described in Chapter 2, this SPEIS assumes that a CPC would provide a manufacturing capacity of 125 pits per year using a single shift, with a contingency of 200 pits through multiple shifts. A CPC would be capable of supporting the surveillance program at a rate of one pit being destructively evaluated per pit type in the stockpile per year. For Los Alamos, this SPEIS also assesses an alternative that would result in a smaller pit production capacity (80 pits per year), based on the use of the existing and planned infrastructure at that site.
- A newly constructed CPC would be constructed and started up over a six year period, and would be fully operational by approximately 2022. A CPC would be designed for a service life of at least 50 years.

- The sites being considered as potential locations for a CPC and consolidation of Category I/II quantities of SNM include: Los Alamos, NTS, Pantex, SRS, and Y-12.
- A newly constructed CPC would consist of a central core area surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS), which would enclose all operations involving Category I/II quantities of SNM. The enclosed area would be approximately 40 acres. A buffer area would provide unobstructed view of the area surrounding the PIDAS. All administrative and non-SNM support buildings would be located outside the edge of the buffer area. Once operational, approximate 110 acres would be required for a new CPC (Table A.1-1). As shown in Table A.1-1, two CPC alternatives at Los Alamos (Upgrade Alternative and 50/80 Alternative) could reduce land area requirements by the use of existing and planned facilities and infrastructure.

Table A.1-1 — Land Requirements for CPC Alternatives

Greenfield Alternative	Construction (acres)	Operation (acres)	
	140	110*	
PIDAS		Non-PIDAS	
40		70	
Upgrade Alternative	13	6.5 (All within PIDAS)	
50/80 Alternative	6.5	2.5 (All within PIDAS)	

* Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

- It is assumed that CPC facilities would be constructed above ground. During design activities, studies would be performed on worker safety, security enhancements, and costs. Examining whether the site of the CPC facilities above or below ground is an example of such a study. All 5 sites are assumed to be able to support a buried or partially buried/bermed facility. This SPEIS includes a discussion of the potential differences among the sites in supporting a buried or bermed facility (see Section A.1.5).
- If Los Alamos is not selected for the CPC mission, it is assumed that plutonium facilities at that site would be reduced to Category III or IV nuclear facilities for R&D purposes, or closure, after the CPC begins operations. Any residual non-Defense Program (DP) missions (i.e. Pu-238) would be responsible for funding to meet safety/security requirements. However, as explained in Section 3.4.1.6, facilities at Los Alamos are also being considered for upgrade to meet CPC requirements.
- SNM storage at the CPC would be based on the need to support a 3 month production period. Approximately 3 metric tons of storage is anticipated.
- Any transuranic (TRU) waste from a CPC is assumed to be disposed of at the Waste Isolation Pilot Plant (WIPP) (see Section 10.5.5).

A.1.1 CPC Operations

The following section discusses the operations for the CPC. The section begins with a summary of the pit production process that would occur in a CPC. The overall process would involve three main areas: (1) Material Receipt, Unpacking, and Storage; (2) Feed Preparation; and (3) Manufacturing.

A.1.1.1 *Material Receipt, Unpacking, and Storage*

Plutonium feedstock material would be delivered from offsite sources in DOE/Department of Transportation (DOT) approved shipping containers. The shipping containers would be held in Cargo Restraint Transporters (CRT) and hauled by Safeguards Transporters (SGTs). The bulk of the feedstock material would come from Pantex, in the form of pits from retired weapons. Additionally, small amounts of plutonium metal from LANL and SRS could be used. The CRTs would be unloaded from the truck and the shipping packages unpacked from the CRT. Each shipment would be measured to confirm the plutonium content, entered into the facility's Material Control & Accountability (MC&A) database, and placed into temporary storage. The shipping packages would later be removed from storage and opened to remove the inner containment vessel. Containment vessels with the feedstock material would then be measured for purposes of and transferred to the Receipt Storage Vault pending transfer to the Feed Preparation Area.

A.1.1.2 *Feed Preparation*

The containers would then be transferred through a secure transfer corridor to an adjacent Feed Preparation Area where plutonium metal is prepared for manufacturing. For pits to be recycled, the pit is first cut in half and all non-plutonium components are removed. Notable among these non-plutonium components is enriched uranium (EU), which would be decontaminated and then shipped to Y-12 for recycling. All of the other disassembled components would be decontaminated, to the maximum extent possible, and then disposed of as either low-level waste (LLW) or transuranic (TRU) waste, as appropriate.

There are two baseline processes currently being evaluated for the purification of the plutonium metal. One process relies more heavily on aqueous chemistry (aqueous process) and the other on pyrochemical reactions (pyrochemical process). The primary difference between the two processes is that the aqueous process does not employ chloride containing aqueous solutions, which means conventional stainless steels can readily be used to contain all of its processes. On the other hand, the pyrochemical process requires specialized materials to contain the corrosive chloride bearing solutions that it employs.

The primary process evaluated in this SPEIS is the aqueous process. This is a well known process, which has been successfully used at DOE sites for many years. It is comparatively simple and experiences few, but well controlled corrosion problems. This process requires more space than the pyrochemical process and does not produce as pure a product metal as the pyrochemical process. This lower purity requires additional processing runs and therefore produces significantly more waste than the pyrochemical process. The aqueous process provides a bounding analysis of the waste impacts from a CPC.

The pyrochemical process is more complex than the aqueous process, employing seven versus four major processing steps. However, this can be done in less space with more processing flexibility. It also produces very pure metal and a lower volume of waste. The purity of metal allows the pyrochemical process to have the option of only partially processing metallic plutonium to obtain adequate production purity. The pyrochemical process, however, requires special materials to contain the corrosive chloride solutions. Based on results from ongoing

technology development, the pyrochemical process appears to have the greatest potential for improvements in efficiencies and in waste stream reductions. The pyrochemical process has been successfully used for many years at LANL.

The pyrochemical process has the potential to be environmentally more benign, thus having less environmental impact than the aqueous process. As the design of a CPC develops and a final purification process is selected, the site-specific, tiered EIS would evaluate in more detail the impact of the actual process to be used. Additionally, for a CPC that might be constructed at SRS, this SPEIS includes consideration of using facilities and infrastructure that are being constructed in support of the Materials Disposition Program. One particular facility, the Pit Disassembly and Conversion Facility (PDCF), could provide the capability to disassemble pits and convert the plutonium to a form suitable for producing new pits. The PDCF would include a hardened plutonium processing building, conventional buildings and structures housing support personnel, systems, and equipment (see Section 3.4.1.2).

A.1.1.3 *Manufacturing*

The pit manufacturing work includes the fabrication of the plutonium components for pits and the assembly of pits. A pit in this context is the assembly of all components into the full pit that is shipped to Pantex. Typically, non-plutonium parts would be government-furnished equipment and fabricated elsewhere. Non-plutonium components would be shipped to the CPC to be assembled along with the plutonium components into pits. A quality assurance acceptance program would be required to receive and accept non-plutonium parts. In addition, a bonded stores capability must be provided for interim storage of government-furnished equipment and other parts/materials for war reserve (WR) production. The CPC would require the capability to perform SNM shipping, receiving, and storage; pit disassembly and feedstock sampling; metal preparation, recovery, and refining; product forming, machining, welding, cleaning, and assembly; and product inspection (including radiography), process qualification, production surveillance, and analytical chemistry support. Supporting and ancillary functions (waste handling, security operations, training, maintenance, administration, process development, and testing) required to perform pit manufacturing are also included in the CPC. These capabilities would be applied to both WR production and production of parts/samples in support of certification and new production surveillance activities.

The CPC would deploy manufacturing processes that would enable the production of RRW pits as components for replacement of warheads in the enduring stockpile. The facility would be designed based on an agile facility concept, whereby processes could be changed out as new technologies are developed and limited additional capacity created as contingency for unforeseen requirements. Feedstock for the fabrication of the plutonium components would consist primarily of site-return pits requiring disassembly and reprocessing, but would also include purified metal from the CPC processing line. The capability to manufacture legacy pits would be retained through the agility and flexibility aspects of design with the manufacturing modules and floor space within the facility.

New pits would be inspected and prepared for storage and eventual shipment to Pantex. The majority of the waste from this process would be plutonium shavings that would be recycled within a CPC.

A.1.1.3.1 Manufacturing Process Development

During the projected lifetime of the facility, there would be changes in technology and changes in design of warheads where new processes and equipment would need to be developed and tested before they enter the production line. Process development requires both cold and hot space. Examples currently underway are foundry development where a new casting process is being developed to increase capacity and efficiency; metal purification where a new piece of equipment would accelerate activities, reduce radiation exposure, and reduce waste; machining where multi-functional equipment can replace the need for 3 or 4 separate pieces of equipment; new dimensional analysis to reduce time and improve accuracy of measurement; and module development to locate multiple pieces of equipment in a manner that increases efficiency within a set of operations. This area also provides capability for training new personnel, developing processes, and evaluating new equipment without unnecessary exposure to radiation.

A.1.1.3.2 Manufacture of Certification Parts

Besides the manufacture of pits for the stockpile, the manufacture of pits or parts of pits would be required for support of physics and engineering certification testing. In most instances, such pits or parts may be manufactured on the production line. Their production, however, must be considered in design of the floor space and equipment to ensure the production line is not interrupted in achieving its required capacity and output.

A.1.1.4 *Plutonium Research and Development*

The CPC would also conduct plutonium research and development. Plutonium research and development seeks to understand the properties and performance characteristics of plutonium, including fundamental thermodynamic, shock-induced deformation, intermediate strain-rate elastic-plastic behavior, spall, and surface ejecta. Understanding of the properties and performance characteristics supports modeling of weapon performance and provides assurance of stockpile reliability. Samples are prepared to support tests, such as those using the JASPER gas-gun facility at NTS. Parts are manufactured to support subcritical experiments to study specific fundamental plutonium properties. R&D also supports studies on plutonium aging to measure and understand weapon characteristics as the material ages. Sample fabrication requires the use of lathes, drill presses, tomography, metallographic equipment, polishing, precision machining and inspection, and rolling mill equipment. This research and development resource would also constantly assess the activities required for pit processing and work to develop new more efficient and environmentally preferred methods.

A.1.1.5 *Plutonium Pit Surveillance*

Pit surveillance is the periodic disassembly and inspection of pits removed from the active stockpile to help identify any defects or degradation and assure that nuclear weapons in the enduring stockpile are safe and reliable. Evaluations include leak testing, weighing, dimensional inspection, dye penetration inspection, ultrasonic inspection, radiographic inspection, metallographic analysis, chemical analysis, pressure tests, and mechanical properties testing.

A.1.2 CPC Facility Requirements

In order to allow for the pit production process, as described above, the CPC would require the design of facilities to allow for its operation. Although the overall specific requirements are still in the design stage, the general needs are clearly known and are as follows:

Security — The majority of CPC would be located within a PIDAS. The PIDAS would be a multiple-sensor system within a 30-foot wide zone enclosed by two fences that surround the entire Security Protection Area. There would be an Entry Control Facility (ECF) at the entrance to the Security Protection Area.

Process and R&D Buildings — A proposed concept being evaluated for a CPC divides the major plant components into four separate buildings identified as Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D to perform the functions described in Section 3.1.1. The process buildings would be two-story reinforced concrete structures located aboveground at grade. The exterior walls and roofs would be designed to resist all credible man-made and natural phenomena hazards and comply with all NNSA security requirements.

The first story of each building would include plutonium processing areas, manufacturing support areas, waste handling, control rooms, and support facilities for operations personnel. The second story of each of the three process buildings would include the heating, ventilating, and air conditioning (HVAC) supply fans, exhaust fans and high-efficiency particulate air (HEPA) filters, breathing/plant/instrument air compressor rooms, electrical rooms, process support equipment rooms, and miscellaneous support space. Interior walls are typically reinforced concrete to provide personnel shielding and durability for the 50-year facility design life. Each of these processing buildings would have its own ECF, truck loading docks, operations support facility, and safe havens designed in accordance with applicable safety and security requirements. The three processing buildings would be connected by secure transfer corridors.

Support Buildings Within the PIDAS — The major support structures located within the PIDAS would include an Analytical Support Building and a Production Support Building. The Analytical Support Building would contain the laboratory equipment and instrumentation required to provide analytical chemistry and metallurgical support for the CPC processes, including radiological analyses. The Production Support Building would provide the capability for performing nonradiological classified work related to the development, testing, staging and troubleshooting of CPC processes and equipment. A number of other smaller structures also supporting a CPC would include standby generator buildings, fuel and liquid gas storage tanks, an HVAC chiller building, cooling towers, and an HVAC exhaust stack.

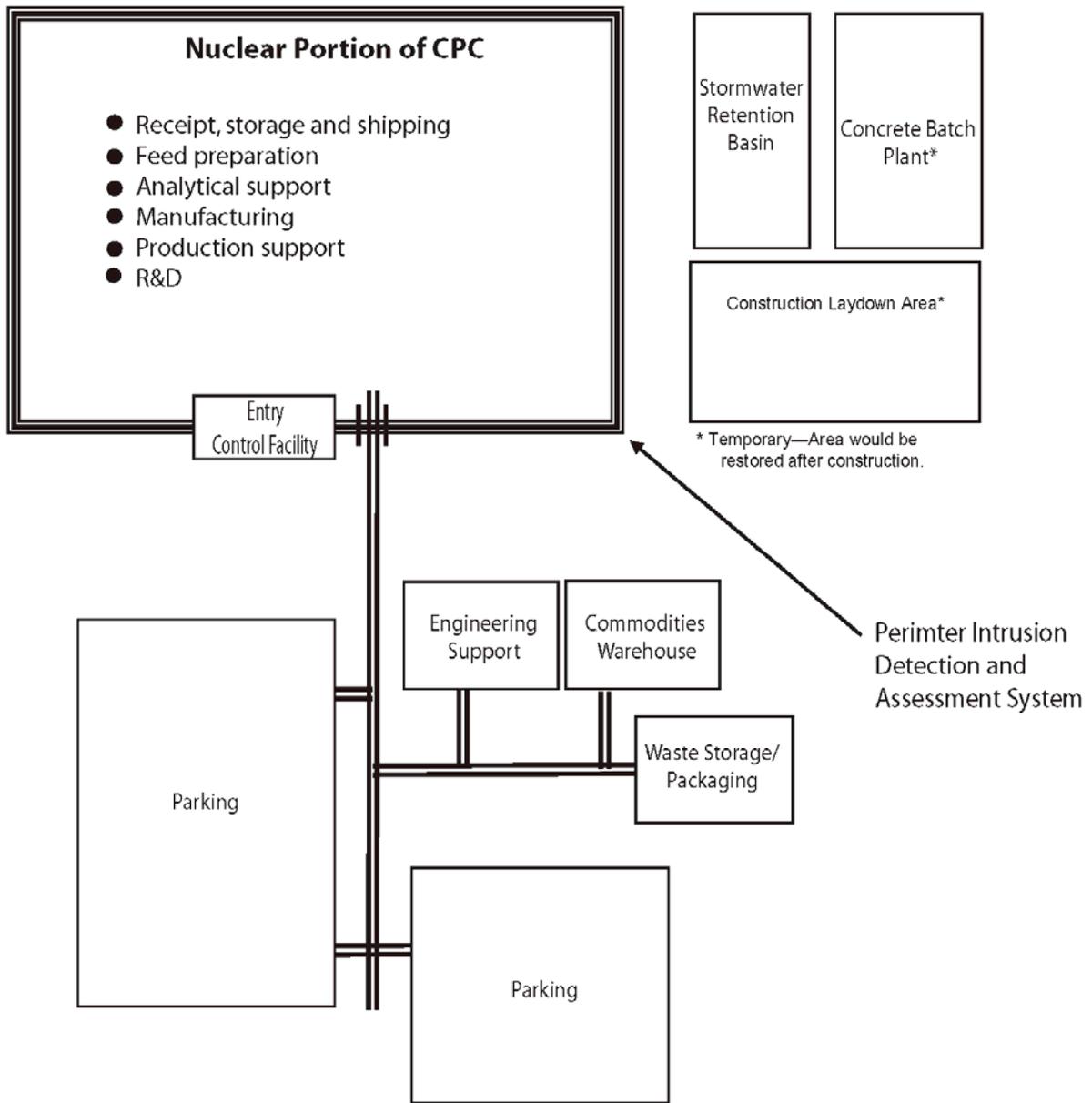
Support Buildings Outside the PIDAS — The major structures located outside the PIDAS would include an Engineering Support Building, a Commodities Warehouse, and a Waste Staging/TRU Packaging Building. This Waste Staging/TRU Packaging Building would be used for characterizing and certifying the TRU waste prior to packaging and short-term lag storage prior to shipment to the TRU waste disposal site. Parking areas and storm water detention basins would also be located outside the PIDAS. In addition, a temporary concrete batch plant and construction laydown area would be required during construction. A generic layout showing the major buildings and their relationship to each other is shown in Figure A.1.2-1. Table A.1.2-1

shows the dimension estimates. The overall plant layout in this generic representation is a greenfield campus type layout, and would be adapted to each site, as necessary. The actual footprint of all of the buildings, as shown in the table, is considerably less than the “developed” area from the generic layout. Thus, the actual developed site layout could be much less than that shown in Table A.1.2-2, and could fit any site with enough space for buildings footprint and adequate security standoff distances.

Table A.1.2-1 — Dimensions for the CPC

	Dimension
Processing Facilities Footprint (ft ²)	308,000
Support Facilities Footprint (ft ²)	280,000
Research and Development (ft ²)	57,000
Total Facilities Footprint (ft ²)	645,000
Area Developed During Construction (acres)	140
Post Construction Developed Area (acres)	110

Source: NNSA 2007.



Source: NNSA 2007.

Figure A.1.2-1 — Generic Layout of a CPC

A.1.3 CPC Transportation Requirements

The CPC would require transportation activities as described in this section. Plutonium pit assemblies would be shipped from Pantex to the CPC site under consideration. During startup, and potentially at other infrequent times, additional plutonium metal could be required. This additional plutonium could be shipped to the CPC from SRS. Additionally, as discussed in Section 3.4.1.4, once the CPC becomes operational, LANL would transfer its Category I/II plutonium to the CPC if LANL is not selected as the CPC site.

Both TRU waste and LLW would be generated at the CPC site. DOE's Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico or a WIPP-like facility would be the destination for TRU waste from all CPC alternative sites. Three CPC site alternatives (LANL, NTS, and SRS) have LLW disposal facilities and would dispose of LLW on-site. Although Y-12 has some LLW disposal capability, it currently ships its LLW to NTS for disposal. Pantex does not have any LLW disposal capacity and would have to ship LLW to the NTS, if Pantex is selected as the CPC site. A matrix depicting the origins, destinations, and materials shipped is provided in Table A.1.3-1. The matrix also includes shipments under the No Action Alternative and LANL Upgrade Alternative (see Section 3.4.1.2). The number of shipments per year is presented in Table A.1.3-2.

Table A.1.3-1 — Origins, Destinations, and Material Shipped to Support the CPC

Shipment Type	CPC at SRS	CPC at Pantex	CPC at LANL	CPC at NTS	CPC at Y-12
LANL Plutonium in	LANL ⇒ SRS	LANL ⇒ Pantex	None	LANL ⇒ NTS	LANL ⇒ Y-12
Pits in	Pantex ⇒ SRS	None	Pantex ⇒ LANL	Pantex ⇒ NTS	Pantex ⇒ Y-12
EU in	Y-12 ⇒ SRS	Y-12 ⇒ Pantex	Y-12 ⇒ LANL	Y-12 ⇒ NTS	None
EU out	SRS ⇒ Y-12	Pantex ⇒ Y-12	LANL ⇒ Y-12	NTS ⇒ Y-12	None
Pits out	SRS ⇒ Pantex	None	LANL ⇒ Pantex	NTS ⇒ Pantex	Y-12 ⇒ Pantex
TRU waste out	SRS ⇒ WIPP	Pantex ⇒ WIPP	LANL ⇒ WIPP	NTS ⇒ WIPP	Y-12 ⇒ WIPP
LLW out	Onsite Disposal	Pantex ⇒ NTS	Onsite Disposal	Onsite Disposal	Y-12 ⇒ NTS

Materials Shipped — The materials which would require shipping are described as follows:

- *SRS plutonium/LANL plutonium:* This material is plutonium metal that is primarily plutonium-239, but contains other plutonium isotopes in small amounts. It would be used for start-up testing and once the CPC becomes operational could be infrequently shipped. Additionally, once the CPC becomes operational, LANL would transfer its Category I/II plutonium to the CPC if LANL is not selected as the CPC site (see Section 3.4.1.4).
- *Pits:* Pits would be the feed and product stream for the CPC. A pit is actually an assembly of plutonium metal. The plutonium is primarily plutonium-239, and the uranium is primarily uranium-235. A single shipment of pits would contain several hundred pounds of plutonium and uranium. In order to produce 125 pits per year it is estimated that 7 annual round trips (or 14 total) would be required.
- *EU:* The EU parts from disassembled pits would be shipped to Y-12 for processing and returned to the CPC. A single shipment of EU contains more than a thousand pounds of uranium.

- *TRU waste:* Processing of plutonium pits would produce contact-handled TRU waste, primarily americium-241. It is estimated that this would require about 74 shipments per year to the WIPP in New Mexico or a WIPP-like facility
- *LLW:* This waste would consist of job control waste and decontamination wastes. The radioisotopes would primarily be transuranics, but their concentrations would be sufficiently low to classify the waste as LLW. Approximately 0.1 percent of the volume analyzed for shipping LLW would be mixed LLW. Waste generation is expected to be sufficiently low to allow for disposal on-site for all candidate sites, except for Y-12 and Pantex which would ship its LLW either to NTS or a commercial LLW disposal facility. It is estimated that this would require up to 10 shipments per year.

Table A.1.3-2 — Numbers of Shipments per Year for the CPC

Transported Materials	200 ppy
Pits	22
TRU waste	118
Total	156

Source: NNSA 2007.

A.1.4 Differences between a CPC and the Rocky Flats Plant

A CPC would be designed and operated to minimize risk to both workers and the general public during normal operations and in the event of an accident. Benefiting from decades of experience, a CPC would employ modern processes and manufacturing technologies and would utilize an oversight structure for safety, environmental protection, and management oversight that has been established since the closure of the Rocky Flats Plant.

A.1.4.1 Building Design

Modern safety and security design standards of today require substantially different structures from the earlier pit manufacturing facilities at the Rocky Flats Plant, near Golden, Colorado. The buildings at the Rocky Flats Plant were constructed in the 1950s with metal roof sheeting covered by a built-up weather seal. In contrast, the exterior walls and roof of PF-4 (the current interim production plutonium machining facility at LANL) are constructed of reinforced concrete greater than a foot thick. Internal walls at PF-4 provide multiple-hour fire barriers between wings. A CPC would be designed with similar improvements.

A.1.4.2 Fire Control

Although DOE experienced accidents associated with the manufacture of plutonium pits, most of these accidents occurred in a relatively short time period (from 1966-1969) at the Rocky Flats Plant. The majority of these accidents involved plutonium metal and chips undergoing spontaneous ignition. Such events can occur when the environment they are in allows for the rapid oxidation of plutonium, often in association with a moist air environment. Efforts at Rocky Flats concentrated on the elimination of such fires. It is now recognized that potential for fire initiation cannot be totally eliminated. Although the frequency and severity of fires can be reduced through the management of combustible materials and facility design, such events are now anticipated and planned for in the structural and process design and operational procedures.

Engineering monitoring systems would be activated if a fire were to occur. These systems would activate controls and procedures to control, quickly suppress, and contain fires within the specific originating glovebox, minimizing the risk to workers and the general public.

Today, plutonium machining activities are conducted in gloveboxes supplied with an inert gas. Furthermore, gloveboxes are now equipped with exhaust filter systems. All working areas are separately vented with systems containing HEPA filters. These HEPA filters are fabricated of special non-flammable bonded material. Filter plenums are equipped with an automatic cooling system to reduce the temperature of the air reaching the final stages of HEPA filters. Unlike Rocky Flats, a CPC would have an automatic fire detection and suppression system designed to meet the latest National Fire Protection Association life safety codes and standards for manufacturing facilities. The design features would include multiple zones for both fire detection and suppression to assure that any fire which may occur would be isolated in small, separated areas of the facility, and thereby preclude the spread of fire to other separated areas or the entire building.

A.1.4.3 *Waste Management and Material Control*

A CPC would have a dedicated waste handling area capable of preparing waste for transport in accordance with established procedures and waste acceptance requirements. In addition, all waste streams to be generated by the CPC would have an established disposition path for each alternative being considered. Since the CPC SEIS analyzes operations over a 50-year period, it is reasonable to expect that some disposition paths may change. A CPC would utilize a stringent MC&A System to accurately account for all special nuclear material.

A.1.5 *Above Ground versus Below-Grade or Bermed CPC*

An above ground facility is the basic pre-conceptual design configuration for a Consolidated Plutonium Center. During conceptual design, a below grade facility configuration would be considered during the conduct of alternative studies. Although an above grade facility can be designed to meet required security from the present design basis threat, a below grade facility provides for a more passive security design with less reliance on active security systems and can provide additional physical security protection. However, a below grade facility poses additional life-safety considerations to protect personnel in an emergency and for them to be able to egress the facility in a timely manner. These issues together with physical security would be explored during a conceptual design period.

With regard to environmental considerations, a pre-conceptual design representation of a below grade production building, bermed with a concrete overcap, would require 25 percent to 50 percent more acreage than an above grade facility due to the extension of the berm to the physical structure. This soil overburden has the potential to reduce challenges to the building confinement system from events such as external fires and tornados. As much as 100 percent more concrete in volume is estimated to be necessary for support structures and an overcap, together with a 100 percent to 200 percent increase in the volume of material excavated, backfilled, and compacted. A 25 percent increase in asphalt paving is also estimated to take place.

There are additional costs and schedule increases estimated for a below grade facility. Additional project costs are estimated to be between \$100 million to \$500 million depending upon both the design and the soil characterization. For example, a below grade facility with soft soil and some involvement of groundwater might only add as little as 2 to 3 months to the project schedule, however, a 100 percent solid bedrock earthwork could take an additional 2 ½ years to 3 years for excavation. Both examples provide bounding estimates with no site expected to be 100 percent solid bedrock.

As part of a preliminary business case analysis for this SPEIS, NNSA has evaluated the issues, challenges, advantages and disadvantages of underground facilities. The information in this section is summarized from that report.¹ For each of the 5 sites considered in this SPEIS (Los Alamos, NTS, Pantex, SRS, and Y-12), two “cut and fill” options were assessed: (1) a buried facility with about 5 feet of soil cover; and (2) a facility buried at 20 feet below grade (i.e., 20 feet of soil cover). With any cut and fill option, a relatively shallow depression is excavated in the earth, the facility is built, followed by back-filling to bury the structure. The 5-foot underground option was evaluated because this depth provides the equivalent overpressure protection as hardening gives an above ground building. The 20-foot underground option was evaluated because a concrete breaker slab over this earth cover would protect the facility from the impact of a fully loaded airliner. Modeling of the effects of the impact of an aircraft show that, for the worst case, nine feet of earth cover will prevent penetration of aircraft parts, and a design for a 50 psi overpressure will protect from the blast from the detonation of the aircraft fuel. The building designed for the 35 psi overpressure buried 20 feet deep is capable of withstanding the 50 psi surface blast.

Building underground would require increased excavation and the need to construct the roof slab and roof slab support system to support the pressure from the earth cover. Conversely, the walls underground do not need to be as robust as the equivalent above ground structure. Underground buildings could use earth to shield between structures and to contain migration of materials in an accident. Underground facilities could be constructed in stages or modules connected to one another via underground passages after the construction is completed. This would allow facility expansion in stages and consolidation of activities at a single site.

The results from this feasibility study show putting nuclear facilities underground is not a significant discriminator among the proposed five sites as all five sites can employ underground construction. All of the proposed sites for the CPC/CNC/CNPC were assessed to be capable of using underground construction. For sites where the water table is high or the earth is less amenable to excavation, most of the cover for the building can be bermed by bringing in fill material. In addition, the underground options are more robust in meeting the DBT and will likely be capable of adapting to changes in the DBT in the future. Proper planning of the underground facilities can allow expansion without a significant change in the PIDAS or the protective force. This could lead to a consolidation strategy which could occur in stages over a number of years.

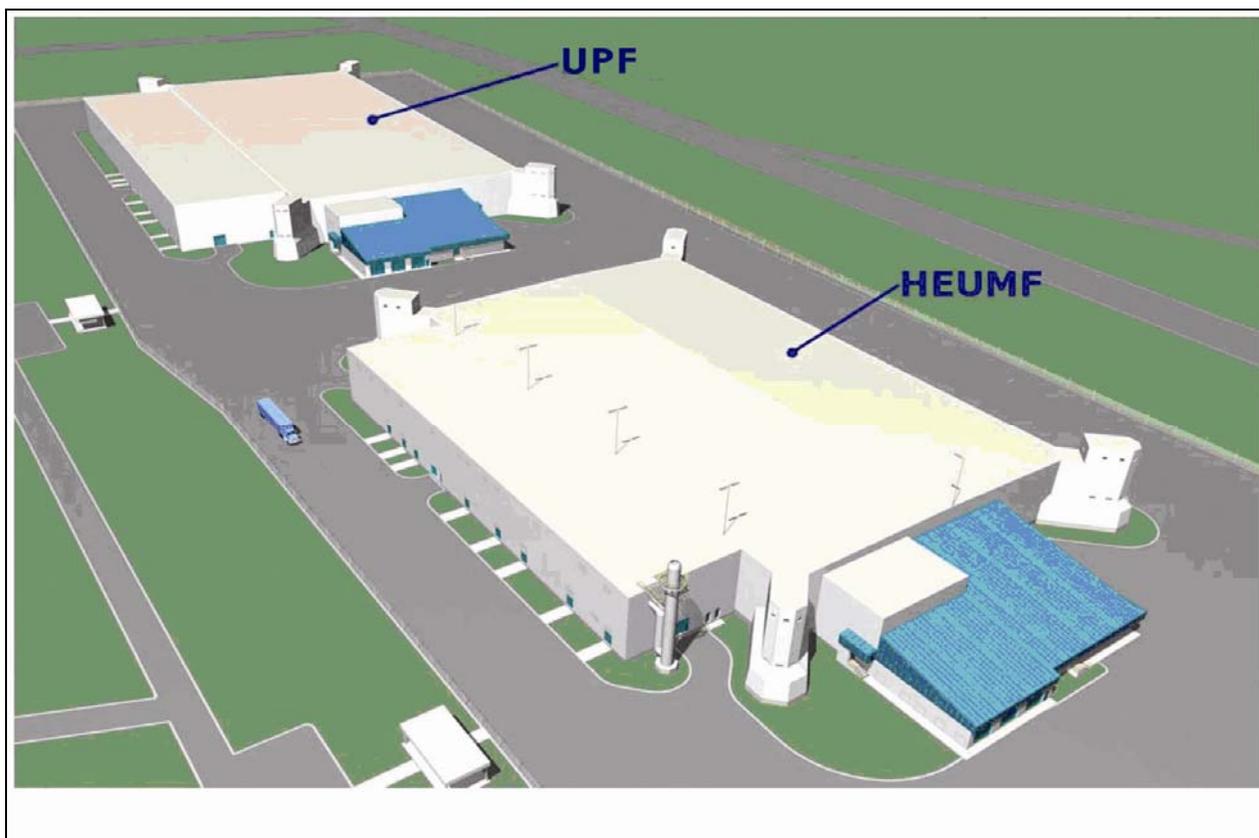
Modeling showed that the underground facility (5 or 20, no difference) could be protected with 85 less security guards than the same structure above ground. In addition, this modeling showed

¹Independent Business Case Analysis of Consolidated Options for the Defense Programs SNM and Weapons Production Mission, September 2007, Preliminary Draft, Prepared

that the reduced guard force required two hardened fighting positions versus the five hardened fighting positions required for the above ground construction. Seismic resistance is improved slightly for both the structure and sensitive equipment underground. However, worker safety and construction would be much more complex for the underground option.

A.2 URANIUM PROCESSING FACILITY (UPF) AT Y-12

The UPF would replace multiple existing EU and other processing facilities. The current operating and support areas occupy approximately 633,000 square feet in multiple buildings, while the consolidated UPF would result in approximately a 33 percent reduction, to approximately 400,000 square feet in one building. Once the UPF becomes operational, some of those existing facilities would be available for decontamination and decommissioning (D&D), while other facilities could be used for non-EU processes. Figure A.2-1 shows an artist's rendering of the proposed UPF. Figure A.2-2 shows the location of the UPF relative to other buildings at Y-12.



Source: NNSA 2005c.

Figure A.2-1 — Artist's Rendering of the UPF Adjacent to the HEUMF

A.2.1 UPF Construction

The new structures and support facilities that would comprise the UPF complex include the following:

- UPF building;
- UPF electrical switching center;
- chiller building and chiller building switch center; cooling tower;
- aboveground water tank for a seismic-qualified firewater system with a firewater pumping facility;
- electrical generators; and
- modified PIDAS to encompass the UPF complex.

The design service life of the UPF would be 50 years. The UPF would be equipped with safety support systems to protect workers, the public, and the environment. The UPF would be housed in a multistory, reinforced concrete building designed and built for security. The main building would be a reinforced concrete structure with reinforced concrete exterior walls, floor slabs, and roof. The roof and exterior walls would be sized to protect the interior from tornado- and wind-borne missiles and blast effects.

Conventional construction techniques would be used to build the UPF. The preliminary schedule for the project indicates that site preparation would begin in approximately 2011, with completion by approximately 2016, and operations beginning by approximately 2018. Construction activities would be performed in a manner that assures protection of the environment during the construction phase. Disposal of construction debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the construction process storm water management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

As shown on Figure A.2-2, construction of the UPF would require approximately 35 acres of land, which includes land for a construction laydown area and temporary parking. Once constructed, the UPF facilities would take up approximately 8 acres. The construction laydown area for the UPF would be developed on the west side of the proposed UPF site. This area would be finished with an 8-inch thick compacted, stabilized base for the construction phase. Interim employee parking lots would be developed west of the proposed construction laydown area. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards. After construction of the UPF is complete, it may be feasible to rework the laydown area to provide for additional parking.

A.2.2 Traffic Planning and Parking

The entrance road to the existing Polaris parking lot would be relocated to facilitate site work. Up to 1,200 car spaces may be built to replace the parking spaces lost when the proposed UPF is constructed. Further PIDAS modifications would be constructed to encompass the HEUMF (under construction) and the proposed UPF.

A.2.3 Site Preparation and Facility Construction

Site preparation would include any excavation, filling, and grading needed to meet design requirements for an on-grade, reinforced concrete structure. Detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as to sample for

radioactive contamination, mercury, and other materials of concern before construction. The structure's foundation would be concrete piers that are drilled down into the bedrock of the site, or a thick concrete slab. To reduce the overall footprint of the structure, a precast-concrete crib retaining wall would be constructed on the north and west sides of the UPF would be constructed with the same rigorous natural phenomena (NP) resistance design as the Highly Enriched Uranium Processing Facility (HEUMF), which is defined as Performance Category² (PC) 3.

A.2.4 Security Considerations

Upon completion of construction, both the UPF and the HEUMF (which is already under construction and will have its full PIDAS in place) would be surrounded by a PIDAS security barrier. The PIDAS would be a multiple-sensor system within a 30-foot wide zone enclosed by two fences that surround the entire Security Protection Area

A.2.5 UPF Operations

The core operations of the new consolidated UPF would be assembly, disassembly, Quality Evaluation, specialized chemical and metallurgical operations of EU processing, and product certification/inspection. The full range of operations would include:

- Assembly of subassemblies from refurbished and new components;
- Disassembly or dismantlement of returned weapons subassemblies resulting in recycle;
- Refurbishment, surplus generation, and disposal of components;
- Product certification through dimensional inspection, physical testing, and radiography;
- Quality evaluation (specially designed tests and inspections to collect data and determine the condition of units and components to assess the future reliability of the weapons systems in the stockpile);
- Metallurgical operations, including EU metal casting, rolling, forming, and machining;
- Analytical services for Uranium; and
- Chemical processing, including conversion to uranium compounds and metal from salvage scrap and oxides. Chemical processing streams would be provided to process high enrichment, mixed enrichment, and special EU materials.

² Performance Categories classify the performance goals of a facility in terms of facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). In general, facilities that are classified as: PC 0 do not consider safety, mission, or cost considerations; PC 1 must maintain occupant safety; PC 2 must maintain occupant safety and continued operations with minimum interruption; PC 3 must maintain occupant safety, continued operations, and hazard materials confinement; and PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement.

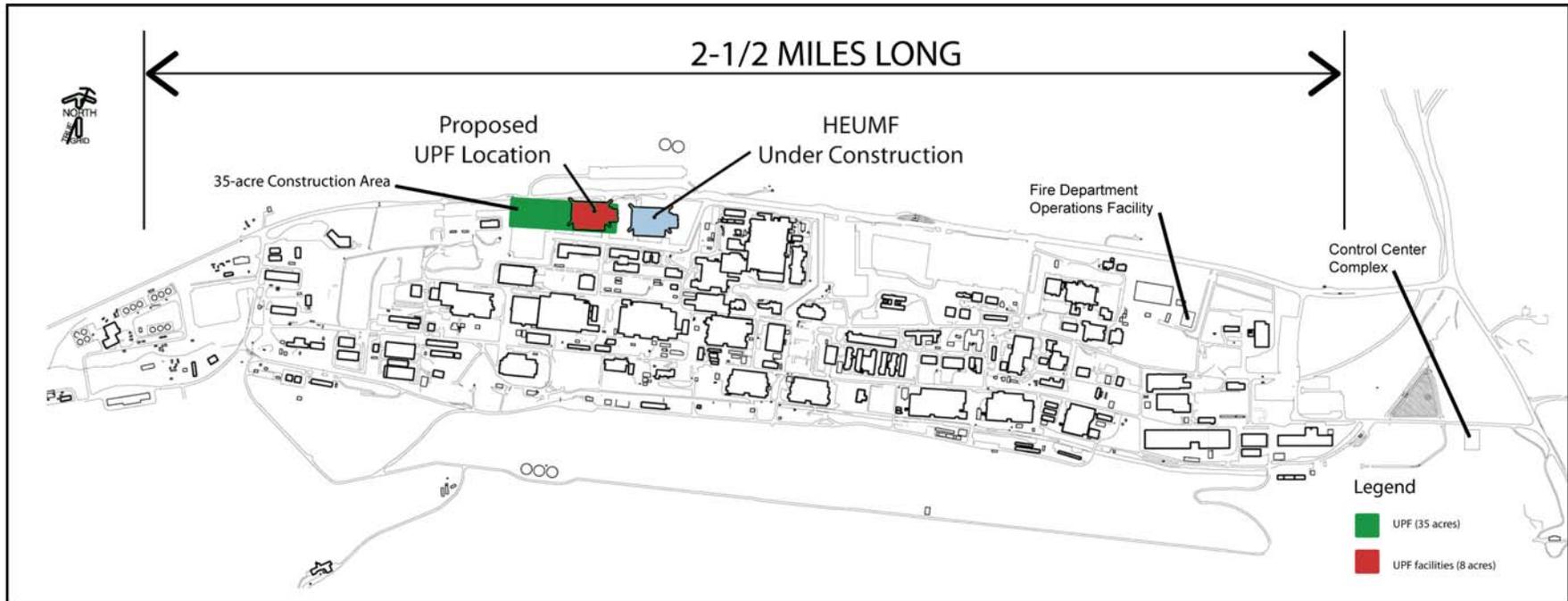


Figure A.2-2 — Location of the UPF Relative to Other Buildings at Y-12

A.2.6 Utility and Safety Support Systems

The material processing areas within the UPF would incorporate the appropriate use of gloveboxes, inert atmosphere, negative air pressure, and other engineered controls, supported by administrative controls, to protect workers and the public from exposure to radiological and hazardous materials. Exhaust emissions for the facility would comply with the applicable Federal and state requirements. In conjunction with other engineered containment measures, the ventilation system barriers would provide a layered system of protection.

Other systems that would be included in the new UPF for facility operation and ES&H protection include:

- Criticality Accident Alarm System
- Emergency Notification System
- Alarm System
- Fire Suppression Alarm Systems
- Telephone and public address system
- Classified and unclassified computer network
- Personnel Monitoring System
- Security-related sensors
- Automated inventory system with continuous real-time monitoring

The UPF would use a three-level negative air pressure approach to maintaining containment of particulate- and vapor-contaminated air, with the area having the lowest air pressure (i.e., highest negative air pressure) being primary containment. Secondary containment would be maintained at a lesser negative pressure, while the office and administrative areas would be maintained at a positive pressure with respect to the secondary containment areas. The primary containment ventilation system would consist of fans and collection ducts, scrubbers, mist eliminators, instrumentation, and HEPA filter banks. A secondary containment ventilation system would provide containment, negative pressure confinement, monitoring, and treatment for exhaust air from secondary containment areas frequented or occupied by operating personnel as well as other areas subject to contamination.

HEPA filters would be used in all process exhaust air streams to limit releases of EU. HEPA filters installed for this purpose would be performance qualified to limit off-site exposures to the public and releases to the environment. Current plans have a single exhaust stack being used as a central air emission point from the facility. All UPF process and exhaust air streams would be discharged from this stack, which would be located and designed to optimize the effects of plume dilution from the prevailing winds as well as to minimize the possibility of cross-contamination through the UPF and other Y-12 facility ventilation air intakes. The UPF discharge stack would be equipped with continuous emissions monitors for radiological emissions to meet Y-12 requirements to comply with environmental laws and reporting required data to the State of Tennessee as evidence of meeting those requirements.

Potable water, process water, and safety shower water would be supplied through the utility access corridors. The potable water would be used for sanitary purposes. Process water would be

provided by a dedicated system. Safety shower water also would be provided by a dedicated system.

A dedicated breathing air system would be installed within the UPF and would consist of dedicated compressors, receivers, filters, dryers, monitoring instrumentation and alarms, distribution piping, and breathing air stations at multiple points of use throughout the facility.

Liquid effluent monitors would be installed in all discharge lines from processes handling uranium metal or uranium compounds. Systems would be designed to detect and record concentrations in parts per million of uranium in solution. Discharge streams exceeding established limits for concentrations of uranium would be automatically diverted to geometrically safe holdup tanks.

A defense-in-depth approach would be used in the UPF to prevent the occurrence of a fire and ensure that sufficient means are provided to detect and suppress fires. The facility would be fully sprinklered (except for X-ray vaults), which would enable the performance of process operations except where the presence of water is a criticality safety concern. All systems, equipment, and processes would be designed in accordance with appropriate fire protection codes, building codes, and other available safety documentation. In addition to the water suppression capabilities, fire extinguishers would be installed throughout the facility.

The UPF would be built of noncombustible materials so that the building structure would not contribute to the fire loading. The process building would be separated from all other significant facilities. Roadways serving the UPF would provide access, from either direction, to any point on the exterior of the building and would be configured to allow emergency vehicles to maintain a standoff distance of 50 feet. Fire hydrants would be located 50 feet from the building with the pumper connection pointing to an accessible paved area.

Extension of the current fire alarm system would support UPF fire alarm needs. All water flow, smoke, and heat detection would be alarmed. Fire hazards and potential losses inside the UPF would be controlled. Storage for combustibles would be minimized in processing areas and would be properly stored in areas established for such materials. Use of flammable liquids and gases would be minimized to the extent practical. Bulk storage of flammable gases would be located outside the building, and appropriate excess flow valves would be installed in gas supply systems to stop flow in the event of a line break.

Two new 161 kilovolts (kV)/13.8 kV substations north of the UPF would provide electrical power to the UPF. For the purposes of this SPEIS, underground electric utility construction would be utilized. Auxiliary electrical power would be provided for safety and operational support utilizing hydrocarbon burning engine/generator sets.

A.2.7 Upgrades to Existing Enriched Uranium Facilities at Y-12

The upgrade projects proposed would be internal modifications to the existing facilities and would improve worker health and safety, enable the conversion of legacy SNM to long-term storage forms, and extend the life of existing facilities. For continued operations in the existing

facilities, major investments will be required for roof replacements; structural upgrades; heating, ventilating, and air conditioning (HVAC) replacements; and fire protection system replacement/upgrades. The projects would improve airflow controls between clean, buffer, and contamination zones; upgrade internal electrical distribution systems; and upgrade a number of building structures to comply with current Natural Phenomena criteria (BWXT 2004a).

For the purpose of this analysis, it is assumed that the upgrades would be performed over a 10-year construction period, following issuance of this SPEIS ROD. This would enable NNSA to spread out the capital costs associated with the upgrades, and minimize disruption of operations.

Conventional construction techniques would be used for upgrade projects. Under this alternative, a preliminary schedule for the project indicates that site preparation would begin in 2008, with upgrades complete in approximately 2018. Upgrade activities would be performed in a manner that assures protection of the environment during the construction phase. Techniques would be used to minimize the generation of debris that would require disposal. Disposal of debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the upgrade construction process stormwater management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

Natural Phenomena: Structural. The current authorization basis for many of the EU buildings has been designated as PC 2, which means these buildings must maintain occupant safety and continued operations with minimum interruption. An assessment of the structural adequacy of the buildings indicates they do not meet current codes and standards related to natural phenomena (NP) events (e.g., tornados and earthquakes) required for a PC 2 designation. If the buildings are intended to operate an additional 50 years, they would require structural upgrades to bring the buildings into compliance (BWXT 2004a).

Fire Protection. The existing fire protection systems for many of the EU buildings are primarily piping systems operating under the Code of Record in effect at the time of installation. These codes have changed significantly over the years, and if the life of facility is intended to be extended any significant length of time, the systems may need to be upgraded to meet current codes and standards if exemptions for continued operations are denied. Upgrades would likely require total replacement of the current systems. Replacements would be required for sprinkler systems, riser replacements, and underground supply line upgrades (BWXT 2004a).

Utilities Replacement/Upgrades: Mechanical Systems. HVAC systems have an expected life in the range of 25 to 30 years. Many of the systems serving the EU building are beyond or are approaching the end of their useful life and are in need of replacement. The majority of the HEPA filters are located in antiquated systems. These systems also do not include test sections that allow the systems to be tested without removal of the prefilters. This arrangement subjects the filter change crews to added exposures compared to currently available filters with test sections. The continued long-term operations of existing facilities would require these filter systems to be replaced (BWXT 2004a).

Roofing. A majority of the existing roofs for the EU buildings would need to be replaced (BWXT 2004a).

A.3 CONSOLIDATED NUCLEAR PRODUCTION CENTER (CNPC)

Program Requirements

- The CNPC would be sized and configured to support the U.S. nuclear weapons stockpile projected to exist after full implementation of the Moscow Treaty. The CNPC capacity would be sized to support delivery of 125 weapon assemblies per year in five-day, single shift operations. Multiple shift operation would yield up to 200 weapon assemblies per year.
- Sufficient capacity would be provided at the CNPC to support 75 weapon surveillance units per year. A capacity to perform up to 15 destructive nuclear component surveillances per year would be constructed.
- Weapon dismantlement sufficient to achieve the Moscow Treaty-accountable stockpile level of 1,700-2,200 operationally deployed strategic nuclear weapons is assumed to occur at Pantex in existing facilities. Because it is likely that further stockpile reductions and associated weapon dismantlements would occur during the operating life of the CNPC, a baseline dismantlement capacity of 400 units per year in five-day, single shift operations is assumed.
- The future US nuclear weapons stockpile is assumed to consist of the same number of weapon types as exist today. The US national security and political leadership are currently considering the authorization of a new weapon type, the RRW, to replace over the next several decades the weapon types in the existing nuclear weapons stockpile. Because a multi-decade series of decisions can not be forecast with confidence at this time, the CNPC would be equipped to allow the future production of both legacy type replacement weapons and the new RRW weapons.
- Plutonium and HEU (together referred to as SNM) would be stored at the CNPC to support future NNSA needs.

Required CNPC Capabilities

- The CNPC would include capabilities for HEU processing and weapon component production as currently performed at Y-12, and plutonium processing and weapon component production as currently performed on a limited capacity basis at LANL. In addition, R&D in support of LANL and LLNL programs requiring the use of Category I or II quantities of SNM would be performed at the CNPC.
- In addition, the CNPC would include facilities for the assembly/disassembly (A/D) mission currently performed at the Pantex Plant. In all cases, the HE processing and fabrication mission is assumed to be an integral part of the weapons A/D mission. As explained in Section 3.5.2, there is an option to separate the weapon A/D mission to allow decision makers to consider an alternative that locates the nuclear production facilities portion of the CNPC at a different site than the weapons A/D mission.

- Fabrication, inspection, and assembly equipment at the CNPC must support the fabrication of new RRW weapons or replacement legacy weapons. In general, the ability to produce legacy weapons would also provide RRW production capability. RRW concepts use fewer hazardous materials (than found in most legacy weapons) and require production tolerances within the range of those required for legacy weapons production.
- The assembly of plutonium and HEU nuclear weapons components also requires the production of several unique nonnuclear components. For plutonium components, it is assumed that the stainless steel and other unique metallic parts would be fabricated at or procured by Kansas City Plant (KCP). Legacy weapon plutonium components also require the production of beryllium components. It is assumed that the limited beryllium component production capability at LANL would be sufficient to support any required legacy plutonium component production.
- For HEU secondaries, it is assumed that non-nuclear components currently produced at Y-12 would be produced at the CNPC.
- The CNPC would be designed to provide best reasonably achievable levels of security to protect SNM and complete nuclear weapons. Current classified 2005 Design Basis Threat requirements from NNSA are to be used for the CNPC design. Trade studies would be performed to seek to balance worker safety, security enhancements, and costs for the CNPC. The siting of the CNPC facilities above or below ground is a major example of such a trade study. For initial planning purposes, it is assumed that CNPC facilities would be constructed above ground.
- The CNPC would be designed to have a useful operating life of at least 50 years without major facility renovation beyond normal preventive and corrective maintenance.
- The CNPC would be designed and operated to meet all existing applicable federal, state, and local laws and regulations.

CNPC Facility and Siting Requirements

- The CNPC would be considered for location at one of the following NNSA sites: Los Alamos, Pantex, NTS, SRS, and Y-12. Should a site not have adequate space for the full CNPC mission, an option that locates only the plutonium and HEU missions at the site would be evaluated, with the weapons A/D mission remaining at Pantex or relocated to the NTS.
- Beneficial use would be sought from existing and planned assets and capabilities at each site that are expected to have a reasonable remaining useful life at the time of CNPC occupancy. For example, the new HEUMF being constructed at Y-12 is assumed to provide storage for planned inventories of DOE and NNSA HEU at least until the CNPC is operational. Should the CNPC be constructed at Y-12, the HEUMF would continue to support DOE and NNSA needs, and the Y-12-specific CNPC design would not require new HEU storage facilities.

- A modular arrangement of facilities (campus) is assumed for the CCE options rather than separate operational wings of a single large facility under one roof. The facilities making up the CCE campus would be configured so that they can be constructed sequentially. A single building to house the CCE functions was not considered to be reasonable due to the need to bring facilities on-line in sequence and the fundamental differences in uranium, plutonium, and assembly/disassembly operations.³ The assumed schedule for the CCE facilities is:

Facility	Start Detailed Facility Design	Begin Operations
CUC	2009	2018
CPC	2012	2022
A/D/HE Center	2015	2025

- It is assumed that facilities at Y-12 and Pantex, whose missions would be included in the CCE alternative, would be brought to a safe shutdown condition as soon as possible if these sites were not selected for a CCE.
- A CNPC or CNC would consist of a central area that includes all operations involving Category I/II quantities of SNM that would be surrounded by a PIDAS. A buffer area would provide unobstructed view of the area surrounding the PIDAS. Support facilities requiring lower levels of security protection would be outside the PIDAS. The land requirements for operation of a CNPC and CNC are shown in Tables A.3-1 and A.3-2 respectively.

Table A.3-1 — Land Requirements to Operate a CNPC*

Operation (acres)	Total Area: 445 Acres**	
	PIDAS	Non-PIDAS
Total: 235	Total: 210	
<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120 	

*Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

Table A.3-2 — Land Requirements to Operate a CNC*

Operation (acres)	Total Area: 145**	
	PIDAS	Non-PIDAS
Total: 55	Total: 90	
<ul style="list-style-type: none"> • CPC: 40 • CUC: 15 	<ul style="list-style-type: none"> • Non-SNM component production: 20 • Administrative Support: 70 	

*Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.

** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

³ The facilities that would constitute a CCE would be separate buildings in a campus because they have different safety and operational requirements, and it would not be technically feasible to put them in a single large facility without having separate systems for the operation of the three facilities and other physical features (blast wall separation, etc.) to keep them separate. They would be built in sequence because they are very complex facilities and the realities of construction logistics, cash flow, and start-up management would not support a single facility. Building them in sequence reduces the construction management risk and allows lessons learned from one to benefit the others. The CUC would be first because the existing uranium facilities at Y-12 are very old. The CPC would be built second because the LANL facilities can handle the immediate need for pits. The weapons A/D/HE facilities would be last because there is the least programmatic urgency for them.

A generic layout of the CNPC is shown in Figure A.3-1.

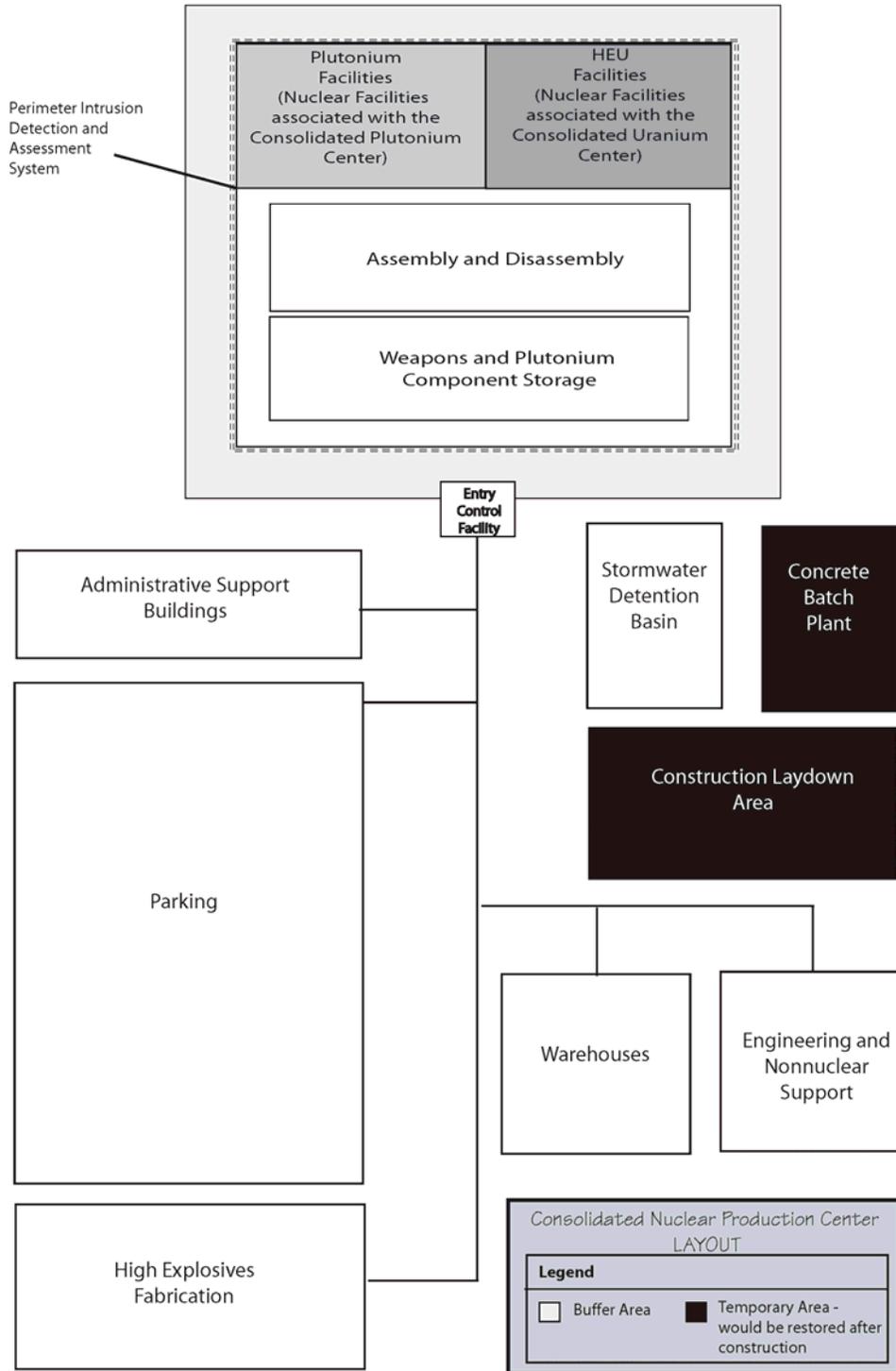


Figure A.3-1 — Generic Layout of the CNPC

A.3.1 Consolidated Uranium Center (CUC)

The CUC would primarily be made up of a nuclear facility⁴ located within the PIDAS, and non-nuclear support facilities outside the PIDAS. The nuclear facility would process HEU, produce nuclear weapon secondary components, and provide the capability to perform HEU R&D in support of LANL and LLNL. The nuclear facility would also store HEU. The non-nuclear facilities would contain the necessary and support operations associated with additional weapon materials, such as depleted uranium alloys; lithium hydride and lithium deuteride; stainless steel, and other general manufacturing materials.

The CUC would be constructed over a 6-year period, beginning in approximately 2011, with completion by approximately 2016, and operations beginning by approximately 2018. The design service life of the CUC would be 50 years.

This section presents major differences between the UPF described in Section 3.4.2 and the CUC that could be built at sites other than Y-12. The major difference involves the addition of HEU storage and the non-nuclear support facilities outside the PIDAS. Construction of the CUC at sites other than Y-12 would require approximately 50 acres of land.

The nuclear portion of the CUC would contain approximately 500,000 square feet in one building. Of this, storage would account for approximately 100,000 square feet, and would be used for long-term storage of Categories I/II HEU. A capacity to store approximately 10,500 cans and 10,500 drums (55-gallon equivalents) of HEU, a surge capacity area for an additional 3,000 drums, and a storage area for material currently under international safeguards would be provided. The non-nuclear support facilities outside the PIDAS would contain approximately 150,000 square feet.

The CUC would provide secure docking for safeguard transports (SGTs) to ensure the secure, safe transfer of secondaries and other materials containing HEU. The shipping and receiving docks at the CUC would accommodate the simultaneous loading and unloading of three SGTs or SSTs. The main operational steps that would be involved in handling containers with HEU materials are presented below:

- SGT arrives at the loading dock
- Shipping containers are offloaded and moved to the nondestructive assay (NDA) and re-containerization area
- A transfer check is performed
- Containers undergo NDA
- HEU materials are placed in new containers if required
- Each container entered into the computerized tracking system and is assigned a rack location
- Each container is moved by forklift to its assigned location in the storage area
- Each container is connected to the automated inventory system

⁴ For purposes of this SPEIS, this nuclear facility will be referred to as the Uranium Processing Facility (UPF), as generally described in Section 3.4.2. However, the UPF at Y-12 would not require HEU storage within the UPF, as an existing HEU Materials Facility (HEUMF) exists at that site. The UPF for all other site alternatives would include HEU storage integral to the UPF. The UPF described in this section includes such integral HEU storage.

A.3.2 Assembly/Disassembly/High Explosives Center (A/D/HE Center)

The A/D/HE Center would carry out the following major missions:

- Assemble warheads;
- Dismantle weapons that are surplus to the strategic stockpile and sanitize or dispose of components from dismantled weapons;
- Develop and fabricate explosive components; and
- Conduct surveillance related to certifying weapon safety and reliability.

The A/D/HE Center would be made up nuclear facilities located within the PIDAS, and non-nuclear facilities outside the PIDAS. In support of this mission, approximately 300 acres would be required for the A/D/HE Center. The nuclear facilities would contain the cells and bays in which maintenance, modification, disassembly, and assembly operations are conducted. The facilities would be designed to mitigate the effects of the unlikely accidental detonation of the weapon's explosive components. Bays differ from cells in that bays are designed to vent an explosion to the atmosphere while protecting adjacent facilities from the blast, while cells are designed to filter the explosion products, while also protecting the adjacent facilities from the blast.

An area of 180 acres would be provided in the PIDAS for the weapons assembly and disassembly facilities, and the associated weapons and plutonium component storage. Located outside the PIDAS area would be a buffer zone and nonnuclear facilities for HE fabrication, administrative support, and disposal of explosive materials. This area would be approximately 120 acres. The A/D/HE Center would be constructed over a 6-year period, beginning in approximately 2021, with completion by approximately 2026, and operations beginning by approximately 2027. The design service life of the A/D/HE Center would be 50 years.

A.3.2.1 Operations Conducted at the A/D/HE Center

Assembly

Weapons assembly requires written, prescribed steps to combine separate parts to form a new weapon. Complete weapons assembly would be accomplished in the following stages:

- Physics Package assembly;
- Mechanical and Electronic Components assembly; and
- Final Package or Ultimate User Package assembly.

The physics package is a subassembly combining HE components (to be produced at the A/D/HE Center) and nuclear components (to be manufactured at the CPC and CUC) within a protective shell. Physics package assembly entails bonding or mating the main charge subassemblies to a nuclear pit and then inserting this subassembly into a case along with other components. Mechanical and electronic components assembly entails placing the physics package in a warhead case and then installing the components for the arming, fusing, and firing systems; the neutron generator; and the gas transfer system. The final package assembly involves installing additional components and packaging the weapon for shipment.

Dismantlement

Dismantlement consists of disassembly and disposal or sanitization of weapon components. The dismantlement process begins with the arrival of the weapon at the A/D/HE Center. Disassembly would include the following activities:

- Weapons staging, which includes inspection and verification after receipt from DoD
- A variety of specialty operations (e.g., X-ray examinations, leak testing, coding, packaging, painting, verification, etc.) in special purpose bays
- Mechanical disassembly operations in bays
- Nuclear disassembly operations in cells
- Demilitarization and sanitization of weapon components, which includes grinding, crushing, and open-air burning
- Packaging and shipping HEU to the CUC and tritium components to the SRS
- Packaging and shipping pits to the CPC
- Segregation of waste products into nonhazardous, hazardous, low-level radioactive, and low-level mixed waste categories

High Explosives Fabrication

The A/D/HE Center would manufacture the main charge HE and other small explosive components. The fabrication process for explosives involves synthesizing energetic materials (explosives) and then formulating the energetic materials with other materials as appropriate. Some of the energetic materials are manufactured at the plant, while others are procured commercially. The explosive powder is then pressed into the configurations needed and machined for use in nuclear weapons. The products of manufacturing operations are explosive main charges, small explosive components, and other highly specialized explosive materials. Main charge subassemblies are emplaced in the physics package of a nuclear explosive during the weapon assembly process. Various small explosive subassemblies and pellets are produced from explosives, metal or plastic components, electrical components, hardware, assembly materials, and small explosive components that are manufactured offsite.

Surveillance

To maintain the reliability of the nation's nuclear weapons, a certain number of randomly selected weapons from all active systems would be annually removed from the stockpile and returned to the A/D/HE Center. The weapons are disassembled, tested and evaluated to ensure the operability of the weapons components. Most testing is done onsite, but tests associated with component aging are performed at other laboratories and production agencies. Some weapons are configured as Joint Test Assemblies (JTAs) and provided to the military for flight-testing. Main charge explosive components and special nuclear material are removed from weapons before this testing. Certain components are physically removed from the weapon, assembled into test configurations, and subjected to electrical and/or explosives testing. Components not destroyed during the testing process can be recycled and made available for use in other weapon system assemblies.

Security at the A/D/HE Center

Security at the A/D/HE Center would be charged with protecting plant personnel, facilities, materials and information from intrusion. Protective forces guard against any events that may cause adverse impacts on national security, the environment or the health and safety of the public or employees. Special response security team members prepare for any situation that may arise. Specially equipped and trained, these individuals face a range of events that may develop as a result of the constantly changing world situation or local events. State-of-the-art technologies would augment security forces to provide early detection, warning and deterrence.

A.4 A/D/HE CENTER AT NTS

At NTS, the A/D/HE Center would make use of the existing capabilities at NTS such that construction requirements would be reduced compared to the generic A/D/HE Center described above. The A/D/HE Center at NTS would maximize use of existing facilities at the Device Assembly Facility (DAF), the underground complex of tunnels at U1a, the Big Explosive Experiment Facility (BEEF), the Explosives Ordnance Disposal Unit (EODU), existing NTS site infrastructure, and the support areas of Mercury, the Control Point and Area 6 Construction (Figure A.4-1). By utilizing each of these unique existing assets, the need for additional construction is minimized and the existing benefits of each site are maximized.

The existing DAF would form the cornerstone of the A/D/HE Center at NTS. The NTS alternative would utilize the DAF for disassembly operations. DAF can fully support disassembly operations and continue to support the existing criticality experiment missions that were recently added to the DAF. Disassembly operations in the DAF would not require additional construction within the PIDAS or additions to the existing PIDAS. In the non-PIDAS area of the DAF and outside the buffer zones, an administrative facility and parking area would be constructed to support the increased personnel processing requirement for disassembly. The available space in DAF consists of the following:

- 3 Assembly Cells (8,510 square feet)
- 2 Radiography Bays (6,351 square feet)
- 1 Downdraft Table Bay (1,681 square feet)
- 1 Assembly Bay (1,681 square feet)
- 2 Bunkers (1,872 square feet)
- 2 limited use Vaults (180 square feet)
- 1 High Bay (1,790 square feet)
- 1 Bunker (936 square feet)
- 1 MC&A Measurement Building (2,142 square feet)
- 1 Shipping/Receive Bay (2,012 square feet)
- Admin Space (3,700 square feet)
- 1 Glovebox Bay (1,681 square feet)
- Corridors (20,000 square feet)

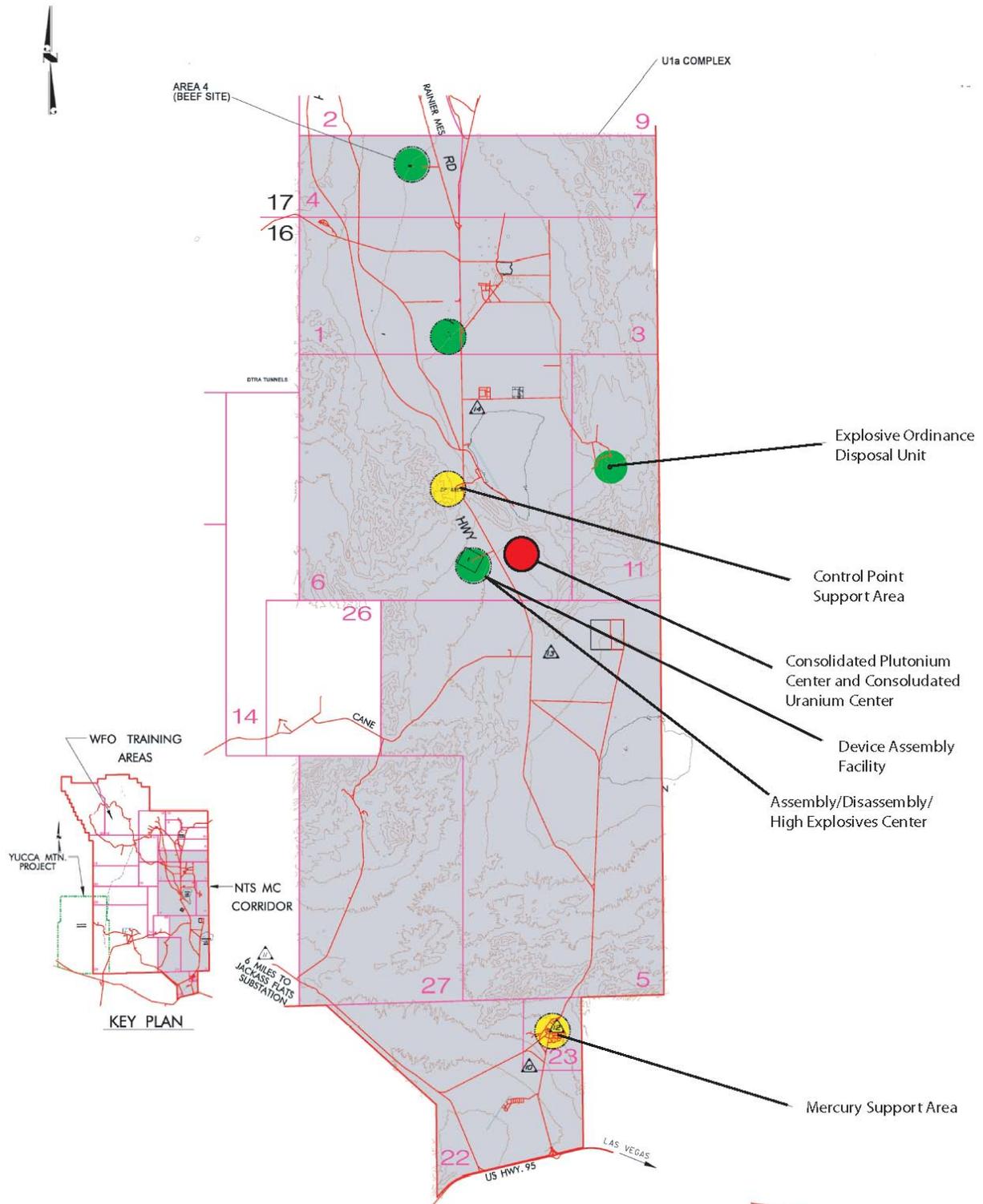


Figure A.4-1 — NTS CNPC Reference Location

The remaining operations of assembly, longer-term storage for nuclear and non-nuclear components that are generated by DAF disassembly activities, weapon surveillance, and strategic reserve storage of plutonium would be located 900 feet underground in the tunnel complex at U1a. This alternative would include construction of new tunnels and alcoves in accordance with nuclear explosive requirements for assembly and storage operations. At U1a, access to the tunnel network is limited to two (2) vertical access/egress shafts that would require construction of a small PIDAS around the surface footprint of each shaft.

A.5 CONSOLIDATION OF CATEGORY I/II SNM

A.5.1 No Action Alternative

A.5.1.1 *Lawrence Livermore National Laboratory*

LLNL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and isotope separation. Based on facility design and operation, LLNL establishes administrative limits for fissile, special use, radioactive, and sealed materials. An administrative limit is the total amount of certain materials allowed in a specific building at LLNL. These limits are used in determining potential risks associated with accidents. Actual inventories may be classified. Non-waste management facilities at LLNL authorized to have Category I/II SNM quantities are Building 332, Building 334, and Building 239. However, only Building 332 stores such material, and both Building 334 and Building 239 have no materials stored in them. As such, only Building 332 is germane to the discussion below. With respect to waste management facilities with Category I/II SNM, the Decontamination and Waste Treatment Facility (DWTF) (Figure A.5.1-1) manages TRU waste that would be shipped to WIPP.

The Building 332 Plutonium Facility is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site (see Figure A.5.1-2). This building has a total area of 104,687 gross square feet, including radioactive materials laboratories, mechanical shops, change rooms, storage vaults, a fan loft, basement, equipment rooms, and offices. There are currently 24 laboratories in which radioactive materials can be handled within the radioactive material areas (RMAs) of the facility (LLNL 2005).

The mission of Building 332 includes R&D in the physical, chemical, and metallurgical properties of plutonium and uranium isotopes, compounds and alloys, and certain actinide elements. Operations within Building 332 include melting, casting, welding, and machining; developing alloys and heat treating; testing torsion, tensile, and compression; measuring density and heat capacity; machining, inspecting, and testing components; using chemical processes to purify, separate, or convert actinide materials; pressure testing and gas filling operations; and assembling components. Chemical analyses can also be conducted on gram-sized samples in support of these activities.

The Materials Management Division is responsible for all shipments of radioactive and other controlled materials to and from Building 332, as well as movement within the building. This division also controls storage of these materials in the building vaults. The vaults are equipped to

safely store fissile, radioactive, and certain other SNM required for programmatic operations. Criticality safety controls for the vaults include specially designed storage racks and containers to control the spacing of stored fissile materials and mass limits for each storage location or rack cell within a storage vault. LLNL criticality safety controls also specify mass limits for each workstation (LLNL 2005). Legacy and new transuranic waste is temporarily stored in the basement, and the individual waste drums are scanned by a segmented gamma scanner to verify radionuclide and curie content. Although actual quantities of Category I/II SNM in Building 332 are classified, the administrative limits are as follows:

Plutonium	1,400 kg
Enriched uranium	500 kg

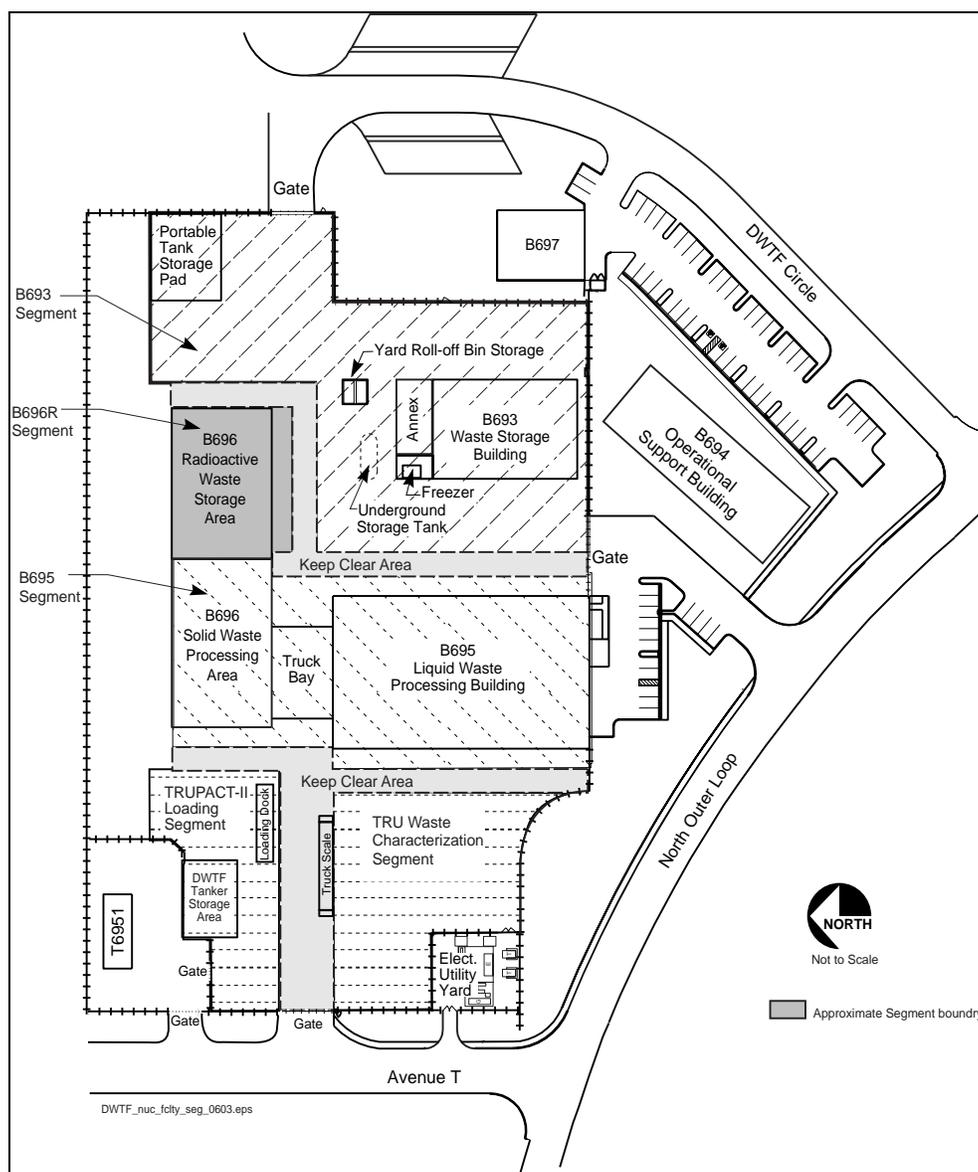


Figure A.5.1-1 — Decontamination and Waste Treatment Facility at LLNL

In 1996, construction of a new, consolidated waste treatment facility, the DWTF, began in the northwest corner of the Livermore Site (see Figure A.5.1-1). The DWTF construction has been completed and currently consists of Buildings 6951, 693, 694, 695, 696, and 697 and associated yard areas. The DWTF replaces waste management operations in Area 514 and Building 233 and consolidates other waste management activities into one facility (Figure A.5.1-3).

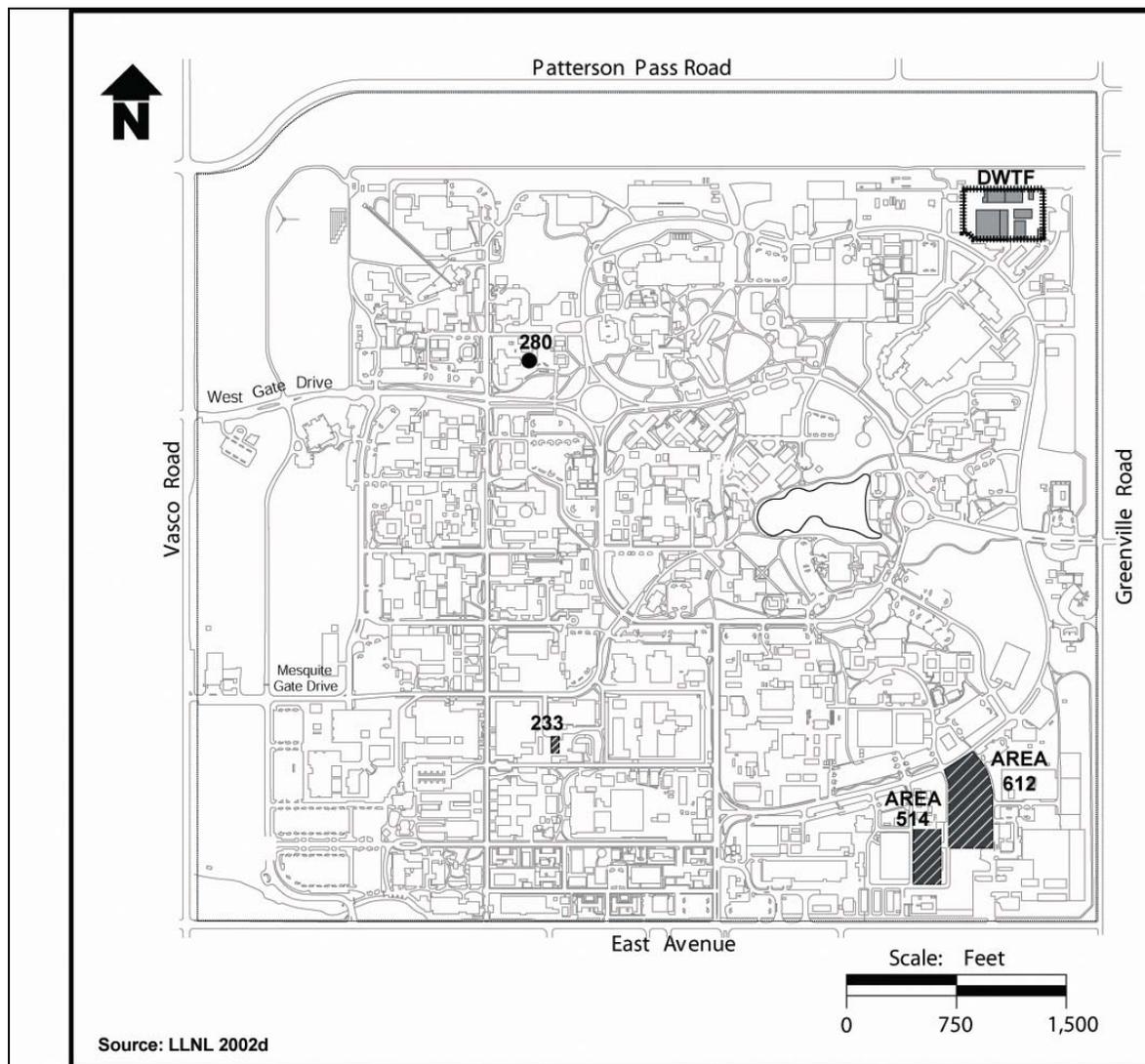


Figure A.5.1-3 — Location of Waste Management Areas at LLNL

The DWTF is a hazardous, radioactive, and mixed waste treatment and storage facility located in the northeast corner of the Livermore Site. Hazardous and mixed waste management activities involve five individual facilities: Buildings 693, 694, 695, 696, and 697, and associated yard areas (see Figure A.5.1-3). Building 693 is a container storage unit and activities include waste packaging and storage. Building 695 provides storage and waste treatment capabilities including bulking and blending of wastes into treatment tanks; treating liquid and solid hazardous, mixed, and low-level radioactive wastes; storing; container rinsing; and waste transfer. Building 694 is the operational support facility and Building 697 is a Chemical Exchange Warehouse used for

chemical exchange operations. Building 696 provides radioactive waste storage and solid waste receiving and processing capabilities. Building 695 includes a maintenance shop. Areas within the DWTF yard include a rainwater management area, a tanker storage area, a covered truck bay, and truck scales. Yard areas are used by mobile vendors to certify TRU waste and load it for shipment to WIPP.

Building 696R is designed for the storage of solid TRU waste, solid and liquid LLW, and combined waste (i.e., radioactive and California-regulated hazardous waste). Operations in the Building 696R segment include loading, unloading, staging, storage, over packing, LLW sampling, and periodic visual inspections of waste containers. Building 635 also stores TRU waste.

The mission performed in the TRU Waste Segments is to characterize LLNL TRU waste, repackage it as necessary, and load the waste drums into Transuranic Package Transporter-II (TRUPAC-II) casks for offsite shipment. The waste needs to meet both the DOT shipping requirements and the waste acceptance criteria for the receiving facility, which will be the WIPP. The amount of TRU managed at DWTF is approximately 110 cubic meters/year (LLNL 2005).

A.5.1.2 *Los Alamos National Laboratory*

LANL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and plutonium pit production. The TA-55 Plutonium Facility Complex (TA-55 Complex) encompasses about 40 acres and is located about 1 mile southeast of TA-3 (Figure A.5.1-4). The Plutonium Facility Complex has the capability to process and perform research on actinide materials, although plutonium is the principal actinide used in the facility. Most of TA-55 is situated inside a restricted area surrounded by a double security fence. The main complex has five connected buildings: the Administration Building, Support Office Building, Support Building, Plutonium Facility, and Warehouse.

The Plutonium Facility, a two-story laboratory of approximately 151,000 square feet, is the major R&D facility in the complex (Figure A.5.1-5). The Plutonium Facility provides storage, shipping, and receiving activities for the majority of the LANL SNM inventory, mainly plutonium. This includes temporary storage of Security Category I/II materials removed from TA-18 in support of TA-18 closure until these materials are shipped to NTS and other DOE sites. All materials from TA-18 are scheduled to be moved to final disposition locations by March 2008. In addition, sealed sources collected under DOE's Off-Site Source Recovery Project are stored at TA-55 or sent to other LANL locations for storage pending final disposition. When appropriate, mixed-oxide fuel materials stored at TA-55 would be transported to other DOE sites. TA-55 provides interim storage of up to 7.3 tons of the LANL SNM inventory, mainly plutonium.

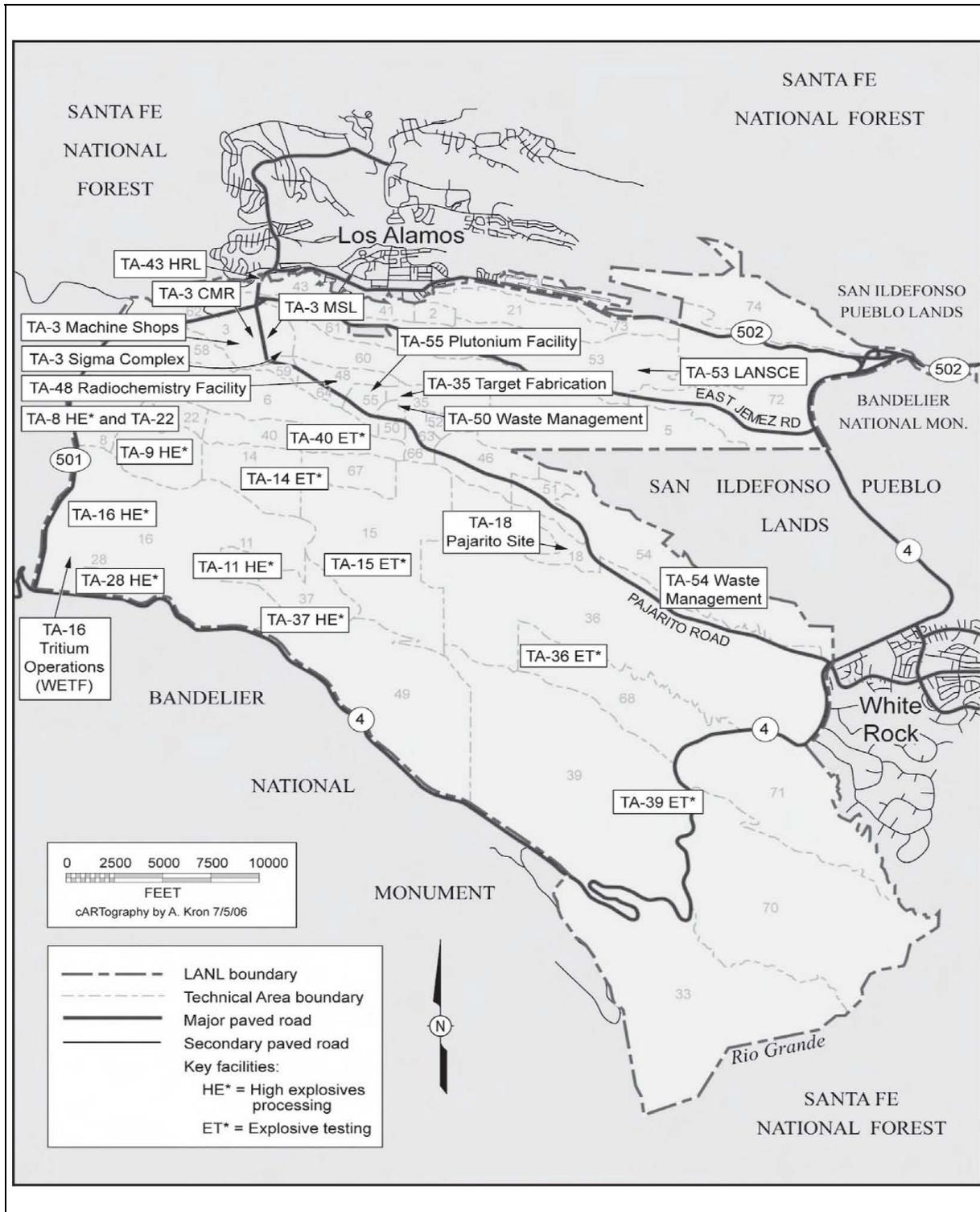


Figure A.5.1-4 — Major Technical Areas at LANL, including TA-55 Plutonium Facility Complex



Figure A.5.1-5 — Plutonium Facility at TA-55

PROJECT-SPECIFIC ALTERNATIVES

A.6 HIGH EXPLOSIVES R&D

A.6.1 No Action Alternative

This section describes the HE R&D facilities and missions currently conducted at weapons complex sites.

A.6.1.1 *Lawrence Livermore National Laboratory*

HE R&D at LLNL is carried out primarily in two facilities – the HEAF at the main Livermore site, and the Chemistry, Materials and Life Sciences Facility at Site 300. A basic description of each of these facilities is given below.

The High Explosives Application Facility (HEAF) is a full-spectrum R&D facility which performs the following missions:

- explosive characterization and lab-scale development;

- performance and safety testing; and
- modeling and simulation of explosive properties and reactions.

The HEAF includes laboratory areas approved for handling explosives in quantities up to 10 kilograms, and office space for the research and support staff. The net usable area of the facility is approximately 65,000 square feet. An aerial view of the HEAF is shown in Figure A.6.1-1.



Note: The facility section at the bottom of the image is the office area; the area behind that houses the laboratory areas including firing tanks

Figure A.6.1-1 — The LLNL HEAF

The Chemistry, Materials and Life Sciences Facility at Site 300 provides the capability for larger scale synthesis and formulation, HE R&D part fabrication (e.g. pressing radiography, machining and assembly), and explosives waste packaging, storage and treatment. These capabilities are provided by the Chemistry Area, the Process Area, the Explosive Waste Storage Facility, and the Explosive Waste Treatment Facility. The net usable space is approximately 35,000 square feet. Figures A.6.1-2 and A.6.1-3 show the Chemistry, Materials and Life Sciences Facility at Site 300.



Figure A.6.1-2 — Chemistry Area at Site 300, providing scale up of formulation and synthesis of HE



Note: Shown are B.806 (foreground), B807 directly behind B806 to the left, B805 behind B806 to the right, and the EWSF at the top of the photo

Figure A.6.1-3 — A portion of the Process Area at Site 300

There are approximately 175 scientists, engineers, and technicians associated with the HE R&D mission at LLNL.

A.6.1.2 *Los Alamos National Laboratory*

LANL conducts HE R&D activities in nine technical areas, as discussed below. While the LANL HE R&D facilities share some common spaces with the hydrodynamic program, for

purposes of this SPEIS, the current HE R&D activities at LANL are considered to be housed in approximately 250,000 square feet, managed as three facilities (HE Science, HE Fabrication, and HE Firing Sites), in 31 buildings (>1000 square feet), which includes magazines and firing points. The major TAs with HE R&D facilities are discussed below and shown on Figure A.6.1-4.

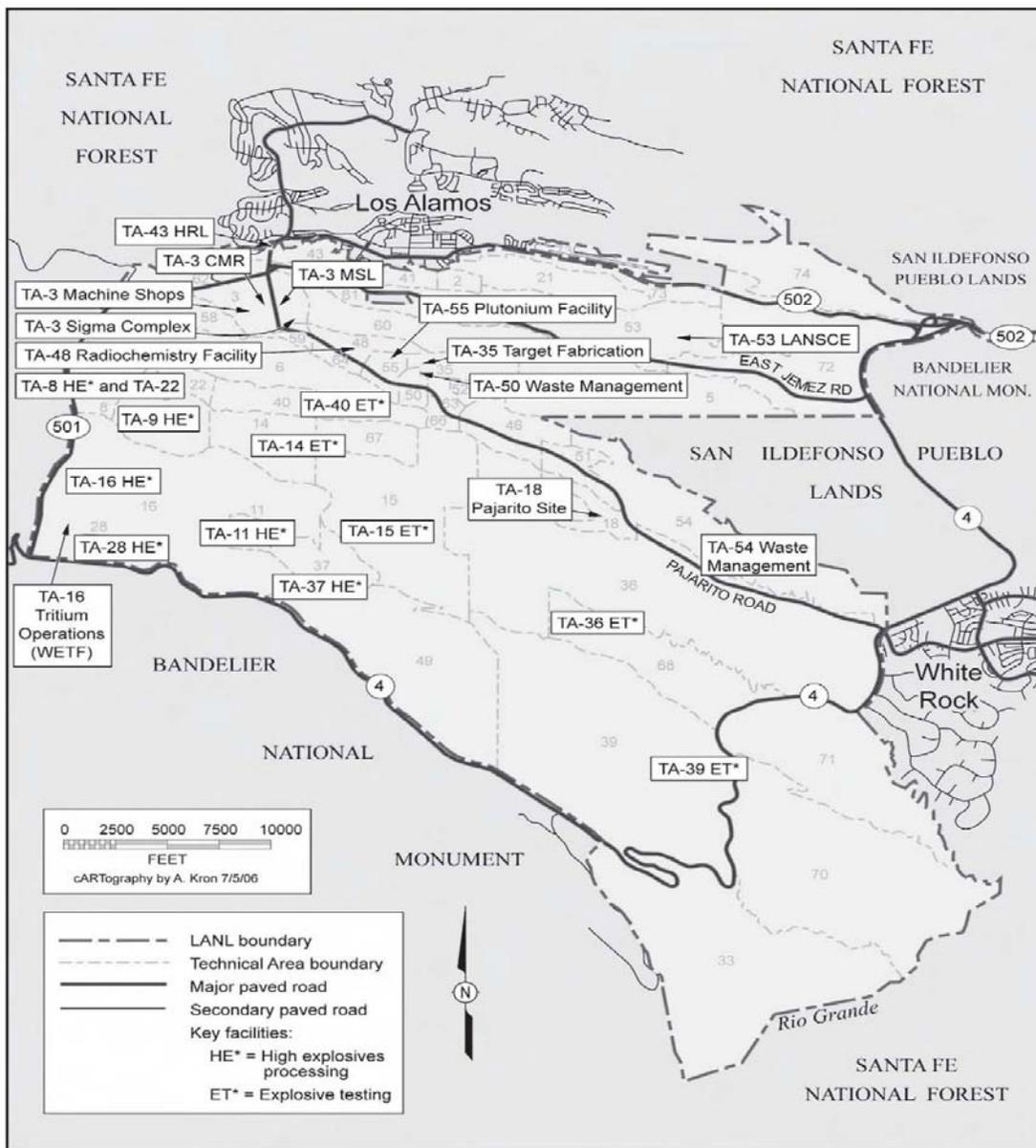


Figure A.6.1-4 — LANL Technical Areas

- TA-9** This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this site, and new organic compounds are investigated for possible use as explosives. Storage and stability problems are also studied.
- TA-14** Located in the northwestern part of LANL, this TA is one of fourteen firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning. Tests are conducted on explosives charges to investigate fragmentation impact, explosives sensitivity, and thermal responses of new high explosives. This site is currently permitted to treat waste through open detonation or open burning under the *RCRA*.
- TA-16** Fabrication of precision explosive assemblies, from powder pressing to machining and inspection, occurs at TA-16 to support HE R&D experimentation. LANL owns and maintains the only capability for fabrication of plane wave lenses used throughout the nation, at this facility.
- TA-22** This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. Research, development, and fabrication of high-energy detonators and related devices are conducted at this facility.
- TA-36** TA-36 is in a remotely located area in the eastern portion of LANL that is fenced and patrolled. It has two active firing sites that support the HE R&D mission (it has two other firing sites that support the hydrotesting mission). The sites are used for a wide variety of nonnuclear ordnance tests pertaining to warhead designs, armor and armor-defeating mechanisms, explosive vulnerability to projectile and shaped-charge attack, warhead lethality, and determining the effects of shock waves on explosives and propellants. Diagnostics include optical photography, multiple beam laser velocimetry, high speed electrical signal recording, and pulsed X-ray techniques.
- TA-39** TA-39 is located at the bottom of Ancho Canyon. The behavior of nonnuclear weapons is studied here, primarily by photographic techniques. Also studied are the various phenomenological aspects of explosives, interactions of explosives, explosions involving other materials, shock wave physics, equation-of-state measurements, and pulsed-power systems design and experimentation.
- TA-40** TA-40, centrally located within LANL, is used for studies of explosive initiation, detonation, and shock wave response of other materials related to weapon systems. Both fundamental and applied research investigating phenomena associated with the physics of high explosives and shock-induced chemical reactions are conducted. In addition, surveillance and qualification studies of War Reserve (WR) detonators are conducted.

TA-46 TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL's basic research sites. Activities have focused on applied photochemistry operations and have included development of technologies for laser isotope separation and laser enhancement of chemical processes. Current operations include studies of the response of small quantities of explosives to thermal and mechanical stimuli, with the experiments housed in boomboxes.

TA 53 At Area C of LANSCE, located at TA-53, LANL has developed Proton Radiography, a unique National resource. Proton radiography (800 megaelectron volts [MeV]) has the ability to capture a sequence of images, creating a movie of an explosive event (up to 33 frames, currently). Protons have approximately 100 micrometers (μm) spatial resolution for HE systems, with high contrast over a wide range of areal densities. Protons are different from x-rays in that there is no background or detector scatter, so quantitative density measurements are possible. Proton radiography shots are currently limited to 10 pounds Trinitrotoluene (TNT) equivalent in a containment vessel.

The general HE R&D activities at LANL can be broken down into the following missions:

- HE Synthesis and Formulation R&D;
- Physics and Engineering Performance & Safety Models;
- Thermal Response of HE;
- HE Characterization;
- Characterization of HE Driven Materials;
- Detonator Technology R&D;
- HE Test Fire Capabilities; and
- Military and Commercial Applications of HE.

A.6.1.3 *Pantex Plant*

The Pantex Plant researches the physical and chemical characteristics of the parts used in nuclear weapons. Highly specialized explosive main charges and initiation systems are required for a weapon to produce a nuclear explosion. Research at Pantex includes the use of insensitive HE for increased safety as well as refinement of HE manufacturing methods and safety procedures. Pantex performs HE synthesis, formulation, machining, extrusion, testing, process development, and analytical operations in performing its HE research and development and production missions. These operations are performed in Zone 11 or Zone 12 using HE materials stored in Zone 4 East remote firing sites (see Figure A.6.1-5). HE R&D activities and HE production mission work at Pantex occurs in common facilities and work areas. As a result, R&D and production missions are not segregated in terms of facilities, infrastructure or work force. In general, less than 10 percent of the annual HE-related budget at Pantex is associated with HE R&D activities.

R&D activities at Pantex, not related specifically to production process improvement, primarily involve stockpile-related surveillance and periodic reimbursable work typically with technical direction from the national laboratories. This work is traditionally concentrated within the

testing mission categories. There are currently no Pantex facilities dedicated entirely to HE R&D work. By conducting HE R&D efforts in the production facilities, NNSA is able to leverage the infrastructure investment to accomplish both objectives.

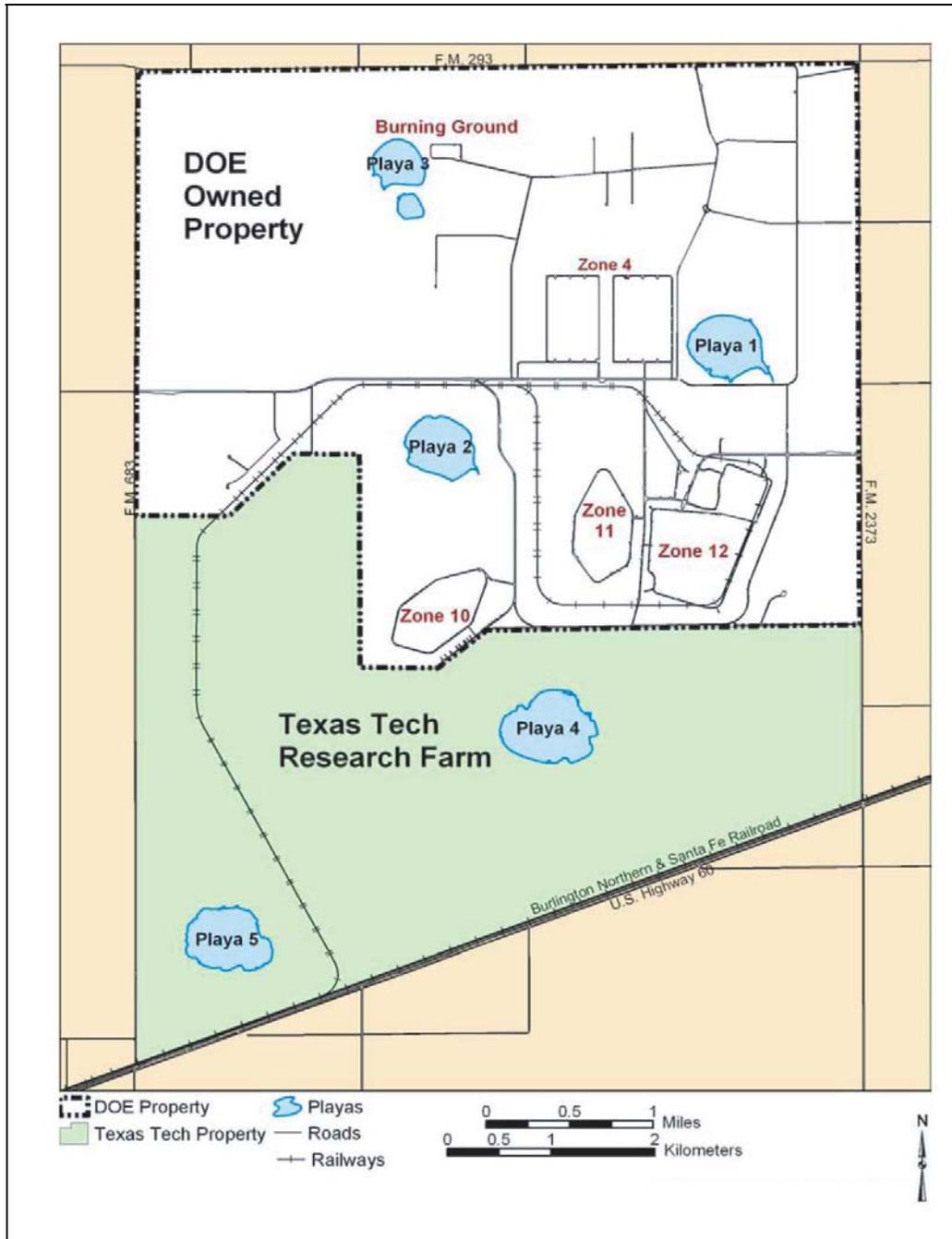


Figure A.6.1-5 — Relevant Zones at Pantex for HE R&D

A.6.1.4 *Sandia National Laboratories/New Mexico (SNL/NM)*

SNL/NM has mission responsibility for the nonnuclear components, which comprise approximately 95 percent of the components in a weapons system, and for assuring the safety and reliability of the complete, integrated nuclear weapon system. The major SNL/NM facilities and labs that conduct HE R&D are described below.

The Explosive Component Facility (ECF), shown in Figure A.6.1-6, was built specifically to conduct the SNL/NM work on explosive components. The ECF includes over 100,000 square feet of laboratories, diagnostic centers and performance facilities for the research and development of advanced explosive technology and sits on 22 acres on Tech Area II (see Figure A.6.1-7). Unique facility features include explosives labs qualified for all types of explosives, HE chambers and firing pads, explosive component disassembly area, explosives receiving area, and explosives storage. The ECF includes the ability to handle, store, test and model all types of explosive materials, conduct performance testing and material compatibility studies, and surety assessments related to safety and reliability. Approximately 80 people work at the ECF.



Figure A.6.1-6 — Explosives Component Facility (ECF); SNL/NM Bldg 905

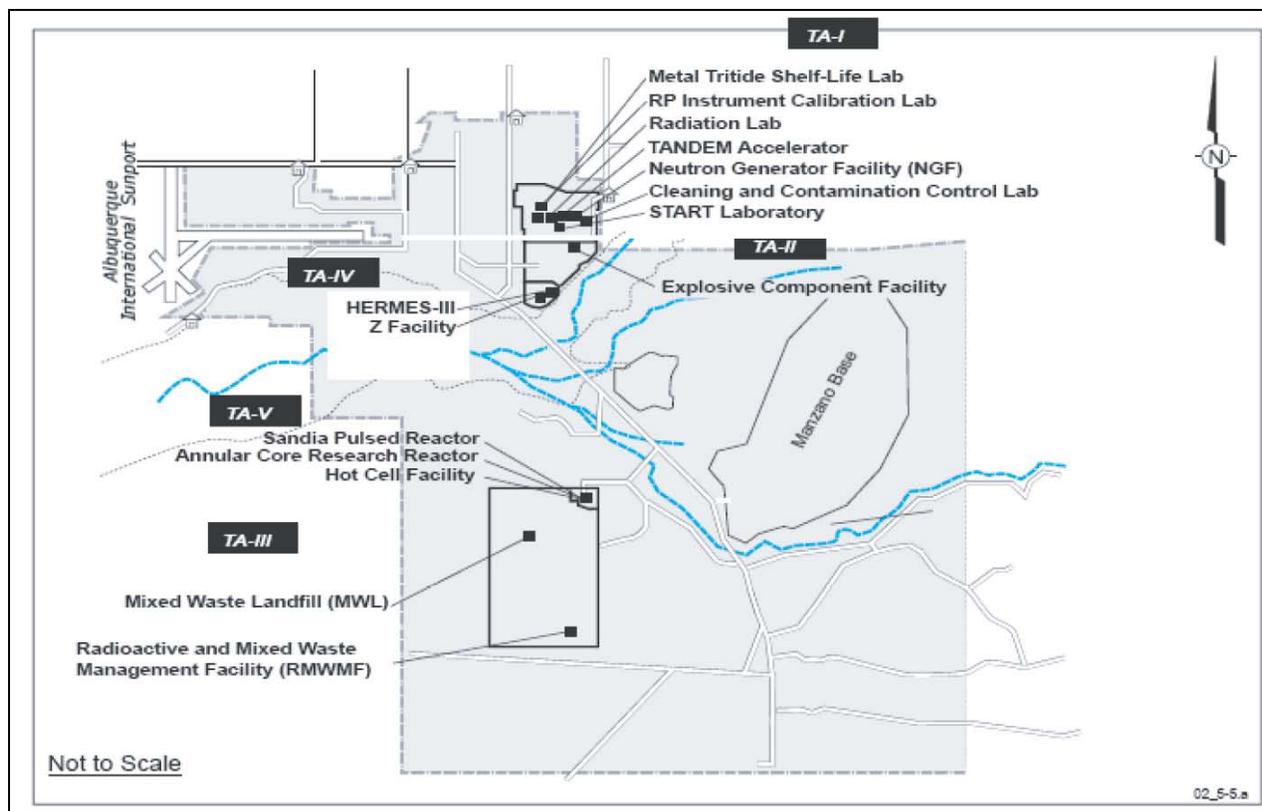


Figure A.6.1-7 — SNL/NM Technical Areas

The Terminal Ballistics Facility (TBF) includes a 1,000 square-foot indoor and a 100-acre outdoor firing range that accommodate live testing and firing of guns ranging in size from 0.17 caliber to 8-inch. The facility retains the world's fastest launch capability for masses of 300 to 2000 grams. The site also conducts static firings of solid fuel rocket motors of up to 100,000 pounds thrust. The firing site can accommodate explosive detonation tests up to 50-lb TNT equivalent. Up to 12 people work at the TBF depending upon the test being supported. These staff are part of the approximately 80 people who work at the ECF.

Currently there are two facility infrastructures used for explosive storage: the “6000 Igloos” and Manzano. Both storage infrastructures and the facilities are owned by Kirtland AFB. The 6000 Igloo storage area has a total of 21,000 square feet and includes 21 facilities (10 of 21 are for classified storage). The Manzano storage area includes 43 facilities, of which 13 are used for explosive storage. Approximately 18 people maintain the storage facilities.

Sandia utilizes facilities in 9930, 9939, 9920 to conduct research, design, development, manufacture and testing of explosive components, explosive systems, and arming and firing system hardware. The department also operates laboratories in Tech Area IV and the Explosives Applications Laboratory (Site 9930) in Coyote Canyon. Approximately 36 people support this mission.

The DETS Complex utilizes facility 9940 and is located on the Coyote Test Field. Current work at the facility involves arming and firing of explosives and the testing of explosive systems components in both terrestrial and aquatic settings. The site can fire up to 50 pounds TNT equivalent. These facilities are used to serve the needs of the Joint Tactical Operations Teams (JTOT) nuclear emergency response program and to meet the energetics technology needs of the Department of Defense Special Forces and the Intelligence Community. There are three lines of business: energetics research, emergency response training, and threat assessments. This now includes a firing site on Thunder Range, which is 523 acres and can fire up to 500 pounds TNT equivalent. Staffing at these two sites is approximately 30 to 60 people.

A.7 TRITIUM R&D

A.7.1 Tritium R&D No Action Alternative

Under the No Action Alternative, NNSA would continue the ongoing tritium mission at current sites. This would entail the following tritium operations at the sites described below.

A.7.1.1 *Lawrence Livermore National Laboratory*

The LLNL Tritium Facility is a Hazard Category 3 (HC-3) Nuclear Facility supporting a variety of NNSA, Department of Defense, Department of Homeland Security and work-for-others programs using tritium, plutonium, uranium and other radionuclides. It is located within the Superblock limited security area (see Figure A.7.1-1) at LLNL's main Livermore site. The primary tritium mission of the LLNL Tritium Facility is NIF target R&D with NIF production target filling to be added in support of the NIF Ignition Campaign beginning in 2009. As a result, per the LLNL SWEIS ROD, LLNL has received NNSA approval to increase its tritium inventory to 35 grams. The facility also hosts Gas Transfer System Research and Development experiments conducted by Sandia National Laboratory/California (SNL/CA) researchers, which is engaged in neutron generator development and provides maintenance and recertification services for the UC-609 Type B tritium shipping package.



Figure A.7.1-1 — LLNL Tritium Facility within Superblock

A.7.1.2 *Los Alamos National Laboratory*

The LANL WETF is a Hazard Category 2 nuclear facility located at TA-16, which also is referred to as S-Site. TA-16 is in a remote area with controlled access (that is, a limited security area) (Figure A.7.1-2). WETF is in the early stages of its anticipated operational life of 30 to 40 years. The WETF mission is to perform tritium R&D in support of LANL's stockpile stewardship mission, primarily the GTS design agency (DA) mission. Support of the GTS DA mission requires the flexibility to quickly react to any issue that is discovered in the stockpile. The primary use of tritium in the stockpile is in GTS, which requires that large quantities of tritium be processed and handled. Typical WETF tritium processing activities include: (1) loading and unloading; (2) removing tritium decay products and other impurities from gaseous tritium; (3) mixing tritium with other gases; (4) analyzing tritium as mixtures; (5) loading tritium onto various metals and metal alloys; (6) repackaging tritium and other gases to user specifications; (7) environmental storage and conditioning of GTS components; (8) performing various user-defined experiments with tritium; (9) unloading (depressurizing) containers of tritium; and (10) functionally testing R&D GTS.

A number of WETF systems support tritium processing, experiments, containment, confinement, gaseous tritium cleanup, analysis, and tritium monitoring. WETF's inventory is limited to a total of 1000 grams of tritium. With some physical modifications to the facility, the current Documented Safety Analysis (DSA) would support a tritium inventory as high as 2000 grams. A portion of the WETF is dedicated to shipping and receiving tritium, which is usually received from SRS in PV-18 primary containers inside UC-609 DOT Type B containers.



Figure A.7.1-2 — Aerial Photo of the WETF

All tritium R&D at LANL is performed by approximately 25 people. The number of programmatic R&D researchers is approximately 10 full time employee (FTEs), with portions of R&D support people making up the remaining 15 FTEs (performing gas analysis, gas mixing, R&D material preparation, R&D apparatus construction/maintenance, etc.).

A.7.1.3 Savannah River Site

The SRS Tritium Facilities consist of six HC-2 facilities and two HC-3 facilities which support the NNSA Stockpile Stewardship missions for tritium target extraction; tritium unloading, purification and enrichment; tritium and non-tritium reservoir loading; reservoir reclamation; and GTS surveillance. These are collectively referred to as the "tritium production" missions, although the actual production of new tritium is carried out in a Tennessee Valley Authority reactor, with extraction taking place at SRS in the Tritium Extraction Facility (TEF). The TEF includes two of the HC-2 facilities and became operational in late 2006. This facility was designed for a 40 year service life. Final processing of new tritium gas from TEF, as well as all other tritium gas processing, is carried out in the H-Area New Manufacturing Facility (HANMF). This facility became operational in 1994 and was also designed for a 40 year service life. The Tritium Facility Modernization & Consolidation Project, completed in 2004, significantly expanded the tritium gas processing capabilities in the HANMF and added surveillance capabilities in a new 234-7H facility.

The SRS Tritium Facilities, shown in Figure A.7.1-3, are located adjacent to H-Area near the center of the site and about 7 miles from the nearest site boundary. The bounding safety basis tritium inventory for the SRS Tritium Facilities is 75,520 grams. All tritium gas processing is done within secondary containment glove-boxes or modules which have either nitrogen or argon atmospheres. The glove-box and module atmospheres are continuously re-circulated through stripper systems to recover any tritium which may leak out of piping or components. All gas streams released to the environment are processed through a recovery system to reduce tritium levels to as low as reasonable achievable.



Figure A.7.1-3 — Aerial Photo of SRS Tritium Facilities

A.7.1.4 *Sandia National Laboratories/New Mexico (SNL/NM)*

Tritium Operations at SNL/NM are primarily associated with the Neutron Generator Production Facility (NGPF) (Figure A.7.1-4). The primary responsibility of the NGPF is to produce and manufacture neutron generators, which fuse deuterium and tritium to produce neutrons used to initiate the fission reaction in nuclear weapons. The neutron generator is a “limited-life” component of a nuclear weapon that uses tritium and must be replaced periodically due to the relatively short half-life of tritium. Neutron generators were produced at the Pinellas Peninsula Plant in Florida starting in the late 1950’s. In 1993, as part of the Nonnuclear Reconfiguration Program, Sandia was given the mission assignment for production of various nuclear weapons components, including neutron generators.

SNL/NM also performs weapons research qualification and testing on neutron tube and generator materials, process and lot samples, sub-components, and post-mortem examinations on final product. The department also performs technical studies that characterize processes and products in collaboration with production and development and design organizations. The site-wide reporting issue for tritium at SNL/NM is about 65,000 curies. The NGPF has a maximum inventory level of 12,000 curies and has the ability to increase to 15,999 curies if required. Presently, the inventory on site at the NGPF is about 3,500 curies.



Figure A.7.1-4 — Neutron Generator Production Facility at SNL/NM

A.8 NNSA FLIGHT TEST OPERATIONS

Introduction

NNSA Flight Test Operations is a SNL-managed program to assure compatibility of the hardware necessary to interface between the NNSA weapons and the Department of Defense

delivery systems and to assess weapon system functions in realistic delivery conditions. The actual flight tests are conducted with both the B83 and B61 weapons, which are pulled from the stockpile and are converted into units called Joint Test Assemblies (JTAs). In addition, development tests of gravity bomb and short-range systems are conducted at TTR. These flight tests are presently conducted at the TTR, a 179,200 acre site, located about 140 air-miles northwest of Las Vegas, Nevada. NNSA operates this facility under the terms of a Land Use Agreement, signed with the United States Air Force. This Land Use Agreement expires in 2019. NNSA has decided to defer the decision to seek renewal of this Land Permit until 2015.

Conversion of nuclear weapons into Joint Test Assemblies is a multi-step operation. Pantex denuclearizes selected nuclear weapon that become JTAs. These JTAs are not capable of producing nuclear yield. These JTAs may then be further modified at SNL. These JTAs are then dropped from nuclear certified aircraft at various altitudes and velocities. Depleted uranium usually remains in all JTAs but because there is no explosive event, the depleted uranium is contained within the weapon case and fully recovered after each flight test experiment. There is no contamination of the soil as the result of a JTA flight test. In some cases, JTAs are flown at velocities and altitudes of interest and not dropped at Tonopah Test Range (TTR). In this case, the aircraft returns to its base with the JTA on-board. Each year from ten to twelve JTAs are tested at TTR. Figure A.8-1 shows the location of TTR, and its proximity to NTS.

In addition to analyzing the impacts associated with the No Action Alternative, four additional alternatives are evaluated in the Complex Transformation SPEIS for conducting NNSA Flight Test Operations. These alternatives are as follows: (1) upgrade the existing program at the TTR, using state-of-the-art, high technology, mobile equipment; (2) operate the Flight Test Program at the TTR in a “campaign” mode; (3) transfer the NNSA Flight Test Operations program to the WSMR in New Mexico; and (4) transfer the NNSA Flight Test Operations program to the NTS. Specific locations within WSMR and NTS are being evaluated to assure that the required geological conditions exist to successfully support all flight testing requirements.

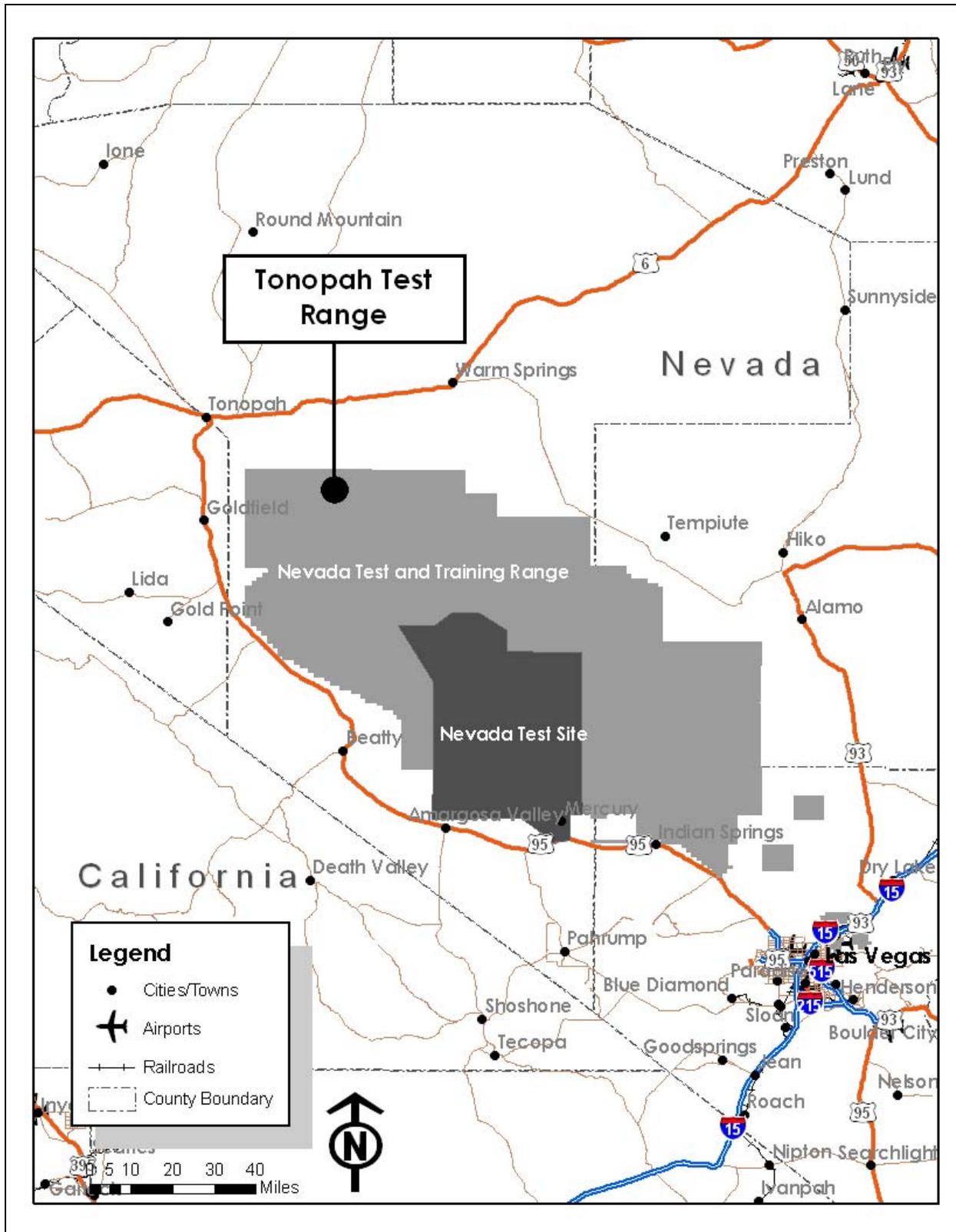


Figure A.8.1 — Location of TTR and NTS

NNSA Flight Test Operations Alternatives

- **No Action** – continue operations at TTR
- **Upgrade Alternative** – continue operations at TTR and upgrade equipment with state-of-the-art mobile technology
- **Campaign Mode Operations** – continue operations at TTR but reduce permanent staff and conduct tests with other DOE employees
- **Transfer to WSMR** — discontinue NNSA Flight Testing at TTR, move NNSA Flight Testing to WSMR
- **Transfer to NTS--** discontinue NNSA Flight Testing at TTR, move NNSA Flight Testing to NTS

A.8.1 No Action Alternative

Under the No Action Alternative, NNSA would continue to conduct the Flight Test Mission at TTR. This section describes the NNSA Flight Test Operations Program currently being conducted at the TTR. Figure A.8–1 shows the location of TTR. There would be no construction required at the TTR for the No Action Alternative. The current facilities would continue to remain serviceable, assuming adequate funding is provided for the normal maintenance of existing facilities and equipment.

It is noted that the No Action Alternative includes minimal investments to maintain current operations capabilities and to enable a commensurate level of Flight Tests in the future. This investment would maintain the existing TTR capabilities through the year 2030. The TTR can be sustained to meet its present mission requirements only with such minimal reasonable investments in technology and infrastructure. The investment required covers the following areas, the details for each area are described below:

Radar — This includes a transformation of one radar from a maintenance intensive unit to a modern fully functional unit, eliminating the prone to failure systems/parts; a future depot-level maintenance effort for a second radar; and the acquisition of an Identification, Friend or Foe (IFF) system. The acquisition of this IFF system would allow for the elimination of 2 existing maintenance intensive radar systems.

Optics — The Optics group upgrade under this option would consist of three distinct functions: (1) addition of a Time Space Positioning Information (TSPI) section to collect precise positional data; (2) addition of an Event Optics section using telescope tracking mounts to record event data for documentary purposes; and (3) addition of a Photometrics section utilizing both high speed fixed camera arrays to augment the existing still photography capability.

Facilities — TTR will continue to use the existing facilities and maintain them within the normal budget process. A new HVAC system for the control facility and a roof and siding repair on one building would be required under this minimal investment option. Repair to the electrical grid and road surfaces would also be required under this minimal investment option.

Table A.8-2 — TTR No Action Annual Operational Requirements

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595
Peak electrical demand (MWe)	812
Other process gas (N, Ar, etc.)	480 ft ³
Diesel generators	44 (about 20 per test)
Water (Yearly for entire range including AF)	6 million gallons
Steam (tons)	0
Range area (sq. miles)	280
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 Mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Chemical use	0
Maximum inventory of fissile material/throughput	0
Hazardous	
Liquid (gal.)	35
Solid (yds ³)	<1
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds ³)	15

Source: NNSA 2007

Past weapons destruction tests, unrelated to the Flight Test Program, have contaminated soil at TTR in three distinct areas. These sites have been characterized and remediation is ongoing. Additional details on this can be found in Section 4.4.6.2.1, of this document. In addition to these remediation projects there are several structures which must undergo D&D in order to continue ongoing operations at TTR. It is estimated that the soil and structure remediation activities will entail a two year project involving 80,000 worker hours, and the requirements listed in Table A.8-3. The soil remediation activities are only the petroleum-contaminated areas under the buildings which are scheduled for demolition. The small quantities of LLW and hazardous wastes generated by this effort would be transported to NTS, or a commercial facility, for treatment and disposal. Non-hazardous waste would be disposed of on-site.

Table A.8-3 — D&D Associated with TTR Operations—No Action Alternative

D&D Ongoing at TTR	D&D Amounts
Soil D&D (yd ³)	0
LLW generated (yd ³)	20
Non-Hazardous waste (yd ³)	8000
Hazardous waste (yd ³)	3703
Debris/Earth moving equip.(dozers/trucks)	2/3
D&D Related employment	
Peak	20
Total worker hours	80000

A.8.2 Upgrade of Tonopah Test Range Alternative

This option, referred to as the High-Tech Mobile (HTM) option, would allow for a reduction in the operational costs at TTR through the introduction of newer, more efficient, and more technologically advanced equipment. This option would lower manpower test operational needs and keep all test equipment highly reliable and operational between test dates, thereby reducing recalibration and start-up costs. With this HTM option, additional range campaign activities could be considered and conducted with minimal additional costs.

A vision of the HTM at TTR is shown in Figure A.8-2. It includes the acquisition of modern, digital equipment that is compatible with other national test range standards. The emphasis is on highly mobile command, telemetry, communications, and radar units which could be readily moved to the different testing locations at TTR. This would not only eliminate duplicative permanent structures, but would also eliminate costly, start-up calibration.

The actions required for the HTM option are as follows:

Documentary / TSPI Optics — This action would include an additional five combined mount [TSPI and documentary telescopes] units with a separate optics Control Trailer for remote control operations. Encryption capability would be included.

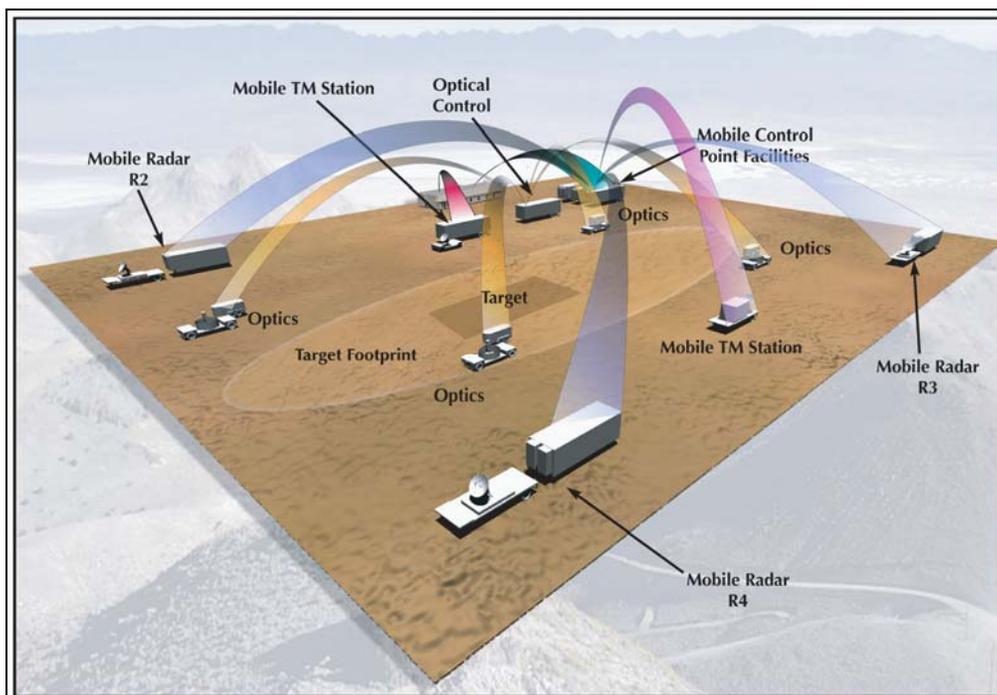


Figure A.8-2 — HTM Upgrade Alternative

Radar — The proposal is identical to that proposed above for the minimum investment option.

Telemetry — New telemetry trailers, fully equipped, and antennas would be purchased and all trailers would be DOT certified. This would allow both assets to be fully mobile.

Operations Control Equipment — Two operational control trailers, fully equipped, would be acquired to replace the operations that currently take place in the operational control tower at TTR. Test coordination, communications, and safety would all be housed in these trailers. Operation displays would provide continuous coverage of the test in progress.

Facilities — The proposal is identical to that proposed above for the minimum investment option.

There would be no construction for the TTR upgrade alternative. The HTM alternative would rely on trailer and vehicular modules which would not require any construction. Since this alternative would use existing infrastructure and personnel, without any increases in the number or intensity of tests, the operational resources would be the same for both the upgrade alternative and the No Action Alternative.

A.8.3 Campaign Mode Operation of TTR

An alternative to immediately relocating the entire TTR to another site would be to conduct the JTA tests at TTR on a campaign basis, bringing in employees from other DOE sites to conduct tests, while doing Work for Others (WFO) as schedule permits. SNL would continue to be the program manager, and National Security Technologies (NSTec) would be the Management and Operations (M&O) contractor. This alternative would accomplish multiple programmatic objectives, not the least of which is to maintain the national security mission, and in particular the science-based Stockpile Stewardship Program, as the primary mission of the national security laboratories while optimizing the WFO activities of those laboratories to support other national security objectives in fields such as intelligence and homeland security.

SNL has indicated that a limited, permanent staff at TTR would be required, on a full time basis, to continuously maintain the facilities and equipment at TTR. For a drop test, this permanent staff at TTR would be augmented by technical staff members integrated into NTS operations. By the end of 2015 a decision could be made to:

1. Discontinue NNSA Flight Testing at TTR in 2019 and use the interim period between 2015 and 2019 to transition equipment and further build-up infrastructure needs at NTS, or
2. Renew the USAF – DOE/NNSA permit at TTR and continue work at that site, managed by the NTS and mission driven by SNL with the flexibility to alter what is necessary, given the mission requirements at that time.

The TTR capabilities under this alternative are the same as the existing TTR capabilities presented in Section A.8.1 for the period before 2019. After 2019, the capabilities are upgraded with the High Tech Mobile improvements presented in Section A.8.2, above. Under this Alternative, there would be no construction required. The existing facilities at TTR would be utilized and upgraded with mobile equipment after 2019. Annual operations would change with a lower employment level. This employment level would be supplemented with imported workers from other DOE sites to conduct actual tests.

A.8.4 Transfer to WSMR Alternative

This section describes the alternative for transferring the NNSA Flight Test Operations activities, presently being conducted at the TTR, to the WSMR, near White Sands, New Mexico. Figure A.8-3 shows the location of WSMR. Located in south central New Mexico, WSMR is the largest installation in the DoD. WSMR is a Major Range and Test Facility Base (MRTFB) under the Department of the Army Test and Evaluation Command, Developmental Test Command providing test and evaluation services to the Army, Air Force, Navy, other Government agencies and industry. The Range spans 3,420 square miles of land space and 10,026 square miles of contiguous restricted airspace fully managed, scheduled and controlled by the WSMR. Holloman Air Force Base is located within and contiguous to the range east boundary with capabilities for aircraft support and staging.

WSMR has a full suite of flight test instrumentation including radar, telemetry and optical equipment, which allows complete coverage of NNSA gravity weapons flight testing. As an MRTFB, the range infrastructure and instrumentation modernization and maintenance is funded under the DoD Test Resource Management Center and Army Test and Evaluation Command including additional investments made for Air Force, Navy and Joint test missions. WSMR has extensive experience conducting flight tests with requirements and flight test scenarios similar to the NNSA flight test program to include penetrating weapons, weapons recovery and handling classified and special materials.

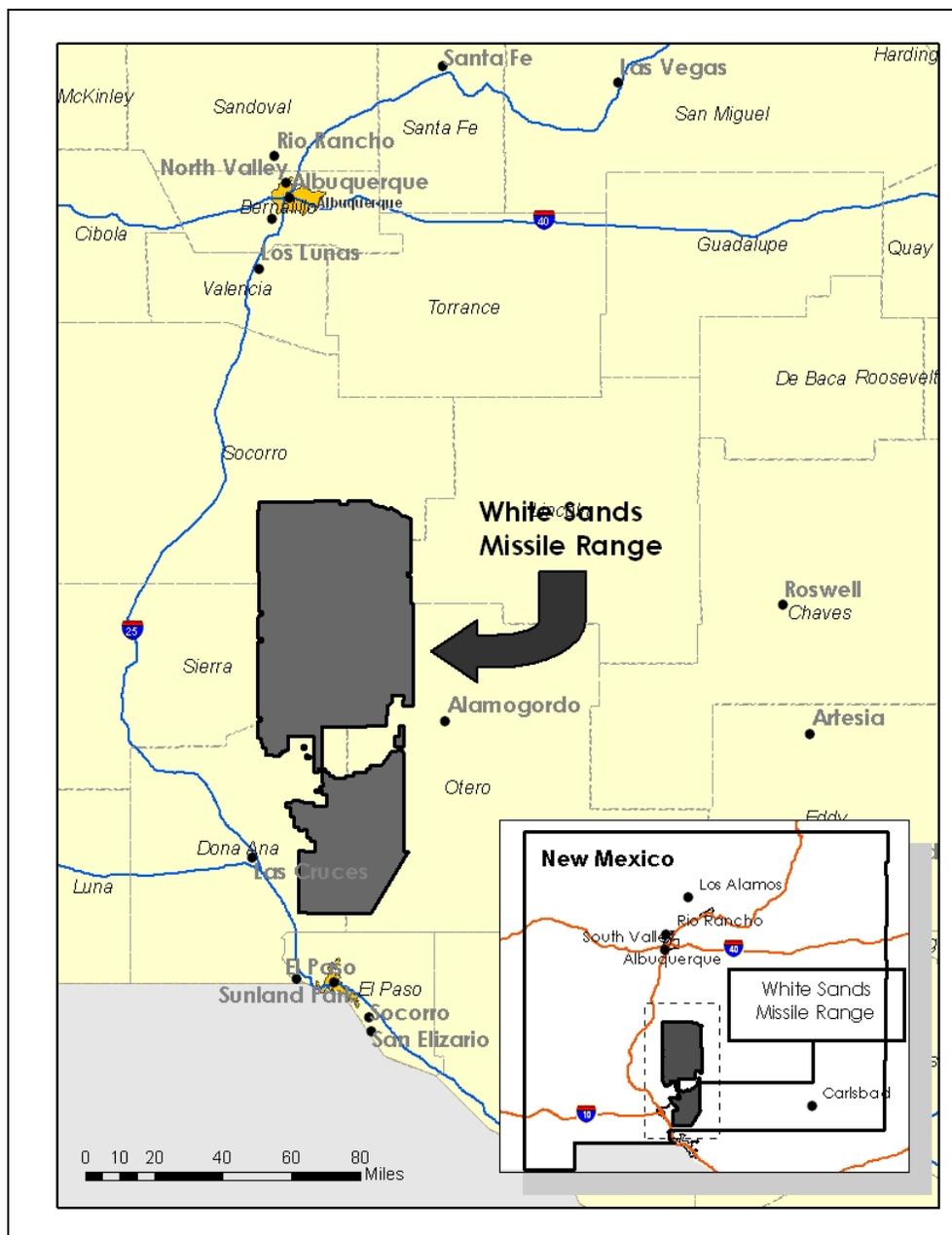


Figure A.8-3 — Location of WSMR

A.8.4.1 Existing WSMR Capabilities

Command and Control. The WSMR range control center is a state of the art facility with real-time graphics and telemetry displays, an air traffic control center meteorological data displays, as well as communications centrally connected through the range network infrastructure for data acquisition and distribution across the entire test range.

Optical/video. WSMR has a complete range of optical tracking and video capabilities for event detection, documentation and Time-Space-Position Information (TSPI) data including position,

altitude, aspect angle and roll rate. WSMR's optical tracking capabilities include mobile and fixed tracking mounts capable of multiple visible, near IR and far IR sensors.

Tracking Radars. The radar suite at WSMR consists mostly of C-band, gated CW, metric radars capable of tracking in skin or beacon mode. There are ten Single Object Tracking radars of which eight are mobile. In addition, WSMR has two mobile Multiple Object Tracking radars. WSMR also has one mobile Weibel radar Doppler radar.

Telemetry. WSMR has an array of fixed telemetry sites to provide coverage of flight tests across the range and a set of mobile telemetry stations for receiving, recording and relaying telemetry information at custom locations to meet test requirements. Telemetry data acquisition capabilities include fixed and mobile local and long range secure, multi-stream and high data rate (excess of 20 megabites per second) telemetry, FM, PCM, PAM, 1553, RS232, 422, IRIG 106, JTIDS/Link 16 and other standard analog and digital data protocols and formats.

Operations Control Center. The Range Control Center (RCC) is a state-of-the-art digital data facility central to test operations, data collection and distribution. The center houses the operations control and data facility, telemetry data center, air traffic control radar facility, network operations center, flight safety engineering, real-time data display and reduction facility, instrumentation controllers, meteorological data center and test customer and analyst cells.

Photometrics and Photography. WSMR has an extensive capability to provide photographic data acquisition, editing and production for on-demand and planned documentary photo of the test setup and any incidents of interest. Photographic support includes still photography, closed circuit video surveillance and non-track optical data video in the visible, image intensification and IR bands at frame rates up to 2000 digital and over 20,000 frames per second film.

Communications. WSMR range communications operates the main switch for all telecommunications and network operations including fiber, RF and hardwire networks. The range utilizes a radio system with repeater systems to provide test conduct and local radio communication service.

Aircraft flight safety. Team WSMR has a renowned capability and experience in flight safety systems to include modeling and measuring instantaneous impact predictions, design and certification of flight termination systems (FTS) and safe test operations for aircraft and weapons systems. WSMR conducts mission analysis and real-time control and decision making for mission operations including meteorological data considerations, flight profile and instrumentation information for flight safety operations. Aircraft and test operations safety is highly afforded by the control, management and vast restricted air and land space.

Airspace. WSMR controls and manages over 10,000 square miles of restricted airspace with the full authority of the Federal Aviation Administration (FAA). Thus, WSMR is not required to call-up or schedule airspace operations or receive FAA approval for operations within the restricted airspace.

Explosive Ordnance Disposal/Recovery. WSMR has trained explosive ordnance disposal and recovery operations personnel for recovery and disposal of explosive ordnance that are utilized either on call or on standby for test operations as required by the test plan and safety operations.

Meteorology. WSMR has a meteorology section that provides a wide range of technical meteorological support including forecasts, warnings, and atmospheric observations and measurements for test data and control.

Trajectory Plotting. The graphics facility provides the operational and display environment for the aircraft control operator and the radar director. The displays and the facility are located in the RCC. The trajectory is projected in the RCC operations center for the TD and other test personnel on the same plot as the planned trajectory, allowing the test team to evaluate the aircraft and test unit flight safety.

Security. WSMR has an integral security workforce for operations security, evacuation and roadblock services across the range. In association with the operation of the nuclear test reactor, WSMR has personnel programs and special security training suitable for NNSA test operation requirements.

Radiological Technician. Provided by SNL/NM from Albuquerque. For any tests that require post-test radiography, the equipment and specialists are provided by one of the physics laboratories.

Emergency Services. A medical aid station with an ambulance, staffed by highly qualified medical technicians, is located at the Stallion range center within 10 minutes of the planned NNSA test area. Modern full service hospitals are located in the towns of Socorro and Alamogordo, about 20 and 45 miles respectively, from the proposed test location on the range. Additionally, a full service fire station and Emergency Medical Services (EMS) unit is located at the Stallion range camp.

Shipping and Receiving. WSMR performs all requirements to handle, classify, package, and ship hazardous and non-hazardous post-test assets and material off range.

Working Space. Workspace for NNSA test operations could be provided by mobile facilities, at the Stallion range camp or at the Defense.

Targets. WSMR has a wide variety of targets located throughout the range. Targets similar to those presently used by NNSA at TTR are located in the northern section of WSMR. The final determination of the specific target areas which would be used will be determined by the geological study. Potentially, a concrete target would be constructed in the general area of the penetration target to facilitate all missions in the same location

Computer Facility. The WSMR computer facility is located inside the RCC. This facility provides support to all facets of the test, from safety calculations and basic communications support, to the coordinated real-time radar and video picture so the test team can make instantaneous decisions about range safety and test execution.

A.8.4.2 *Siting Locations*

The northwest area of the WSMR would provide several target area options for flight testing. An Environmental Assessment (EA) is currently being prepared to support core sampling that is required to assess the geologic suitability of the target area options. Pending completion of that EA and soil core sampling, it is anticipated that one or more locations in this area would meet the requirements for the penetration testing. A review of the preliminary data indicates that this area of the WSMR could accommodate the safety footprints of all current flight test scenarios. If this alternative were to be selected, transition from TTR to WSMR would occur during the latter part of 2009 and the beginning of 2010. Construction of the needed pads and target would be designed and built after the Record of Decision for the SPEIS. Flight Test Program system upgrades would only begin after the construction of the needed facilities was completed and a smooth transition completed.

The only construction that would be required to support the JTA flight test operations at the WSMR would be the installation of a circular concrete target. The target would be used to aid in recovery efforts for all Retard Air and Retard Ground configurations. It would also be used for free-fall test units. The concrete target would be constructed of 4,000 psi (pounds per square inch) non-reinforced concrete, 500 feet in diameter with a depth of 12 inches.

Under this alternative, NNSA Flight Testing would be discontinued at TTR. The environmental impacts of discontinuing NNSA Flight Testing at TTR are addressed in Section 5.15.4.

Table A.8-6 — WSMR Construction Requirements

Construction Requirements	Consumption/Use
Peak Electrical Energy Use (KW-hr)	40,000
Diesel Generators (Yes or No)	Yes
Concrete (yd ³)	800
Steel (t)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Range land required (acres)	3,774
Lay down Area Size	Two 11.5 acre sites
Parking Lots	N/A
Total employment (worker years)	37
Peak employment (workers)	30
Construction period	15 months
Waste Generated	Volume
Hazardous	
Liquid (gal)	0
Solid (yds ³)	0
Non-hazardous (Sanitary)	
Liquid (gal)	0
Solid (yds ³)	6,000
Non-hazardous (Other)	
Liquid (gal)	0
Solid (yds ³)	45

Source: NNSA 2007

Table A.8-7 — WSMR Operational Requirements

Operation Requirements	Consumption/Use
Annual electrical energy (MWh)	595
Peak electrical demand (MWe)	812
Fuel usage (gal)	32,150
Other process gas (N, Ar, etc.)	480cu.ft.
Diesel generators	44 (about 20 per test)
Water (Yearly in gallons)	6 million gallons
Steam (tons)	0
Plant footprint (acres)	
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 Mrem
Radionuclide emissions and effluents—	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7 x 10 ⁻⁶
Chemical use	0
Maximum inventory of fissile material/throughput	0
Waste Category	Volume
Hazardous	
Liquid (gal.)	35
Solid (yds ³)	<1
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds ³)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds ³)	15

Source: NNSA 2007

The only construction that would be required to support the JTA flight test operations at the WSMR would be the installation of a circular concrete target. The target would be used to aid in recovery efforts. It would also be used for free-fall test units. The concrete target would be constructed of 4000 psi non-reinforced concrete, 500 feet in diameter with a depth of 12 inches. Tables A.8-6 and A.8-7 provide the construction and operational requirements associated with relocating NNSA Flight Test Operations to the WSMR.

The required construction is a small project and it is not anticipated that the employment of 30 construction personnel over a 15 month period would have a significant impact on the existing labor pool of the area.

During Flight Test operations, the primary noise would be generated by aircraft flying over the WSMR drop areas. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to those employed by WSMR. They would not likely result in any adverse effect on sensitive wildlife species or their habitats, and would be similar to the effects discussed under the No Action Alternative.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased flights at WSMR as a result of NNSA conducting Flight Test Operations.

Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are remotely located from the flight-path of the aircraft. The public is not allowed on WSMR and noise levels produced by the aircraft are sufficiently reduced at locations where the public would be present to preclude hearing damage.

Sensitive wildlife species are unlikely to be adversely affected by the aircraft noise. WSMR has conducted such tests on a weekly basis over a number of years with no apparent adverse impacts to any species.

It is assumed that operational impacts, as shown in Table A.8-8 would be the same as the operational requirements for the No Action Alternative operation at TTR. Although they will certainly be different, there is no reason to believe they would be sufficiently different from the existing operation, such that existing requirements cannot be used as a guide to what they would be for WSMR.

A.8.5 Transfer to NTS Alternative

This section describes the alternative for transferring the NNSA Flight Test Operations activities, presently being conducted at the TTR, to the NTS. Figure A.8-1 shows the location of TTR, and its proximity to NTS. A review of possible sites at NTS was conducted and although no site was eliminated, a drop test site on Mid-Valley, Area 14 was chosen for the purposes of this analysis, since it provides the greatest isolation from other NTS activities. Figure A.8-4 shows the location of Mid-Valley Area 14 on NTS. Although the isolation is a benefit, this site location would require a larger investment in infrastructure, due to its remoteness.

This site meets the necessary safety criteria to permit the program to use this area of the NTS. Mid-Valley site preparation includes test bed design, concrete pads, roads, and generator power. The NTS would provide a microwave data/video link from the SNL/NM-provided technical systems in Mid-Valley to the NTS Control Point (CP) complex. Other sites are also available on the NTS offering a variety of geologic conditions for testing advanced weapons designs.

If this alternative were to be selected, transition from TTR to NTS would occur during the latter part of 2009 and the beginning of 2010. Construction of the needed pad and target would be designed and occur after the ROD for the SPEIS. Flight Test Program system upgrades would only begin after the construction of the needed facilities was completed and a smooth transition completed. The JTA Flight Test Program staff would be housed in CP-40, an existing NTS facility that includes an available high-bay area and office space (See Figure A.8-5). CP-20 (see Figure A.8-6) could also be used for housing Flight Test Program electronic equipment. Minor building preparation would be required for both. In addition to the installation of roads and utilities construction of a circular concrete target, similar to the one which would be required for the WSMR Alternative would have to be constructed. The target would be used to aid in recovery efforts for all Retard Air and Retard Ground configurations. It would also be used for free-fall test units. The concrete target would be constructed of 4,000 psi non-reinforced concrete, 500 feet in diameter with a depth of 12 inches.

Under this alternative, NNSA Flight Testing would be discontinued at TTR. The environmental impacts of discontinuing NNSA Flight Testing at TTR are addressed in Section 5.15.4.

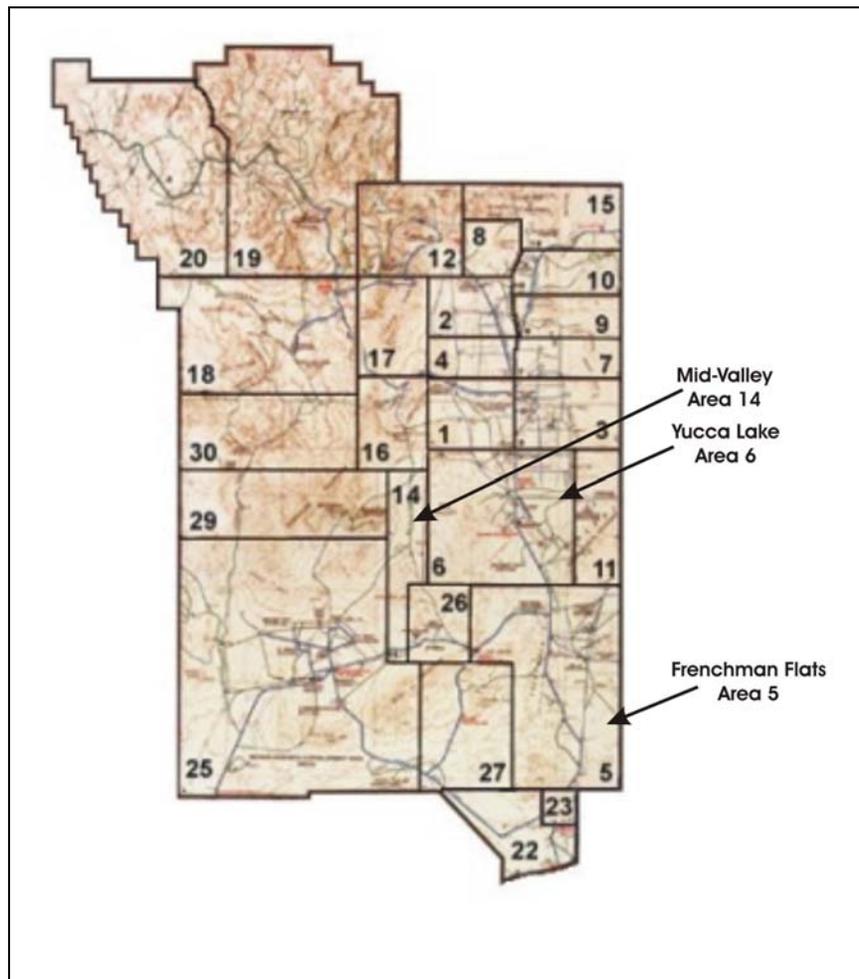


Figure A.8-4 — Mid-Valley, Area 14, at NTS



Figure A.8-5 — CP-40 includes administrative areas and a high bay that would be useful for personnel and assembling test hardware



Figure A.8-6 — CP-20 is an ideal facility for housing the electronics for the Flight Test Program

Existing communications capabilities between the CP facilities located in the southeast portion of Area 6, include a fiber optic link between the CP microwave towers and CP-1, 20, and 40. Microwave data communications are available for connecting data and video requirements from the target area to the CP complex. Setup of the microwave data/video links is a routine test requirement on the NTS. These same communications infrastructure elements can readily be applied to other locations on the site should the JTA Flight Test Program desire to test in different geological regimes.

A.8.5.1 Construction Requirements

As mentioned in the sections above, a target area would have to be constructed and a few enhancements to Building CP-40 would have to be made. The following tables give the impacts associated with the required construction and for the operation of the Flight Test Operations Program at NTS. Table A.8-12 and A.8-13 show the construction and operational requirements for the Relocation of Flight Test Operations to NTS Alternative.

Table A.8-12 — Construction Requirements for NTS Alternative

Construction Requirements	Consumption/Use
Peak Electrical Energy (MWh)	40,000
Diesel Generators (Yes or No)	Yes
Concrete (yd3)	800
Steel (t)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Range land required (acres)	3,774
Laydown Area Size	Two 11.5 acre sites
Parking Lots	N/A
Construction Employment	0
Total employment (worker years)	37
Peak employment (workers)	30
Construction period (months)	15
Waste Generated	Volume
Low level	
Liquid (gal)	0
Solid (yd3)	0
Mixed Low-level	
Liquid (gal)	0
Solid (yd3)	0
Hazardous	
Liquid (gal)	0
Solid (yd3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	6,000

Table A.8-12 — Construction Requirements for NTS Alternative (continued)

Waste Generated	Volume
Solid (yd3)	
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd3)	45

Source: NNSA 2007.

Table A.8-13 — Operation Requirements for NTS Alternative

Operational Requirements	Consumption/Use
Annual Electrical energy (MWh)	595
Peak electrical demand (Mwe)	812
Fuel usage (gal)	32,150
Other Process Gas (N, Ar, etc)	480 cubic feet
Water (gal)	6,000,000
Steam (tons)	0
Range land required (acres)	3,047
Employment (workers)	129
Number of Radiation Workers	1
Average annual dose (per Sandia)	<10 mrem
Radionuclide emissions and effluents	0
NAAQS emissions (tons/yr) (per Sandia)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	HCL - 3.7E-06
Chemical Use (per Sandia)	0
Maximum inventory of fissile material/throughout	0
Waste Category	Volume
Hazardous	
Liquid (gal)	35
Solid (yd3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd3)	60
Nonhazardous (Sanitary)	
Liquid (gal)	700
Solid (yd3)	

Source: NNSA 2007.

A.8.6 Transportation

All post-test transportation from the NTS to Pantex would be identical to the transportation requirements of the current TTR process. New agreements replacing NTS as the originating site would replace the TTR agreements. NTS has a long history including formal agreements with Albuquerque for the shipment of SNM and classified components to and from major DOE/NNSA sites and is therefore thoroughly familiar with the processes and procedures for these shipments.

Due to the proximity of all alternative sites, the transportation requirements are similar for all three alternatives. All transportation of nuclear weapons, as well as, JTAs is conducted in DOE safe secure trailers by the DOE Office of Secure Transport, based in Albuquerque, New Mexico. Vehicles are state-of-the-art and all personnel associated with such shipments are highly trained both initially and on an ongoing basis. Although routes have been determined and environmental impacts evaluated for such transport, specifics of this information are not available to the public.

A.8.6.1 *Removal of weapons from the stockpile*

Under the existing operation at TTR, weapons are removed from the stockpile at various locations across the U.S. and abroad and are transported to Pantex. The specific locations are not for public release. Once the weapon has been inspected, the SNM removed from the weapon, and instrumentation added to the weapon, the weapon is considered a JTA. Transportation required to support this activity would be the same as for existing operations and would be the same for all alternatives.

A.8.6.2 *Transport of JTAs to Air Force installations to be loaded onto test aircraft*

Once the JTAs have been inspected and certified at Pantex, they are transported to U. S. Air Force installations on DOE's fleet of SST vehicles to be loaded onto test aircraft. Transportation required to support this activity would be the same as for existing operations and would be about the same for all alternatives.

A.8.6.3 *Transport of JTAs from test site to Pantex*

Once the JTA test has been completed, the JTA is returned to Pantex for post testing analysis and disposition. For fly-over tests, this transportation route would be from the Air Force installation from which the aircraft originated to Pantex. Transportation required to support this activity would be the same for existing operations as it would be for all alternatives. Dropped JTAs would be transported from the test facility to Pantex. Transportation required to support this activity would be site specific and vary for each alternative site. The No Action Alternative, the two TTR Upgrade Alternatives, and the Relocation to NTS would all be similar, since the distances and routes to Pantex are about the same for TTR and NTS. The transportation route from the Relocation to the WSMR Alternative is less than half of the other two alternatives.

A.9 **HYDRODYNAMIC TESTING**

Hydrodynamic testing (hydrotesting) is the execution of high-explosive-driven experiments to assess the performance and safety of nuclear weapons. Data from experiments including hydrotesting, coupled with modeling and simulation using high performance computers, is used to certify the safety, reliability, and performance of the nuclear physics package of nuclear weapons without underground nuclear testing.

The alternatives for meeting the goal of the National Hydrotest Plan (NHP) are explained in the sections that follow. Section A.9.1 discusses the No Action Alternative, which would continue

operations at the existing facilities of LANL, LLNL, NTS, SNL, and Pantex. Section A.9.2.1 discusses an alternative which would downsize the number of hydrotesting facilities at LANL, LLNL, NTS, SNL, and Pantex. Section A.9.2.2 discusses an alternative that would consolidate non-fissile hydrotesting activities at LANL. Section A.9.2.3 discusses a next generation alternative which would consolidate all hydrotesting activities at the NTS.

Hydrodynamic Testing Alternatives

- **No Action** – continue hydrotesting at LLNL, LANL, NTS, Pantex, and SNL/NM
- **Downsize in Place**
 - Consolidate LLNL hydrotesting at Contained Firing Facility (CFF)
 - Consolidate LANL hydrotesting at Dual Axis Radiographic Hydrodynamic Test (DARHT) facility
 - Consolidate NTS hydrotesting to single confined and single open-air sites
 - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidation at LANL**
 - Integrate hydrotesting program at LANL
 - Construct new CFF-like facility at LANL
 - Discontinue hydrotesting at LLNL once CFF-like facility is operational
 - Maintain BEEF at NTS
 - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidation at NTS¹**
 - Integrate hydrotesting program at NTS
 - Construct new DARHT-like facility at NTS
 - Construct new CFF-like facility at NTS
 - Discontinue hydrotesting at LLNL, LANL, Pantex, and SNL/NM

¹The NTS Alternative is considered a “next generation” alternative because NNSA is not proposing these changes at this time.

Hydrotesting coupled with high performance computer modeling and simulation and data from DPES, is used to certify the safety, reliability, and performance of the nuclear physics package of nuclear weapons without underground nuclear testing. Radiographic images and other data from hydrotesting help to ensure continued confidence in NNSA’s assessments of nuclear weapons by providing critical experimental data for representative nuclear weapons geometries, fine tuning computer modeling of nuclear weapons performance and behavior, evaluating effects of aging on materials, and evaluating performance of remanufactured or new materials and components.

As described in Section A.9.1, the majority of stockpile stewardship hydrotesting is conducted at LLNL in the Contained Firing Facility (CFF) at Site 300 and at LANL at the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT). The diagnostic capabilities have been developed at these two facilities to meet specific nuclear weapons design and agency needs. Hydrotesting is also conducted at Pantex, SNL/NM, and NTS to support surveillance, production and fundamental equation of state (EOS) research on shock driven Pu. No single existing NNSA hydrotest facility offers all of the diagnostic capabilities or capacity necessary to meet the entire hydrotesting requirements for certifying the safety and reliability of the nuclear weapons stockpile.

The goal of NNSA's National Hydrotesting Program (NHP) is to meet the hydrotest requirements for certifying the safety and reliability of the nuclear weapons stockpile. This will require a wide range of facility capabilities to enable scientists from around the complex to deal with differing issues. In addition, since the large hydrotesting experiments involve the development and detonation of state-of-the-art high explosives many of the hydrotesting facilities are well suited for other uses and are therefore used for experiments which fall outside the scope of large-scale hydrotesting. Conversely, many of the HE R&D facilities are able to support hydrotesting experiments.

A.9.1 No Action Alternative

This section describes the hydrotesting facilities and missions currently being conducted at weapons complex sites. A summary of this information may be found in Section 3.11.

A.9.1.1 *Hydrotesting Facilities at LLNL*

LLNL's Site 300 has been used since 1955 to perform experiments that measure variables important to nuclear weapon safety, conventional ordnance designs, and possible accidents (such as fires) involving explosives. The facilities used for Site 300 firing activities consist of four firing point complexes and associated support facilities. The locations of the four firing complexes are indicated in Figure A.9-1.

The Building 801 Complex comprises Buildings 801A, 801B, and 801D, and encompasses approximately 51,000 square feet. The Building 801 Complex is in the northeast quadrant of the site, called the east firing area.

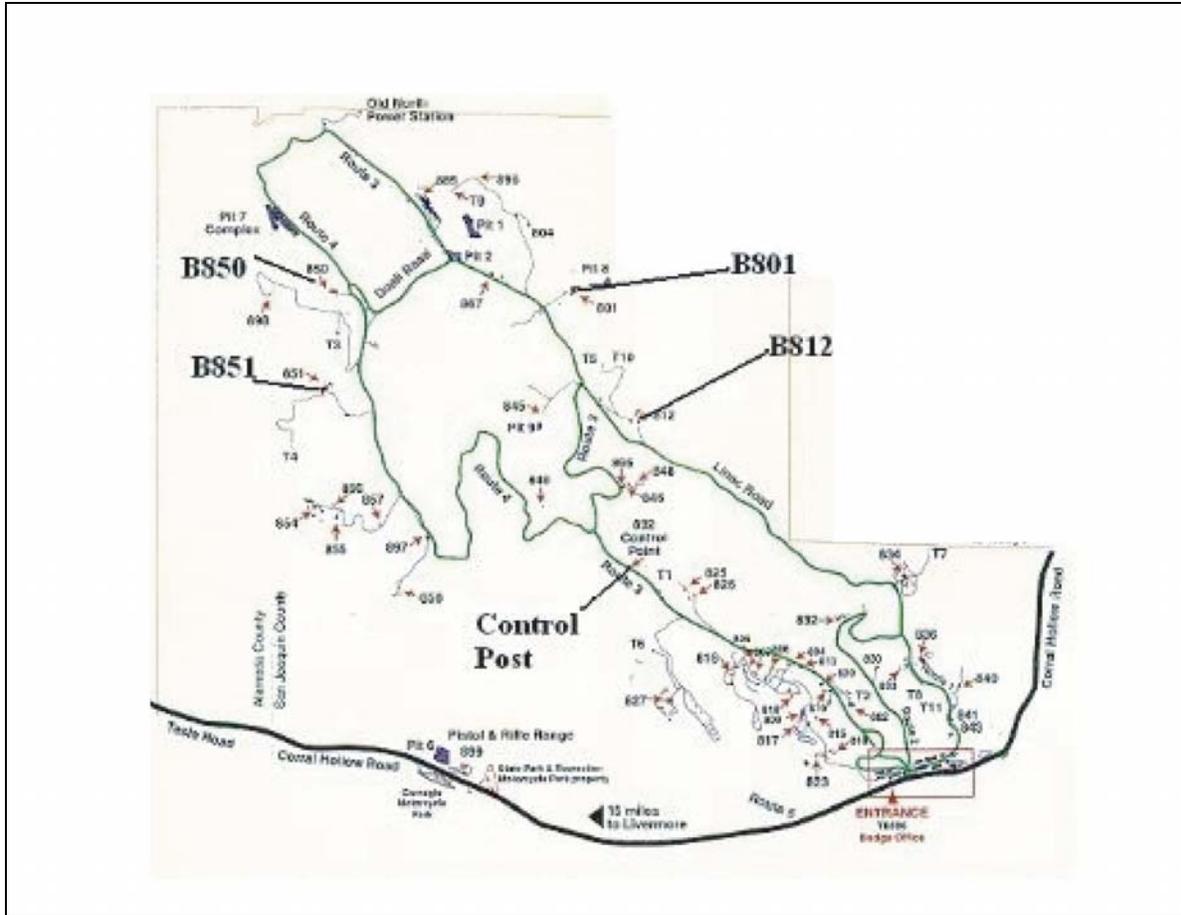


Figure A.9-1 — Locations of B801, B812, B850, and B851 at Site 300 Building 801 Complex

The CFF is located at the Building 801 Complex and is capable of full-scale dynamic weapons radiography (Figure A.9-2). Without the validation provided by underground nuclear tests, LLNL and LANL scientists must utilize the results of experiments conducted here to assure the safety and reliability of our nation's nuclear stockpile as weapons age beyond their originally planned life. The data gathered at the CFF, in conjunction with computer modeling supplies a wealth of information about how the explosives and assemblies in nuclear weapons will behave. The CFF drastically reduces emissions to the environment and minimize the generation of hazardous waste, noise, and blast pressures.



Figure A.9-2 — The Contained Firing Facility at the Building 801 Complex

CFF is a permanent, state-of-the-art firing chamber constructed on the site of Building 801's previous open-air firing table. The CFF additions consisted of four components: a firing chamber, a support area, a diagnostic equipment area, and an office/conference module. The heart of the CFF is the firing chamber. Slightly larger than half a small gymnasium (52 by 60 feet and 32 feet high), the firing chamber contains the blast overpressure and debris from detonations of up to 60 kilograms of cased explosive charges. The inside surfaces of the chamber are protected from shrapnel traveling as fast as 1.5 kilometers per second with 38-millimeter-thick mild steel plates. To permit repetitive firings, all main structural elements of the firing chamber are required to remain elastic when subjected to blast. Detonations will be conducted above a 150-millimeter-thick steel firing surface (the shot anvil) embedded in the floor.

All main structural elements of the firing chamber must be able to withstand repetitive firing as well as meet design safety standards. These criteria require the structure to withstand a 94-kilograms TNT blast, which is the equivalent to 60 kilograms of HE. During the testing phase of the project, "overtests" were run using 75 kilograms of HE to assure that the building can withstand planned 60- kilogram detonations.

A key aspect of the new facility is that the rectangular concrete firing chamber was made with low-cost, conventional reinforcement, as opposed to the labor-intensive, laced reinforcement commonly found in many blast-resistant structures. From a materials standpoint, a spherical chamber shape would have been more blast efficient, but a slightly heavier, rectangular shape was cheaper to construct, provides easier and more desirable setup and working surfaces, and encompasses existing diagnostic systems. The thickness of the reinforced concrete walls, ceiling, and floor of the chamber are 3.9, 4.6, and 5.9 feet, respectively. The support area, which

measures about 16,000 square feet, is for preparing the non-explosive components of an experiment and also for equipment and materials storage, personnel locker rooms, rest rooms, and decontamination showers. It also houses filters, scrubbers, and a temporary waste-accumulation area for the waste products from testing.

In addition to the CFF, Building 801 Complex is designed to obtain explosives test data through the use of the flash x-ray accelerator, designed to accelerate charged particles and generate x-rays; a high-speed camera; and a laser-doppler interferometry operation. About 26,000 additional square feet were recently added to Building 801, also the site of LLNL's recently upgraded 18-megaelectron-volt flash x-ray (FXR) machine. Building 801 contains a variety of other advanced, high-speed optical and electronic diagnostic equipment that together constitute a unique capability to diagnose the behavior of high-explosives-driven assemblies. This equipment measures the velocity of explosively driven surfaces. Other electronic and mechanical systems capable of diagnosing various aspects of the high explosives tests are housed in Building 801 Complex facilities.

A.9.1.1.1 Building 812 Complex

The Building 812 Complex is an active open-air explosives firing facility. The complex includes five buildings (Buildings 812A, 812B, and 812C, 812D [currently inactive], and 812E), two magazines, and an open-air firing table. Building 812E is currently used to repair and test portable x-ray equipment. The current total operational building area is 5,532 square feet.

A.9.1.1.2 Building 850 Complex

The Building 850 Complex is an explosives testing facility. This 5,840 square-foot complex consists of Bunker 850 and a magazine in the northwest quadrant of the site (called the west firing area) and comprises an active firing, explosives test, and high-speed camera repair and test facility. The multidagnostic facility includes a permanently mounted, smooth-bore, 155-millimeter gun for conducting impact experiments, high-speed rotating-mirror cameras, specialized light sources, portable flash x-ray sources, and various other diagnostic equipment.

This facility has an outdoor detonation firing table with gravel covered pads for stands of concrete, wood, or steel. During an experiment, the explosive is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. This debris is potentially contaminated with high explosives, beryllium, and depleted uranium.

A.9.1.1.3 Building 851 Complex

The Building 851 Complex is part of the explosive test facility operations. This 13,681 square-foot complex is in the northwest quadrant of the site and houses specialized laser equipment in a laser room, several laboratories, a portable x-ray room, several shop areas, and offices.

Building 851 Complex includes an open-air firing table of gravel-covered pads with stands of concrete, wood, or steel. During an experiment, an explosive device is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. The debris is potentially contaminated with unexpended explosives, beryllium, and depleted uranium.

Building 851 Complex is equipped for the radiography of explosives devices during detonation testing, including high-speed rotating-mirror cameras; optical interferometry for precise, free-surface velocity measurements; electronic pin timing diagnostics; and various other photo processing operations that involve both manual and automatic film and paper developing.

A.9.1.2 *Associated Support Facilities*

The following list includes facilities that are necessary support facilities for hydrotesting or facilities that are necessary to the operation of Site 300 as a hydrotesting facility.

- Site 300 HE casting and machining facilities (covered under HE R&D)
- Site 300 Shaker and Environmental test facilities (covered under Environmental Testing)
- Site 300 supporting magazines, shops, offices, observation posts, guard stations, and materials management

Four other facilities which do not conduct hydrotesting experiments, but are necessary for supporting the hydrotest facilities are not addressed here, since they are addressed in the HE R&D or Environmental Testing Sections. These four facilities are as follows:

A.9.1.2.1 **Building 806 Complex**

The Building 806 Complex is located in the process area in the southeast quadrant of Site 300 and consists of Buildings 806A and 806B. This 8,314 square foot complex is used for machining and inspecting explosive parts. Explosives are also temporarily stored at the complex.

A.9.1.2.2 **Building 810 Complex**

The 5,079 square-foot Building 810 Complex is located in the process area, in the southeast quadrant of Site 300, and consists of Buildings 810A, 810B, and 810C. Building 810A and 810B are used to assemble explosives parts into test components. Building 810A is also used for the temporary storage of explosives components. Building 810C is used for storing nonexplosive parts for test components. The test components may also include beryllium, lithium, tritium, thorium, or depleted uranium.

A.9.1.2.3 **Building 823 Complex**

The 2,748 square-foot Building 823 is in the southeast quadrant of Site 300 and consists of two buildings. Building 823A contains office space, a darkroom with a radiographic film processor, and control panels for three real-time imaging systems housed in Building 823B. These units include a transportable 9-million-electron-volt (MeV), a 2-MeV, and 120-thousand-electron-volt (KeV) x-ray machines. Building 823B contains staging and real-time imaging systems, and a doubly encapsulated cobalt-60 isotope source in a lead-shielded radiographic projector. The isotope source is no longer operational and is being stored in Building 823 until it is sent back to the manufacturer for disposal. This complex provides the means for radiographic inspection of

pressed explosives parts and weapon test components. After x-ray film has been exposed in Building 823B, it is processed through the automatic film processor in Building 823A.

Building 823B has an earthen berm on two sides that provides radiation shielding for the office/control building located east of the berm. The Varian 9-million-electron-volt LINAC is used in Building 823B to beam into the open space directly to the west.

A.9.1.2.4 Building 845, Explosive Waste Treatment Facility (EWTF)

The EWTF is a 666 square-foot facility located in the north-central section of Site 300. The EWTF replaced Building 829, which had been closed. The EWTF consists of an earth-covered control room, Building 845A; an inert storage area, Building 845B; a thermal treatment unit (burn cage), an open burn unit (burn pad), and an open detonation unit (detonation pad). The EWTF is permitted under a hazardous waste permit issued by the California Department of Toxic Substance Control for the treatment of explosives waste. Treatment of other hazardous, radioactive, or mixed waste materials is prohibited.

A.9.1.3 *Hydrotesting Facilities at LANL*

The Hydrotesting Facilities at LANL are located within one of the five technical areas (TAs) that contain HE R&D facilities. TA-15, located approximately 2.6 miles from the main administrative area, in the central portion of LANL, is the location of two firing sites: the DARHT, which has an intense high-resolution, dual-machine radiographic capability, and Building 306 (R306), a multipurpose facility where primary diagnostics are performed (see Figure A.9-3). Currently, there exists no permanent radiographic capability at R306. Figure A.5.1-4 shows the location of TA-15 at LANL. The Pulsed High Energy Radiation Machine Emitting XRays (PHERMEX) Facility, a multiple-cavity electron accelerator capable of producing a very large flux of x-rays, was disabled in 2004. D&D of this facility has not yet been completed. LANL conducts about 100 hydrotest experiments a year.

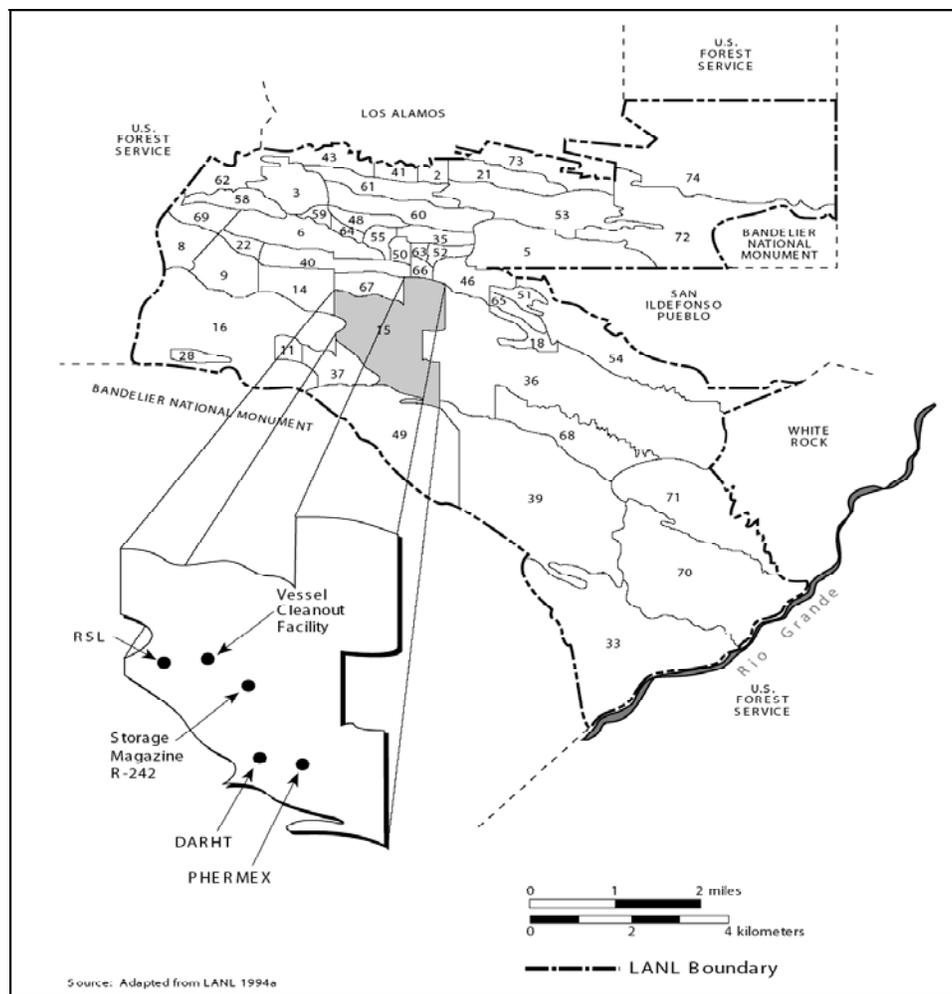


Figure A.9-3 — TA-15 at LANL

DARHT is a state-of-the-art, full scale radiography facility and is used to investigate weapons functioning and systems behavior in nonnuclear testing. DARHT is designed to include two high intensity x-ray machines whose beams cross at right angles. Each machine has been designed to generate radiographs of far higher resolution than anything previously obtainable--the resolution required for stockpile stewardship without underground nuclear testing. The first axis became operational in 1999 and the second axis was tested in late 2002. In 2003, failing accelerator cells of the DARHT Facility Axis II began to be refurbished to bring them up to design specifications. The second axis is scheduled to be operational in May 2008. For the first time ever in this country, the dual-axis nature of the facility will allow researchers to obtain three-dimensional as well as time-resolved radiographic information.

The DARHT x-ray machines are based on linear induction accelerators, a technology derived from that of the Fusion Energy Research Program at Lawrence Berkeley Laboratory. An intense pulsed electron beam strikes an x-ray target, creating x-rays. The first machine provides a pulse 60 nanoseconds long. In the second machine, a "macropulse" 1.6 microseconds long will be chopped into four shorter pulses, providing four snapshots in quick succession. One of the pulses

from the second axis will be able to be synchronized with that of the first axis so that three-dimensional information can be reconstructed. Figure A.9.2-4 shows the DARHT facility.



Figure A.9-4 — The DARHT at LANL

TA-15 also includes office space for approximately 100 staff in buildings 494, 484 and 183. The DARHT uses office space at Building R306. Also in TA-15, is the Vessel Preparation Building that serves as a facility to clean out the steel vessels used in hydrodynamic testing. The Vessel Preparation Area also includes a low-energy x-ray calibration facility, a carpenter shop, and a warehouse.

Additional facilities required to support hydrotesting are located in six other TAs, at LANL. The Test Device Assembly Building is one such facility. The Test Device Assembly Building provides the capacity to assemble test devices ranging from full-scale nuclear-explosive-like assemblies (where fissile material has been replaced by inert material) to materials characterization tests. In addition to assembly operations, other facilities conduct explosives testing support and radiography examinations of the final assemblies. Other activities conducted at these support facilities support HE R&D. LANL also performs research, development, and fabrication of High-Power Detonators at these facilities.

A.9.1.4 *Hydrotesting Facilities at Pantex, SNL/NM, and NTS*

Smaller hydrotest facilities, which are not capable of dynamic weapons radiography, are also located at Pantex, SNL/NM, and NTS. Both Pantex and SNL/NM have several outside blasting table facilities which are primarily used for HE R&D activities and can only handle small hydrotesting experiments. NTS has several facilities which are utilized for very large explosion-type experiments. The BEEF is one such facility at NTS which is the only NNSA facility where some experiments, due to the amount of HE utilized, can be conducted. Three additional and similar facilities, at Pantex, conduct both HE R&D and hydrotesting experiments. All three will require upgrades within the next several years. The upgrades will include two open-air firing sites with bunkers and one facility containing indoor firing chambers. SNL/NM has several small HE R&D firing sites and the Explosives Component Facility and ancillary facilities, which have been used for hydrodynamic tests. Because none of SNL/NM's facilities are used primarily for hydrotesting, they are described more completely in the No Action Option for HE R&D in Section 3.7.2.1. The Explosives Component Facility and its ancillary locations support the design, development, and life cycle management of all explosive components outside the nuclear package.

A.9.2 **Action Alternatives**

A.9.2.1 *Downsize in Place Alternative*

This option would continue hydrotesting activities by consolidating LANL activities at the DARHT, consolidating LLNL activities at Building Complex 801 and the CFF, closing some of the smaller facilities at both of these sites, and moving tests requiring larger amounts of HE to the BEEF at NTS and LANL. Although outside the scope of large-scale hydrotesting, six firing sites at Pantex, used for HE production, development, and surveillance, and also previously used on an intermittent basis for hydrotesting experiments, will be decommissioned and decontaminated. SNL/NM would continue to operate several small HE R&D firing sites and the ECF and its ancillary locations, which would be available for hydrodynamic tests.

This alternative would entail the closure of a number of facilities both at LLNL and LANL. It could also entail the closure of facilities at Pantex and SNL/NM. At LLNL, this would entail the closing of at least Building 812 Complex, Building 850 Complex and Building 851 Complex. The associated support facilities probably would not be impacted by this alternative. At LANL, this would entail the closing of all hydrotesting facilities except those located on TA-15. At TA-15, several of the support facilities would be consolidated into one facility and closure of the idle PHERMEX would continue. At Pantex, at least six outdoor burn areas would be closed. At SNL/NM, at least three outdoor burn areas could be closed if their joint sponsor program, HE R&D, were to concur with a decision from the Hydrotesting Program that these facilities were no longer needed. NTS would maintain operations at BEEF and continue DPE operations at U1a.

Closure of over a dozen facilities would entail a substantial clean-up and D&D effort. Although not heavily contaminated, these facilities all have a substantial amount of reinforced concrete and steel structures designed to withstand sizeable HE explosions. It is estimated that at least 100,000 square feet of hardened concrete and steel structures would have to be dismantled, razed and disposed of.

A.9.2.2 *Consolidation at LANL*

This option integrates all large-scale hydrotesting at the single location of LANL. Since LLNL and NTS both have required capabilities not presently at LANL, this alternative would entail maintaining those facilities presently at LLNL until such time that a new facility which has the capabilities presently at the CFF and Building 801 Complex at LLNL could be constructed. For a description of what such a new facility entails, see Section 3.5.7.1, Building 801 Complex. There are three potential sites at LANL where such a “CFF-like” facility could be constructed. Figure A.9-5 shows these three alternative locations at LANL.

Until such time as these capabilities could be established at LANL, the CFF capabilities, at LLNL, would have to remain in operation. In addition, it is not anticipated that it would be possible to transfer the capability to conduct experiments requiring very large amounts of HE, presently being conducted at the BEEF, to LANL. Accordingly, under a consolidation of hydrotest capabilities at LANL, the BEEF would still be required to maintain its operational status at NTS and continue DPE operations at U1a.

This alternative would entail a large amount of clean-up and D&D associated with the closure of all hydrotest facilities at LLNL, SNL/NM (based on a joint agreement of the HE R&D Program and the Hydrotesting Program), and Pantex and a substantial number of facilities at LANL. It is estimated that this alternative would entail the closure and clean-up of close to 170,000 gross square feet of hardened concrete and steel structures designed to withstand very large HE explosions.

In this process it would make sense to collocate distant support facilities (storage, staging and assembly) during the construction of such a facility. The construction of such a facility would involve a two to three year process resulting in an 8,000-12,000 square foot primary structure, with two to three smaller support buildings situated on a five to seven acre site.

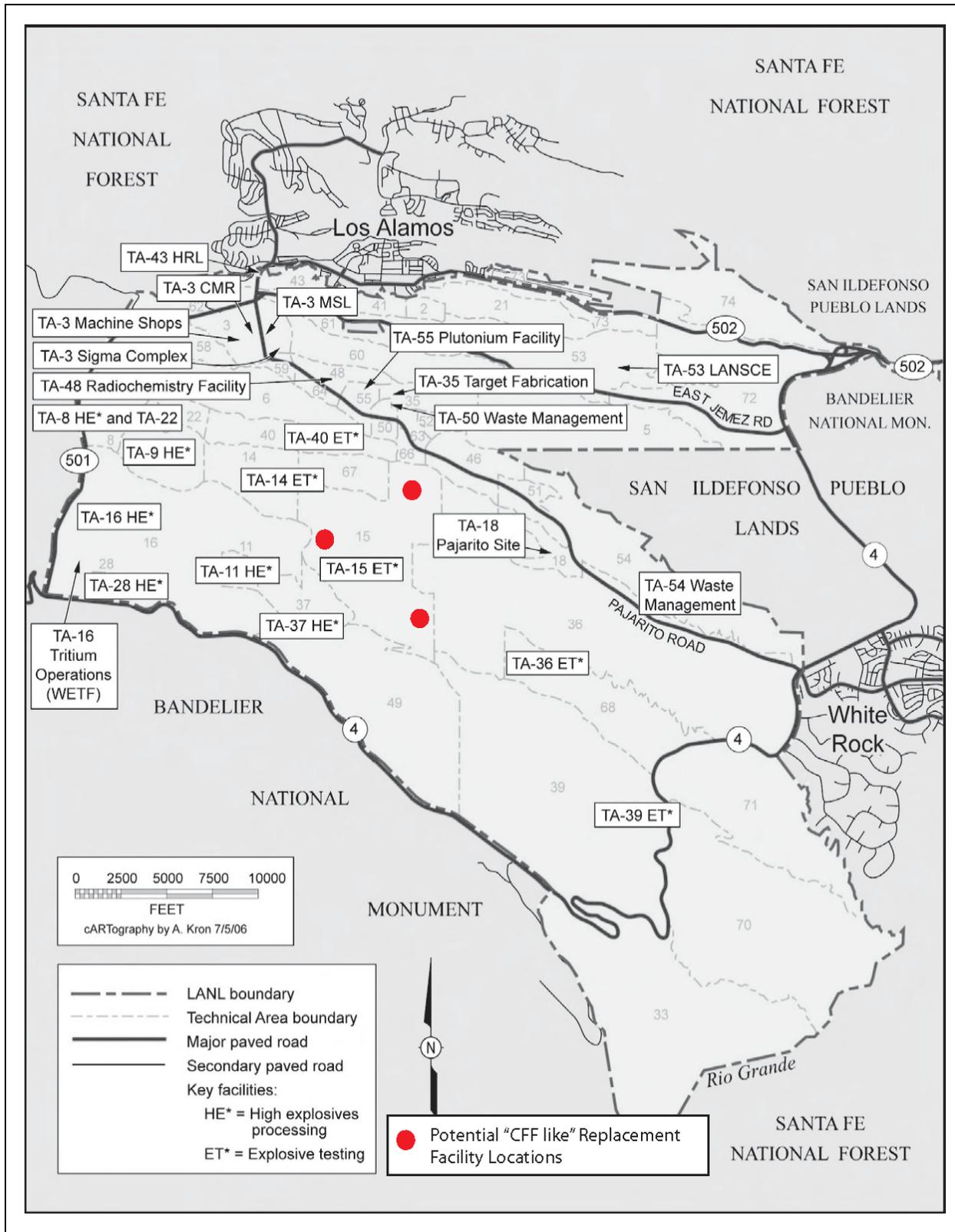


Figure A.9-5 — Potential Locations of “CFF-Like” Replacement Facility at LANL

A.9.2.3 *Consolidation at NTS – A Next Generation Alternative*

The next generation hydrodynamic experimental facility would be an improved SNM-capable radiographic facility that would provide for imaging on two or more axes, each with multiple time frame capability, though the number of axes and time frames is still subject to requirements definition and design evolution. The facility would be used to better reveal the evolution of weapon primaries implosion symmetry and boost-cavity formation under normal conditions and in accident scenarios. Due to the nature of the dynamic plutonium experiments and hydrodynamic testing with SNM to be conducted at the facility, the next generation hydrodynamic experimental facility would probably be considered for location at NTS only.

A next generation hydrodynamic experimental facility, either aboveground or underground, would require new building construction and considerable infrastructure (i.e., facilities, equipment, and personnel) in support of test events. Existing infrastructure at NTS might be used to the extent practical. The construction and operational requirements for the next generation hydrodynamic test facility might be greater than that of the DARHT Facility. The impacts associated with construction and operation of facilities based on the different technology approaches could be significantly different. For example, the acreage required could be comparable to or somewhat larger than the 9 acres of land resources required for DARHT, but use of proton radiography could require an accelerator comparable in scale to the kilometer-long LANSCE or to other large accelerators operated by DOE. Based on information on the DARHT Facility, it is estimated that over 250 additional workers would be required for construction and operation of the next generation hydrodynamic test facility. Construction and operation of the next generation hydrodynamic test facility is not anticipated to use large quantities of water. New construction activities would be expected to result in an increase in short-term air emissions. Operation of the next generation hydrodynamic test facility would be expected to have a minimal impact on the air quality considering the impacts projected for DARHT operations. The next generation hydrodynamic test facility would not be expected to impact existing community infrastructure or services in the area; however, depending on the specific design, a proton accelerator could require significant electrical power resources. Waste volumes would not be expected to increase substantially over existing operations at NTS, and waste management associated with dynamic experiments with plutonium at NTS could require additional infrastructure.

In addition to the next generation facility which would be constructed for the consolidation at NTS Alternative, an alternative to also construct a new CFF-like facility at NTS in the 2040 timeframe is also being considered. This facility would be similar to the facility described in the LANL Consolidation Alternative (see Section 3.11.2.2).

A.10 **MAJOR ENVIRONMENTAL TEST FACILITIES**

Environmental testing supports a primary DOE/NNSA mission of maintaining and demonstrating the safety, reliability and performance of the nation's nuclear weapons systems. The environmental testing facilities (ETFs) to support environmental testing are divided into two categories – base ETFs and system ETFs. The base ETFs are those facilities and laboratory scale (or “table-top”) items used to evaluate components or subassemblies in the environments defined

by the Stockpile-to-Target Sequence (STS) and the Military Characteristics requirements for each nuclear weapon in the enduring stockpile. Every laboratory within the DOE/NNSA complex has some base capability essential for day-to-day operations. The system ETFs are those facilities used to test full-scale weapons systems (with or without SNM or A/D) or those unique major facilities that are applied to development and certification of components, cases, accessories, subsystems and systems. This SPEIS is focused on the subset of base and system environmental testing facilities, referred to as “major” ETFs that are costly to maintain or have potentially significant environmental impacts. Major ETFs are located at SNL, LANL, LLNL, and NTS.

Section A.10.1 discusses the No Action Alternative, which would continue operations at the existing facilities at SNL, LANL, LLNL, and NTS. Section 3.12.2 discusses an alternative which would downsize facilities in-place. Section 3.12.3 discusses an alternative that would consolidate major ETFs at one site (NTS or SNL). The analysis of the environmental impacts of the alternatives is contained in Section 5.17.

Major ETF Alternatives	
1	No Action (Maintain status quo at each site. All facilities must be maintained, or upgraded to meet current safety and security standards).
2	Downsize-in-Place (downsize - no duplication of capability within a given site, but there may be duplication from site to site - phase out aging and unused facilities).
3	Consolidate ETF Capabilities at One Site (NTS). Entails construction of new facilities at consolidation site. This alternative also includes an option to move LLNL Building 334 ETFs to a facility at Pantex.

A.10.1 No Action Alternative

Under the No-Action Alternative, DOE/NNSA would continue to operate the existing ETFs at the current levels of activity. Only those upgrades and maintenance required to allow for the current activities would take place. ETFs are located at three National Laboratories (SNL/NM, LANL, and LLNL) and the NTS. It should be noted that ETF laboratories and capabilities also exist at Pantex and SRS. These facilities, however, are not involved in the R&D or weapons/component design process, but instead, utilizes ETF capabilities as an integral part of the production/certification process. Without these ETF capabilities, these sites could not complete their mission. Accordingly they have not been included in this analysis. Table A.10-1 lists the existing ETF facilities at the three DOE/NNSA laboratories and the NTS.

Table A.10-1 — ETFs at LANL, LLNL, Sandia, and NTS

Facility	Size (ft²)
LANL	
K Site Environmental Test Facility	8,452
Weapons Component Test Facility	22,075
Thermo-Conditioning Facility	6,795
PIXY with Sled Track	6,245
Total	43,567 ft²
SNL	
Simulation Tech Lab (HERMES and RHEPP)	56,886
PBFA Saturn and Sphinx	42,052
ACRR and Sandia Pulsed Reactor Facility	13,793
Radiation Metrology Lab`	1,774
Gamma Irradiation Facility	12,514
Low Dose Rate Gamma Irradiation Facility	206
Auxiliary Hot Cell Facility	13,358
Outdoor Centrifuge Complex	12,671
25 Foot Centrifuge	135
Model Validation and System Cert Test Ctr	31,990
Complex Wave Test Facility	2,327
Light Initiated HE Test Facility	4,138
10,000 Foot Sled Track	8,900
Aerial Cable Facility and Control Building	5,022
Radiography Building and Nondestructive Test	5,348
Mobile Guns Complex	2,400
Thermal Test Complex	15,712
Vibration Acoustics and Mass Properties Lab	8,434
Engineered Sciences Experimental Facility	19,416
Component Environ. Test & Adv. Diagn. Fclty.	44,091
Electromagnetic/Environ./Light Strategic Def	<u>103,185</u>
SNL California Environmental Test Complex	<u>65,964</u>
Total	470,316 ft²
LLNL	
Dynamic Testing Facility (836 Complex)	12,913
Thermal Test Facility (834 Complex)	4,289
Hardened Engineering Test Bldg (334 in Superblock)	6,300
Total	23,502 ft²
NTS	
Device Assembly Facility Area (ETF Portion only)	4,790
U1a (Above ground portion only)	2,100
Total	6,890 ft²
Complex Total	544,275 ft²

A.10.1.1 Environmental Test Facilities at LANL

LANL has four primary ETFs located within three different Tech Areas: (1) the K Site ETF; (2) the Weapons Component Test Facility, (3) the Thermo-conditioning Rest House; and (4) the PIXY X-Ray Building with Sled Track. The K Site is a large complex consisting of eleven major structures and is located on TA-11. The total size of all facilities at the K Site is 8,452

square feet. Both the Weapons Component Test Facility and the Thermo-Conditioning Rest House are located at TA-16. Together these two facilities total 28,870 square feet. The Pulse Intense X-Ray (PIXY) facility is a 6,245 square feet facility located on 194 acres at TA-36. In all the ETF structures at LANL total 43,567 square feet and are operated by a staff of about 30. Figure A.10-1 shows the location of the LANL ETF facilities. A more detailed description of this facility is as follows:

K Site Environmental Test Facility

The K Site ETF consists of eleven separate structures and is located at TA-11. In all, these eleven structures consist of a total of about 8,452 square feet and occupy a total area of about 10 acres. LANL also has a substantial number of closed ETF facilities which are a function of old age and past downsizing programs. These facilities occupy an area of about 50 acres and are in the process of undergoing D&D and being cleaned up. The following is a description of the eleven existing ETF facilities presently operating at the K Site ETF at LANL:

11-0001 Storage Building

This building was built in 1945 and is used for storage of test equipment that is used to support many of the laboratory and field testing done by LANL/ WT-4.

11-0002 Test Building

TA-11-0002 was built in 1945 and is being used for the angular acceleration test apparatus. It contains various data acquisition systems used to support the angular acceleration testing, as well as other various tests that are conducted in building 11-0002. It has been used in the past for the air-bearing currently housed in TA-16-207, as well as other various tests. It is one of three, 11-0002, 0003 and 0004, approved bunkers for personnel protection during high hazard test operations.

11-0003 Control Building

TA-11-0003 was built in 1945 and is currently used as the control room for the TA-11 firing site. It was also used as the control room for the drop tower and burn pit described below. There are various data acquisition systems used to support tests conducted at the drop tower, firing site and burn pit. It is one of three, 11-0002, 0003 and 0004, approved bunkers for personnel protection during high hazard test operations.

11-0004 Control Room

TA-11-0004 was built in 1945 and is currently used as the control room for the shock and vibration testing conducted in 11-0030. It contains various data acquisition systems used to support shock and vibration testing, as well as other various tests that are conducted in the building 11-0030. There are capabilities in 11-0030 for remote control of shock and vibration testing in 11-0030. It is one of three, 11-0002, 0003 and 0004, approved bunkers for personnel protection during high hazard test operations.

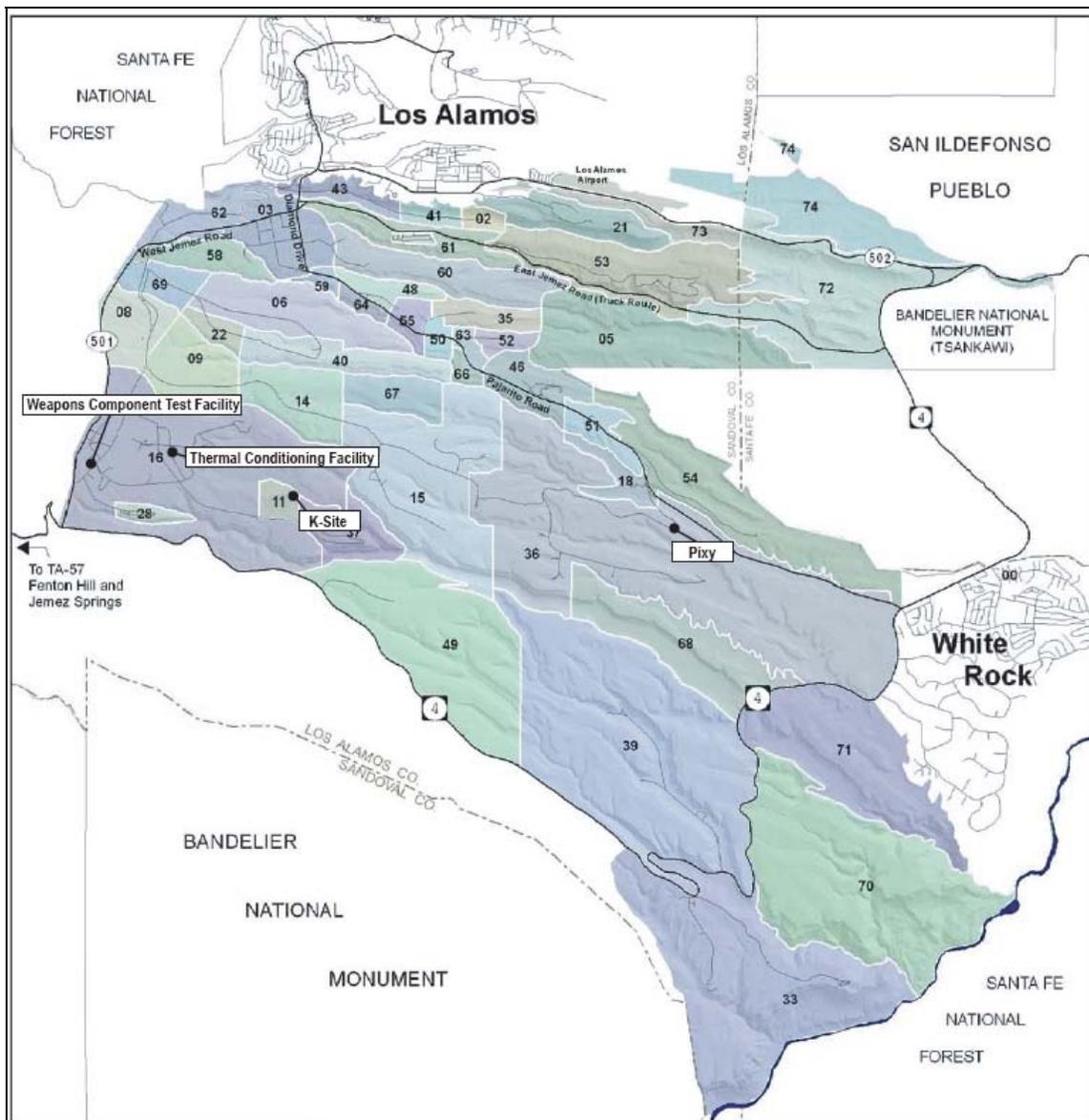


Figure A.10-1 — Location of LANL ETFs

11-0024 Office/Shop/Assembly Building

TA-11-0024 was built in 1957 and is currently used as an office space for five ETF's, and has housed as many as eight. It is also used as a staging and preparation area for non-hazardous tests. It contains data acquisition systems used to support many tests that are performed by LANL/WT-4. It contains a small staff shop used for basic fixture manufacture and modification.

11-0025 Drop Tower

TA-11-0025 is a 165-foot drop tower and was built in the early 1960's. It was used to drop test units from as high as 150 feet. Typical test units included full-up weapons systems, shipping

containers as well as other DOE and DoD test units. The drop tower was also used for HE sensitivity test, where HE was dropped from ever-increasing heights until detonation occurred. Acceleration, strain, overpressure and various other data were acquired during testing activities. The drop tower was decommissioned in 2005.

11-0030 Shock and Vibration Test Facility

TA-11-0030 was built in 1957 and now houses the shock and vibration facilities. There are two vibration exciters, an Unholtz-Dickie T-1000 and an Unholtz-Dickie T-4000. These vibration exciters are controlled remotely from 11-0004. Ambient, hot or cold tests can be performed; either alone or in conjunction with shock or vibration on the vibration exciters. 11-0030 also houses a high-g drop machine. This drop machine is approximately 22 feet tall, with a capable drop height of twenty feet. Ambient, hot or cold shock tests can also be performed. TA-11-0030 is also used for free-fall drop testing. Testing with up to 100 pounds of HE can be performed in TA-11-0030

11-0030A Shock and Vibration Amplifier Room

TA-11-0030A houses the power amplifiers used for the Unholtz-Dickie vibration exciters detailed above.

11-0033 Equipment Room

TA-11-33 was built in 1962 and houses an air compressor that supplies house air to TA-11-0030 and TA-11-0030A.

11-0036 HE Magazine

TA-11-0036 was built in 1966 and is a transient HE magazine used for short term storage of HE prior to being used for testing at TA-11-0025.

11-0076 - TA-11-0076 was built in ~2004 and is an awning that covers a 2500 gallon liquid nitrogen Dewar used for thermal testing in TA-11-0030.

Table A.10-2 — K Site Environmental Test Facility

	Consumption/Use
Electrical usage	750 KW max
Water usage	1,000,000 GPY
Site size (acres)	10
Building footprint (sq. feet)	8,452
Employment (no. of workers)	3
Total	3
Rad Workers	3
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	0
Non-hazardous (yd ³)	0
Emissions	
NAAQS (tons/yr)	No Monitoring
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air pollutants (tons/yr)	No Monitoring

Weapons Component Test Facility

The Weapons Component Test Facility is located at TA-16. Originally built in the 1950's, this 22,075 square foot building was completely refurbished in the early 1990's. The facility is located on about an acre and a quarter site and supports nuclear weapons stockpile surveillance by providing high-fidelity testing for explosive valves, the portable high-speed data acquisition systems and test instrumentation, and QC-1 R10 compliant testing. An Advanced Diagnostics capability is housed in 16-0207 to develop, design, fabricate, qualify, field, and analyze new measurement applications. These systems include HE Radio Telemetry and fiber optic sensors. A main focus of this capability is not only flight testing of our weapon systems, but the development of new fiber based measurements for a broader customer base. The measurements capabilities include quasi-static component and miscellaneous laboratory and field testing and data analysis on many different systems and components. The data acquisition systems used are NIST-traceable and meet A2LA requirements and are capable of up to 120 channels of long-term logging and high-speed data collection of up to 1 sample per microsecond.

Table A.10-3 — Component Test Facility

	Consumption/Use
Electrical usage	450KW
Water usage (gallons per year)	400,000
Site area (acres)	1.25
Building footprint (square feet)	22,075
Employment (no. of workers)	
Total	24
Rad Workers	18
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0.25
Hazardous(yd ³)	0
Non-hazardous (yd ³)	0
Emissions	
NAAQS (tons/yr)	No Monitoring
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air pollutants (tons/yr)	No Monitoring

Thermo-Conditioning Facility

Also located at TA-16 is the Thermo-Conditioning Facility. This 6,795 square foot facility, located of about a three quarter acre site, houses the thermal conditioning capabilities, consisting of a walk-in thermal chamber and a small stand alone thermal chamber. HE and Non-HE tests can be performed with up to 500 pounds of HE. There are also tensile test machines that can be used in conjunction with thermal testing.

Table A.10-4 — Thermo-Conditioning Facility

	Consumption/Use
Water usage	250,000 GPY
Site area (acres)	.75
Building floor space (square feet)	6,795
Employment (no. of workers)	2
Total	
Rad Workers	2
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	0
Non-hazardous (yd ³)	
Emissions	
NAAQS (tons/yr)	No Monitoring
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air pollutants (tons/yr)	0

Pulsed Intense X-Ray Facility (PIXY) with Sled Track

The Pulsed Intense X-Ray Facility (PIXY) is a world class radiographic facility with a combined sled track and gun range capability. This 6,245 square foot facility, located on a large site of about 194 acres. The x-ray capability of the facility is less than 100 ns pulse and stops all motion, even at hypersonic speeds. The X-Ray penetrates 6 inches of steel and the timing of PIXY and other diagnostics to 3 nanoseconds. The facility is capable of high speed photograph to 2,000,000 frames per second. There are oil storage tanks that support PIXY at this site.

Table A.10-5 — Pulsed Intense X-Ray Facility (PIXY) with Sled Track

	Consumption/Use
Water usage	Minimal
Site area (acres)	194
Building and structure footprint(ft ²)	6,245
Employment (no. of workers)	
Total	0
Rad Workers	0
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	0
Non-hazardous (yd ³)	0
Emissions	
NAAQS (tons/yr)	0
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

A.10.1.2 Environmental Test Facilities at LLNL

As a nuclear weapons design facility, LLNL has been involved with weapons testing virtually since its inception in 1952. However, the construction of large scale environmental testing facilities didn't begin until the late 1950's and early 1960's. By 1970 there were a total of 37 buildings associated with weapons testing with approximately 48 people assigned to weapons testing activities. Weapons testing at LLNL was at its peak in 1985 with 46 buildings and roughly 55 people working on testing related activities. Today LLNL's ETF program consists of seven people operating three facilities consisting of nine operational buildings. These three facilities consist of a total area of 23,502 square feet occupying a total site area of seventeen and three quarter acres. There is not a specific and dedicated crew of test technicians or engineers assigned to any of the individual test facilities listed below. Rather, the Weapons Test Group (WTG) that operates the ETF facilities has stewardship to maintain all the facilities and provide support staff to the appropriate building in order to conduct and complete the necessary testing. The WTG has a total of 6 workers, which provide support over all the facilities listed below. Specifically there are 3 test technicians and 3 test engineers. The technicians and engineers rove to each of the buildings on an "as needed" basis to perform the required testing. The following is a description of the three LLNL ETF facilities:

Building 334 (Hardened Engineering Test Building)

Building 334 is a 6,300 square foot facility located on a two and a half acre site in the Superblock section of the LLNL main site. This facility is often referred to as the Hardened Engineering Test Building (HETB). The building is primarily used for environmental testing of SNM. One half of the building is the Radiation Measurement Facility, including the Intrinsic Radiation (INRAD) Bay and the other half is the ETF, consisting of the Engineering Test Bay (ETB). The two bays are separated from each other by a thick concrete wall. The HETB is a unique facility within the Nuclear Weapons Complex (NWC). With regard to INRAD measurement testing, it is currently the only building within the NWC that allows intrinsic radiation detection of SNM on configured assemblies (outside of drums or containers) and without significant background radiation present. The INRAD facility supports measurement operations for Nonproliferation, Homeland and International Security Division (NHI), the Accident Response Group (ARG), the Joint Technical Operations Team (JTOT), and radiation detector development work. With regard to environmental testing, Building 334 is currently the only building within the NWC that can facilitate environmental testing of SNM (i.e., pits and secondary assemblies containing SNM). Environmental testing includes vibration, shock, thermal conditioning, or combinations of these environments. Figure A.10-2 shows the location of Building 334 in Superblock, at LLNL.

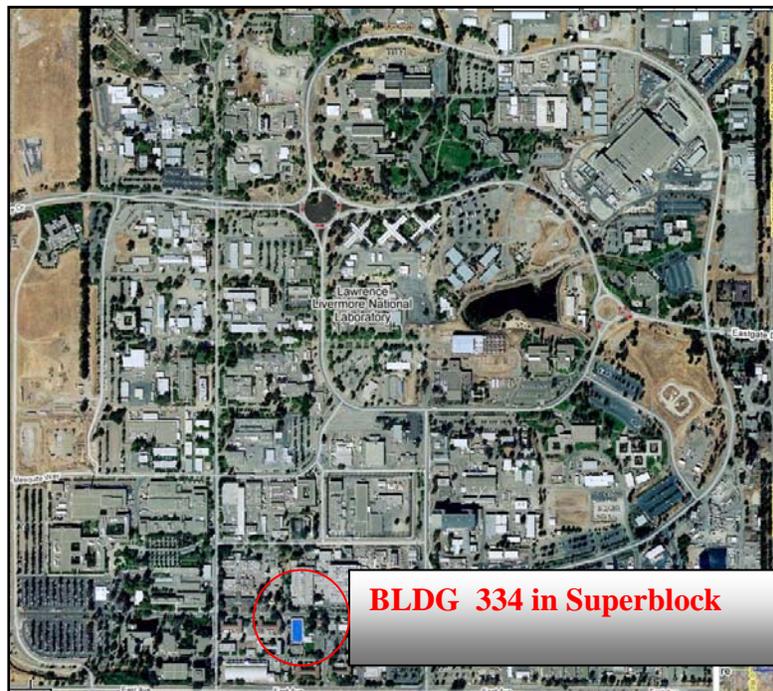


Figure A.10-2 — Building 334 in Superblock at LLNL

Table A.10-6 — Data Table for Building 334

Date of Construction	June 1985
Type of Building	Reinforce concrete
Building Footprint (ft ²)	6,300
Annual Electrical Energy Use (MWh)	~ 480
Water Requirements (gal per year)	< 2000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies)
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0.006
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0



Figure A.10-3 — Build. 834 Complex and Build. 836 Complex at Site 300

Building 834 Complex at Site 300

The 834 Complex is comprised of four buildings totaling 4,289 square feet located on an 11.5 acre site in the Site 300 area of LLNL. The facilities located at this complex are used for thermal and humidity testing of weapons components and systems. The original layout had a total of 12 buildings, but through downsizing efforts now only 4 are used for thermal testing (1 control room, 2 test cells, and 1 temporary storage magazine). The strength of the test facilities at the 834 Complex is the ability to test large weapon assemblies with large quantities of HE. In addition to testing of HE, the 834 Complex has the authorization basis to test other hazardous materials commonly found in Legacy weapon assemblies. Figure A.10-3 shows the location of Building 834 Complex, at Site 300, at LLNL.

Table A.10-7 — Data Table for Building 834 Complex

Number of ETF Buildings	4
Date of Construction	June 1960
Type of Building	Reinforce concrete and modular steel framed
Site area (acres)	11.45
Combined Building Square Footage (ft ²) (combined for all 4 buildings)	4,289
Annual Electrical Usage MWh	~ 400
Water Requirements (gal per year)	< 4000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies)
NAAQS emissions	
CO (tons/yr)	0.0026
NOx (tons/yr)	0.0120
PM10 (tons/yr)	0.0009
SOx (tons/yr)	0.0008
HAPs (tons/yr)	0.0002
POC's (tons/yr)	0.0010
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Building 836 Complex at Site 300

The Building 836 Complex consists of four buildings, with a total size of 12,913 square feet, located on a three and three quarter site in the Site 300 Area of LLNL. This facility is used for dynamic testing of full-up weapon assemblies containing high explosives or other hazardous materials. The four buildings include: 1 control room, 2 test cells, and 1 storage building. The strength of the test facilities at the 836 Complex is the ability to test large weapon assemblies with large quantities of live HE. The authorization basis also allows for testing of other hazardous materials commonly found in Legacy systems. The types of testing performed in the complex are vibration, shock, spin, jerk, and some impact. The test cells are also capable of providing simultaneous thermal conditioning during testing. Figure A.10-4 shows the location of Building 836 at Site 300, at LLNL.



Figure A.10-4 — Building 836 Complex at LLNL

Table A.10-8 — Data Table for Building 836 Complex

Number of ETF Buildings	4
Date of Construction	June 1970 (3), June 1982 (1)
Type of Building	Reinforce concrete
Site area (acres)	3.75
Combined Building Footprint (sq. ft.) (combined for all 4 buildings)	12,913
Annual Electrical Use (MWh/yr)	~ 450
Average Water Requirements (gal/yr)	< 4000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies)
NAAQS emissions	
CO (tons/yr)	0.0039
NOx (tons/yr)	0.0182
PM10 (tons/yr)	0.0013
SOx (tons/yr)	0.0012
HAPs (tons/yr)	0.0003
POC's (tons/yr)	0.0015
Lead (tons/yr)	0
OZONE (tons/yr)	0

A.10.1.3 Environmental Test Facilities at Sandia National Laboratory

SNL/NM has nineteen major ETF complexes, each with multi-operational capability. These facilities have a combined footprint of 462,390 square feet. These facilities as shown in Figure A.10-5 are briefly described below.

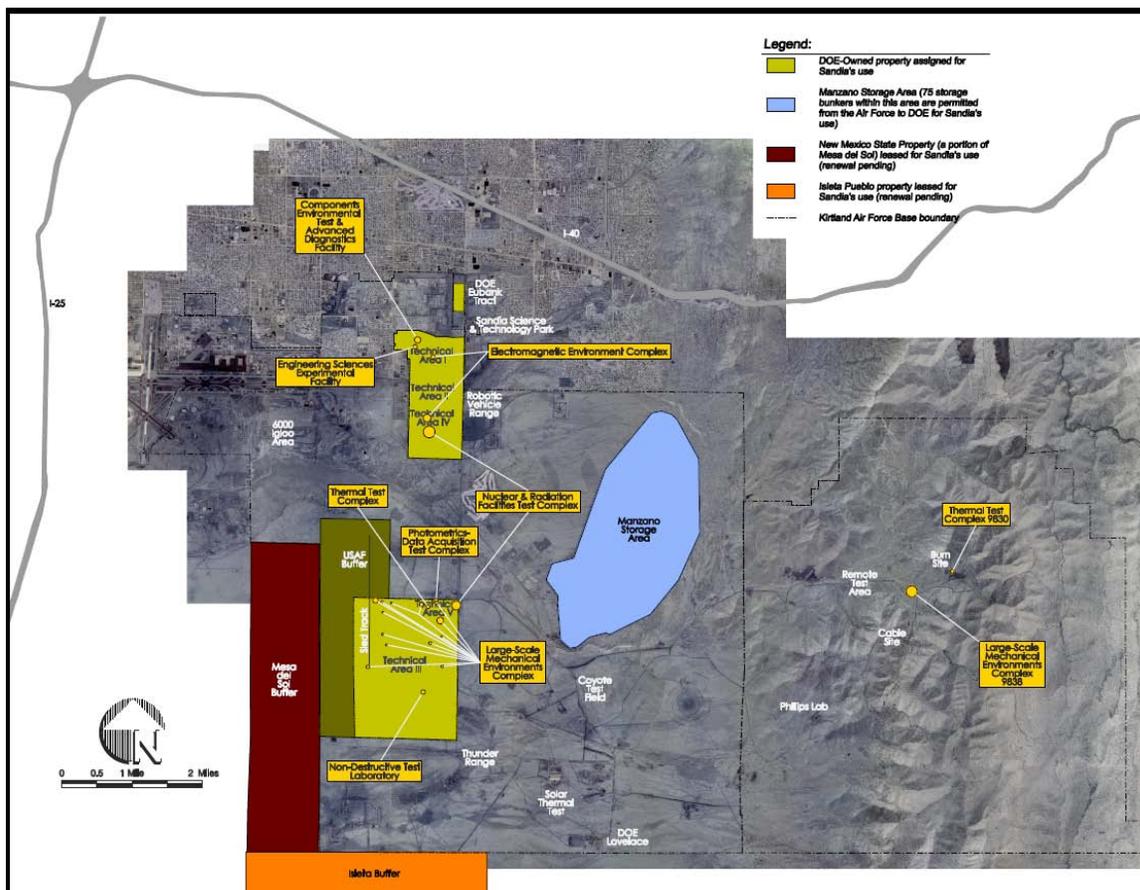


Figure A.10-5 — ETF Facilities at SNL/NM

Simulation Tech Lab Hermes III and Repetitive High Energy Pulsed Power

HERMES III is a 56,886 square foot flash x-ray facility, located on about fourteen and a half acres. HERMES III produces high-energy x rays (up to ~20 MeV) by the bremsstrahlung process providing high spectral and temporal fidelity environments for physical simulation (testing) to STS prompt gamma radiation requirements. No other US facility can provide these testing capabilities at the subsystem level. Without HERMES III, reentry systems cannot be qualified to STS prompt gamma requirements. The capability is critical for qualifying electronic subsystems. In the large test cell, these bremsstrahlung sources can also stimulate high-fidelity source region electromagnetic pulse (SREMP) environments for nuclear weapon as well as other military system testing. In addition, physical simulation modes utilizing direct deposition of the accelerator’s electron beam in experiment objects have been developed and utilized for structural response model development and validation. There are no high-fidelity testing facilities for these responses, and validated models are critical for adequate system qualification.

HERMES III operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set. Eight full-time equivalent positions from this crew are associated with HERMES III, with various mechanical and electrical engineering and technician positions along with administrative and ES&H personnel. In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H support and Facility Maintenance and Operations Committee (FMOC) maintenance of real property.

Table A.10-9 — HERMES III & RHEPP

Site size (acres)	14.4
Building Square Footage (ft ²)	56,886
Electrical Use (MWh per year)	~ 480
Water Requirements (gal/yr)	2000
Average Steam (tons)	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0.006
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Sandia Pulsed Reactor Facility (SPR)

The Sandia Pulsed Power Reactor Facility (SPR) shown in Figure A.10-6 is a 6,099 square foot facility located on about two tenths of an acre. The SPR is a fast-burst reactor used for neutron testing. The SPR directly subjects the part or device being tested to a neutron (and gamma) irradiation environment that simulates the neutron spectrum anticipated from an exo-atmospheric threat. The facility is not presently in operation.



Figure A.10-6 — Sandia Pulsed Reactor Facility

Table A.10-10 — Sandia Pulsed Reactor

Site area (acres)	.2
Building Square Footage (ft ²)	6,099
Electrical usage (MWH/yr)	450
Average Water Requirements (gal/yr)	2000
Employees	42
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0

Table A.10-10 — Sandia Pulsed Reactor (continued)

Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

PFBA Heavy Lab Saturn and Sphinx

Saturn is designed to produce intense x-ray pulses, providing physical simulation for STS hot and cold x-ray requirements. Saturn can be configured for either bremsstrahlung x-ray sources or plasma radiating sources (PRS).

In bremsstrahlung mode, Saturn simulates hot x-ray environments, producing a broad spectrum of x rays peaking near 50 keV energy, extending up to nearly 2 MeV. The x rays are generated in a 17 ns full width at half maximum (FWHM) pulse, providing high spectral and temporal physical simulation (testing) fidelity for hot x-ray requirements for heavily shielded full subsystems such as an Arming, Fuzing and Firing (AF&F) subsystem. No other U.S. facility can provide adequate x-ray environments. Without Saturn, reentry systems cannot be qualified to STS x-ray requirements. Physical simulation (testing) at Saturn is required for system qualification to hot x-ray requirements. In bremsstrahlung mode, Saturn also provides critical physics discovery and model validation data for microelectronics and circuit x-ray response.

In PRS mode, Saturn provides atomic line or combined atomic line/continuum x-ray sources up to 3 keV in energy. There are no US facilities to provide adequate cold or warm x-ray testing environments. Therefore, the PRS sources on Saturn are used to acquire material property data for model development and model validation, including support for system qualification computational simulations.

Saturn operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set. Fourteen FTE positions from this crew are associated with Saturn, with various mechanical and electrical engineering and technician positions along with administrative and ES&H personnel. In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H utilities, and maintenance of real support.

SPHINX has both bremsstrahlung and direct electron beam deposition modes of operation. Accelerator power is approximately a factor of 250 below that of Saturn. SPHINX provides fast turnaround capability (cycle time 5 minutes) for dose-rate studies of microelectronic devices as well as material response research in direct electron beam mode. SPHINX has supported qualification of the W76-1 electronic subsystems as well as the W76-0, W76-1, and W78 neutron generators. SPHINX provides a cost-effective capability for a large volume of experiments that would otherwise be done at significantly more expensive facilities (on a per test item-shot basis) such as Saturn.

SPHINX operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set. One FTE position from this crew is associated with SPHINX (primarily an electrical/mechanical technician with some administrative and ES&H support). In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H support and FMOC maintenance of real property.

Table A.10-11 — Saturn and SPHINX

Site area (acres)	2
Building Square Footage (ft ²)	42,052
Electrical Usage (MWh/yr)	450
Average Water Requirements (gal/yr)	1000
Employment	24
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Annular Core Research Reactor (ACCR)

The ACCR is a 13,793 square foot facility, which is a critical element in the neutron vulnerability and hardness testing and certification of stockpile weapon systems electronic components (e.g., transistors, integrated circuits), subsystems (e.g., fire sets, neutron generators), and systems (e.g., Arming, Fuzing, and Firing [AF&F] system). The ACCR is also a critical element in the hostile environment testing of weapon system physics packages (both primary and secondary) at the full-up system level, as well as material sample tests. In addition, the ACCR performs neutron radiographic nondestructive examinations of weapons systems components (e.g., neutron generators). The Complex Transformation strategy includes the need for a

responsive infrastructure to design, develop, and field new weapon systems if needed, and/or repackage current systems. As noted above, the ACRR would be critical to the neutron vulnerability and hardness testing and certification in such cases. Also, the ACRR would be critical to the neutron vulnerability and hardness testing and certification of primary and secondary components and systems for the Reliable Replacement Warhead (RRW) program.

The ACRR directly subjects the part/device being tested to a neutron (and gamma) irradiation environment that simulates the neutron spectrum anticipated from an endo-atmospheric threat. The environment can be produced over long periods of time (e.g., minutes to hours) in a steady-state operation mode or very short periods of time (10 to 100 milliseconds) in a pulse-operation mode. The irradiation location is accessible for cables that transmit power/signals to the device being tested, and/or receive operational and diagnostic signals from the device being tested. Under appropriate work controls, the device being tested can even include components which contain explosives that can be detonated while being irradiated. These testing capabilities allow for a customer to determine and/or assess the function, failure, and recovery characteristics of the device being tested within neutron-gamma irradiation test environments that simulate STS threat levels. In addition, the ACRR also has a neutron radiography capability to allow customers to perform nondestructive examination of components to search for small defects or other conditions not otherwise detectable.

The ACRR facility includes a relatively modern control room panel with computer-aided control and diagnostic systems, and a newly installed (2005 to 2006) heat rejection system for long duration steady-state operations. Aging reactor power monitoring devices are being replaced as time and funding allow.

Table A.10-12 — Annular Core Research Reactor

Site area (acres)	2
Building Square Footage (ft ²)	13,793
Electrical Usage (MWh/yr)	475
Average Water Requirements (gal/yr)	2000
Employment	42
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0

Table A.10-12 — Annular Core Research Reactor (continued)

Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Radiation Metrology Laboratory (RML)

The RML is a 1,774 square foot facility, which provides measurement of dosimetry for high-dose applications of exposure to neutron and gamma environments. This critical capability provides the underpinning for the SNL/NM radiation effects experimental facilities for dose and dose rate measurements. Dosimeter measurements for neutron environments specifically include the fast burst reactors (SNL/NM-SPR, WSMR-FBR), epi-thermal reactors (ACRR), gamma irradiation environments (Gamma Irradiation Facility [GIF], Low Dose Rate GIF [LDRGIF], HERMES), along with other NNSA test facilities as requested (LANSCE). The RML includes a wide variety of radiation measurement tools, dosimetry, and equipment, including alanine, sulfur, thermoluminescent dosimeter (TLD), alpha spectroscopy, and germanium detectors. The main RML facility is located at SNL/NM TA V, with a satellite laboratory in TA IV to support the pulsed power facilities. All system calibrations are traceable to the National Institute of Standards and Technology (NIST), and measurement procedures follow American Society for Testing Materials (ASTM) international consensus standards.

Along with radiation effects facility experiment support, the RML provides numerous radiation interrogation techniques for a variety of experiments including: specialty R&D projects in the field of radiation testing and measurements, fuel enrichment confirmations, and flux profile mapping of subcritical experiments. The laboratory also has supported environmental analyses for underground storage, such as confirmation of actinide migration through salt columns and other geologic strata. In past operations, the facility has provided direct support to NTS for underground testing as well as mobile testing support for other NNSA laboratories and universities.

Table A.10-13 — Radiation Metrology Laboratory

Site area (acres)	1
Building Square Footage (ft ²)	1,774
Electrical Usage (MWh/yr) Energy	205
Average Water Requirements (gal/yr)	1000
Employment	3
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0

Table A.10-13 — Radiation Metrology Laboratory (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd ³)	0

Gamma Irradiation Facility (GIF)

The GIF is housed in a 12,514 square foot building. The GIF provides for testing, experimentation and system/component performance when exposed to Co-60 gamma environments. The GIF provides extensive flexibility in both high dose rate and total dose testing to support a wide array of radiation effects and experimental needs. Activities include electronic component hardness, survivability, and certification tests for military and commercial applications, weapon component degradation, radiation effects on material properties, and experiments containing radioactive and strategic nuclear materials testing. Typical experimental customers include radiation damage computer modeling testing, support of Qualification Alternatives to Sandia Pulsed Reactor (QASPR) modeling, and National Aeronautics and Space Administration (NASA) and SNL/NM radiation hardness testing for space communications, lasers, and satellite systems. The GIF complements the ACRR facility in that it allows for gamma exposure discrimination to better understand both neutron and gamma damage in radiation environments. The GIF is used to precondition neutron dosimeter transistors used for experimental applications in neutron environments, and organic materials R&D testing in nuclear environment applications.

The facility supports calibration of TLD measurement systems used in support of reactor and pulsed-power machine dose measurements. It has also been utilized for the radiation hardness testing for robotic systems used in nuclear material retrieval devices (i.e., “dirty bombs”). The facility is working with LLNL to determine feasibility of relocating the instrumentation calibration capability from NTS to SNL/NM in support of underground testing, should it be required in the future.

The GIF provides three concrete, dry test cells and a 5.5 meters (approximately 18 feet) deep pool for a variety of gamma irradiation experiments with different test configurations, dose rates,

and dose levels. To accommodate these specific irradiation needs for experiments, custom features have been incorporated into the GIF design as follows:

- Configurable radiation sources provide different geometries for the source array (e.g., point, planar, circular).
- Shielded windows allow for experiment observation during irradiation.
- Remote manipulators available to facilitate experiment or source handling.

The in-cell facilities are dry, shielded rooms where irradiations are performed with a high-intensity gamma ray source. Typical irradiations performed in the dry cells are at high dose rates (typically on the order of 3 mrem per hour at greater than 1 meter [approximately 3.3 feet] from the source) and for short to intermediate durations lasting up to a few days. The facility also provides for future experimental and testing capabilities that would require the radiation shielding provided by the facility experimental test cells.

For the in-pool testing, radioactive sources are held in a submerged irradiation fixture near the bottom of the 5.5 meter (approximately 18 ft) deep pool of demineralized water. Typical irradiations performed in the pool are at moderate and low dose rates and for long durations lasting days, weeks, or months. Dry experiment canisters, which contain test units, are immersed in the pool and positioned in preset locations in the irradiation fixtures. The fixtures are voided of water to provide an unshielded path between the source and the test unit. The pool can store up to 1.5 mega curies of cobalt-60 (^{60}Co). The sources are in the form of pins and can be shared between the in-cell irradiation facilities and the in-pool irradiation facilities.

This Hazard Category 3 facility is operated by a facility supervisor and a facility operator as dedicated staff, as well as system engineers, safety basis analysts, facility maintenance technicians, a radiological control technician, and department management.

Low Dose Rate Gamma Irradiation Facility

The LDRGIF is an 1,844 square foot facility. The LDRGIF provides the ability to perform Enhanced Low Dose Rate Sensitivity (ELDRS) effect testing to a large number of piece parts for extended periods of time (several years in many cases). The program personnel supported in this application are weapons systems component developers responsible for certifying the reliability of their designs maintained in storage configurations over decades. Additionally, satellite piece parts have been tested to predict device degradation over the lifespan of the program mission. A separate exposure room is equipped with a combination of temperature-controlled ovens and radioactive sources that permit the simultaneous exposure to thermal and gamma radiation environments. Finally, work-for-others (WFO) customers, in support of DoD missions, use the facility.

Table A.10-14 — Gamma Irradiation Facility

Site area (acres)	2
Building Square Footage (ft ²)	12,514
Electrical Usage (MWh/yr) Energy	450
Average Water Requirements (gal/yr)	2000
Employment	4
Rad Workers	4
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Attractive features of the facility are simplicity of operation, adequate shielding for personnel working in manned spaces, the use of special form sources, low inventories of source materials, security controls for classified components, an existing infrastructure of radiation protection, industrial hygiene (IH), training, maintenance, administrative, and security support.

The facility is operated by a single operator [1 FTE] with approximately 10 percent of an FTE for supervision and management. This radiological facility is supported by approximately 7.5 percent of an FTE.



Figure A.10-7 — Low Dose Rate Gamma Irradiation Facility

Table A.10-15 — Low Dose Rate Gamma Irradiation Facility

Site area (acres)	.5
Building Square Footage (ft ²)	206
Electrical Usage MWh/yr)	450
Average Water Requirements (gal/yr)	2000
Employment	2
Rad Workers	2
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Generation	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	

Table A.10-15 — Low Dose Rate Gamma Irradiation Facility (continued)

Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Auxiliary Hot Cell Facility (AHCF)

The AHCF is a 8,200 square foot facility. The AHCF is used for characterizing and repackaging nuclear materials, radioactive materials, and mixed waste materials. The AHCF is designed to allow SNL/NM to safely characterize, treat, and repackage radioactive material for reuse, recycling, or ultimate disposal. It is designed to be operated as either a radiological or Hazard Category 3 nuclear facility, depending on material at risk quantities campaigned within the facility. The facility's main purpose is to support the de-inventory of security category 3 and 4 nuclear materials from SNL/NM. The facility systems provide for remote handling capabilities for existing and future items. SNL/NM has an inventory of Legacy nuclear materials that are excess to SNL/NM but not necessarily excess to the DOE complex. Some of these materials have been designated as "no defined use" (NDU). Current disposition plans specify that some of the materials will ultimately be sent to DOE disposal facilities.

The AHCF also provides short-term storage for radioactive materials and wastes. In addition to handling low-level radioactive material, the AHCF has remote-handling capabilities to allow for the characterization and repackaging of high-level radioactive materials and waste. The AHCF is located in the high-bay area of Bldg. 6597 at SNL/NM. The AHCF consists of three parts: 1) a hot cell with two storage silos in the floor (inside the cell) and access ports in the roof; 2) a work area next to the hot cell with a permanent shield wall, a fume hood, and six storage silos in the floor; and 3) space for material storage. The building contains remotely operated bridge cranes, hot cell manipulators, and video capability. Six inch floor silos are available for short-term storage of materials during material campaign processing. The silos are 15 feet deep; four are 9 inch diameter and two are 30 inch diameter. A remote electric chain hoist is used in conjunction with the bridge cranes to introduce material into the hot cell. The hot cell is a 10 feet by 10 feet square, it is lined with stainless steel for ease of decontamination, and it contains a 1 ton jib crane.

The AHCF is currently not operational. DOE has not granted authorization for operation because of limitations and concerns in the DSA for the facility. The facility is being planned for use as a radiological facility to handle low quantities of nuclear materials for disposal processing.

Many of the Legacy material packages will require repackaging at the AHCF because of their Hazard Category quantities or because their form requires remote-handling capabilities. These packages contain uranium oxide in various forms, miscellaneous radioactive materials, depleted uranium, experiment packages and scrap parts, metallographic samples, a small quantity of thorium, and several Americium Beryllium sources.

During operations, the facility is staffed with one facility supervisor, two facility technicians, a radiological control technician, and department management. As a Hazard Category 3 nuclear facility, additional support staff include system engineers, safety basis analysts, and facility maintenance technicians.

The AHCF is a temporary life facility and is intended to support material removal. Its project length of operation is approximately eight years from initial start-up.

Table A.10-16 — Auxiliary Hot Cell Facility

Site area (acres)	1.7
Building Square Footage (ft ²)	13,358
Electrical usage (MWh/yr)	450
Average Water Requirements (gal/yr)	2000
Employment	2
Rad Workers	2
Avg dose to rad worker	500 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Centrifuge Complex

Located in TA III, the Centrifuge Complex consists of an outdoor 35-foot centrifuge with five support buildings and an indoor 25-foot centrifuge with three support buildings. The complex encompasses a total floor space of 12,684 square feet, situated on a site of about four and a half acres. The two centrifuges in this TA III facility generate high-acceleration environments to certify weapons components and systems, satellite systems, guidance systems, and transportation

containers. The 35-foot (indoor) and 29-foot (outdoor) centrifuges simulate Reentry Vehicle (RV) launch and reentry environments, aircraft maneuvering accelerations, crash and impact decelerations, and other acceleration environments within the STS envelope, and support environmental sensing device testing on bomb and missile systems. The two centrifuges simulate Reentry Vehicle launch and reentry environments, aircraft maneuvering accelerations, crash and impact decelerations, and other acceleration environments within the STS envelope. Four technical personnel operate both centrifuges.

The Centrifuge Complex contains a small chemical inventory but no radioactive materials as shown in Table A.10-17. Cleaners, lubricants, solvents, paints, and agents are used in small quantities. Compressed gases used in the assembly areas include acetylene and oxygen, argon, and helium. Chemical emissions, including alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Radioactive air emissions are not produced at this facility. Noise from centrifuge operation, collision impacts, and explosive testing does occur. Fragments resulting from centrifuge-launched explosives are recovered shortly after test events.

Table A.10-17 — Centrifuge Complex

Site area (acres)	2
Building Square Footage (ft ²)	12,671
Electrical Usage (MWh/yr)Energy	750
Average Water Requirements (gal/yr)	2000
Employment	10
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0

25 Foot Centrifuge

The 25 foot centrifuge (Figure A.10-8) generates high-acceleration environments to certify weapons components and systems, satellite systems, guidance systems and transportation containers. There are no radioactive materials at this facility, only cleaning and degreasing chemicals are used at this facility.



Figure A.10-8 — 25 Foot Centrifuge

Table A.10-18 — 25 Foot Centrifuge

Site area (acres)	2
Building Square Footage (ft ²)	12,671
Electrical Usage (MWh/yr)Energy	750
Average Water Requirements (gal/yr)	2000
Employment	10
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0

Table A.10-18 — 25 Foot Centrifuge (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd ³)	0

Model Validation and System Certification Test Center

The Model Validation and system Certification Test Center is housed in Building 6584. This 18,000 square foot building, located on a three and a half acre site, supports development, qualification, and acceptance testing; model validation experiments; and evaluation of weapon components and other hardware. The advanced diagnostic capabilities enable analysis and interpretation of hardware failures and also support model validation efforts. Characteristics and site infrastructure requirements of the Model Validation and System Certification Test Center are shown in Table A.10-19.

The facility includes capabilities for climatic/centrifuge, mass properties, modal/structural dynamics, shock, structural mechanics, and vibration testing. Climatic/centrifuge testing is accomplished using centrifuges and thermal chambers. Structural mechanics testing is accomplished using load machines and actuators. Drop tables, resonant beams and fixtures, and Hopkinson bars are used to simulate mechanical shock. Electrodynamics shakers are used to simulate flight shock and vibration environments. Virtually any STS environment for any stockpile system can be simulated at the component level within this facility. All of the laboratories include a large inventory of instrumentation and high-performance data acquisition systems. Advanced diagnostics are accomplished through radiography, ultrasonics, and computed tomography.

Operations at the component environmental test and advanced diagnostics facility also include the following:

- Receiving, storing, and handling components with small quantities of explosives (typically less than 5 g); and nuclear, radioactive, and chemical materials;
- Assembling high-fidelity test units and other assemblies (e.g., neutron generator assemblies);
- Setting up electronic instrumentation and data recording; and
- Reducing hazards through area, systems, and personnel control.

Small amounts of chemicals are maintained for use in mounting and removing instrumentation from test articles and for processing radiographic images. Cleaners, lubricants, solvents, paints, and other such agents may also be used in small quantities. Liquid nitrogen is used, primarily for thermal conditioning.

Although most of work is done in support of the nuclear weapons program, this facility also supports development, qualification and acceptance of hardware for the Integrated Technologies and Systems Strategic Management Group, particularly nuclear weapons programs involving space assets.

Recent improvements have included a new control room for the vibration laboratory, a new high-frequency electrodynamic shaker, and new data acquisition systems in the modal/structural dynamics and shock labs. A new six degree of freedom vibration system will be installed this summer.

Table A.10-19 — Model Validation and System Certification Test Center

Site area (acres)	.25
Building Square Footage (ft ²)	135
Electrical usage (MWh/yr)	750
Average Water Requirements (gal/yr)	1000
Employment	0
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0

Complex Wave Test Facility

The Complex Wave Facility, located in Bldg. 6610 in TA III, is a 2,327 square foot facility located on a little more than a half acre site. This facility supports development, qualification, and acceptance testing of weapon systems for normal shock and vibration environments. The facility can be operated remotely, which enables testing of systems that include hazardous and explosives materials. The electrodynamic shakers, control systems, and data acquisition systems are located within a vault-type room (VTR), which simplifies logistics associated with testing of classified articles. Characteristics and site infrastructure requirements of the Complex Wave Test Facility are shown in Table A.10-20.

Bldg. 6610 has the highest force rated shakers at SNL/NM and is used extensively for system-level tests of full-scale assemblies or items requiring high vibration levels. For fast and efficient setup, two UD T4000 electrodynamic shakers have been dedicated for vertical and horizontal testing, respectively. The facility has state-of-the-art control and data acquisition systems, allowing for up to 200 channels of data sampled at 102 kilohertz.

Controlled dynamic simulations are performed on test articles ranging from small subsystem components to full-scale assemblies. Tests include random vibration, shock on shakers, sinusoidal vibration, mixed-mode vibration, tracked resonant dwells, and combined temperature and vibration. Recent testing has included weapons, satellite subsystems, rockets and payloads, reentry vehicles, and shipping configurations.

Table A.10-20 — Complex Wave Test Facility

Site area (acres)	.25
Building Square Footage (ft ²)	2,327
Electrical usage (MWh/yr)	750
Average Water Requirements (gal/yr)	1000
Employment	1
Rad Workers	1
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NO _x (tons/yr)	0
PM10 (tons/yr)	0
SO _x (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd ³)	0
TRU	
Liquid (gal)	0
Solid (yd ³)	0
HLW/Spent Fuel	

Table A.10-20 — Complex Wave Test Facility (continued)

Liquid (gal)	0
Solid (yd ³)	0
Hazardous	
Liquid (gal)	0
Solid (yd ³)	0

Light Initiated High Explosive Facility

The Light Initiated High Explosive Facility is a 4,047 square foot facility located on a little more than a three quarter acre site. The primary purpose of the SNL/NM Light Initiated High Explosive (LIHE) facility is to simulate cold x-ray-induced shock loading from an exo-atmospheric nuclear blast, primarily investigating structural response. This one-of-a-kind facility and technique can induce load levels in varying distribution (such as cosine distributions), including load discontinuities. The facility accomplishes this testing by the remote-controlled spray application of a sensitive primary explosive onto the surface of complex structural shapes. The explosive is simultaneously detonated over the sprayed surface by exposing it to an intense flash of light generated by 40 kilovolts to 208 kiloJoules capacitor bank. An emerging technology at the LIHE facility is to drive a thin metallic flyer plate with the silver acetylide-silver nitrate (SASN) explosive. Targets of various geometries, such as flats, rings, cylinders, cones, and RVs can be impacted with representative impulse distributions as well as varying pressure pulse profiles. The LIHE facility is chartered by SNL/NM in concurrence with DOE/NNSA to (a) establish and maintain the LIHE impulse testing capability at SNL/NM, (b) maintain the LIHE facility to modern operating standards, (c) support the development and qualification testing of nuclear weapons for DOE/NNSA, and (d) provide test data for use in validation of computer models developed for the Stockpile Stewardship Program.

The LIHE facility operated continually from 1971 to 1992, when it was mothballed at the end of the Cold War. In 2001, a decision was made to reconstitute the cold x-ray impulse test capability at SNL/NM by restoring the facility to its prior capabilities. Because of the onsite New Mexico Environmental Department permitted Thermal Treatment Facility, where excess explosive and explosive contaminated materials are treated, the restoration of the LIHE facility was constrained to its original location at Bldg. 6715 in TA III. During the time between mothball and restart, the physical condition of 6715 deteriorated to the point that a full renovation of the building was required. Characteristics and site infrastructure requirements of the Light Initiated High Explosive Facility are shown in Table A.10-21.

Table A.10-21 — Light Initiated High Explosive Facility

	Consumption/Use
Electrical usage(KW/yr)	550
Water usage(gal/yr)	2,000
Site area (acres)	2
Total building square footage	4,138
Employment (no. of workers)	
Total	6
Rad Workers	
Average Dose to Rad Worker (mrem)	

Table A.10-21 — Light Initiated High Explosive Facility (continued)

	Consumption/Use
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	0
Non-hazardous (yd ³)	0
Emissions	
NAAQS (tons/yr)	0
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

Sled Track Facility

The 10,000-foot sled track, is a 1,941 acre site, consisting of 16 support buildings located in TA III. The support buildings include observation towers, storage sheds, transformer pads, a total of about 8,900 square feet of buildings. This facility supports weapons system qualification testing and weapons development efforts that must simulate penetration, flight, high-acceleration, and high-shock environments. The simulated environment may be provided through impact, reverse ballistic, or ejection testing. This testing includes shock/laydown tests for bombs, sled ejection tests to verify parachute and laydown performance, impact tests on transportation and container systems, impact fuze tests for reentry vehicles, and a variety of other DOE and DoD system tests that require high-speed impacts. Small amounts of chemicals are maintained for use in assembling rocket sleds and test payloads in Bldgs. 6741, 6743, and 6736. These include various adhesives and epoxies used to fasten transducers and similar items. Cleaners, lubricants, solvents, paints, and other such agents may also be used in small quantities. Compressed gases are used in the assembly areas, including acetylene and oxygen (for welding), argon, and helium; and dry nitrogen and carbon dioxide are used for pneumatic actuators. Characteristics and site infrastructure requirements of the Sled Track Facility are shown in Table A.10-22.

Table A.10-22 — Sled Track Facility

	Consumption/Use
Electrical usage (KW/yr)	550
Water usage(gal/yr)	2,000
Plant footprint (acres)	6
Total building square footage	8,900
Employment (no. of workers)	
Total	0
Rad Workers	
Average Dose to Rad Worker (mrem)	
Waste Generation	
TRU (yd ³)	
Low Level(yd ³)	
Hazardous(yd ³)	
Non-hazardous (yd ³)	
Emissions	
NAAQS (tons/yr)	
Radionuclide emissions (Ci/yr)	
Hazardous air pollutants (tons/yr)	



Figure A.10-9— Sled Track Facility

Aerial Cable Test Facility

The Aerial Cable Test Facility, located in the Coyote Test Field, is a 5,022 total square foot facility, consisting of three structures, located on about a two and a half acre site. This facility performs gravity drop and accelerated pull-down tests in support of bomb qualification tests and weapons development activities. This test capability provides controlled simulations of the worst-case impact environments experienced by weapons systems and shipping containers. Gravity drop tests are performed from a cable suspended between two peaks, giving up to a 600-foot vertical distance for acceleration. A rocket-assisted (320-foot sled track) pull-down technique is used to provide higher impact velocities when gravity tests are not adequate. Characteristics and site infrastructure requirements of the Aerial Cable Test Facility are shown in Table A.10-23.

Operations require the use of a variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous, liquid, and solid forms, in relatively small quantities. No radioactive emissions are routinely produced at this facility. Compressed gases used in the assembly areas include acetylene and oxygen, argon, and helium. There are some chemical emissions, including alcohols, ketones, and other solvents. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Operations associated with preparation of test payloads, fixtures, and rocket sleds involve machining that generates residues, bonding of parts with epoxies, cleaning of parts, and wiping of excess materials.

Table A.10-23 — Aerial Cable Test Facility

	Consumption/Use
Electrical usage (KW/yr)	400
Water usage(gal/yr)	2,400
Site area (acres)	2
Total building square footage	5,022

Radiography Building and Non-Destructive Test Facility

The Non-Destructive Test Laboratory is a two building facility with a total floorspace of 5,348 square feet, located on about a one and a quarter acre site. The purpose of this facility is to allow the radiographic inspection of full weapon systems that contain HE and/or rad materials. These inspections are often necessary to determine the state of the weapon prior to testing in the large-scale facilities in TA III. After testing, it is required to inspect the system prior to shipping to assure that the mechanisms have remained in a safe position. The high-energy capabilities of the facility allow for imaging through numerous layers of materials or thick sections. In addition to its primary function, the facility has also been used to evaluate other items such as solid rocket motors and recovered waste drums to quantify the contents to determine if the drums can be processed without further evaluation. Characteristics and site infrastructure requirements of the Radiography Building and Non-Destructive Test Facility are shown in Table A.10-24.

Table A.10-24 — Radiography Building and Non-Destructive Test Facility

	Consumption/Use
Electrical usage (KW/yr)	400
Water usage (gal/yr)	2,400
Site area (acres)	2
Total building square footage	5,348
Employment (no. of workers)	
Total	6
Rad Workers	0

Mobile Guns Complex

The Mobile Gun Complex (Figure A.10-10) is a large multi-acre facility with no permanent buildings. The Mobile Gun Complex consists of three Davis guns and one gas gun. The Davis guns are smooth bored guns in 8-, 12-, and 16-inch diameters, mounted on mobile carriers. These barrels are open at both ends and employ a moving mass recoil system. This recoil system allows the guns to be trailer mounted and mobile. The 8- and 12-inch barrels are interchangeable on the same trailer, while the 16-inch gun has a dedicated trailer. Each Davis gun trailer includes a hydraulic power unit, a winch for hoisting the load into the barrel, and the hydraulic cylinders necessary to elevate the barrel and operate the stabilizers. The gas gun is a 6-inch diameter gun. It is also trailer mounted for mobility. It contains an onboard compressor and two air storage tanks with a capacity of 27 cubic feet each. These tanks are fed directly by the compressor and are capable of storing compressed air up to 5000 psi. These storage tanks feed the firing chamber, which is 7.2 cubic feet. All guns are hinged to allow firing angles from horizontal to vertical. Characteristics and site infrastructure requirements of the Mobile Guns Complex are shown in Table A.10-25.

The guns have limitations on the size and weight of the projectiles they can deliver. The 16-inch guns can achieve a launch velocity of approximately 1,200 feet per second for a 2000 pound, 16-inch projectile, including sabot and pusher plate assemblies. The maximum weight of a gas gun projectile/sabot assembly is approximately 120 pounds for similar impact velocities.

These mobile guns are unique in that they provide a capability for component (fuzer), subsystem, or full-scale penetration testing into in situ target materials (limestone, granite, layered geologies, etc.) in addition to engineered targets. The mobile guns provide a controlled environment for Hi-G impact conditions (velocity, angle of obliquity, angle of attack, etc.) along with high-fidelity photometric coverage or other off-board measurements. These unique capabilities provide cost-effective alternatives for risk mitigation, qualification, and failure investigations to sled or flight testing.

The mobile guns primarily provide support to penetrating weapons programs for DoD and DOE. The guns are also used in support of other federal agencies, including the Japanese Lunar A space program. Recently, DoD has performed more full-scale testing with the Davis Guns while DOE programs have utilized the gas gun for component qualification and acceptance testing. SNL/NM maintains a capability for full-scale testing of its NW Penetrator, the B61-Mod11 test with the Davis Guns. There are no permanent structures and the guns are mobile. Seven staff are required to manage and operate this program.



Figure A.10-10 — Mobile Guns Complex

Table A.10-25 — Mobile Gun Complex

	Consumption/Use
Electrical usage	400
Water usage (gal/yr)	2,000
Site area (acres)	1
Total building square footage	2,400
Employment (no. of workers)	
Total	7
Rad Workers	0
Average Dose to Worker (mrem)	
Waste Generation	
TRU (yd ³)	
Low Level(yd ³)	
Hazardous(yd ³)	
Non-hazardous (yd ³)	
Emissions	
NAAQS (tons/yr)	
Radionuclide emissions (Ci/yr)	
Hazardous air pollutants (tons/yr)	

Thermal Test Complex (TTC)

The TTC is a four building complex, with a total floor space of 15,712 square feet, located on a 10 acre facility, in TA III. This facility demonstrates through testing that the nuclear weapon stockpile is safe from inadvertent nuclear detonation in abnormal thermal environments. All weapons systems, as part of the weapons design, qualification, and initial certification process, have to demonstrate that they fail safely in fire environments. The Thermal Test Complex contains the test facilities, diagnostics, and highly trained personnel to perform such qualification work. Characteristics and site infrastructure requirements of the Thermal Test Complex are shown in Table A.10-32.

Numerous risk assessments have demonstrated that fire, either alone or in combination with other environments, is a dominant contributor to risk. During accidents, fire occurs frequently when in the presence of fuels, such as are common in transportation modes. Further, fire presents a severe thermal threat to weapon systems. They are not intended to survive, but they must safely fail.

Computational advancements in the coming decades will improve ability to cost effectively test weapons systems as part of design, qualification, and certification but will not replace testing for at least another century. It must be shown that the weapon system maintains a positive safety margin throughout a failure transient so pervasive that the system is rendered irreversibly inoperable. Failure is atomistic in nature and the length scale range is beyond scientific prediction until computational machines become many orders of magnitude larger. On the other hand, engineering prediction has become an invaluable design-of-experiment tool and is considered an indispensable part of the testing process. Cost-effective testing is not possible without computational modeling.

Historically, it has not been necessary to conduct abnormal thermal environment testing with SNM. Acceptable measurement and computational methods exist for making the extrapolation

from test articles without SNM. There is no evidence to suggest that the future will force a change in what has been accepted historically in this regard. If anything, it can be expected that advancements in computing will only solidify the testing basis without SNM.

Weapon system owners use the TTC during all phases of design and initial qualification. It is also used to address significant findings and for nonroutine testing to support the technical basis for annual assessments. Testing includes safety critical components such as capacitors, subsystems, fire sets, and full-up systems. The facility includes multiple environment capability. Examples include ovens and humidity chambers for prepping hardware, test bays for evaluating thermal properties of materials such as thermal diffusivity, and test chambers for fire environments. Fire environments can be cost effectively simulated electrically using radiant heat panels as is often done during the design phase. Fires can be created with gaseous or liquid fuels up to 20 MW.

The TTC consists of Fire Laboratory for the Accreditation of Models and Experiments (FLAME), Cross-wind Test Fire Facility (XTF), radiant heat cells, laboratories, and an outdoor test site in Lurance Canyon for larger, open fires. The FLAME and the XTF were designed with optical access for advanced optical diagnostics to further the multidisciplinary sciences underlying turbulent reacting flow as part of the goal to make fire models more predictive. In addition to weapon system owners, other nuclear weapons users include the computational model developers. The test facilities within the TTC are unique in the world in that they were specifically designed (by CFD fire models) to provide controlled, reproducible boundary conditions necessary to validate fire and thermal response models. The TTC is operated by a staff of twelve.

Table A.10-26 — Thermal Test Complex

Electrical usage (MWh/yr)	5.6
Water usage (gal/yr)	4,000
Plant footprint (acres)	10
Total building square footage	15,712
Employment (no. of workers)	
Total	12

Electromagnetic/Environmental/Lighting, Strategic Defense Facility

The Electromagnetic Environs Complex consists of three buildings located on approximately nineteen and a half acres. This 103,185 total square foot facility consists of the following capabilities: Mode-Stirred and Anechoic Chambers – The Mode-Stirred and Anechoic Chambers are used alone or in combination for Radio Frequency (RF) measurements. The Mode-Stirred Chamber provides a reverberant environment in which electromagnetic fields are statistically uniform, providing 360 degree, homogeneous coverage of test items in a single test run regardless of test item orientation. The Anechoic Chamber simulates a free-field environment where test items are illuminated in a directional manner dependent on the source antenna. Both types of testing have their advantages and disadvantages, but the combination supports the strengths of both. In addition, testing in these chambers can be done at 220 megahertz (MHz) and above. The combination of these chambers with the Electromagnetic Environments Simulator (EMES) in TA I (250 MHz and below) allows for electromagnetic characterization over a very broad frequency range.

Electromagnetic Environments Simulator (EMES) – EMES is a building-sized Transverse Electromagnetic (TEM) cell, which supports electro-magnetic plane wave illumination of test objects. Two electromagnetic (EM) sources are used at the facility, low-frequency Electromagnetic Radiation (EMR) and an Electromagnetic Pulse (EMP) simulator. The TEM cell structure can theoretically support frequencies as low as DC (or 0 hertz [Hz]); however, the current amplifier at the facility can be used from 100 kHz to 250 MHz. This gives good low-frequency coverage to support higher-frequency measurements in the Mode-Stirred and Anechoic Chambers in TA IV. The EMP simulator design is based on Mil-Std 2169B requirements and is unique in its fast-risetime pulse combined with a large range of electric field amplitudes that can be generated.

EMES supports a portion of the frequency range of nuclear-weapon STS EMR environments as well as high-altitude EMP environments. Every weapon has these environmental requirements in most, if not all, weapon stages called out in their respective STSs. EMES was used during 2006 in the EMR mode to characterize electromagnetic leakage into the air-launch cruise missile (ALCM) and Advanced Cruise Missile as part of the W80-3 qualification effort. While the W80-3 program was cancelled, the cruise missile information is still useful for the W80-1 stockpile system, and it has been planned to include this information in the W80 STS. EMES was also used in 2003 and 2004 to conduct EMP testing of commercial items for the congressionally chartered EMP commission.

SNL/NM Lightning Simulator – The SNL/NM Lightning Simulator can replicate severe direct-strike lightning to meet stockpile needs for assuring nuclear safety in lightning environments. The Lightning Simulator can also be used to generate nearby lightning environments, which are a normal-environment concern for reliability of electronic systems. It can generate lightning-like pulses that meet the top 1 percent requirements for peak current, pulse width, and risetime in nuclear weapon STS requirements documents. In the last two years, the Lightning Simulator has been used to characterize a variety of stockpile and new-development Lightning Arrestor Connectors and to qualify the nuclear safety of the W76-1 in lightning environments. The SNL/NM Lightning Simulator is housed in Bldg. 888 on the east end of TA I at SNL/NM. In the past, an F4 airplane was instrumented and tested at this facility. This part of TA I has been significantly developed, virtually eliminating the opportunity to test large items outdoors.

Table A.10-27 — Electromagnetic Environmental Complex

Electrical usage (MWh/yr)	150
Water usage (gal/yr)	4,000
Site area (acres)	19.5
Building footprint (Sq. feet)	103,185
Employment (no. of workers)	
Total	11
Rad Workers	
Average Dose to Worker (mrem)	0
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	0
Non-hazardous (yd ³)	80

Table A.10-27 — Electromagnetic Environmental Complex (continued)

Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

SNL/CA Environmental Test Complex

The California Environmental Test Complex provides a number of table-top capabilities (shock, vibration, acceleration, climatic chambers, mass properties, radiography, etc.) used for proof and qualification of weapon systems, subsystems, and components. In addition to the ongoing weapon design activities between LLNL and SNL/CA, this complex also supports WFO (DoD, Department of Homeland Security, Engineering Campaign Six, Model Validation) projects. The shock, vibration, and climatic chambers have been used by the W80 Program for margin testing. They are also used for weapon Joint Test Assembly and Gas Transfer System activities.

Table A.10-28 — SNL/CA Environmental Test Complex

Electrical usage (KW/yr)	550 KW
Water usage (gal/yr)	4,000
Site area (acres)	8.5
Total building square footage	58,038
Employment (no. of workers)	
Total	6
Rad Workers	6
Average Dose to Worker (mrem)	3 mrem/yr
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	40
Non-hazardous (yd ³)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

A.10.1.4 *Environmental Test Facilities at Nevada Test Site*

NTS has two ETFs, the Device Assembly Facility (DAF) and the U1a Facility. Both DAF and U1a are considered “user facilities,” operated by LLNL and LANL respectively on behalf of the NNSA Nevada Site Office with the site Manage and Operation providing support, primarily in the area of facility maintenance. Under this concept, the facility is maintained in a “warm standby” condition ready to accept programmatic work. The assigned personnel maintain the facility, its authorization basis, and ensure that programmatic work is properly authorized. The actual programmatic work is conducted by project teams that deploy to the facility to conduct their activities. Thus staffing levels would only reflect the personnel required to maintain the facility in a warm standby condition and not programmatic work. In general, waste streams are associated with project activity and not routine day-to-day activities. These facilities are described below:

Device Assembly Facility Area

The DAF is a collection of more than 30 individual steel-concrete buildings connected by a rectangular common corridor. The entire complex, covered by compacted earth, spans an area of 120,000 square feet. It is located in within a 19 acre high security area. The operational buildings in the DAF include five assembly cells (Gravel Gerties); four high bays; three assembly bays; one of which houses a glove box, and one of which houses a down draft table; and two radiography bays. Five staging bunkers provide space for staging nuclear components and high explosives. All material packages arrive or depart the DAF through either of two shipping or receiving bays. The support buildings include three small vaults for staging quantities of high explosives, or special nuclear material; two decontamination areas; two buildings providing laboratory space; and an administration area. Supporting the DAF are an entry guard station and a mechanical/electrical building.

In support of the Critical Experiments Facility (CEF) project, a portion of the DAF (two assembly cells, two high bays, two staging bunkers, and one of the laboratory areas) is undergoing modifications to house the critical assembly machines being moved from Los Alamos Technical Area 18 (TA-18). The nuclear material associated with CEF has been moved to the DAF. This material is being used by various programs to measure the radiation signature of the nuclear material in different configurations. The DAF also supports the assembly of subcritical experiment packages and has been designated as the site for receipt of a damaged nuclear weapon that can not be taken to Pantex. The Nevada Site Office has received direction from NNSA's Principal Assistant Deputy Administrator for Operations to have the approved safety authorization basis for the DAF in place to support a September 2009 operational readiness date to perform specific weapons program work. DAF is being proposed as one siting option for the Engineering Test Bay (Building 334, LLNL) and the ACRR (SNL/NM) has one option within the DAF PIDAS (security area).



Figure A.10-11 — DAF at NTS

Table A.10-29 — Device Assembly Facility

Electrical usage (MWh/yr)	3,700
Water usage (gal/yr)	4,000
Site area (acres)	8.5
Building footprint (sq. feet)	4,790
Employment (no. of workers)	
Total	85
Rad Workers	60
Average Dose to Rad Worker (mrem)	30 mrem/yr
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	40
Non-hazardous (yd ³)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

U1a Complex

U1a is a standard industrial hazard facility with demonstrated capabilities to safely conduct nuclear activities including dynamic experiments involving the combination of high explosives with special nuclear materials. In its current configuration it consists of approximately one and a quarter miles of underground drifts located approximately 1000 feet beneath the surface. Three shafts connect the underground drifts with the surface and provide personnel access, extensive materials handling capabilities, numerous utility systems, and a large diagnostic cable inventory. Improved structures, aboveground, are small and sufficient to enter and exit the facility. Additional underground space can be mined out and tailored to meet experiment/facility requirements. Offices, shops, and diagnostic recording facilities, and parking are located on the surface.

Because of its unique location, 1000 feet beneath the surface, U1a offers the potential for greatly reducing security costs associated with nuclear facilities and of mitigating any potential off-site exposure to radiation. It has been proposed as a potential site for ACRR (SNL/NM) and for the ETB (Building 334, LLNL).



Figure A.10-12 — U1a Complex at NTS

Table A.10-30 — U1a Complex

Electrical usage (MWh/yr)	3,700MW
Water usage (gal/yr)	5,000
Site area (acres)	2
Building footprint (sq. feet)	2,100
Employment (no. of workers)	
Total	85
Rad Workers	60
Average Dose to Rad Worker (mrem)	30 mrem/yr
Waste Generation	
TRU (yd ³)	0
Low Level(yd ³)	0
Hazardous(yd ³)	40
Non-hazardous (yd ³)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

Appendix B
METHODOLOGY

Appendix B

ENVIRONMENTAL IMPACT METHODOLOGY

This appendix briefly describes the methods used to assess the potential direct, indirect, and cumulative effects of the alternatives in the Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS). Included are impact assessment methods for land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and archaeological resources, socioeconomics, human health and safety, accidents, environmental justice, transportation, waste management, and cumulative impacts.

B.1 LAND RESOURCES

B.1.1 Description of Affected Resources and Region of Influence (ROI)

The analysis of impacts to land use considers land use plans and policies, zoning regulations, and existing land use as appropriate for each site analyzed. The potential impacts associated with changes to land use as a result of the alternatives are also discussed.

B.1.2 Description of Impact Assessment

Land use changes associated with the implementation of the Complex Transformation SPEIS could potentially affect both developed and undeveloped land at each site. Potential changes in land use, if any, would likely occur within the existing boundaries of the alternative sites. However, the use of lands adjacent to or in the vicinity of U.S. Department of Energy (DOE) sites (i.e., non-DOE land) could be affected by these changes, including new or expanded safety zones.

Land use changes associated with construction and operation of new facilities could potentially affect both developed and undeveloped land. Land use impacts were assessed based on the extent and type of land that would be affected. The land use analysis also considers potential direct impacts resulting from the conversion of, or the incompatibility of, land use changes with special status lands such as national parks/monuments or prime farmland, and other protected lands such as Federal- and state-controlled lands (e.g., public land administered by the Bureau of Land Management or other government agencies). DOE did not consider the indirect land use impacts that could result from construction and operation of new facilities. In assessing impacts to land, the programmatic and project-specific methodologies were the same.

B.2 VISUAL RESOURCES

B.2.1 Description of Affected Resources and Region of Influence

Visual resources include natural and man-made physical features that give a particular landscape its character and value. The feature categories that form the overall impression a viewer receives of an area include landform, vegetation, water, color, adjacent scenery, rarity, and man-made (cultural) modifications.

B.2.2 Description of Impact Assessment

Criteria used in the visual resources analysis include scenic quality, visual sensitivity, distance, and/or visibility zones from key public viewpoints. The analysis is comparative in nature and consists of a qualitative examination of potential changes in visual resources, scenic values (attractiveness), and view corridors (visibility). Aspects of visual modification examined include site development or modification activities that could alter the visibility of structures at each of the alternative sites or obscure views of the surrounding landscape, and changes in land cover that could make structures more visible. In assessing impacts to visual resources, the programmatic and project-specific methodologies were the same.

B.3 SITE INFRASTRUCTURE

B.3.1 Description of Affected Resources and Region of Influence

Potentially affected site infrastructure resources include ground transportation systems, electrical distribution systems, fuels (primarily natural gas), and water. The ROI is considered to be all the land area and resources within the site boundary

B.3.2 Description of Impact Assessment

The assessment of potential impacts to site infrastructure focuses on the ability of the sites to support any of the facilities assessed in the SPEIS. The programmatic analysis focuses on supporting electrical power requirements. Other infrastructure demands, such as fuels or industrial gases, are not expected to be major discriminators for the programmatic alternatives analyzed in this SPEIS. The analysis addresses whether there is sufficient available and peak capacity to support Complex Transformation. Projections of electricity availability, site development plans, and other DOE mid- and long-range planning documents are used to project site infrastructure conditions. The project-specific analyses identify any significant infrastructure demands. In general, the infrastructure demands of all the project-specific alternatives would be minor compared to the existing infrastructure that exists at the sites analyzed.

B.4 AIR QUALITY AND NOISE

B.4.1 Non-radiological Air Resources

B.4.1.1 *Description of Affected Resources and Region of Influence*

The air quality assessment evaluates the consequences of criteria and hazardous/toxic air pollutants associated with each alternative at each candidate site. The criteria pollutants are specified in 40 *Code of Federal Regulation* (CFR) Part 50, the U.S. Environmental Protection Agency (EPA) Regulations on National Primary and Secondary Ambient Air Quality Standards. The hazardous/toxic air pollutants are listed in Title III of the 1990 *Clean Air Act* (CAA) Amendments, the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61), and standards or guidelines proposed or adopted by the respective states.

Current information on emissions from existing operations and ambient air concentrations have been obtained for each alternative site (e.g., site annual reports, recent Environmental Impact Statements [EISs]).

B.4.1.2 *Description of Impact Assessment*

Industrial Source Complex Model 3 (ISC3) is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for settling and dry deposition of particles; downwash; point, area, line, and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. ISC3 operates in both long-term and short-term modes. The screening version of ISC3 is SCREEN3. The impacts of construction emissions are evaluated based on results of SCREEN3 dispersion model and Industrial Source Complex Short Term (ISCST) model. The SCREEN3 model estimates pollutant concentrations (in units of $\mu\text{g}/\text{m}^3$) as a function of distance from the source. EPA-approved conversions are applied to adjust the predicted concentrations for comparison to the ambient air quality standards (NRC 2005). Pollutant emissions that contribute to or cause a violation of air quality standards are considered to have a major impact. Mitigation measures are identified where appropriate.

For the programmatic alternatives, which have the potential to disturb significant land during construction, modeling was performed to determine if PM_{10} emissions (which were considered to be the most likely criteria pollutant to exceed regulatory limits) at the site boundary would exceed regulatory limits. Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. Fugitive emissions were estimated based on the EPA emission factor of 1.20 tons per acre per month of activity (EPA 1995). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). A multiplication factor of 0.75 was used to correct the emission rate to one for PM_{10} (EPA 1995). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent.

The impacts of non-radiological emissions from operations are evaluated based on results of the ISCST3 dispersion model. The predicted concentrations at the nearest site boundary are added to regional background concentrations for comparison with the ambient air quality standards to assess compliance. Additional qualitative evaluation is applied to describe potential adverse impacts for proposed sites that are located within 50 miles of a federal Class I area. Pollutant emissions that contribute to or cause a violation of air quality standards are considered to have a major impact.

For the project-specific alternatives, increases in air emissions were compared to emissions from existing operations to determine if detailed modeling was necessary to demonstrate National Ambient Air Quality Standards (NAAQS) compliance. For minor increases and/or situations in which the ambient concentrations of pollutants are well below NAAQS standards, modeling was not necessary.

B.4.2 Radiological Air Resources

B.4.2.1 *Description of Affected Resources and Region of Influence*

Inhalation and ingestion are the two primary modes of exposure from radionuclide emissions. Inhalation occurs while the radionuclides are still airborne. The ROI for inhalation exposure is considered the DOE site boundary because Federal regulations limit the airborne dose exposures at the site boundary.

Radionuclide emissions will eventually settle back to the earth onto vegetation, soils, and waterbodies. Vegetation can then absorb radionuclides from the soils, and fish can absorb radionuclides from the water. When people and wildlife eat the plants or fish, they can potentially ingest radionuclides. Wildlife and waterbodies are generally not confined within the site boundary; therefore ingestion impacts can extend to a larger region, but are generally bounded within 50 miles of the point of release.

Current information on dose to non-involved workers, MEI, and collective dose to surrounding population due to radiological releases from existing operations has been obtained from each alternative site (e.g., site annual reports, recent EISs). Impacts from implementation of Complex Transformation programmatic alternatives were modeled at each potentially affected site using the CAP-88 model. The CAP-88 model was developed by EPA for assessments of both collective populations and maximally-exposed individuals.

B.4.2.2 *Description of Impact Assessment*

It is expected that radiological impacts from Complex Transformation to workers and surrounding population will be predominantly via the air pathway because no effluents are anticipated to be released. The impacts from implementation of Complex Transformation at each site are based on a combination of site-specific and technology-specific data. Site-specific data required for modeling include meteorology (e.g., wind speed, wind direction, precipitation), population distribution (for impacts on population), agricultural production (distribution about the release, types and quantity produced), and distances and directions to the fenceline (or other locations at which the public could be exposed; for MEI calculations).

Operations data required for the calculations include release rates (i.e., curies per year by nuclide) and modes of release (e.g., stack height, stack velocity, diffuse release area). Doses have been calculated for the general population and for non-involved workers (i.e., onsite workers not directly involved in the pit manufacturing operations). Doses were converted to impacts as explained in Section B.11.2. For the project-specific tritium analysis, radiological emissions associated with tritium alternatives were used to estimate potential impacts based on comparisons to the impacts from other tritium emissions. There were no other radiological releases associated with other project-specific analyses.

B.4.3 Noise

B.4.3.1 *Description of Affected Resources and Region of Influence*

Current information on noise from existing operations has been obtained from each alternative site (e.g., site annual reports, recent EISs). Resources potentially affected by noise include wildlife and sensitive receptors in the vicinity of the project site. Construction noise levels would generally be higher than operation noise levels; therefore the ROI is the radial area within 500 to 1,000 feet of the project site, depending on the specific conditions affected noise propagation that include topography and presence of large structures or dense vegetation.

B.4.3.2 *Description of Impact Assessment*

The methodology used to determine environmental impacts of Complex Transformation at each of the alternative sites with respect to noise involves a two-step analysis. The first step is to identify noise levels associated with implementation of Complex Transformation and determine if they are likely to exceed noise levels defining ambient background conditions. If these noise levels could exceed ambient conditions, the analysis determines whether the impacts are significant, using a qualitative assessment of the increase or decrease in noise level experienced by receptors near the source.

In the noise assessment, DOE included a description of the noise sources and noise levels anticipated for construction. Unmitigated logarithmic sound attenuation is assumed to estimate the distance needed for sound levels to achieve an acceptable level for both human and wildlife populations. It is anticipated that operational noise levels would be consistent with other noise sources at the site, and that they would not impose an appreciable change to the overall noise environment. In assessing noise impacts, the programmatic and project-specific methodologies were the same.

B.5 WATER RESOURCES

B.5.1 Surface Water

B.5.1.1 *Description of Affected Resources and Region of Influence*

Surface waters include rivers, streams, lakes, ponds, playas, and reservoirs. An inventory of surface water resources in the project region of influence (ROI), a description of areas in the ROI currently using surface water, general flow characteristics, reservoirs, and an identification of classifications applicable to the surface water have been used to determine the affected environment at each alternative site. Emphasis has been placed on those waterbodies that have the potential to be impacted during the facility's operations over the timeframe analyzed. Current wastewater treatment facilities and discharges have also been described in the baseline.

The affected environment descriptions for water quality of potentially affected receiving waters for each site have been developed by reviewing current monitoring data to identify parameters that exceed water quality criteria. Monitoring reports for discharges permitted under the National

Pollutant Discharge Elimination System (NPDES) program and state regulations have been examined for exceeding permit limits or requirements. In addition, surface water quality has been evaluated in terms of whether the water body supports the designated use assigned by the individual states under the *Clean Water Act* (CWA).

B.5.1.2 *Description of Impact Assessment*

The assessment of potential water quality impacts includes evaluation of the type (wastewater effluent), rate, and potential discharge constituents. Environmental consequences may result if: (1) the surface water flow rate is decreased to the point where the capacity of the receiving waterbody to assimilate discharges is noticeably diminished; (2) the proposed increases in discharge cannot comply with NPDES permit limits on flow rates; (3) the proposed increases in discharges contribute to receiving waters already identified as exceeding applicable surface water quality criteria; or (4) the proposed increases in effluent cannot comply with pre-treatment limits on flow rates or specific constituent contributions without additional treatment. In addition, any expected increases in surface water runoff are discussed along with the potential impact to surface water features at each site.

B.5.2 **Groundwater**

B.5.2.1 *Description of Affected Resources and Region of Influence*

As part of the affected environment section of the SPEIS, groundwater is described in terms of the local aquifers' extent and yield, thickness, EPA classification, and recharge and discharge areas for each site. Areas in the ROI currently experiencing groundwater overdraft and related problems, and areas that have experienced large water table declines are described if applicable. Current potable and process water supplies and systems, water rights agreements, and water allocation of the site areas are also described. The latest environmental data, including maps, reports, and other literature are used to the maximum extent possible to evaluate these conditions.

The affected groundwater quality at the site was evaluated by reviewing current monitoring data and identifying any parameters that exceed state water quality standards, drinking water standards, and DOE derived concentration guides for radionuclides in water. Parameters that exceed water quality criteria are further described and contaminant plumes delineated, where possible.

B.5.2.2 *Description of Impact Assessment*

An assessment of potential groundwater quality environmental consequences associated with pollutant discharges during facility modification and operation phases (e.g., process wastes and sanitary wastes) is examined for each site to determine if a direct input to groundwater could occur. The results of the groundwater quality projections are then discussed relative to Federal and state groundwater quality standards, effluent limitations, and safe drinking water standards to assess the acceptability of each alternative. Operation parameters from the alternatives with the potential to further degrade existing groundwater quality have been identified.

The potential effects to groundwater availability are assessed for each alternative at each candidate site by evaluating whether the proposed project: (1) increases groundwater withdrawals in areas already experiencing overdraft and other related problems (e.g., land subsidence); (2) potentially decreases groundwater levels causing a substantial depletion of the resource; (3) water requirements exceed the allotment, water rights, or available supply limits, if present; or (4) reduces or ceases the flow of one or more major springs. Suitable mitigation measures to reduce impacts are identified and discussed. In assessing impacts to water resources, the programmatic and project-specific methodologies were the same.

B.5.3 Floodplains

Floodplains include any lowlands that border a water body and encompass areas that may be covered by overflow during flood stages. As part of the affected environment discussion at each site, floodplains are identified from maps and environmental documents. Any potential facility location within a 100-year floodplain or a critical action in a 500-year floodplain is assessed for environmental consequence. The 500-year floodplain evaluation is of concern for activities determined to be critical actions for which even a slight chance of flooding would be intolerable. Appropriate mitigation measures are identified to minimize potential floodplain impacts. In assessing impacts to floodplains for both the programmatic and project-specific alternatives, if any potential facility were located in a 100-year or 500-year floodplain, this was identified.

B.6 GEOLOGY AND SOILS

B.6.1 Description of Affected Resources and Region of Influence

The analysis of geology and soils examines the ROI, or lands occupied by and immediately surrounding each alternative site. Information on the regional structural geology, stratigraphy, and soils have been collated and summarized.

In addition, the seismicity of the region surrounding each site is evaluated to provide a perspective on the probability of earthquakes in the area and their likely severity. This information is used to provide input to the evaluation of accidents due to natural phenomena.

B.6.2 Description of Impact Assessment

The proposed project areas at each site are evaluated for the amount of disturbance that may affect the geology and/or soils of the areas under study. These impacts may include, among others, potential erosion impacts and impacts to potential geologic economic resources. Impacts, if any, have been evaluated and a determination made as to severity. Possible mitigation has also been identified for adverse impacts. In assessing impacts to geology/soils, the programmatic and project-specific methodologies were the same.

B.7 BIOLOGICAL RESOURCES

B.7.1 Description of Affected Resources and Region of Influence

The affected biological resources may include both terrestrial and aquatic plants and animals. Subsets of these categories include threatened and endangered (T&E) species, and specific protected habitats, such as wetlands. Biological resources have been described within the ROI, which is defined by the lands occupied by and immediately surrounding each alternative site. In the case of T&E species, and other special interest species, biotic information includes species distribution within the county of each alternative site location. Biological data from earlier projects, wetlands surveys, and plant and animal inventories of the proposed sites were reviewed to identify the locations of plant and animal species and wetlands and to identify the impact from physical, chemical, or radiological stressors. Descriptions are at a summary level and focus within four categories: Terrestrial Resources, Wetlands, Aquatic Resources, and T&E species.

B.7.2 Description of Impact Assessment

During construction, impacts to biotic resources, including terrestrial resources, wetlands, aquatic resources, and T&E species, may result from land-clearing activities, erosion and sedimentation, and human disturbance and noise. Operations may affect biotic resources as a result of changes in land use, emission of radionuclides, water withdrawal, wastewater discharge, and human disturbance and noise. In general, potential impacts have been assessed based on the degree to which various habitats or species could be affected by an alternative. Where appropriate, impacts have been evaluated with respect to Federal and state protection regulations and standards.

The analysis of impacts of Complex Transformation programmatic alternatives to biological resources were addressed at a level that was appropriate to allow for a comparison of alternatives using the best information available. In general, the programmatic analysis of impacts to biological resources presented in the Complex Transformation SPEIS is qualitative rather than quantitative. Quantitative analyses would be performed in follow-on site- and project-specific NEPA documentation. For the project-specific analyses, the analysis evaluated the amount of land disturbed, and if any critical habitats or special status species could be affected, these were identified.

B.7.2.1 *Terrestrial Resources*

Impacts of the Complex Transformation proposed alternatives on terrestrial plant communities have been evaluated by comparing data on site vegetation communities to proposed land requirements for construction and operation. The analysis of impacts to wildlife is based to a large extent on plant community loss or modification, which directly affects animal habitat. The loss of important or sensitive habitats and species is considered more important than the loss of regionally abundant habitats or species. Impacts on biotic resources from the release of radionuclides were not evaluated because there are no data to suggest that biotic resources are more adversely affected than humans.

B.7.2.2 *Wetlands*

The potential direct loss of wetlands resulting from implementation of Complex Transformation have been addressed in a way similar to the evaluation of impacts on terrestrial plant communities; that is, by comparing data on site or area wetlands to proposed land requirements. Sedimentation impacts have been evaluated based on the proximity of wetlands to Complex Transformation project areas. Impacts resulting from wastewater discharge and other transport pathways (e.g. spills) into a wetland system have been evaluated, recognizing that effluents would be required to meet applicable federal and state standards. In assessing impacts to wetlands, the programmatic and project-specific analyses identified whether any wetlands would likely be affected by new facilities.

B.7.2.3 *Aquatic Resources*

Impacts to aquatic resources resulting from sedimentation and wastewater discharge have been evaluated as described for wetlands. Potential impacts from radionuclides have not been addressed for the same reasons described for terrestrial resources.

B.7.2.4 *Threatened and Endangered Species*

Impacts on T&E species and other special interest species have been determined in a manner similar to that used to describe terrestrial and aquatic resources since the sources of potential impacts are similar. A list of species potentially present on each candidate site or in proximity to the candidate site or area has been developed using information obtained from the U.S. Fish and Wildlife Service (USFWS) and appropriate state agencies' databases. This list, along with consideration of site environmental and engineering data, and provisions of the *Endangered Species Act*, have been used to evaluate whether the various Complex Transformation siting alternatives could impact any threatened or endangered plant or animal (or its habitat). In assessing impacts to T&E species, the programmatic and project-specific analyses identified whether any T&E species would likely to be affected by new facilities.

B.8 **CULTURAL AND ARCHAEOLOGICAL RESOURCES**

B.8.1 **Description of Affected Resources and Region of Influence**

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. For this SPEIS, cultural resources are divided into three general categories: archaeological resources, historic resources, and Native American resources. A cultural resource can fall into more than one of these categories due to use through a long period of time or multiple functions.

Archaeological resources means any material remains of past human life or activities which are of archaeological interest (Public Law 96-95; 16 U.S.C. 470aa-mm). By definition, these resources pre-date written records. Historic resources include the material remains and landscape alterations that have occurred since the arrival of Europeans to the area. Due to the focus of this SPEIS on DOE facilities, historic resources often include resources associated with the

Manhattan Project, World War II, and the Cold War. Native American resources are material remains, locations, and natural materials important to Native Americans for traditional religious or heritage reasons (Public Law 101-601). These resources are rooted in the community's history or are important in maintaining cultural identity.

The ROI includes the area within which cultural and archaeological resources could be physically impacted by construction and operation activities include the area in and around the footprint of the proposed facilities. The ROI for all alternatives also includes cultural resources nearby that could have their historic settings adversely affected by the introduction of the new facility into the viewshed.

B.8.2 Description of Impact Assessment

The analyses of potential impacts to cultural and archaeological resources are very similar because the two types of resources can be affected by the alternatives in much the same manner. The analyses address potential direct and indirect impacts at each candidate site from construction activities and operation of the facility. Most potential impacts are those resulting from groundbreaking activities; however, other types of impacts are considered, such as reduced access by practitioners to resources, introduction of visual, audible, or atmospheric elements out of character with the resources, and increased visitation to sensitive areas. Analyses of impacts take into consideration the location of the reference site, the acreage required for the proposed facility, and the likelihood of resources being located in that area. In assessing potential impacts to cultural and archaeological resources, the programmatic and project-specific methodologies were the same.

B.9 SOCIOECONOMICS

The analysis of socioeconomics describes impacts on local and regional socioeconomic conditions and factors including employment, economy, population, housing and community services at each alternative site considered in the Complex Transformation SPEIS. The potential for socioeconomic impacts is greatest in those local jurisdictions immediately adjacent to each site. Therefore, potential socioeconomic impacts are assessed using a geographic ROI. ROIs are used to assess potential effects on the economy as well as effects that are more localized in political jurisdictions surrounding the sites.

For each site, socioeconomic impacts were estimated using two geographic areas. First, a region of influence (ROI) was identified based on the distribution of residences for current Department of Energy (DOE) and contractor employees. The ROI is defined as those counties where approximately 90 percent of the current DOE and contractor employees reside. The ROI for each candidate site is presented in Table B.9.1-1. This residential distribution reflects existing commuting patterns and attractiveness of area communities for people employed at each site, and is used to estimate the future distribution of direct workers associated with the each alternative. The evaluation of impacts is based on the degree to which change in population affects the housing market and community services.

The ROI for each site encompasses an area that involves trade among and between regional industrial and service sectors. It is characterized by strong economic linkages between the communities located in the region. These linkages determine the nature and magnitude of multiplier effects on economic activity (i.e., purchases, earnings, and employment) at each candidate site. Demographic characteristics included in the socioeconomic analysis within the ROI include population, housing, and community services.

The U.S. Bureau of Economic Analysis measures multiplier effects of inter-industry linkages with the Regional Input-Output Modeling System (RIMS II). RIMS II is based on an accounting framework called an input-output table. An input-output table shows, for each industry, industrial distributions of input purchased and outputs sold. RIMS II Total Direct-Effect Multipliers has been used in the Complex Transformation SPEIS to estimate additional regional employment and income generated by employment and income directly associated with the Proposed Action. In assessing potential impacts to socioeconomics for the project-specific alternatives, the analysis focused on identifying jobs lost or added, and compared these changes to the baseline. For the flight testing alternatives that would cease operations at the Tonopah Test Range (TTR), a more detailed socioeconomic analysis was performed, due to the potential to cause more significant impacts. That specific methodology is described in Section 5.15.4.2.1.

Table B.9.1-1 — Candidate Sites’ Region of Influence

LANL	LLNL	NTS	TTR	Pantex	SNL	WSMR	SRS	Y-12
New Mexico	California	Nevada	Nevada	Texas	New Mexico	New Mexico	Georgia	Tennessee
Los Alamos	Alameda	Clark	Esmeralda	Armstrong	Bernalillo	Dona Ana	Columbia	Anderson
Rio Arriba	Contra Costa	Nye	Nye	Carson	Sandoval	Lincoln	Richmond	Knox
Santa Fe	San Joaquin	Lincoln	Lincoln	Potter	Torrance	Otero	South Carolina	Loudon
	Stanislaus			Randall	Valencia	Sierra Socorro	Aiken Barnwell	Roane

B.10 ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, signed by President Clinton in February 1994, requires each Federal agency to formulate a strategy for addressing environmental issues in human health and environment related programs, policies, planning and public participation processes, enforcement, and rulemaking. The White House memorandum accompanying the Executive Order directs Federal agencies to “analyze the environmental effects...of Federal actions, including effects on minority communities and low income communities when such analysis is required by NEPA.”

Any disproportionately high and adverse human health effects on minority populations or low-income populations that could result from Complex Transformation at any of the proposed alternative sites have been analyzed. The minority population and low-income population composition of the area surrounding the proposed alternative sites will be compared to that of a larger geographic area to determine whether possible impacts of siting Complex Transformation

at a particular site will have a disproportionately high and adverse impact on minority or low-income populations. In assessing potential environmental justice impacts, the programmatic and project-specific methodologies were the same. As a first step, the analysis focused on whether there would be any high and adverse human health effects. If none were determined, then there was no need to determine if these high and adverse human health effects were disproportionate. For this PEIS, none of the health effects were determined to be both high and adverse.

B.11 HEALTH AND SAFETY

Potential impacts of construction and operation of facilities on public and worker health and safety include cancer fatalities resulting from exposure to radionuclides, and occupational injuries and illnesses resulting from facility construction and operation. Included in this appendix is a brief discussion of the methodology for analysis of impacts to public and worker health and safety.

B.11.1 Description of Affected Resources and Region of Influence

Potential impacts to human health and safety posed by Complex Transformation include radiological and non-radiological exposure pathways and occupational injuries, illnesses, and fatalities resulting from construction activities and normal (accident-free) operations of the completed facility. Exposure pathways include inhalation, immersion, ingestion, and exposure to external sources. Occupational regions of influence include involved and uninvolved workers. Non-occupational ROIs for the public include the maximally exposed individual (MEI) and the general population surrounding the candidate sites.

Because NNSA operations have the potential to release measurable quantities of radionuclides to the environment that result in exposure to the worker and the public, NNSA conducts environmental surveillance and monitoring activities at its sites. These activities provide data that are used to evaluate radiation exposures that contribute doses to the public. Each year, environmental data from the NNSA sites are collected and analyzed. The results of these environmental monitoring activities are summarized in an *Annual Site Environmental Report* (ASER). The environmental monitoring conducted at most NNSA sites consists of two major activities: effluent monitoring and environmental surveillance.

Effluent monitoring involves the collection and analysis of samples or measurements of liquid (waterborne) and gaseous (airborne) effluents prior to release into the environment. These analytical data provide the basis for the evaluation and official reporting of contaminants, assessment of radiation and chemical exposures to the public, and demonstration of compliance with applicable standards and permit requirements.

Environmental surveillance data provide a direct measurement of contaminants in air, water, groundwater, soil, food, biota, and other media subsequent to effluent release into the environment. These data verify the NNSA site's compliance status and, combined with data from effluent monitoring, allow the determination of chemical and radiation dose and exposure assessment of NNSA operations and effects, if any, on the local environment. The effluent and environmental surveillance data presented in the ASERs were used as the primary source of data for the analysis of radiation exposure to the public for the No Action Alternative.

The public health consequences of radionuclides released to the atmosphere from normal operations at NNSA sites are characterized and calculated in the applicable ASER. Radiation doses are calculated for the MEI and the entire population residing within 50 miles of the center of the site. In this SPEIS, dose calculations from normal operations were made using the CAP-88 package of computer codes (Beres 1990), which was developed under EPA sponsorship to demonstrate compliance with 40 CFR Part 61, Subpart H, which governs the emissions of radionuclides other than radon from DOE facilities. This package implements a steady-state Gaussian plume atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground and uses Regulatory Guide 1.109 (NRC 1977) food-chain models to calculate radionuclide concentrations in foodstuffs (vegetables, meat, and milk) and subsequent intakes by humans.

Meteorological data used in the calculations were in the form of joint frequency distributions of wind direction, wind speed class, and atmospheric stability category. For occupants of residences, the dose calculations assume that the occupant remained at home (actually, unprotected outside the house) during the entire year and obtained food according to the rural pattern defined in the NESHAP background documents (EPA 1989). This pattern specifies that 70 percent of the vegetables and produce, 44.2 percent of the meat, and 39.9 percent of the milk consumed are produced in the local area (e.g., a home garden). The remaining portion of each food is assumed to be produced within 50 miles of the site. The same assumptions are used for occupants of businesses, but the resulting doses are divided by 2 to compensate for the fact that businesses are occupied for less than one-half a year and that less than one-half of a worker's food intake occurs at work. For collective effective dose equivalent (EDE) estimates, production of beef, milk, and crops within 50 miles of the site was calculated using production rates provided with CAP-88.

B.11.2 Description of Impact Assessment

Radiological impacts have been assessed for workers (both involved and non-involved in Complex Transformation operations) and for the public (MEI and population). Health impacts to involved workers from Complex Transformation operations are based on information from the Complex Transformation alternative data report [NNSA 2007]. NNSA converted radiological doses to health effects (latent cancer fatalities) using a multiplier of 600 fatal cancers per 10⁶ person-rem based on "Radiation Risk Estimation from Total Effective Dose Equivalents (TEDEs)", Office of Environmental Policy and Guidance. Washington, DC. August 9. Similarly, health impacts to the MEI and population are based on doses calculated by the radiological air analyses. Continuous exposure over the year is assumed. For worker exposures, impacts were estimated based on estimates of the number of radiation workers and the average radiological dose, based on information from the Complex Transformation alternative data report [NNSA 2007]. In assessing potential human health impacts, the programmatic and project-specific methodologies were the same.

B.11.3 Occupational Safety

Occupational injury, illness, and fatality estimates are evaluated using occupational incidence rates of major industry groups, DOE, and DOE contractors. When site-specific evaluations are performed, DOE Computerized Accident/Incident Reporting System (CAIRS) data is used. Since

activities similar to Complex Transformation operations or facility construction are not being performed at all of the potential Complex Transformation sites, U.S. Department of Labor, Bureau of Labor Statistics injury, illness and fatality information for similar activities have been used. These rates are compared to person-hour estimates for the project. Occupational injury, illness, and fatality categories used in this analysis are in accordance with OSHA definitions. Incident rates were developed for facility construction and facility operations.

Facility operations were evaluated to determine if any chemical-related health impacts would be associated with normal (accident-free) operations. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize the worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as ISMS, work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness. In assessing potential human health impacts, the programmatic and project-specific methodologies were the same.

B.12 ACCIDENT ANALYSIS

B.12.1 Description of Affected Resources and Region of Influence

Potential impacts to human health and safety from postulated accidents include radiological and non-radiological exposures. For both radiological and chemical accidents associated with operations, the affected resources are the facility and site workers and the offsite population. Specifically, for radiological accidents, the impact is incremental adverse health effects (i.e., latent cancer fatalities [LCFs]) for a non-involved worker, the maximally exposed offsite individual, and the offsite population within 50 miles of each alternative site. For non-radiological accidents, airborne concentrations and potential health effects have been calculated for the non-involved worker and the maximally exposed offsite individual.

B.12.2 Description of Impact Assessment

Postulated accidents can be initiated by internal operations (e.g., fire, spill, criticality), external events (e.g., airplane crash), or natural phenomena (e.g., earthquake, flood). The Complex Transformation SPEIS evaluates unmitigated accident scenarios chosen to reflect the range and kinds of accidents that are postulated. The range of accidents is from low frequency high consequence events (probabilities as low as approximately 10^{-6}) to high frequency-low consequence events (probabilities as high as approximately 10^{-2}) in order to assess potential risks. The spectrum of accidents and their calculated impacts should provide a baseline for each site that can be used to judge the environmental implications of locating particular facilities and missions at different sites. The accident analyses were performed in accordance with the *Recommendations for Analyzing Accidents Under the National Environmental Policy Act* (July 2002). Appendix C provides additional information on the accident methodology.

For radiological accidents, point estimates of radiation dose and, for the offsite population, corresponding incremental LCFs were calculated for a hypothetical non-involved worker from release points at proposed sites, the maximally exposed offsite individual, and the offsite

population within 50 miles of each alternative site. For non-radiological accidents, estimates of airborne concentrations of chemical substances have been calculated for a hypothetical non-involved worker and the maximally exposed offsite individual.

It should be noted that the purpose of this SPEIS is to assist NNSA in making site selection decisions. Since nuclear weapons activities or facilities would be the same regardless of location, the risk to involved workers is independent of where the activity occurs or the facility is located and would not be a discriminating factor for programmatic siting decisions. For the project-specific analyses, potential impacts to involved workers were considered and discussed as appropriate.

For radiological and chemical accidents, the following general analytical steps were followed:

1. Screen operations at the facilities to identify those with the potential to contribute to offsite risk.
2. Identify and screen postulated accident scenarios associated with those operations.
3. Calculate source terms (release rates and frequencies) for these unmitigated scenarios assuming no mitigation of releases or frequencies.
4. Calculate onsite and offsite consequences (impacts to the health and safety of workers and the general public) of these scenarios.

The unmitigated consequences of accidental releases of radioactivity were calculated using the MELCOR Accident Consequence Code System Version 2 (MACCS2) with the radiological source term values described above. In addition to the source term data, the following input data for the MACCS2 code were obtained:

- Estimated location of specific facilities and their distance from the site boundary
- Release heights (i.e., stack release, building release, or ground level release)
- Local meteorological conditions
- Offsite population distribution (using the 2000 census data)
- Offsite agricultural and economic data

The consequences of accidental releases of hazardous chemicals were calculated using the Aerial Location of Hazardous Atmospheres (ALOHA) code based on information from the Complex Transformation alternative data report [NNSA 2007]. In addition to the source term data, input data for the ALOHA code is similar to that required for the radiological accident analysis, with the exception that offsite agricultural and economic data are not required.

For accident scenarios involving multiple operations within nuclear weapons facilities, such as those that might be caused by natural phenomena, estimates of radiation dose and corresponding incremental LCFs and estimates of airborne concentrations of chemical substances were calculated for the same receptors as described previously. .

B.12.3 Terrorist Attacks

Analyses of the potential impacts of terrorist attacks are in a classified appendix to this SPEIS. The impacts of some terrorist attacks would be similar to the accident impacts described earlier in this section, while others would have more severe impacts. This section describes the methodology NNSA uses to assess the vulnerability of its sites to terrorist attacks and then designs its systems to prevent and deter those threats.

B.12.3.1 *Assessment of Vulnerability to Terrorist Threats*

In accordance with DOE Order 470.3A, Design Basis Threat Policy, and DOE Order 470.4, Safeguards and Security Program, NNSA conducts vulnerability assessments and risk analyses of its facilities and sites to determine the physical protection elements, technologies, and administrative controls NNSA should use to protect its assets, its workers, and the public. DOE Order 470.4 establishes the roles and responsibilities for the conduct of DOE's Safeguards and Security Program. DOE Order 470.3A establishes requirements designed to prevent unauthorized access, theft, diversion, or sabotage of nuclear weapons, components, and special nuclear material controlled by NNSA.

Among other things, DOE Order 470.3A: (a) specifies those national security assets that require protection; (b) outlines threat considerations for safeguards and security programs to provide a basis for planning, designing, and constructing new facilities; and (c) requires the development of credible scenarios of threats that are used to design and test safeguards and security systems. NNSA must also protect against espionage, sabotage, and theft of materials, classified matter, and critical technologies.

NNSA's safeguards and security programs and systems employ state-of-the-art technologies to:

- Deny adversaries access to nuclear weapons, nuclear test devices, and completed nuclear assemblies;
- Deny adversaries the opportunity to steal special nuclear materials (SNM), sabotage weapons or facilities, or produce an unauthorized nuclear yield (criticality) of SNM;
- Protect the public and employees from harm resulting from an adversary's use of radiological, chemical, or biological materials; and
- Protect classified information, classified matter, and designated critical facilities or activities from sabotage, espionage, and theft.

NNSA's vulnerability assessments employ a rigorous methodology based on guidance from the DOE Vulnerability Assessment Process Guide (September 2004), and the Vulnerability Assessment Certification course. Typically, a vulnerability assessment involves analyses by subject matter experts to determine the effectiveness of a safeguard and security system used to protect against an adversary with certain capabilities. Vulnerability assessments generally include the following activities:

Characterizing the threat. Threat characterization provides a detailed description of a physical threat by a malevolent adversary to a site's physical protection systems. Usually the description includes information about the types of potential adversaries, their motivations, objectives,

actions, capabilities, and site-specific tactical considerations. Much of the information required to develop a threat characterization is described in DOE Order 470.3A and the Adversary Capabilities List. The Department also issues site-specific guidance, to assist in this process.

Determining the target. Target determination involves identifying, describing, and prioritizing potential targets among NNSA's security interests. Results of target determinations are used to help characterize potential threats and objectives, as well as, protective force and neutralization requirements.

Defining the scope. The scope of a vulnerability assessment is determined by subject matter experts and depends on the site vulnerabilities. In addition to defining the threat and possible terrorist objectives, the scope establishes the key assumptions and interpretations that will guide the analyses, as well as the objectives, methods, and format for documenting the results of the vulnerability assessment.

Characterizing the facility or site. This activity requires defining and documenting every aspect of the facility or site to be assessed, particularly existing security programs (personnel security, information security, physical security, material control and accountability, etc.), to assist in identifying strengths and weaknesses. Results are used as inputs to the pathway analyses, which DOE uses to develop representative scenarios for evaluating the security system. Facility and site characterization modeling tools include Analytical System and Software for Evaluating Safeguards and Security (ASSESS), Adversary Time-Line Analysis System (ATLAS), VISA, tabletop analysis, and others.

Characterizing the protective force. To assess a facility or site's vulnerability, analysts must accurately characterize protective force's capabilities against a defined threat and objective, particularly its ability to detect, assess, interrupt, and neutralize an adversary. Specific data used for this activity include special nuclear materials categorization; configuration, flow, and movement of special nuclear materials within or from a facility or site; defined threats; detection and assessment times; and adversary delay and task time. The protective force's equipment, weapons, size, and posts also are considered in the characterization. The characterization information is validated and verified via observation, alarm response assessments, performance tests, force-on-force exercises, joint conflict and tactical simulation (JCATS), and tabletop analyses. The JCATS software tool is used for training, analysis, planning, and mission rehearsal, as well as characterization of the protective force. It employs detailed graphics and models of buildings, natural terrain features, and roads to simulate realistic operations in urban and rural environments.

Analyzing adversary pathways. This activity identifies and analyzes adversary pathways based on the results of threat, target, facility, and protective force characterization, as well as ancillary analyses such as explosives analysis. ASSESS and ATLAS are two primary tools that are used in this analysis. Analysts also conduct insider analysis as part of this activity.

Developing credible scenarios. Credible scenarios are developed for use in performance testing and to determine the effectiveness of the security system in place against a potential adversary's objectives. As part of this activity, data from the adversary pathways analyses are used to

identify applicable threats, threat strategies, and objectives, and combined with protective force strategies and capabilities to develop scenarios that include specific adversary resources, capabilities, and projected task times to successfully achieve their objectives. Specialists also work with the vulnerability assessment team to develop realistic scenarios that provide a structured and informal analysis of the strengths and weaknesses of potential adversaries.

Determining the probability of neutralization. The probability of neutralization is the probability that a protective force can prevent an adversary from achieving its objectives. The probability is derived from more than one source, one of which must be based on Joint Tactical Simulation, JCATS analysis, or force-on-force exercises.

Determining system effectiveness. System effectiveness is determined by applying an equation that reflects the capabilities of a multi-layered protection system. Analysis data derived from the various vulnerability assessment activities are used to calculate this equation, which reflects the security system's effectiveness against each of the scenarios developed for the vulnerability assessment. If system effectiveness is unacceptable for a scenario, the root cause of the weakness must be analyzed and security upgrades must be identified. The scenarios are reanalyzed with the upgrades, and effective upgrades are documented in the vulnerability analysis report.

Implementation. The culmination of the vulnerability assessment is development of a report documenting the analyses and results and a plan for implementing any necessary changes to security systems. NNSA verifies the results of the vulnerability assessment report and the conclusions of the implementation plan. NNSA also oversees the implementation of security system upgrades.

B.12.3.2 *Terrorist Impacts Analysis*

Substantive details of the credible scenarios for terrorist attacks NNSA's countermeasures, and potential impacts of attacks are not released to the public because disclosure of this information could be exploited by terrorists and assist them in the planning of attacks. Depending on the intentionally destructive acts, impacts may be similar to or would exceed those of bounding accidents analyzed elsewhere in the SPEIS. A separate classified appendix to this SPEIS evaluates the impacts of an adversary achieving its objectives in one or more of the credible scenarios.

The classified appendix evaluates the potential impacts of the successful execution of credible scenarios for the alternatives at all six sites (LANL TA-16, LANL TA-55, NTS, SRS, Pantex, and Y-12) and calculates consequences to a noninvolved worker, maximally exposed individual, and population in terms of direct effects, radiation dose, and LCFs. Risks are not calculated because the probability that an adversary could successfully execute the attack in a scenario cannot be quantified. The MACCS2 and RISKIND computer codes are used along with other manual methods to calculate human health effects of each credible scenario. The same site-specific meteorology and population distribution that is used in the accident analyses in SPEIS Appendix C are used in analyses of the impacts of an adversary achieving its objectives in the credible attack scenario.

B.12.3.3 *Mitigation of Impacts from Potential Terrorist Attacks*

The DOE strategy for the mitigation of environmental impacts resulting from a terrorist attack has three distinct components: (1) prevent and deter terrorists from executing successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

B.12.3.3.1 Actions to Prevent or Reduce the Probability of Successful Attacks

NNSA employs a well-established system of engineered and administrative controls to prevent or reduce the probability of occurrence of extreme events and to limit their potential impacts on the environment. This system has evolved over time and will continue to evolve as new security requirements are identified, as new become available, and as new engineering standards or best practices are developed. The directing requirements and the framework for implementing this system of controls are embodied in the Code of Federal Regulations and in DOE Orders. These are imposed as contractual requirements for DOE management and operating (M&O) contractors. The NNSA system of safety requirements and quality assurance guidelines and controls covers all aspects of key nuclear and non-nuclear facilities including design requirements, construction practices, start-up and operational readiness reviews, and routine operations and maintenance. The contractor and federal staff at these facilities are evaluated for trustworthiness and reliability.

B.12.3.3.2 Plan for and Respond to Emergency Situations

While NNSA has comprehensive security measures to prevent terrorist attacks, it is also necessary to have the capability for timely and adequate response to emergency situations. Therefore, in addition to the systems of workplace hazard controls and safeguards and security measures, the NNSA emergency management system imposes additional protections over operations involving dispersible hazardous materials in quantities that could harm people outside the immediate workplace. NNSA's comprehensive all-hazards approach to emergency management is established in DOE Order 151.1C, Comprehensive Emergency Management System. This Order provides a general structure and framework for responding to any emergency at an NNSA facility or for an NNSA activity and specific requirements to address protection of workers, the public, and the environment from the release of hazardous materials.

NNSA's comprehensive emergency management system is based on a three-tiered structure consisting of facility, site, or activity management; the Cognizant Field Element; and Headquarters, with each tier having specific roles and responsibilities during an emergency. Each organizational tier provides management, direction, and support of emergency response activities. Management personnel of a facility, site, or activity manage the tactical response to the emergency by directing the mitigative actions necessary to resolve the problem, protect the workforce, the public, and the environment; and return the facility, site, or activity to a safe condition. The Cognizant Field Element oversees the facility/site response and provides local assistance, guidance, and operational direction to the facility/site management. The Cognizant

Field Element also coordinates the tactical response to the event with tribal, state, and local governments. NNSA Headquarters provides strategic direction to the response, provides assistance and guidance to the Cognizant Field Element, and evaluates the broad impacts of the emergency on the NNSA complex. Headquarters also coordinates with other Federal agencies on a national level, provides information to representatives of the executive and legislative branches of the Federal government, and responds to inquiries from the national media.

Each NNSA facility, site, or activity is required by DOE Order 151.1C to have an Operational Emergency Base Program, which provides the framework for responding to serious events or conditions that involve the health and safety of the workforce and the public, the environment, and safeguards and security. The objective of the Operational Emergency Base Program is to achieve an effective integration of emergency planning and preparedness requirements into an emergency management program that provides capabilities for all emergency responses through communication, coordination, and an efficient and effective use of resources, that is commensurate with the hazards present at that facility, site, or activity.

DOE Order 151.C requires that a Hazards Survey be prepared, maintained, and used for emergency planning purposes. The Order requires that emergency management efforts begin with the identification and qualitative assessment of the facility- or site-specific hazards and the associated emergency conditions that may require response, and that the scope and extent of emergency planning and preparedness reflect these facility-specific hazards. Hazards Surveys are used to:

- identify the generic emergency conditions that apply to each facility;
- qualitatively describe the potential health, safety, or environmental impacts of the applicable emergencies;
- identify the applicable planning and preparedness requirements; and
- indicate the need for further evaluation of hazardous materials in an Emergency Planning Hazards Assessment (EPHA).

Some facilities have been analyzed as stand-alone facilities; however, several structures or component units with common or related purposes have been combined into a facility- or complex-wide hazards survey. Each facility- or complex-specific hazards survey clearly identifies the facility and describes the facility's mission, operations, and physical characteristics.

Using the knowledge and insights gained through the Hazards Survey and EPHA processes, the emergency management organization at each NNSA site or facility develops detailed plans and procedures and trains the staff to carry out response actions to reduce the severity of hazardous material release events and to minimize health impacts.

The Response Activities of the Emergency Management Program that would come into play should an operational emergency occur would include many of the following elements, depending on the specific circumstances:

Emergency Response Organization (ERO) The ERO is structured to enable it to assume overall responsibility for initial and ongoing site actions associated with the emergency response and mitigation. The ERO establishes effective control at the event/incident scene and integrates local

agencies and organizations providing onsite response services.

Offsite Response Interfaces DOE Order 151.1C requires coordination with tribal, state, and local agencies and organizations responsible for offsite emergency response. Interrelationships and interfaces for fire, HAZMET, medical, and law enforcement and mutual assistance and support are pre-arranged and documented in various formal plans, agreements, and memoranda of understanding.

Emergency Facilities and Equipment The EPHA is used to assist in determining the types and amounts of personal protective equipment, radiation monitoring, communications, and other equipment and supplies required to be maintained and operable for immediate use in responding to an operational emergency. Facilities established for either dedicated permanent use or on an adhoc basis depending on the specific type and location of the operational emergency can include Emergency Operations Centers (EOCs), Command Centers, and Joint Information Centers. Departmental assets that may be required in the event of an operational emergency involving nuclear weapons, weapons components, or the dispersal of special nuclear materials include the Accident Response Group, Nuclear Emergency Search Team, Federal Radiological Monitoring and Assessment Center, Aerial Measuring System, Atmospheric Advisory Capability, Radiological Emergency Assistance Center/Training Site, and the Radiological Assistance Program.

Emergency Categorization and Classification DOE Order 151.1C and the associated Emergency Management Guide (DOE G 151.1-1A) require a DOE site or facility to declare an operational emergency when unplanned or abnormal events or conditions require time-urgent response from outside the immediate affected site, facility, or area of the incident. Events or conditions meeting the criteria for categorization as operational emergencies are those events or conditions that have the potential to cause: serious health or safety impacts to workers or the public; serious detrimental effects on the environment; direct harm to people or the environment as a result of degradation of security or safeguards conditions; direct harm to people or the environment as a result of a major degradation of safety systems, protocols, or practices involving hazardous biological agents or toxins; or loss of control over hazardous materials (for example, toxic chemicals or radioactive materials). NNSA sites or facilities are also required to classify an operational emergency that involves the loss of control over hazardous materials resulting in an actual or potential airborne release to the environment (outside a structure or enclosure on an NNSA facility or site) as either an Alert, Site Area Emergency, or General Emergency, in order of increasing severity.

Notifications and Communications The accurate, timely, and useful exchange of information during an emergency response is a key factor in understanding the scope of an emergency and providing proper response to limit its impacts. Emergency reporting includes initial notifications to onsite personnel, emergency response personnel, and offsite authorities including applicable NNSA elements; other Federal Agencies; and local, state, and tribal government organizations, and follow-on emergency status updates.

Consequent Assessment Consequence assessment includes all processes utilized to perform data collection and analysis necessary to support critical initial assessments and the continuing processes of refining the assessments as more information and additional resources become

available. These can involve monitoring for specific indicators or field measurements and the integration of monitoring data with calculations and modeling capabilities. Consequence assessment is integrated with both event classification and protective action decision making and can include coordination with offsite entities including federal, state, local, and tribal organizations.

Protective Actions and Re-entry Protective actions can be implemented either individually or in combination to reduce exposure of the workforce and the public to special nuclear materials or other hazardous materials. These can include:

- Controlling, monitoring, and maintaining records of personnel exposure to radiological and non-radiological hazardous materials
- Sheltering or evaluation
- Turning off heating, ventilation, and air conditioning systems during sheltering
- Controlling access to contaminated areas and decontaminating personnel or equipment exiting the area
- Controlling foodstuffs and water, or changing livestock and agricultural practices
- Developing and deploying for use in protective action decision making prepared Protective Action Guides and Emergency Response Planning Guidelines using DOE-approved guidance applicable to the actual or potential release of hazardous materials.

Planning and executing re-entry activities must include establishing adequate measures for the protection of response personnel from unnecessary exposure to hazardous materials or conditions either known or suspected to exist at the site of the accident or incident.

Emergency Medical Support Emergency medical support includes providing various levels of treatment to those who may become injured or contaminated and arranging with offsite medical facilities to transport, accept, and treat contaminated, injured personnel. DOE Order 440.1A establishes requirements for facility and site medical programs required to meet the provisions of 10 CFR 851.210, *Occupational Medicine*, and addresses the medical organization, facilities and equipment, communications planning, and preparedness activities considered necessary for providing the medical treatment and access to medical services for mass casualty situations and medical response to an operational emergency involving contamination.

Emergency Public Information The Emergency Public Information program plays a critical role in establishing and maintaining coordination with tribal, state, and local governments and the public. The program is expected to provide timely, candid, and accurate information to the workforce, the news media, and the public during an operational emergency. Providing accurate and factual health and safety information and security information helps to avoid and discourage speculation. The elements of an effective program can be pre-established by developing appropriate broadcast and print media interfaces, establishing a system for assembling and releasing emergency information that may include set-up of a Joint Information Center with representatives of offsite organizations, and conducting various drills and exercises that include exercising various Emergency Public Information program systems to educate the press and the public.

Termination and Recovery An operational emergency is terminated only after a predetermined set of criteria is met and in many scenarios, termination must be coordinated with various offsite

agencies. The various pathways and timelines for recovery and resumption of normal operations must be developed to ensure the health and safety of the work force and the public. Actions may include the creation of a recovery organization to manage the conduct of recovery operations and to maintain communication and coordination with local, state, and tribal organizations, and other federal agencies providing support at the site. Specific recovery procedures may include dissemination of information to federal, state, tribal, and local organizations regarding the emergency and conditions required for the relaxation of public protection measures; planning and conducting decontamination actions; development and compliance with reporting requirements; and the creation of processes and procedures to guide the resumption of normal operations. Recovery also specifically includes the evaluation of the accident or incident and the response to identify lessons learned and develop potential means to mitigate the effects of future operational emergencies.

B.12.3.3.3 Progressive Recovery Through Long-Term Response

The recovery phase of an operational emergency in which radioactive materials are dispersed over a wide area could require years to complete and might require an extended response by NNSA. The specific requirements for an extended response would be dictated by the circumstances. Requirements may include a continuing coordination with local authorities and various government agencies to continue protective actions and controls; long-term monitoring of the affected environment, population, or both for effects attributable to the operational emergency; providing medical support for affected individuals; maintaining public information and various technical and other response interfaces; and performing periodic reassessments and evaluations of progress in the recovery and return to more normal conditions.

B.13 TRANSPORTATION

B.13.1 Description of Affected Resources and Region of Influence

Transportation routes in the vicinity of the proposed Complex Transformation location have been identified, in text and on a map, to indicate which highways would be impacted by Complex Transformation traffic, including commuters and shipments. Traffic data, such as annual average daily traffic, is presented as a baseline for a subsequent qualitative analysis of increased traffic congestion. Traffic data has been derived from recent DOE environmental documentation or from state agencies.

B.13.2 Description of Impact Assessment

The Complex Transformation SPEIS assesses the impacts associated with the transportation of radiological materials and workers as described below. The methodology for both the programmatic alternatives and project-specific alternatives was the same.

B.13.2.1 *Incident-Free Transportation Impacts*

The amount of radiological material requiring transportation was first determined based on information from the Complex Transformation alternative data report [NNSA 2007]. Next,

using the RADTRAN 5 code, routes and routing characteristics were determined for the origin-destination pairs associated with the transportation of radiological material.

Radiological dose during normal, incident-free transportation of radioactive materials results from exposure to the external radiation field that surrounds the shipping containers. The dose is a function of the number of people exposed, their proximity to the containers, their length of time of exposure, and the intensity of the radiation field surrounding the containers. For the purpose of providing a conservative estimate of impacts, exposure rates assumed exposure rates of 5 mrem/hour. This assumption is much higher than assumptions utilized in the handling/loading analysis of pits and canned subassemblies (CSAs) provided in the *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*. In that FEIS, an external exposure rate of 1 mrem/hour was assumed (DOE 1996).

Loading operations typically represent the largest exposure impacts involved with the transportation of nuclear materials. NNSA assumed that loading operations would require 1 shift-day for each truck trailer loaded. A shift-day would represent a crew of five workers exposed to the load for eight hours. Estimation of loading operation impacts of other materials and waste products was based on the size and number of packages per load.

Radiological impacts were determined for crew workers and the general population during normal, incident-free transportation. For shipments, the crew was defined as the driver and passenger of the shipment vehicles. The general population was the individuals within 800 meters (2,625 feet) of the road, sharing the road, and at stops. Collective doses for the crew and general population were calculated using the RADTRAN 5.6/RadCat 2.3 computer codes (Weiner et al. 2006).

For the worker populations, DOE evaluated the following scenario:

- A truck driver and passenger, serving as an escort, that would be expected to drive radioactive shipments for 1,000 hours per year and unload shipments for 1,000 hour per year.

For shipments, the three scenarios for members of the public were:

- A person caught in traffic and located 1 meter (3 feet) away from the surface of the shipping container for 30 minutes;
- A service station worker working at a distance of 20 meters (66 feet) from the shipping container for 1 hour; and,
- A resident living 30 meters (98 feet) from the highway used to transport the shipping container.

The hypothetical maximum exposed individual doses were accumulated for all shipments over 1 year. For workers, it was assumed that they would be exposed to 23 percent of the shipments, based on working 2,000 hours per year. However, for the scenario involving an individual caught in traffic next to a truck, the radiological exposures were calculated for only one event because it was considered unlikely that the same individual would be caught in traffic next to all containers

for all shipments. The maximum exposed transportation worker is the driver who was assumed to drive shipments for up to 1,000 hours per year. In the maximum exposed individual scenarios, the exposure rate for the shipments depended on the type of material being transported. Also, the maximum exposure rate for the truck driver was 2 mrem per hour (10 CFR Part 71.47(b) (4)).

Incident-free nonradiological fatalities were estimated using unit risk factors. These fatalities would result from exhaust and fugitive dust emissions from highway and rail traffic and are associated with 10-micrometer particles. The nonradiological unit risk factors were adopted from the transportation analysis conducted for the Final West Valley Demonstration Waste Management EIS (DOE 2003). The unit risk factors used in this analysis was 1.5×10^{-11} fatalities per kilometer per persons per square kilometer for diesel truck transport.

B.13.2.2 *Transportation Accidents*

The offsite transportation accident analysis considers the impacts of accidents during the transportation of radiological materials. Under accident conditions, impacts to human health and the environment may result from the release and dispersal of radioactive material. Accidents that could potentially breach the shipping container are represented by a spectrum of accident severities and radioactive release conditions. Historically, most transportation accidents involving radioactive materials have resulted in little or no release of radioactive material from the shipping container. Consequently, the analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. This accident analysis calculates the probabilities and consequences from this spectrum of accidents.

To provide NNSA and the public with a reasonable assessment of radioactive waste transportation accident impacts, two types of analyses were performed. An accident risk assessment was performed that takes into account the probabilities and consequences of a spectrum of potential accident severities using a methodology developed by the NRC (NRC 1977; Fischer et al. 1987; Sprung et al. 2000). For the spectrum of accidents considered in the analysis, accident consequences in terms of collective dose to the population within 80 kilometers (50 miles) were multiplied by the accident probabilities to yield collective dose risk using the RADTRAN 5.6/RadCat 2.3 computer code (Weiner 2006).

The impacts for specific alternatives were calculated in units of dose (rem or person-rem). Impacts are further expressed as health risks in terms of estimated latent cancer fatalities in exposed populations. The health risk conversion factor of 0.0006 LCF/person-rem was derived from the Interagency Steering Committee on Radiation Standards report (ISCOR 2002), A Method for Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE).

The risk analyses consider a spectrum of accidents of varying severity. Each first determines the conditional probability that the accident will be of a specified severity. Then, based on the accident environment associated with each severe accident, each models the behavior of the material being shipped and the response of the packaging. The models estimate the fraction of each species of radioactive material that might be released for each of the severe accidents being considered.

B.13.2.3 *Traffic Impacts*

Traffic flow has been analyzed to determine whether or not the flow would be adversely impacted by the addition of new commuters at each of the potential sites for both construction and operations phases. The number of new commuters has been determined based on construction and operations employment. The analysis determined the percent change in traffic as a result of the alternatives.

B.14 WASTE MANAGEMENT

B.14.1 Description of Affected Resources and Region of Influence

A key goal of Complex Transformation is to develop a safe, secure, environmentally compliant facilities based on modern manufacturing procedures. Waste minimization is a goal of Complex Transformation. The production of waste requiring offsite disposal will be reduced to as low as reasonably achievable (ALARA) consistent with cost-benefit analyses. Waste minimization and pollution prevention efforts and the management of Complex Transformation-related wastes have been analyzed for each alternative site. The impact assessment addresses the projected waste types and volumes from Complex Transformation facilities and operations at each site compared to the No Action Alternative. The methodology for both the programmatic alternatives and project-specific alternatives was the same.

Wastes generated during Complex Transformation operations would consist of five primary types: transuranic (TRU) waste, low-level waste (LLW), mixed LLW, hazardous waste, and nonhazardous waste. Waste management facilities supporting Complex Transformation operations would treat and package the waste into forms that would enable long-term storage or disposal. Other waste types generated by Complex Transformation facilities would be transferred to existing facilities and managed in accordance with current practices at the DOE site.

B.14.2 Description of Impact Assessment

To provide a framework for addressing the impacts of waste management for Complex Transformation facilities, descriptive information has been presented on each site's waste management capabilities. The volumes of each waste type generated are estimated. These estimates, obtained from the Complex Transformation data call, include consideration of concepts for waste minimization. Impacts have been assessed in the context of existing site practices for treatment, storage, and disposal including the applicable regulatory requirements. Permits, compliance agreements, and other site-specific practices have been reviewed and analyzed to assess the ability to conduct the Complex Transformation-related waste management activities.

DOE generates both "routine" waste (e.g., job control, maintenance) and waste associated with Environmental Restoration (ER) and Decontamination and Decommissioning (D&D) activities. The ER/D&D waste volumes can vary greatly from year to year and often exceed the routine waste volumes. ER/D&D waste is fundamentally different (more volume, less contamination) from routine wastes and is frequently managed at separate facilities. The estimated waste volumes for Complex Transformation operations have been compared to the routine waste

generation at each site to identify potential impacts to the site's waste management infrastructure.

For any alternatives that generate transuranic (TRU) waste, the number of additional shipments required to transport TRU waste to the WIPP was estimated and the impacts assessed as part of the transportation analysis. The SPEIS acknowledges that the total disposal capacity at WIPP is limited to 6,180,000 ft³ under the *WIPP Land Management Act*. However, DOE continues to recognize that the amount of TRU waste to be disposed of could exceed these volumes. In the future, if inventory projects show a need for additional disposal capacity for TRU waste, DOE would initiate the development of strategies for expanding such capacity at an appropriate time. However, because DOE has made no plans to date regarding the location or design of a waste disposal facility for TRU waste beyond WIPP's current capacity, this SPEIS assumed WIPP as the disposal location for TRU waste generated under each alternative, for the purposes of transportation analysis only.

For sites under consideration for Complex Transformation that do not have existing or planned onsite LLW disposal, the number of additional shipments required to transport LLW from the site to a DOE LLW disposal facility has been estimated. For example, for purposes of this analysis, it is assumed that the Pantex Plant would ship its LLW to the Nevada Test Site as per current practice. The risks associated with additional LLW shipments have been addressed as part of the transportation impacts assessment.

B.15 CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations implementing NEPA define cumulative effects as "the impact on the environment which results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR Part 1508.7). The regulations further explain "cumulative effects can result from individually minor but collectively significant actions taking place over a period of time." Other DOE programs and other Federal, state, and local development programs all have the potential to contribute to cumulative effects on DOE sites.

The methodology for the analysis of cumulative effects for the Complex Transformation SPEIS was developed from the guidelines and methodology in the CEQ's *Considering Cumulative Effects Under the National Environmental Policy Act*. The major components of the CEQ methodology include:

- Scoping, including identifying the significant potential cumulative effects issues associated with the proposed action, and identifying other actions affecting the resources
- Describing the affected environment
- Determining the environmental consequences, including the impacts from the proposed action and other activities in the ROI, and the magnitude and significance of the cumulative effects

The cumulative effects of the Complex Transformation SPEIS alternatives have been analyzed for each alternative site by reviewing and analyzing data from existing NEPA documents and other DOE documents. To update the data and to supplement this information, Internet searches,

literature reviews of environmental documents for the regions surrounding the proposed sites, and personal contacts with local government planning departments have been undertaken, as needed, to obtain information on the potential cumulative effects for each resource area. For some resource areas, the analysis includes the cumulative regional impacts. For example, the air analysis must examine air quality in the region for each potential site in order to assess the impacts of the proposed action.

Environmental impacts for other DOE programs and other Federal, state, and local development programs for each potential site have been reviewed and the cumulative impacts analyzed. The analysis includes impacts from previous actions at each of the sites and within the region of influence, current actions, and actions planned for reasonably foreseeable future actions. These impacts, combined with the impacts from the Complex Transformation SPEIS, form the basis of the analysis of cumulative effects. Where possible, quantifiable data is used. The level of analysis for each resource area is commensurate to the importance of the potential cumulative impacts on that resource. The data and analysis is then summarized and potential cumulative impacts for each site identified. For the project-specific analyses, because impacts were generally very small relative to existing operations at sites, the analysis of the additive project-specific impacts to the site baseline was tantamount to a cumulative assessment.

Appendix C
HUMAN HEALTH AND ACCIDENTS

Appendix C

HUMAN HEALTH, SAFETY, AND ACCIDENTS

This appendix to the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) provides supplemental information pertaining to potential human health impacts associated with radiation exposures, chemical exposures, accidents, and worker safety issues due to operations of the major facilities (as identified in Chapter 3) associated with the programmatic alternatives analyzed. Located at the end of this appendix is a separate reference section.

C.1 RADIOLOGICAL IMPACTS ON HUMAN HEALTH

C.1.1 Radiation and Radioactivity

Humans are constantly exposed to naturally occurring radiation through sources such as from the universe and from the earth's rocks and soils. This type of radiation is referred to as *background radiation*, and it is always around us. Background radiation remains relatively constant over time and is present in the environment today just as it was hundreds of years ago. In addition, humans are also exposed to manmade sources of radiation, including medical and dental x-rays, household smoke detectors, materials released from coal burning power plants and nuclear facilities. The following sections describe some important principles concerning the nature, types, sources, and effects of radiation and radioactivity.

C.1.1.1 What Is Radiation?

Some atoms have large amounts of energy and are inherently unstable. They may reach a stable, less energetic state through the emission of subatomic particles or electromagnetic radiation, a process referred to as radioactivity. The main subatomic particles that comprise an atom are electrons, protons, and neutrons. *Electrons* are negatively charged particles that are principally responsible for chemical reactivity. *Protons* are positively charged particles, and *neutrons* are neutral. Protons and neutrons are located in the center of the atom, called the nucleus. Electrons reside in a designated space around the *nucleus*. The total number of protons in an atom is called its *atomic number*.

Atoms of different types are known as elements. There are more than 100 natural and manmade elements. Atoms of the same element always contain the same number of protons and electrons, but may differ by their number of constituent neutrons. Such atoms of elements having a different number of neutrons are called the *isotopes* of the element. The total number of protons and neutrons in the nucleus of an atom is called its *mass number*, which is used to identify the isotope. For example, the element uranium has 92 protons. Therefore, all isotopes of uranium have 92 protons. Each isotope of uranium is designated by its unique mass number: ^{238}U , the principal naturally occurring isotope of uranium, has 92 protons and 146 neutrons; ^{234}U has 92 protons and 142 neutrons; and ^{235}U has 92 protons and 143 neutrons. Atoms can lose or gain electrons in a process known as *ionization*.

Ionizing radiation has enough energy to free electrons from atoms, creating ions that can cause biological damage. Although it is potentially harmful to human health, ionizing radiation is used in a variety of ways, many of which are familiar to us in our everyday lives. An x-ray machine is one source of ionizing radiation. Likewise, most home smoke detectors use a small source of ionizing radiation to detect smoke particles in the room's air. The two most common mechanisms in which ionizing radiation is generated are the electrical acceleration of atomic particles such as electrons (as in x-ray machines) and the emission of energy from nuclear reactions in atoms. Examples of ionizing radiation include alpha, beta, and gamma radiation.

Alpha radiation occurs when a particle consisting of two protons and two neutrons is emitted from the nucleus of an unstable atom. Alpha particles, because of their relatively large size, do not travel very far and do not penetrate materials well. Alpha particles lose their energy almost as soon as they collide with anything, and therefore a sheet of notebook paper or the skin's surface can be used to block the penetration of most alpha particles. Alpha emitters only become a source of radiation dose after they are inhaled, ingested, or otherwise taken into the body.

Beta radiation occurs when an electron or positron is emitted from an atom. Beta particles are much lighter than alpha particles and therefore can travel faster and farther. Greater precautions must be taken to guard against beta radiation and some shielding is usually recommended to limit exposure to beta radiation. Beta particles can pass through a sheet of paper but can be stopped by a thin sheet of aluminum foil or glass. Most of the radiation dose from beta particles occurs in the first tissue they penetrate, such as the skin, or dose may occur as the result of internal deposition of beta emitters.

Gamma and x-ray radiation are known as electromagnetic radiation and are emitted as energy packets called *photons*, similar to light and radio waves, but from a different energy region of the electromagnetic spectrum. Gamma rays and x-rays are the most penetrating type of radiation. Gamma rays are emitted from the nucleus as waves of pure energy, whereas x-rays originate from the electron field surrounding the nucleus. Gamma rays travel at the speed of light, and because they are so penetrating, concrete, lead, or steel is required to shield them. The amount of shielding required, depends upon the energy and intensity of the gamma or x-radiation. For example, to absorb 95 percent of the gamma radiation from a ^{60}Co source, 6 centimeters of lead, 10 centimeters of iron, or 33 centimeters of concrete would be needed.

The neutron is another particle that contributes to radiation exposure, both directly and indirectly. Indirect exposure results from gamma rays and alpha particles that are emitted after neutrons are captured in matter. A neutron has about one quarter of the weight of an alpha particle and can travel 2.5 times faster than an alpha particle. Neutrons are less penetrating than gamma rays because they have mass, but neutrons are more penetrating than beta particles because they are uncharged. They can be shielded effectively by water, graphite, paraffin, or concrete.

Some elements such as uranium, radium, plutonium, and thorium, share a common characteristic: they are unstable or radioactive. Such radioactive isotopes are called *radionuclides* or *radioisotopes*. As these elements attempt to change into more stable forms, they emit invisible rays of energy or particles at rates which decrease with time. This emission is

known as radioactive decay. The time it takes a material to lose half of its original radioactivity is referred to as its half-life. Each radioactive isotope has a characteristic half-life. The half-life may vary from a millionth of a second to millions of years, depending upon the radionuclide. Eventually, the radioactivity will essentially disappear.

As a radioactive element emits radioactivity, it often changes into an entirely different element that may or may not be radioactive. Eventually, however, a stable element is formed. This transformation may require several steps, known as a decay chain. Radium, for example, is a naturally occurring radioactive element with a half-life of 1,622 years. It emits an alpha particle and becomes radon, a radioactive gas with a half-life of only 3.8 days. Radon decays to polonium and, through a series of steps, to bismuth, and ultimately to lead.

Nonionizing radiation bounces off or passes through matter without displacing electrons. Examples include visible light and radio waves. At this time, scientists are unclear as to the effects of nonionizing radiation on human health. In this SPEIS, the term radiation is used to describe ionizing radiation.

C.1.1.2 *How is Radiation Measured?*

Scientists and engineers use a variety of units to quantify the measurement of radiation. These different units can be used to determine the amount, and intensity of radiation. Radiation is usually measured in *curies*, *rads*, or *rems*. The *curie* describes the activity of radioactive material. One curie is equal to 3.7×10^{10} disintegrations (decays) per second.

Absorbed radiation dose is the amount of energy deposited in a unit mass of material, such as a gram of tissue. Radiation dose is expressed in units of *rad*. One rad is 0.01 joule of energy deposited per kilogram of absorbing material. A joule is a very small amount of energy. For example, a 60-watt light bulb on for about 0.02 seconds would use 1 joule of energy.

A *rem* is a unit of equivalent dose, which is the absorbed dose modified by a weighting factor to account for the relative biological effectiveness of different types of radiation. The rem is used to measure the effects of radiation on the body. As such, 1 rem of one type of radiation is presumed to have the same biological effects as 1 rem of any other type of radiation. This standard allows comparison of the biological effects of different types of radiation. Note that the term millirem (mrem) is also often used. A millirem is one one-thousandth (0.001) of a rem.

C.1.1.3 *How Does Radiation Affect the Human Body?*

Ionizing radiation affects the body through two basic mechanisms. The ionization of atoms can generate chemical changes in body fluids and cellular material. Also, in some cases the amount of energy transferred can be sufficient to actually knock an atom out of its chemical bonds, again resulting in chemical changes. These chemical changes can lead to alteration or disruption of the normal function of the affected area. At low levels of exposure, such as the levels experienced in an occupational or environmental setting, these chemical changes are very small and ineffective. The body has a wide variety of mechanisms that repair the damage induced. However, occasionally, these changes can cause irreparable damage that could ultimately lead to initiation of a cancer, or change to genetic material that could be passed to the next generation. The

probability for the occurrence of health effects of this nature depends upon the type and amount of radiation received, and the sensitivity of the part of the body receiving the dose.

At much higher levels of acute whole-body exposure, at least 10 to 20 times higher than the legal limits for occupational exposures (the limit for annual occupational exposures is 5 rem); damage is much more immediate, direct, and observable. Health effects range from reversible changes in the blood to vomiting, loss of hair, temporary or permanent sterility, and other changes leading ultimately to death at acute exposures (above about 100 times the regulatory limits). In these cases, the severity of the health effect is dependent upon the amount and type of radiation received. Exposures to radiation at these levels are quite rare.

For low levels of radiation exposure, the probabilities for induction of various cancers or genetic effects have been extensively studied by both national and international expert groups. The problem is that the potential for health effects at low levels is extremely difficult to determine without extremely large, well-characterized populations. For example, to get a statistically valid estimate of the number of cancers caused by an external dose equivalent of 1 rem, 10 million people would be required for the test group, with another 10 million for the control group. The risk factors for radiation-induced cancer at low levels of exposure are very small, and it is extremely important to account for the many nonradiation-related mechanisms for cancer induction, such as smoking, diet, lifestyle, chemical exposure, and genetic predisposition. Refer to the glossary for the definition of risk. These multiple factors also make it difficult to establish cause-and-effect relationships that could attribute high or low cancer rates to specific initiators.

The most significant ill-health effects that result from environmental and occupational radiation exposure are cancer fatalities. These ill-health effects are referred to as “latent” cancer fatalities (LCFs) because the cancer may take many years to develop and for death to occur. Furthermore, when death does occur, these ill-health effects may not actually have been the cause of death.

Health impacts from radiation exposure, whether from sources external or internal to the body, generally are identified as somatic (affecting the individual exposed) or genetic (affecting descendants of the exposed individual). Radiation is more likely to produce somatic effects rather than genetic effects. The somatic risks of most importance are the induction of cancers.

For a uniform irradiation of the body, the incidence of cancer varies among organs and tissues. The thyroid and skin demonstrate a greater sensitivity than other organs; however, such cancers also produce relatively low mortality rates because they are relatively amenable to medical treatment.

C.1.1.4 *What are Some Types of Radiation Dose Measurements?*

The amount of ionizing radiation that the individual receives during the exposure is referred to as *dose*. An external dose is delivered only during the actual time of exposure to the external radiation source. An internal dose, however, continues to be delivered as long as the radioactive material is in the body, although both radioactive decay and elimination of the radionuclide by ordinary metabolic processes decrease the dose rate with the passage of time. The measurement of radiation dose is called *radiation dosimetry* and is completed by a variety of methods

depending upon the characteristics of the incident radiation. External radiation is measured as a value called deep dose equivalent. Internal radiation is measured in terms of the committed effective dose equivalent (CEDE). The sum of the two contributions (deep dose equivalent and CEDE) provides the total dose to the individual, called the total effective dose equivalent (TEDE). Often the radiation dose to a selected group or population is of interest and is referred to as the collective dose equivalent, with the measurement units of *person-rem*.

C.1.1.5 *What are Some Sources of Radiation?*

Several different sources of radiation have been identified. Most sources are naturally occurring, or background sources, which can be categorized as cosmic, terrestrial, or internal radiation sources. Manmade radiation sources include consumer products, medical sources, and other miscellaneous sources. The average American receives a total of about 360 mrem per year from all sources of radiation, both natural and manmade (ATSDR/CDC,2006).

Cosmic radiation is ionizing radiation resulting from energetically charged particles from space that continuously hit the earth's atmosphere. These particles and the secondary particles and photons they create are referred to as cosmic radiation. Because the atmosphere provides some shielding against cosmic radiation, the intensity of this radiation increases with altitude above sea level. For example, a person in Denver, CO, is exposed to more cosmic radiation than a person in New Orleans, LA. The average annual dose from cosmic radiation to a person in the United States is about 27 mrem.

Terrestrial radiation is emitted from the radioactive materials in the earth's rocks, soils, and minerals. Radon, radon progeny, potassium, isotopes of thorium, and isotopes of uranium are the elements responsible for most terrestrial radiation. The average annual dose from terrestrial radiation is about 28 mrem, but the dose varies geographically across the country [insert reference]. Typically reported values are about 16 mrem on the Atlantic and Gulf coastal plains and about 63 mrem on the eastern slopes of the Rocky Mountains.

Internal radiation arises from the human body metabolizing natural radioactive material that has entered the body by inhalation, ingestion, or through an open wound. Natural radionuclides in the body include isotopes of uranium, thorium, radium, radon, bismuth, polonium, potassium, rubidium, and carbon. The major contributors to the annual dose equivalent for internal radioactivity are the short-lived decay products of radon which contribute about 200 mrem per year. The average dose from other internal radionuclides is about 39 mrem per year, most of which results from potassium-40 and polonium-210. Internal exposure can also come from man-made radiation; not only "natural." (Ingestion is primarily associated with natural radioactive materials, e.g., K-40. Inhalation is associated with both natural and manmade radioactive materials with the dose delivered to the bronchii of the lungs – without the body metabolizing the material. Open wounds are primarily a concern for internal radiation exposure resulting from occupational settings.)

Consumer products also contain sources of ionizing radiation. In some products, like smoke detectors and airport x-ray machines, the radiation source is essential to the operation of the product. In other products, such as televisions and tobacco products, the radiation occurs incidentally to the product function. The average annual dose from consumer products is about 10 mrem.

Medical source radiation is an important diagnostic tool and is the main source of exposure to the public from manmade radiation. Exposure is deliberate and directly beneficial to the patient exposed. In general, medical exposures from diagnostic or therapeutic x rays result from beams directed to specific areas of the body. Thus, all body organs generally are not irradiated uniformly. Nuclear medicine examinations and treatments involve the internal administration of radioactive compounds or radiopharmaceuticals by injection, inhalation, consumption, or insertion. Even then, radionuclides are not distributed uniformly throughout the body. Radiation and radioactive materials also are used in the preparation of medical instruments, including the sterilization of heat-sensitive products such as plastic heart valves. Diagnostic x rays result in an average annual exposure of 39 mrem. Nuclear medical procedures result in an average annual exposure of 14 mrem. It is recognized that the averaging of medical doses over the entire population does not account for the potentially significant variations in annual dose among individuals, where greater doses are received by older or less healthy members of the population.

A few additional sources of radiation contribute minor doses to individuals in the United States. The doses from nuclear fuel cycle facilities, such as uranium mines, mills, and fuel processing plants, nuclear power plants, and transportation routes have been established to be less than 1 mrem per year. Radioactive fallout from atmospheric atomic bomb tests, emissions of radioactive material from U.S. Department of Energy (DOE) facilities, emissions from certain mineral extraction facilities, and transportation of radioactive materials contributes less than 1 mrem per year to the average individual dose. Air travel contributes approximately 1 mrem per year to the average dose.

C.1.2 Radioactive Materials in this SPEIS

The release of radiological contaminants into the environment at National Nuclear Security Administration (NNSA) sites occurs as a result of nuclear weapons production, research and development, maintenance, and waste management activities. This section describes the primary types of radioactive sources at NNSA sites, how DOE regulates radiation and radioactive materials, and the data sources and methodologies used to evaluate the potential health effects of radiation exposure to the worker and public.

C.1.2.1 *What Are Some Sources That May Lead to Radiation Exposure?*

Historically, NNSA has conducted many operations that involve the use of uranium, plutonium, tritium, and other radionuclides. These have included nuclear material production; recovery and recycle operations; purification processes; and metal forming, machining, and material handling operations. The releases from these operations consisted primarily of particulates, liquids, fumes, and vapors.

Airborne emissions contribute to the potential for radiation dose at, and around, NNSA sites with operations involving radioactive materials. National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations specify that any source that potentially can contribute greater than 0.1 mrem per year TEDE to an off site individual is to be considered a “major source” and emissions from that source must be continuously sampled. As such, there are a number of process exhaust stacks at NNSA sites that are considered major sources.

In addition to major sources, there are a number of minor sources that have the potential to emit radionuclides to the atmosphere. Minor sources are composed of any ventilation systems or components such as vents, laboratory hoods, room exhausts, and stacks that do not meet the criteria for a major source but are located in or vent from a radiological control area. Emissions from NNSA facility ventilation systems are estimated from radiation control data collected on airborne radioactivity concentrations in the work areas. Other emissions from unmonitored processes and laboratory exhausts are categorized as minor emission sources. Additionally, as explained in Section C.3, accidents can release radionuclides that can result in radiation exposure.

In addition, there are also areas of potential fugitive and diffuse sources at NNSA sites, such as contaminated soils and structures. Diffuse and fugitive sources include any source that is spatially distributed, diffuse in nature, or not emitted with forced air from a stack, vent, or other confined conduit. Radionuclides are transported entirely by diffusion or thermally driven air currents. Typical examples include emissions from building breathing; resuspension of contaminated soils, debris, or other materials; unventilated tanks; ponds, lakes, and streams; wastewater treatment systems; outdoor storage and processing areas; and leaks in piping, valves, or other process equipment.

Liquid discharges are another source of radiation release and exposure. Three types of liquid discharge sources at NNSA sites include treatment facilities, other point- and area-source discharges, and in-stream locations. A radiological monitoring plan is in place at NNSA sites required to address compliance with DOE orders and National Pollutant Discharge Elimination System (NPDES) Permits. Radiological monitoring of storm water is also usually required by the applicable NPDES permits.

C.1.2.2 *How is Radiation Exposure Regulated?*

The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by the DOE for its contractor facilities. Under conditions of the *Atomic Energy Act* (as amended by the *Price-Anderson Amendments Act of 1988*), DOE is authorized to establish Federal rules controlling radiological activities at the DOE sites. The act also authorizes DOE to impose civil and criminal penalties for violations of these requirements. Some NNSA activities are also regulated through a DOE Directives System that is contractually enforced.

Occupational radiation protection is regulated by 10 CFR Part 835, Occupational Radiation Protection. DOE has set occupational dose limits for an individual worker at 5,000 mrem per year. NNSA sites have set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material as low as reasonably achievable (ALARA).

Environmental radiation protection is currently regulated contractually with DOE Order 5400.5, Radiation Protection of the Public and the Environment. This Order is applicable to all DOE/NNSA contractor entities managing radioactive materials. This Order sets annual dose standards to members of the public, as a consequence of routine DOE operations, of 100 mrem

through all exposure pathways. The Order requires that no member of the public receive an annual dose greater than 10 mrem from the airborne pathway and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the Radionuclide National Emission Standards for Hazardous Air Pollutants (Rad-NESHAP) limit exposure of an individual member of the public to airborne releases of radionuclides to a maximum of 10 mrem/year.

Limits of exposure to members of the public and radiation workers are derived from International Commission on Radiological Protection recommendations. The EPA uses the National Council on Radiation Protection and Measurements and the International Commission on Radiological Protection recommendations and sets specific annual exposure limits (usually less than those specified by the Commission) in *Radiation Protection Guidance to Federal Agencies* documents.

Each regulatory organization then establishes its own set of radiation standards. The various exposure limits set by DOE and the EPA for radiation workers and members of the public are given in Table C.1-1.

Table C.1-1 — Exposure Limits for Members of the Public and Radiation Workers

Guidance Criteria (organization)	Public Exposure Limit at the Site Boundary	Worker Exposure Limit
10 CFR 835 (DOE)	--	5,000 millirem per year ^a
10 CFR 835.1002 (DOE)	--	1,000 millirem per year ^b
DOE Order 5400.5 (DOE) ^c	10 millirem per year (all air pathways) 4 millirem per year (drinking water pathways) 100 millirem per year (all pathways)	--
40 CFR 61 (EPA)	10 millirem per year (all air pathways)	--
40 CFR 141 (EPA)	4 millirem per year (drinking water pathways)	--

^a Although this is a limit (or level) that is enforced by DOE, worker doses must be managed in accordance with as low as is reasonably achievable principles. Refer to footnote b.

^b This is a control level. It was established by DOE to assist in achieving its goal to maintain radiological doses as low as is reasonably achievable. DOE recommends that facilities adopt a more limiting 500 millirem per year Administrative Control.

^c Derived from 40 CFR 61, 40 CFR 141, and 10 CFR 20.

C.1.2.3 *Data Sources Used to Evaluate Public Health Consequences from Routine Operations*

Because NNSA operations have the potential to release measurable quantities of radionuclides to the environment that result in exposure to the worker and the public, NNSA conducts environmental surveillance and monitoring activities at its sites. These activities provide data that are used to evaluate radiation exposures that contribute doses to the public. Each year, environmental data from the NNSA sites are collected and analyzed. The results of these environmental monitoring activities are summarized in an *Annual Site Environmental Report* (ASER). The environmental monitoring conducted at most NNSA sites consists of two major activities: effluent monitoring and environmental surveillance.

Effluent monitoring involves the collection and analysis of samples or measurements of liquid (waterborne) and gaseous (airborne) effluents prior to release into the environment. These analytical data provide the basis for the evaluation and official reporting of contaminants,

assessment of radiation and chemical exposures to the public, and demonstration of compliance with applicable standards and permit requirements.

Environmental surveillance data provide a direct measurement of contaminants in air, water, groundwater, soil, food, biota, and other media subsequent to effluent release into the environment. These data verify the NNSA site's compliance status and, combined with data from effluent monitoring, allow the determination of chemical and radiation dose and exposure assessment of NNSA operations and effects, if any, on the local environment. The effluent and environmental surveillance data presented in the ASERs were used as the primary source of data for the analysis of radiation exposure to the public for the No Action Alternative.

C.1.3 Methodology for Estimating Radiological Impacts

The public health consequences of radionuclides released to the atmosphere from normal operations at NNSA sites are characterized and calculated in the applicable ASER. Radiation doses are calculated for the maximally exposed individual (MEI) and the entire population residing within 50 miles of the center of the site. In this SPEIS, dose calculations from normal operations were made using the CAP-88 package of computer codes (Beres 1990), which was developed under EPA sponsorship to demonstrate compliance with 40 CFR Part 61, Subpart H, which governs the emissions of radionuclides other than radon from DOE facilities. This package implements a steady-state Gaussian plume atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground and uses Regulatory Guide 1.109 (NRC 1977) food-chain models to calculate radionuclide concentrations in foodstuffs (vegetables, meat, and milk) and subsequent intakes by humans.

Meteorological data used in the calculations were in the form of joint frequency distributions of wind direction, wind speed class, and atmospheric stability category. For occupants of residences, the dose calculations assume that the occupant remained at home (actually, unprotected outside the house) during the entire year and obtained food according to the rural pattern defined in the NESHAP background documents (EPA 1989). This pattern specifies that 70 percent of the vegetables and produce, 44.2 percent of the meat, and 39.9 percent of the milk consumed are produced in the local area (e.g., a home garden). The remaining portion of each food is assumed to be produced within 50 miles of the site. The same assumptions are used for occupants of businesses, but the resulting doses are divided by 2 to compensate for the fact that businesses are occupied for less than one-half a year and that less than one-half of a worker's food intake occurs at work. For collective effective dose equivalent (EDE) estimates, production of beef, milk, and crops within 50 miles of the site was calculated using production rates provided with CAP-88.

C.1.4 Risk Characterization and Interpretation of Radiological Data

The Interagency Steering Committee on Radiation Standards (Lawrence 2002) recommended a risk estimator of 6×10^{-4} excess (above those naturally occurring) fatal cancers per person-rem of dose in order to assess health effects to the public and to workers. The probability of an individual worker or member of the public contracting a fatal cancer is 6×10^{-7} per millirem. Radiation exposure can also cause nonfatal cancers and genetic disorders. The probability of

incidence of these is one third that of a cancer fatality (Lawrence 2002). In this SPEIS, only estimates of potential fatal cancers are presented.

The radiation exposure risk estimators are denoted as excess because they result in fatal cancers above the naturally occurring annual rate, which is 171.4 per 100,000 population nationally (Ries et al. 2002). Thus, approximately 1,714 fatal cancer deaths per year would be expected to naturally occur in the approximately 1,000,000 people surrounding an NNSA site. The doses to which they are applied is the effective dose equivalent, which weights the impacts on particular organs so that the dose from radionuclides that affect different organs can be compared on a similar (effect on whole body) risk basis. All doses in this document are effective dose equivalent unless otherwise noted.

The number of latent cancer fatalities (LCFs) in the general population or in the workforce is determined by multiplying 600 LCFs per million person-rem with the calculated collective population dose (person-rem), or calculated collective workforce dose (person-rem). For example, in a population of 100,000 people exposed only to natural background radiation of 0.3 rem per year, 18 cancer fatalities per year would be inferred to be caused by the radiation (100,000 persons \times 0.3 rem per year \times 0.0006 cancer fatalities per person-rem = 18 cancer fatalities per year).

Sometimes calculations of the number of excess cancer fatalities associated with radiation exposure do not yield whole numbers and, especially in environmental applications, may yield numbers less than 1.0. For example, if a population of 100,000 were exposed as above, but to a total dose of only 0.001 rem, the collective dose would be 100 person-rem, and the corresponding estimated number of cancer fatalities would be 0.06 (100,000 persons \times 0.001 rem \times 0.0006 cancer fatalities/person-rem = 0.06 fatal cancers).

A nonintegral number of cancer fatalities such as 0.06 should be interpreted as a statistical estimate. That is, 0.06 is interpreted as the average number of deaths that would result if the same exposure situation were applied to many different groups of 100,000 people. In most groups, no person (0 people) would incur a cancer fatality from the 0.001 rem dose each member would have received. In a small fraction of the groups, one fatal cancer would result; in exceptionally few groups, two or more fatal cancers would occur. The average number of deaths over all the groups would be 0.06 fatal cancers (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome is 0 cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on a single individual. Consider the effects, for example, of exposure to background radiation over a lifetime. The “number of cancer fatalities” corresponding to a single individual’s exposure over a (presumed) 70-year lifetime to 0.3 rem per year is the following:

$$1 \text{ person} \times 0.3 \text{ rem/year} \times 70 \text{ years} \times 0.0006 \text{ cancer fatalities/person-rem} = 0.013 \text{ cancer fatalities}$$

This could be interpreted that the estimated effect of background radiation exposure on the exposed individual would produce a 1.3 percent chance that the individual might incur a fatal cancer caused by the exposure.

Health effects resulting from exposure to both airborne and waterborne radionuclides may also be evaluated by comparing estimated concentrations to established radionuclide-specific, risk-based concentration values. For example, DOE Order 5400.5 establishes Derived Concentration Guidelines (DCGs) for the inhalation of air and the ingestion of water. The DCG is the concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation) would result in an effective dose equivalent of 100 mrem per year. To ensure that exposure via the drinking water pathway does not exceed 4 mrem/year, as required by DOE Order 5400.5, 4 percent of the DCG values are used as comparison values.

Members of the public are assumed to ingest 730 liters per year (2 liters per day) of water or to inhale 8,400 cubic meters per year (23 cubic meters per day) of air. The DCG values are used as reference concentrations for conducting environmental protection programs at DOE sites, as screening values for considering best available technology for treatment of liquid effluents, and for making dose comparisons.

C.1.5 Risk Estimates and Health Effects for Potential Radiation Exposures to Workers

For the purpose of evaluating radiation exposure on an ongoing basis, NNSA workers may be designated as radiation workers, nonradiation workers, or visitors based upon the potential level of exposure they are expected to encounter in performing their work assignments. For purposes of estimating radiation doses to workers resulting from potential accidents, NNSA looks at involved workers (those workers actually working with radioactive materials) and noninvolved workers (those workers performing other tasks near the involved workers).

Radiation workers have job assignments that place them in proximity to radiation-producing equipment and/or radioactive materials. These workers are trained for unescorted access to radiological areas, and may also be trained radiation workers from another DOE site. These workers are assigned to areas that could potentially contribute to an annual TEDE of more than 100 mrem per year. All trained radiation workers wear dosimeters.

Nonradiation workers are those not currently trained as radiation workers but whose job assignment may require their occasional presence within a radiologically controlled area with an escort. They may be exposed to transient radiation fields as they pass by or through a particular area, but their job assignments are such that annual dose equivalents in excess of 100 mrem are unlikely. Based upon the locations where such personnel work on a daily basis, they may be issued a Personal Nuclear Accident Dosimeter.

Visitors are individuals who are not trained radiation workers and are not expected to receive 100 mrem in a year. Their presence in radiological areas is limited, in terms of time and access. These individuals generally enter specified radiological areas on a limited basis for walk-through or tours with a trained escort. As appropriate, visitors participate in dosimetry monitoring when requested by the hosting division.

C.1.5.1 *NNSA's Radiation Protection Program*

A primary goal of the NNSA Radiation Protection Program is to keep worker exposures to radiation and radioactive material ALARA. Such a program must evaluate both external and internal exposures with the goal to minimize worker radiation dose. The worker radiation dose presented in this SWEIS is the total TEDE incurred by workers as a result of normal operations. This dose is the sum of the external whole body dose, including dose from both photons and neutrons, and internal dose, as required by 10 CFR Part 835. The internal dose is the 50-year CEDE. These values are determined through the NNSA External and Internal Dosimetry Programs.

The External Dosimetry Program at NNSA provides personnel monitoring information necessary to determine the dose equivalent received following external exposure of a person to ionizing radiation. The program is based on the concepts of effective dose equivalent, as described in publications of the ICRP and the International Commission on Radiation Quantities and Units.

Internal dose monitoring programs are conducted at NNSA sites to estimate the quantity and distribution of radionuclides to which a worker may have been exposed. The internal dose monitoring program consists of urinalysis, fecal analysis, lung counting, continuous air monitoring, and retrospective air sampling. Dose assessments are generally based on bioassay data. Bioassay monitoring methods and participation frequencies are required to be established for individuals who are likely to receive intakes that could result in a CEDE that is greater than 100 mrem.

C.2 HAZARDOUS CHEMICAL IMPACTS TO HUMAN HEALTH

C.2.1 Chemicals and Human Health

We use chemicals in our everyday tasks—as pesticides in our gardens, cleaning products in our homes, insulating materials in buildings, and as ingredients in medications. Potentially hazardous chemicals can be found in all of these products, but usually the quantities are not large enough to cause adverse health effects. In contrast to home use, chemicals used in industrial settings are often found in concentrations that may affect the health of individuals in the workplace and in the surrounding community.

For the programmatic alternatives considered in this SPEIS, the chemicals of with the highest hazards were determined to be nitric acid, hydrofluoric acid, formic acid, and chlorine. This determination was based on considerations of vapor pressure, acceptable concentration, and quantity available for release. The following sections describe both the carcinogenic and noncarcinogenic effects of chemicals on the body and how these effects are assessed.

C.2.1.1 *How Do Chemicals Affect the Body?*

Industrial pollutants may be released either intentionally or accidentally to the environment in quantities that could result in health effects to those who come in contact with them. Chemicals that are airborne, or released from stacks and vents, can migrate in the prevailing wind direction

for many miles. The public may then be exposed by inhaling chemical vapors or particles of dust contaminated by the pollutants. Additionally, the pollutants may be deposited on the surface soil and biota (plants and animals) and subsequent human exposure could occur. Chemicals may also be released from industries as liquid or solid waste (effluent) and can migrate or be transported from the point of release to a location where exposure could occur.

Exposure is defined as the contact of a person with a chemical or physical agent. For exposure to occur, a chemical source or contaminated media such as soil, water, or air must exist. This source may serve as a point of exposure, or contaminants may be transported away from the source to a point where exposure could occur. In addition, an individual (receptor) must come into either direct or indirect contact with the contaminant. Contact with a chemical can occur through ingestion, inhalation, dermal contact, or external exposure. The exposure may occur over a short (acute or subchronic) or long (chronic) period of time. These methods of contact are typically referred to as exposure routes. The process of assessing all of the methods by which an individual might be exposed to a chemical is referred to as an exposure assessment.

Once an individual is exposed to a hazardous chemical, the body's metabolic processes typically alter the chemical structure of the compound in its efforts to expel the chemical from the system. For example, when compounds are inhaled into the lungs they may be absorbed depending on their size (for particulates) or solubility (for gases and vapors) through the lining of the lungs directly into the blood stream. After absorption, chemicals are distributed in the body and may be metabolized, usually by the liver, into metabolites that may be more toxic than the parent compound. The compound may reach its target tissue, organ, or portion of the body where it will exert an effect, before it is excreted via the kidneys, liver, or lungs. The relative toxicity of a compound is affected by the physical and chemical characteristics of the contaminant, the physical and chemical processes ongoing in the human body and the overall health of an individual. For example, infants, the elderly, and pregnant women are considered more susceptible to certain chemicals.

C.2.2 How Does DOE Regulate Chemical Exposures?

C.2.2.1 *Environmental Protection Standards*

DOE Order 450.1 requires implementation of sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by the DOE operations and by which DOE cost-effectively meets or exceeds compliance with applicable environmental; public health; and resource protection laws, regulations, executive orders, and DOE requirements. The objective is accomplished by implementing Environmental Management Systems (EMSs) at DOE sites. An EMS is a continuing cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental goals. Applicable Federal and state environmental acts/agreements include:

- *Resource Conservation and Recovery Act (RCRA)*
- *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* as amended by the *Superfund Amendments and Reauthorization Act (SARA)*
- *Federal Facility Compliance Agreement*

- *Endangered Species Act*
- *Safe Drinking Water Act*
- *Clean Water Act (CWA)*(which resulted in the establishment of the NPDES and pretreatment regulations for Publicly-Owned Treatment Works [POTW])
- *Clean Air Act (CAA)* (Title III, Hazardous Air pollutants Rad-NESHAP, Asbestos NESHAP)
- *Toxic Substances Control Act (TSCA)*
- *Federal Insecticide, Fungicide, and Rodenticide Act*

Many of these acts/agreements include environmental standards that must be met to ensure the protection of the public and the environment. Most of the acts/agreements require completed permit applications in order to treat, store, dispose of, or release contaminants to the environment. The applicable environmental standards and reporting requirements are set forth in the issued permits and must be met to ensure compliance.

The *Emergency Planning and Community Right-To-Know Act*, also referred to as SARA Title III, requires reporting of emergency planning information, hazardous chemical inventories, and environmental releases to Federal, state, and local authorities. The annual Toxics Release Inventory report addresses releases of toxic chemicals into the environment, waste management activities, and pollution prevention activities associated with those chemicals.

C.2.2.2 *Regulated Occupational Exposure Limits*

Occupational limits for hazardous chemicals are regulated by the Occupational Safety and Health Administration (OSHA). The permissible exposure limits (PELs) represent the legal concentration levels set by OSHA that are safe for 8-hour exposures without causing noncancer health effects. Other agencies, including the National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) provide guidelines. The NIOSH guidelines are Recommended Exposure Limits and the ACGIH guides are Threshold Limit Values (TLVs). Occupational limits are further defined as time-weighted averages (TWAs), or concentrations for a conventional 8-hour workday and a 40-hour workweek, to which it is believed nearly all workers may be exposed, day after day, without adverse effects. Often ceiling limits, or airborne concentrations that should not be exceeded during any part of the workday, are also specified. In addition to the TWA and ceiling limit, short-term exposure limits may be set. Short-term exposure limits are 15-minute TWA exposures that should not be exceeded at any time during a workday, even if the 8-hour TWA is within limits. OSHA also uses action levels to trigger certain provisions of a standard, for instance appropriate workplace precautions, training, and medical surveillance, for workers whose exposures could approach the PEL.

C.2.2.3 *Department of Energy Regulation of Worker Safety*

DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, regulates the health and safety of workers at all DOE sites. This comprehensive standard directs the contractor facilities to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by

providing DOE Federal and contractor workers with a safe and healthful workplace. Baseline exposure assessments are outlined in this requirement, along with day-by-day health and safety responsibilities.

Industrial hygiene limits for occupational chemical exposures at Federal sites are regulated by 29 CFR Part 1910 and 29 CFR Part 1926, *Occupational Safety and Health Standards*, including the PELs set by OSHA. DOE requires that all sites comply with the PELs unless a lower limit (more protective) exists in the ACGIH TLVs.

C.3 ACCIDENTS

C.3.1 Introduction

An accident is a sequence of one or more unplanned events with potential unmitigated outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as a human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident's progression and the extent of materials released. Initiating events fall into three categories:

- *Internal initiators* normally originate in and around the facility, but are always a result of facility operations. Examples include equipment or structural failures and human errors.
- *External initiators* are independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.
- *Natural phenomena initiators* are natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, wild fires, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident were to occur involving the release of radioactive or chemical materials, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, the dispersion of released hazardous materials and their effects are predicted. However, prediction of latent potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be precisely defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident itself.

The potential for facility accidents and the magnitudes of their consequences are important factors in evaluating the alternatives addressed in this SPEIS. The health risk issues are twofold:

- *Whether accidents at any of the individual facilities (or reasonable combinations thereof) pose unacceptable health risks to workers or the general public.*
- *Whether alternative locations for facilities (or reasonable combinations thereof) can provide lesser public or worker health risks. These lesser risks may arise either from a greater isolation of the site from the public or from a reduced frequency of such external accident initiators as seismic events.*

Guidance for implementing Council on Environmental Quality (CEQ) regulation, 40 Code of Federal Regulations 1502.22, as amended (51 FR 15618), requires the evaluation of impacts which have low probability of occurrence but high consequences if they do occur; thus, facility accidents must be addressed to the extent feasible in this SPEIS. Further, public comments received during the scoping process clearly indicated the public's concern with facility safety and consequent health risks and the need to address these concerns in the decision-making process.

For the No Action alternative, potential accidents are defined in existing facility documentation, such as safety analysis reports, hazards assessment documents, NEPA documents, and probabilistic risk assessments. The accidents include radiological and chemical accidents that produce high consequences but have a low likelihood of occurrence, and a spectrum of other accidents that have a higher likelihood of occurrence and lesser consequences. The data in these documents include accident scenarios, probabilities, materials at risk, source terms (quantities of hazardous materials released to the environment), and consequences.

For new, modified, or upgraded NNSA facilities, the identification of accident scenarios and associated data would normally be a product of safety analysis reports performed on completed facility designs. However, facility designs have not been completed for the facility alternatives analyzed in the programmatic portion of this SPEIS. Accordingly, the accident information developed for this SPEIS was developed based upon existing information for similar facilities. The first step in the process was to review all of the potential types of facilities and processes that could be associated with the Consolidated Plutonium Center (CPC), Consolidated Uranium Center (CUC), and Assembly/Disassembly/High Explosives (A/D/HE) Center, with emphasis on building hazard classification and radionuclide inventories (including type, quantity, and physical form) and storage and use conditions. First, administrative buildings without radioactive materials were excluded. Then, buildings ranked as low hazard and those without radioactive materials were eliminated from consideration. The potential offsite consequences of facilities screened out would be well bounded by a nuclear facility's bounding accident scenarios.

The next step in the selection process was to identify the most current documentation describing/quantifying the hazards associated with each facility's operation. Current safety documentation, which is either classified or contains Unclassified Controlled Nuclear Information that is not releasable to the general public, was obtained for these facilities, and reviewed to determine a reasonable range of bounding accidents for the CPC, CUC, and A/D/HE Center. Documents such as those shown in Table C.3-1 were reviewed for applicable accident scenarios and data.

The process sought to identify a bounding accident in each of several classes of events (e.g., fire, explosion, spill, mechanical, criticality, natural phenomena initiators, and external initiators) applicable to the alternative. The process also sought to identify bounding accidents over the spectrum of high to low probability of occurrence in order to include high-consequence/low-probability and low-consequence/high-probability accidents. These accidents are generally referred to as beyond evaluation basis accidents and evaluation basis accidents, respectively.

Beyond evaluation basis accidents are generally in the probability of occurrence range of 1×10^{-7} to 10^{-6} per year, and evaluation basis accidents generally have a probability of occurrence greater than 1×10^{-6} per year. These two designations are used only if formal SARs have not been prepared. In cases where Safety Analyses Reports (SARs) have been prepared, they are the source documents for two equivalent designations "beyond design basis accidents" and "design basis accidents."

Table C.3-1 — Source Documents Reviewed for Applicable Accident Scenarios

Title	Date
"The Continued Operation of the Pantex Plant & Associated Storage of Weapons Components" Unclassified Controlled Nuclear Information	Sep. 1995
"CMR Facility (SM-29) Final Safety Analysis Report" Unclassified Controlled Nuclear Information	Feb. 1994
Executive Summary - "Hazards Analysis of the Los Alamos National Laboratory Plutonium Facility (TA-55)" Unclassified Controlled Nuclear Information	July 13, 1995
Stockpile Stewardship and Management/PEIS "Alternative Report for Pit Manufacturing at SRS" Unclassified Controlled Nuclear Information	Sep. 1, 1995
Draft Safety Analysis Report for "The Device Assembly Facility at the Nevada Test Site" Unclassified Controlled Nuclear Information	March 1995
"U.S. Department of Energy Defense Programs Safety Survey Report" Volume III: Appendix B - Uranium Facilities Unclassified Controlled Nuclear Information	Nov. 1993
"U.S. Department of Energy Defense Programs Safety Survey Report" Volume I: Main Report Unclassified Controlled Nuclear Information	Nov. 1993
"U.S. Department of Energy Defense Programs Safety Survey Report" Volume II: Appendix A - Plutonium Facilities Unclassified Controlled Nuclear Information	Nov. 1993
"U.S. Department Of Energy Defense Programs Safety Survey Report" Volume VI: Appendix E - Spent-fuel Handling Facilities Unclassified Controlled Nuclear Information	Nov. 1993
"TA-55 Final Safety Analysis Report" Volume I Unclassified Controlled Nuclear Information	July 13, 1995
"TA-55 Final Safety Analysis Report" Volume II Unclassified Controlled Nuclear Information	July 13, 1995
"TA-55 Hazard Analysis" Unclassified Controlled Nuclear Information	July 13, 1995
"Nuclear Explosive Facilities Final Safety Analysis Report Nuclear Explosive Cells Module" (Buildings 12-44 Cells 1-6, 12-85, 12-96, and 12-98) Unclassified Controlled Nuclear Information	July 1995
"Nuclear Explosive Facilities Final Safety Analysis Report Nuclear Explosive Cells Module" (Buildings 12-44 Cells 1-6, 12-85, 12-96, and 12-98) Unclassified Controlled Nuclear Information	July 1995
"Nuclear Explosive Facilities Final Safety Analysis Report Nuclear Explosive Bays Module" (Buildings 12-64, 12-84, 12-99, and 12-104) Unclassified Controlled Nuclear Information	Dec. 1994

**Table C.3-1 — Source Documents Reviewed for Applicable Accident Scenarios
(continued)**

Title	Date
"Nuclear Explosive Facilities Final Safety Analysis Report Nuclear Explosive Bays Module" (Buildings 12-64, 12-84, 12-99, and 12-104) Unclassified Controlled Nuclear Information	Dec. 1994
"Preliminary Safety Analysis Report Special Nuclear Materials Component Staging Facility" Unclassified Controlled Nuclear Information	April 1989
"Safety Analysis Report - On-Site Transportation" Unclassified Controlled Nuclear Information	Sept. 1995
Appendix 11-K - Release Fraction Data, Appendix 11-J - Consequence Equations Used in the Accident Analysis, Appendix 11-F - Seismic Accident Analysis, Appendix 11-E - Derivation of Data Values Used in the Accident Analysis Unclassified Controlled Nuclear Information	Feb. 1994
<i>Topical Report – Supporting Documentation for the Accident Impacts Presented in the Modern Pit Facility Environmental Impact Statement</i> (Tetra Tech 2003)	May 2003
<i>Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management</i> (DOE 1996c)	Sep. 1996
<i>Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory</i> (DOE 1999a)	Jan. 1999
<i>Final Supplement Analysis for Pit Manufacturing Facilities at Los Alamos National Laboratory, Stockpile Stewardship and Management Programmatic Environmental Impact Statement</i> (DOE 1999f)	Sep. 1999
<i>Topical Report – Supporting Documentation for the Accident Impacts Presented in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement</i> (Maltese et al., 1996)	June 1996
<i>Modern Pit Facility Pre-Conceptual Design Radiological Hazards Evaluation</i> (WSRC 2002d)	Jan. 2002
Safety Analysis Report for the 9215 Complex, Y/MA-7886, Rev. 4, Effective 12/08/2005 Unclassified Controlled Nuclear Information	Dec. 2005
Safety Analysis Report for the 9204-2E Facility, Y/SAR-003, Rev. 4, Effective 12/01/2005 Unclassified Controlled Nuclear Information	Dec. 2005
Safety Analysis Report for the 9204-2 Facility, Y/SM-SAR-005, Rev. 4, Effective 12/20/2005 Unclassified Controlled Nuclear Information	Dec. 2005
Safety Analysis Report for the 9204-4 Facility, Y/SAR-004, Rev. 4, Effective 02/24/2005 Unclassified Controlled Nuclear Information	Feb. 2005
Safety Analysis Report for the Nuclear Material Safeguarded Shipping and Storage Facility, Y/SAR-10, Rev. 5, Effective 12/21/2005 Unclassified Controlled Nuclear Information	Dec. 2005
Preliminary Documented Safety Analysis for the Highly Enriched Uranium Materials Facility, Y/HEU-0091 Rev. 0, 08/17/04 Unclassified Controlled Nuclear Information	Aug. 2004
Basis for Interim Operation for the Enriched Uranium Operations Complex, Y/MA-7254, Rev. 18, Effective 09/23/2004 Unclassified Controlled Nuclear Information	Sep. 2004
Safety Analysis Report for 9212 Complex, Y/MA-7926, Rev. 1, 11/18/05 (Approved not yet effective) Unclassified Controlled Nuclear Information	Nov. 2005
Safety Analysis Report for Building 9995, Y/ENG/SAR-79, Rev. 4, 05/20/2005, Effective 06/22/2005 Unclassified Controlled Nuclear Information	May 2005
Safety Analysis Report for Building 9201-5/5E, Y/NA-1836, Rev. 3, 05/16/2005, Effective 06/30/2005 Unclassified Controlled Nuclear Information	May 2005
Safety Analysis Report for Buildings 9201-5N/5W, Y/NA-1839, Rev. 3, 05/16/2005, Effective 06/30/2005 Unclassified Controlled Nuclear Information	May 2005

**Table C.3-1 — Source Documents Reviewed for Applicable Accident Scenarios
(continued)**

Title	Date
<i>Basis for Interim Operations for the Pantex Plant</i> , Amarillo, Texas, Pantex Plant, June 1995 (Pantex 1995j). Unclassified Controlled Nuclear Information	June 1995
<i>Basis for Interim Operations for the Non-Nuclear Facilities</i> Amarillo, Texas, Pantex Plant, September 1995 (Pantex 1995). Unclassified Controlled Nuclear Information	Sep 1995
<i>Chemical High Explosives Hazards Assessment for the Pantex Plant</i> , Jacobs Engineering, October 1993 (Jacobs 1993a). Unclassified Controlled Nuclear Information	Oct 1993
<i>Natural Phenomena Hazards Assessment for the Pantex Plant</i> Amarillo, Texas, Jacobs Engineering, October 1993 (Jacobs 1993). Unclassified Controlled Nuclear Information	Oct 1993
<i>Recalculation of Potential Deposition Levels and Dose Exposure Levels for the Pantex Radiological Hazards Assessment</i> , Jacobs Engineering, October 1993 (Jacobs 1993b). Unclassified Controlled Nuclear Information	Oct 1993
Pantex Plant, <i>Safety Information Document</i> , prepared for the U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM, September 1996 (Pantex 1996a). Unclassified Controlled Nuclear Information	Sep 1996

For each facility, applicable accidents were analyzed to estimate risk (i.e., mathematical product of an accident's probability of occurrence and the accident's consequences) and consequences (e.g., LCF) to a noninvolved worker, a MEI (a hypothetical member of the public located at the closest site boundary), and the surrounding population within 50 miles of the site. This analysis considers the potential differences in likelihood of accident initiators at specific sites (e.g., beyond design basis seismic events, and so forth). The likelihood and consequences of accidents (which are site dependent) are analyzed at each of the sites where a particular facility may be located. This calculation reflects the effects of such site parameters as population size and distribution, meteorology, and distance to the site boundary. Based on this process, the following reference report was prepared: *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007).

The accidents described in Sections C.4 through C.6 were selected from a wide spectrum of potential accident scenarios. The selection process, screening criteria used, and conservative estimates of material at risk and source term ensure that the accidents chosen for evaluation in this SPEIS bound the impacts of all reasonably foreseeable accidents that could occur under an alternative. Thus, in the event that any other accident that was not evaluated in this SPEIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated. All accidents are assumed to result in ground-level, one-hour duration releases unless indicated otherwise. All releases are assumed neutrally buoyant except the uranium operations aircraft crash, for which the added heat was taken as 4.6 megawatts, the value used in the Lawrence Livermore Continued Operations SWEIS (2005).

Of particular interest are the uncertainties in the estimates of cancer fatalities from exposure to radioactive materials. The numerical values of the health risk estimators used in this SPEIS were obtained by linear extrapolation from the nominal risk estimate for lifetime total cancer mortality resulting from exposures of 10 rad. There is uncertainty about cancer risk in the low-dose region

and the possibility of no risk cannot be excluded. Because the health risk estimators are multiplied by conservatively calculated radiological doses to predict fatal cancer risks, the fatal cancer values presented in this EIS are expected to be overestimates.

For the purposes of this EIS, the impacts calculated from the linear model are treated as an upper-bound case, consistent with the widely used methodologies for quantifying radiogenic health impacts. This does not imply that health effects are expected. Moreover, in cases where the upper-bound estimators predict a number of LCFs greater than 1, this does not imply that the LCF risk can be determined for a specific individual.

C.3.1.1 Assessment of Vulnerability to Terrorist Threats

The methodology for the assessment of vulnerability to terrorist threats is discussed in Appendix B, Section B.12.3.

C.3.2 Safety Design Process

Subsequent to this SPEIS, evaluation of the specific benefits achieved would be presented for each new facility in a Hazards Analysis Document. This document would identify and estimate the effects of all major hazards that have the potential to impact the environment, workers, and the public, and would be issued in conjunction with the Conceptual Design Package. Additional accident analyses for identified major hazards would be provided in a Preliminary SAR to be issued during the period of Definitive Design (Title II) Review. A Final SAR would be prepared during the construction period and issued before testing begins as final documented evidence that the new facility can be operated in a manner that does not present any undue risk to the health and safety of workers and the public.

One of the major design goals for any Complex Transformation facility is to achieve a reduced risk to workers and the public relative to that associated with similar facilities in the existing Nuclear Weapons Complex. Any new NNSA facilities would be designed to comply with current Federal, state, and local laws; DOE orders; and industrial codes and standards. As a result, a facility will be provided that is highly resistant to the effects of natural phenomena, including earthquake, flood, tornado, high wind, as well as credible events appropriate to the site, such as fire and explosions, and manmade threats. The facilities would be designed to maintain their continuing structural integrity in the event of any credible accident or event, including an aircraft crash, if credible at these sites.

The design process for new and modified facilities would comply with the requirements for safety analysis and evaluation in DOE O 430.1, Life-Cycle Asset Management and DOE Order 5480.23, Nuclear Safety Analysis Reports. Safety assessment is required to be an integral part of the design process to ensure compliance with all DOE safety criteria by the time that the facilities are constructed and in operation.

For new facilities, the safety analysis process begins early in conceptual design by identifying hazards with the potential to produce unacceptable safety consequences to workers or the public. As the design develops, failure mode and effects analyses are performed to identify events that

have the potential to release hazardous material. The kinds of events considered include equipment failure, spills, human error, fire and explosions, criticality, earthquake, electrical storms, tornado, flood, and aircraft crash. These postulated events become focal points for design changes or improvements to prevent unacceptable accidents. These analyses continue as the design progresses to assess the need for safety equipment and to assess the performance of this equipment in accident mitigation. Eventually, the safety analyses are formally documented in an SAR and/or in a probabilistic risk assessment. The probabilistic risk assessment documents the estimated frequency and consequence for an entire spectrum of accidents and helps to identify design improvements that could make meaningful safety improvements.

The first SAR is completed at the conclusion of conceptual design and includes identification of hazards and some limited assessment of a few enveloping design basis accidents. This analysis includes deterministic safety analysis and failure modes and effects analysis of major systems. A detailed, comprehensive Preliminary SAR is completed during preliminary design and provides a broad assessment of the range of design basis accident scenarios and the performance of equipment provided in the facility specifically for accident consequence mitigation. A limited probability risk assessment may be included in that analysis.

The SAR continues to be developed during detailed design. The safety review of this report and any supporting probabilistic risk assessment is completed and safety issues resolved before the facility construction is initiated. The Final SAR documents safety-related design changes during construction and the impact of those changes on the safety assessment. It also includes the results of any safety-related research and development that has been performed to support the safety assessment of the facility.

C.3.3 Consequence Analysis Methodology

The MELCOR Accident Consequence Code System (MACCS) was used to estimate the radiological consequences of all stockpile stewardship and management facilities for all accidents. MACCS2 is a United States Department of Energy/Nuclear Regulatory Commission (DOE/NRC) sponsored computer code that has been widely used in support of probabilistic risk assessments for the nuclear power industry and in support of safety and NEPA documentation for facilities throughout the DOE complex. A brief description of MAACS follows. A detailed description of the MACCS model is available in a three volume report: *MELCOR Accident Consequence Code System* (MACCS), NUREG/CR-4691, SAND 86-1562, February 1990.

MACCS models the offsite consequences of an accident that releases a plume of radioactive materials to the atmosphere. Should such an accidental release occur, the radioactive gases and aerosols in the plume would be transported by the prevailing wind while dispersing in the atmosphere. The environment would be contaminated by radioactive materials deposited from the plume, and the population would be exposed to radiation. The objectives of a MACCS calculation are to estimate the range and probability of the health induced by the radiation exposures not avoided by protective actions.

The MACCS2 code uses three distinct modules for consequence calculations: The ATMOS module performs atmospheric transport calculations, including dispersion, deposition, and decay.

The EARLY module performs exposure calculations corresponding to the period immediately following the release; this module also includes the capability to simulate evacuation from areas surrounding the release. The EARLY module exposure pathways include inhalation, cloudshine, and groundshine. The CHRONC module considers the time period following the early phase; i.e., after the plume has passed. CHRONC exposure pathways include groundshine, resuspension inhalation, and ingestion of contaminated food and water. Land use interdiction (e.g., decontamination) can be simulated in this module. Other supporting input files include a meteorological data file and a site data file containing distributions of the population and agriculture surrounding the release site.

In order to understand MACCS, one must understand its two essential elements: the time scale after an accident is divided into various "phases" and the region surrounding the facility is divided into a polar-coordinate grid. The time scale after the accident is divided into three phases: emergency phase, intermediate phase, and long-term phase. The emergency phase begins immediately after the accident and could last up to seven days. In this period, the exposure of the population to both radioactive clouds and contaminated ground is modeled. Various protective measures can be specified for this phase, including evacuation, sheltering, and dose-dependent relocation.

The intermediate phase can be used to represent a period in which evaluations are performed and decisions are made regarding the type of protective measure actions that need to be taken. In this period, the radioactive clouds are assumed to be gone, and the only exposure pathways are those from the contaminated ground. The only protective measure that can be taken during this period is temporary relocation.

The long-term phase represents all time subsequent to the intermediate phase. The only exposure pathways considered here are those resulting from the contaminated ground. A variety of protective measures can be taken in the long-term phase in order to reduce doses to acceptable levels: decontamination, interdiction, and condemnation of property.

As implemented, the MACCS2 model evaluates doses due to inhalation of airborne material, as well as external exposure to the passing plume. This represents the major portion of the dose that an individual would receive because of a facility accident. The longer-term effects of radioactive material deposited on the ground after a postulated accident, including the resuspension and subsequent inhalation of radioactive material and the ingestion of contaminated crops, were not modeled for this SPEIS because these pathways have been studied and found to contribute less significantly to the dosage than the inhalation of radioactive material in the passing plume; they are also controllable through interdiction. Instead, the deposition velocity of the radioactive material was set to zero, so that material that might otherwise be deposited on surfaces remained airborne and available for inhalation. Thus, the method used in this SPEIS is conservative compared with dose results that would be obtained if deposition and resuspension were taken into account.

The source terms were handled by the code by considering the materials at risk (MAR) as the inventory. The release fraction of each scenario was then the product of the various factors (damage ratio [DR], airborne release fraction [ARF], respirable fraction [RF], and leak path factor [LPF]) that describe the material available to actually impact a receptor. The

meteorological data consisted of sequential hourly wind speed, wind direction, stability class, and precipitation for one year.

Each 4-hour period of the annual meteorological site specific data set for each site was randomly sampled, assuring a good representation of the entire meteorological data set. The results from each of these samples were then ranked and combined (according to their frequency of occurrence) and a distribution of results is presented by the code. This distribution includes statistics such as 95th percentile, 50th percentile, and mean dose. The latter is presented in this SPEIS.

Because of assumptions used in this SPEIS analysis, not all of the code's capabilities were used. For example, it was conservatively assumed that no special actions would be taken to avoid or mitigate exposure to the general population following an accidental release of radionuclides. Population and individual doses were statistically sampled by assuming an equally likely accident start time during any hour of the year. MEI and noninvolved worker doses were calculated using conservative assumptions, such as the wind blowing toward the MEI and locating the receptor along the plume centerline. The doses (50-year committed EDE) were converted into LCFs using the factor of 6×10^{-4} LCFs per person-rem for both members of the public and workers (DOE 2002); calculated LCFs were doubled for individual doses greater than 20 rem (NCRP 1993). The MEI and non-involved worker are assumed to be exposed for the duration of the release; they or DOE would take protective or mitigative actions thereafter if required by the size of the release. Exposure to the general population continues after the release as a result of resuspension and inhalation, external exposure and ingestion of deposited radionuclides

C.3.3.1 *Analysis Conservatism and Uncertainty*

The analysis of accidents is based on calculations relevant to hypothetical sequences of events and models of their potential impacts. The models provide estimates of the frequencies, source terms, pathways for dispersion, exposures, and the effects on human health and the environment as realistic as possible within the scope of the analysis. In many cases, the scarcity of experience with the postulated accidents leads to uncertainty in the calculation of the consequences and frequencies. This fact has promoted the use of models or input values that yield conservative estimates of consequences and frequency. Additionally, since no credit is taken for safety systems that may function during an event, these events do not represent expected conditions within the facility at any point in its lifetime.

Due to the layers of conservatism built into the accident analysis for the spectrum of postulated accidents, the estimated consequences and risks to the public represent the upper limit for the individual classes of accidents. A conservative approach is appropriate, and standard practice for analyses of this type, which involve high degrees of uncertainty associated with analytical factors such as accident frequency, MAR, and LPF.

C.3.3.2 *Mitigation Measures*

Mitigations to exposure and therefore mitigations to dose that would affect the postulated results of the accident scenarios are discussed below. In general, no mitigation was assumed for

emergency response in the consequence analysis.

C.3.3.2.1 Emergency Response and Protective Actions

NNSA sites have detailed plans for responding to accidents of the type described in this SPEIS, and the response activities would be closely coordinated with those of local communities. NNSA personnel are trained and drilled in the protective actions to be taken if a release of radioactive or otherwise toxic material occurs. The underlying principle for the protective action guides (PAGs) is that under emergency conditions all reasonable measures should be taken to minimize the radiation exposure of the general public and emergency workers. In the absence of significant constraints, protective actions could be implemented when projected doses are lower than the ranges given in the PAGs. No credit was taken for emergency response and protective actions in the consequence analysis.

C.3.3.2.2 High Efficiency Particulate Air Filtration

In all areas where unconfined plutonium or other radioactive materials can be handled and can exist in a dispersible form, high-efficiency particulate air (HEPA) filters provide a final barrier against the inadvertent release of radioactive aerosols into the outside environment. However, these filters would not trap volatile fission products such as the noble gases and iodine; such gases would be released into the outside environment.

HEPA filter efficiencies are 99.99 percent or greater with the minimum efficiency of 99.97 percent for 0.3-micron particles, the size most easily passed by the filter. To maximize containment of particles and provide redundancy, two HEPA filters in series would be used, as is the normal operational procedure at such NNSA facilities. Additional HEPA filtration would be used, as required, to ensure compliance with regulatory requirements. These HEPA filters are protected by building design features against the consequences of an earthquake or fire. Credit was taken for filtration in the consequence analysis when ventilation and building containment were shown by analysis to survive during the accident.

C.3.3.3 Chemical Releases

Consequences of accidental chemical releases were determined using the ALOHA computer code (EPA 1999b). ALOHA is an EPA/National Oceanic and Atmospheric Administration (NOAA)-sponsored computer code that has been widely used in support of chemical accident responses and also in support of safety and NEPA documentation for DOE facilities.

The ALOHA code is a deterministic representation of atmospheric releases of toxic and hazardous chemicals. The code can predict the rate at which chemical vapors escape (e.g., from puddles or leaking tanks) into the atmosphere; a specified direct release rate is also an option. Either of two dispersion algorithms are applied by the code, depending on whether the release is neutrally buoyant or heavier than air. The former is modeled similarly to radioactive releases in that the plume is assumed to advect with the wind velocity. The latter considers the initial slumping and spreading of the release because of its density. As a heavier-than-air release becomes more dilute, its behavior tends towards that of a neutrally buoyant release.

The ALOHA code uses a constant set of meteorological conditions (e.g., wind speed, stability class) to determine the downwind atmospheric concentrations. The sequential meteorological data sets used for the radiological accident analyses were re-ordered from high to low dispersion by applying a Gaussian dispersion model (such as that used by ALOHA) to the closest site boundary at each site. The median set of hourly conditions for each site (i.e., mean wind speed and mean stability) was used for the analysis; this is roughly equivalent to the conditions corresponding to the mean radiological dose estimates of MACCS2.

In addition to the source term and downwind concentration calculations, ALOHA allows for the specification of concentration limits for the purpose of consequence assessment (e.g., assessment of human health risks from contaminant plume exposure). ALOHA refers to these concentration limits as level-of-concern (LOC) concentrations. Safety analysis work uses the Emergency Response Planning Guidelines (ERPGs) and Temporary Emergency Exposure Limits (TEELs) for assessing human health effects for both facility workers and the general public. While ERPGs and TEELs are not explicitly a part of the ALOHA chemical database, ALOHA allows the user to input any value, including an ERPG or TEEL value, as the LOC concentration. The LOC value is superimposed on the ALOHA generated plot of downwind concentration as a function of time to facilitate comparison. In addition, ALOHA will generate a footprint that shows the area (in terms of longitudinal and lateral boundaries) where the ground-level concentration reached or exceeded the LOC during puff or plume passage (the footprint is most useful for emergency response applications).

ERPG Definitions

ERPG1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

ALOHA contains physical and toxicological properties for the chemical spills included in the EIS and for approximately 1,000 additional chemicals. The physical properties were used to determine which of the dispersion models and accompanying parameters were applied. The toxicological properties were used to determine the levels of concern. Atmospheric concentrations at which health effects are of concern (e.g., ERPG-2) are used to define the footprint of concern because the meteorological conditions specified do not account for wind direction (i.e., it is not known *a priori* in which direction the wind would be blowing in the event of an accident) the areas of concern are defined by a circle of radius equivalent to the downwind distance at which the concentration decreases to levels less than the level of concern. The fraction of the area of concern actually exposed to the concentration of concern (footprint area/circle area) was noted. In addition, the concentration at 1,000 meters (3,281 feet) (potential

exposure to a non-involved worker) and at the nearest site boundary distance (exposure to maximum exposed offsite individual) are calculated and presented.

C.4 RADIOLOGICAL ACCIDENT SCENARIOS - CPC

CPC-related facility radiological and chemical accidents are described in Tables C.4–1 and C.4–2. These tables also identify the estimated maximum MAR and source term and accident frequency. Section C.5 provides additional data on release fractions such as damage ratio, leak path factor, and estimated respirable release fraction (RRF) for each postulated accident. The RRF is the mathematical product of the ARF and the RF calculated by the equation $RRF = ARF \times RF$ (Tetra Tech 2007).

C.4.1 Postulated Accidents

The accident scenarios shown in Tables C.4–1 and C.4–2 cover the types of hazardous situations appropriate for the Complex Transformation SPEIS. The list includes fires, spills, criticality and explosions events, site-specific externally initiated events, and natural phenomena events. For radiological accidents, the material at risk is plutonium and the predominant form of exposure is through inhalation. For radiological accidents, the material at risk is plutonium and the predominant form of exposure is through inhalation. The list also includes the potential release of toxic chemicals used in CPC processes. The accidents listed in this section were selected from a wide spectrum of accidents described in the *Topical Report - Supporting Documentation for the Accident Impacts Presented in the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Tetra Tech 2007).

The results of the accident analysis indicate potential consequences that exceed the DOE exposure guidelines of 25 rem for a member of the public at the nearest site boundary. The analyses in these cases for NEPA purposes are based on unmitigated releases of radioactive material to select a site for the CPC. Following the Record of Decision (ROD) and selection of a site, additional NEPA action would be taken that would identify specific mitigating features that would be incorporated in the CPC design to ensure compliance with DOE exposure guidelines. These could include procedural and equipment safety features, additional HEPA filtration systems, and other design features that would protect radioactive materials from accident conditions and contain any material that might be released. DOE would prepare safety analysis documentation such as a safety analysis report to further ensure that DOE exposure guidelines would not be exceeded. The results of the safety analysis report are reflected in facility and equipment design and defines an operating envelope and procedures to ensure public and worker safety. Specific mitigation measures would be incorporated into a CPC design and operating procedures to ensure that consequences would not exceed the DOE exposure guidelines of 25 rem for a member of the public at the nearest site boundary for any of the site alternatives.

The accident source terms shown in Tables C.4–1 and C.4-2 indicate the quantity of radioactive and chemical material released to the environment with a potential for harm to the public and onsite workers. The radiological source terms are calculated by the equation:

Source Term = $MAR \times ARF \times RF \times DR \times LPF$, where:

MAR—the amount and form of radioactive material at risk of being released to the

environment under accident conditions.

ARF—the airborne release fraction reflecting the fraction of damaged MAR that becomes airborne as a result of the accident.

RF—the respirable fraction reflecting the fraction of airborne radioactive material that is small enough to be inhaled by a human.

DR—the damage ratio reflecting the fraction of MAR that is damaged in the accident and available for release to the environment.

LPF—the leak path factor reflecting the fraction of respirable radioactive material that has a pathway out of the facility for dispersal in the environment.

The accident source terms for chemical accidents are shown in Table C.4–2. The impacts of chemical accidents are measured in terms of ERPG-2 and ERPG-3 concentration limits established by the American Industrial Hygiene Association. ERPG-2 is defined as the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective actions. ERPG-3 is defined as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

Beyond Evaluation Basis Earthquake with Fire

The earthquake accident scenario postulates a seismic event and seismically induced failure of interior nonstructural walls. The collapsed walls cause a loss of confinement and a potential release of materials in multiple areas in the facility. Combustible materials in the area are ignited and the resulting fire propagates to multiple areas of the facility, including storage vaults in three buildings containing the largest quantity of plutonium metal. The MAR for the 125 ppy production case includes 16,929 kilograms (37,322 pounds) metal, 35 kilograms (77 pounds) oxide, and 24 kilograms (53 pounds) solution. The bounding seismic accident with fire conservatively assumes a damage ratio (DR) = 1.0 resulting in all of the MAR to be affected by the fire. The collapsed walls cause a loss of confinement resulting in an assumed leak path factor (LPF) = 1.0. The airborne respirable release fraction is estimated to be $ARF \times RF = 2.5 \times 10^{-4}$ (metal), 6×10^{-5} (oxide), and 2×10^{-3} (solution). No credit is taken for the mitigating effects of safety systems, fire suppression efforts and equipment, plutonium cladding, the shipping containers or the final building state (building collapse and rubble bed). The resulting source term for the 125 ppy case is 4.23 kilograms (9.3 pounds) of plutonium metal, 0.0021 kilograms (0.0046 pounds) of plutonium oxide, and 0.048 kilograms (0.11 pounds) of plutonium solution. The accident frequency is estimated to be in the range of 1×10^{-6} to 1×10^{-5} per year. For the purpose of risk calculations, a conservative frequency of 1×10^{-5} per year is assumed (Tetra Tech 2007).

Fire in a Single Building

A fire is postulated to start within a glovebox, processing room, or storage vault. Possible causes of the fire include an electrical short, equipment failure, welding equipment, or human error. The fire propagates to multiple areas of the facility involving the largest quantities of plutonium metal. The material at risk is a maximum 7,685 kilograms (16,943 pounds) of plutonium metal for the 125 ppy. The bounding fire accident conservatively assumes a DR = 1.0 resulting in all of the MAR to be affected by the fire. No credit is taken for safety systems, building confinement, or filtration resulting in an assumed LPF = 1.0. The airborne respirable release fraction is estimated to be $ARF \times RF = 2.5 \times 10^{-4}$. No credit is taken for the mitigating effects of fire suppression efforts and equipment, plutonium cladding or the shipping containers. The resulting source term is a ground level, thermal release of 1.92 kilograms (4.23 pounds) of plutonium. The accident frequency is estimated to be in the range of 1×10^{-6} to 1×10^{-4} per year. For the purpose of risk calculations, a conservative frequency of 1×10^{-4} per year is assumed (Tetra Tech 2007).

Table C.4-1 — Postulated CPC-Related Facility Radiological Accidents

Accident	Accident Description	Material at Risk	Source Term	Event Frequency
Natural Phenomena Events				
1. Beyond Evaluation Basis Earthquake with Fire	A seismic event is postulated causing failure of interior nonstructural walls. The collapsed walls cause a loss of confinement and a potential release of materials in multiple areas of the facility. Combustible materials in the area are ignited and the fire propagates to multiple areas and storage vaults containing the largest quantity of plutonium metal.	16,988 kg plutonium-239 equivalent: 99.65% metal 0.21% powder 0.14% solution	4.23 kg metal 0.0021 kg oxide 0.048 kg solution	1.0×10^{-6} to 1.0×10^{-5} /yr
Externally Initiated Events				
Addressed in Classified Appendix	Addressed in Classified Appendix	Addressed in Classified Appendix	Addressed in Classified Appendix	Addressed in Classified Appendix
Internal Process Events				
1. Fire in a Single Building	A fire is postulated to start within a glovebox, processing room or storage vault. The fire propagates to multiple areas involving the largest quantities of plutonium metal.	7,685 kg plutonium metal	1.92 kg plutonium	1.0×10^{-6} to 1.0×10^{-4} /yr
2. Explosion in a Feed Casting Furnace	A steam explosion/over-pressurization is postulated to occur in a feed casting furnace in the foundry. The steam explosion occurs due to a cooling water leak or an over-pressurization event. The explosion/over-pressurization impacts molten plutonium metal in seven furnaces. Negligible impacts from the shock/blast are postulated for the solid plutonium metal in the glovebox.	4.5 kg molten plutonium metal	2.25 kg molten plutonium metal	1.0×10^{-4} to 1.0×10^{-2} /yr
3. Nuclear Criticality	An inadvertent criticality is postulated based on several potential events involving handling errors. Accumulation of fissile material in excess of criticality safety limits, addition of a moderator causing a critical configuration, or a seismic event causing collapse of storage vault racks are potential scenarios.	See Table 3-1 ^a	5×10^{17} fissions	1.0×10^{-2} /yr

Table C.4-1 — Postulated CPC-Related Facility Radiological Accidents (continued)

Accident	Accident Description	Material at Risk	Source Term	Event Frequency
Internal Process Events (continued)				
4. Fire-induced Release in the CRT Storage Room	A fire is postulated to occur in the cargo restraint transporter storage room.	600 kg plutonium metal	0.15 kg plutonium	1.0×10^{-4} to $1.0 \times 10^{-2}/\text{yr}$
5. Radioactive Material Spill	A loss of confinement and spill of molten plutonium into the metal reduction glovebox is postulated. The spill occurs due to a failure or rupture of the feed casting furnace.	4.5 kg molten plutonium metal	0.045 kg plutonium	1.0×10^{-4} to $1.0 \times 10^{-2}/\text{yr}$

^a Tetra Tech 2007.
Source: Tetra Tech 2007.

Table C.4-2 — Postulated CPC-Related Facility Chemical Accidents

Chemical Release Events				
1. Nitric Acid release from bulk storage	Nitric acid is inadvertently released from bulk storage due to natural phenomena, equipment failure, mechanical impact, or human error during storage, handling, or process operations.	10,500 kg	10,500 kg	1.0×10^{-5} to $1.0 \times 10^{-4}/\text{yr}$
2. Hydrofluoric Acid Release from Bulk Storage	Hydrofluoric acid is inadvertently released from bulk storage due to natural phenomena, equipment failure, mechanical impact, or human error during storage, handling, or process operations.	550 kg	550 kg	1.0×10^{-5} to $1.0 \times 10^{-4}/\text{yr}$
3. Formic Acid Release from Bulk Storage	Formic acid is inadvertently released from bulk storage due to natural phenomena, equipment failure, mechanical impact, or human error during storage, handling, or process operations.	1,500 kg	1,500 kg	1.0×10^{-5} to $1.0 \times 10^{-4}/\text{yr}$

Source: Tetra Tech 2007.

Explosion in a Feed Casting Furnace

A steam explosion/over-pressurization is postulated to occur in a feed casting furnace in the foundry. The steam explosion occurs due to a cooling water leak or an over-pressurization event. The explosion/over-pressurization impacts molten plutonium metal in seven furnaces. The furnace is assumed to contain 4.5 kilogram (9.9 pounds) of plutonium in the form of molten metal. The airborne respirable release fraction was estimated to be $ARF \times RF = 0.5$ for the 4.5 kilogram (9.9 pounds) of plutonium. Negligible impacts from the shock/blast are postulated for 9 kilogram (19.8 pound) of solid plutonium metal in the glovebox. The bounding scenario assumes a $DR = 1.0$ and an $LPF = 1.0$. The resulting source is 2.25 kilogram (5.0 pounds) of plutonium. The frequency of the accident is estimated to be in the range 1×10^{-4} to 1×10^{-2} per year. For the purpose of risk calculations, a conservative frequency of 1×10^{-2} was used (Tetra Tech 2007).

Nuclear Criticality

An inadvertent criticality is postulated based on any one of several potential events involving handling errors. Accumulation of fissile material in excess of criticality safety limits, addition of a moderator causing a critical configuration, or a seismic event causing collapse of storage vault racks are potential scenarios. The estimated frequency of a criticality is 1×10^{-2} per year (Tetra Tech 2007).

Fire-Induced Release in the Cargo Restraint Transporter Storage Room

A fire is postulated to start in cargo restraint transporter storage room. The fire is confined to the room. The MAR in the room is 600 kilogram (1,322.8 pounds) plutonium metal. The bounding scenario assumes a $DR = 1.0$ resulting in all of the MAR to be affected by the fire. No credit is taken for building confinement or filtration resulting in an assumed $LPF = 1.0$. The airborne respirable fraction is estimated to be $ARF \times RF = 2.5 \times 10^{-4}$. No credit is taken for the mitigating effects of fire suppression efforts and equipment, plutonium cladding or shipping containers. The resulting source term is a ground level, thermal release of 0.15 kilogram (0.33 pound) of plutonium. The accident frequency is estimated to be in the range of 1×10^{-4} to 1×10^{-2} per year. For the purpose of risk calculations, a conservative frequency of 1×10^{-2} per year is assumed (Tetra Tech 2007).

Radioactive Material Spill

A spill of radioactive material occurs in the metal reduction glovebox. A loss of confinement and spill of molten plutonium into the metal reduction glovebox is postulated. The spill occurs due to a failure or rupture of the feed casting furnace. The event does not impact any other material that may be in the glovebox. The spill is assumed to involve 4.5 kilogram (9.9 pounds) molten plutonium metal. An airborne release from disturbed metal surfaces is assumed the release mechanism. The airborne respirable release fraction is estimated to be $ARF \times RF = 1 \times 10^{-2}$. A $DR = 1.0$ was conservatively assumed. For a bounding scenario, no credit is taken for safety systems, building confinement, or ventilation/filtration corresponding to $LPF = 1.0$. The resulting source term is a ground level release of 0.045 kilogram (0.099 pounds) of plutonium. The accident frequency is estimated to be in the range of 1×10^{-4} to 1×10^{-2} per year. For the

purpose of risk calculations, a conservative frequency of 1×10^{-2} per year is assumed (Tetra Tech 2007).

Nitric Acid Release

An accidental release of nitric acid from bulk storage is postulated due to equipment failure, mechanical impact, or human error. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Nitric acid is corrosive and can cause severe burns to all parts of the body. Its vapors may burn the respiratory tract and may cause pulmonary edema, which could prove fatal. The nitric acid is assumed to be stored in bulk quantity in an outdoor facility at MPF. The maximum amount of nitric acid that could be released is 10,500 kilogram (23,149 lb). The nitric acid is released by evaporation to the environment and is transported as an airborne plume with potential impacts in excess of ERPG-2 and ERPG-3 concentration limits to onsite workers and the offsite public. The ERPG-2 and ERPG-3 concentration limits for the chemical are 6 and 78 parts per million (ppm), respectively. The estimated frequency of this accident is in the range of 1.0×10^{-5} to 1.0×10^{-4} per year. For the purpose of risk calculations, a conservative frequency of 1.0×10^{-4} is assumed (Tetra Tech 2007).

Hydrofluoric Acid Release

An accidental release of hydrofluoric acid from bulk storage is postulated due to equipment failure, mechanical impact, or human error. Hydrofluoric acid is extremely toxic and may be fatal if inhaled or ingested. It is readily absorbed through the skin and skin contact may be fatal. It acts as a systemic poison, causes severe burns and is a possible mutagen. The hydrofluoric acid is assumed to be stored in bulk quantity in an outdoor facility at Modern Pit Facility (MPF). The maximum amount of hydrofluoric acid that could be released is 550 kilogram (1,212.5 pounds). The hydrofluoric acid is released by evaporation to the environment and is transported as an airborne plume with potential impacts in excess of ERPG-2 and ERPG-3 concentration limits to onsite workers and the offsite public. The ERPG-2 and ERPG-3 concentration limits for the chemical are 20 and 50 ppm, respectively. The estimated frequency of this accident is in the range of 1.0×10^{-5} to 1.0×10^{-4} per year. For the purpose of risk calculations, a conservative frequency of 1.0×10^{-4} per year is assumed (Tetra Tech 2007).

Formic Acid Release

An accidental release of formic acid from bulk storage is postulated due to equipment failure, mechanical impact, or human error. The accident scenario postulates a major leak, such as a pipe rupture, and the released chemical forming a pool about one inch in depth in the area around the point of release. Formic acid is corrosive and will cause severe burns. It is harmful by inhalation, ingestion, and readily absorbed through skin. It is very destructive to mucous membranes and the upper respiratory tract, eyes, and skin. Inhalation may be fatal. The formic acid is assumed to be stored in bulk quantity in an outdoor facility at MPF. The maximum amount of formic acid that could be released is 1,500 kilogram (3,307 pounds). The formic acid is released by evaporation to the environment and is transported as an airborne plume with potential impacts in excess of ERPG-2 and ERPG-3 concentration limits to onsite workers and

the offsite public. The ERPG-2 and ERPG-3 concentration limits for the chemical are 10 and 30 ppm, respectively. The estimated frequency of this accident is in the range of 1.0×10^{-5} to 1.0×10^{-4} per year. For the purpose of risk calculations, a conservative frequency of 1.0×10^{-4} per year is assumed (Tetra Tech 2007).

Results. Tables C.4-3 through C.4-12 show the consequences and risks of the postulated set of accidents for a noninvolved worker and the public (MEI and the general population living within 50 miles of the site), for the site alternatives for the CPC. Chemical accidents are shown in Tables C.4-13 through C.4-18.

C.4.2 LANL Alternative

C.4.2.1 Greenfield CPC and Upgrade Alternative

Table C.4-3 — CPC Radiological Accident Frequency and Consequences at LANL

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	87.5	0.105	44,200	26.5	1,420	1
Fire in a single building	1.0×10^{-4}	62.4	0.0749	27,600	16.6	2,200	1
Explosion in a feed casting furnace	1.0×10^{-2}	73.2	0.0878	32,400	19.4	2,580	1
Nuclear Criticality	1.0×10^{-2}	0.00014	8.40×10^{-8}	0.0372	2.23×10^{-5}	0.00278	1.67×10^{-6}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	4.88	0.00293	2,160	1.3	172	0.206
Radioactive material spill	1×10^{-2}	0.146	8.76×10^{-5}	64.8	0.0389	5.16	0.0031

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.4-4 — Annual Cancer Risks for CPC at LANL

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	1.05x10 ⁻⁶	2.65x10 ⁻⁴	1x10 ⁻⁵
Fire in a Single Building	7.49x10 ⁻⁶	1.66x10 ⁻³	1x10 ⁻⁴
Explosion in a Feed Casting Furnace	8.78x10 ⁻⁴	0.19	1x10 ⁻²
Nuclear Criticality	8.40x10 ⁻¹⁰	2.23x10 ⁻⁷	1.67x10 ⁻⁸
Fire-induced Release in the CRT Storage Room	2.93x10 ⁻⁵	1.3x10 ⁻²	2.06x10 ⁻³
Radioactive Material Spill	8.76x10 ⁻⁷	3.89x10 ⁻⁴	3.1x10 ⁻⁵

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

C.4.2.2 50/80 Alternative

Under the 50/80 Alternatives at Los Alamos, the Plutonium Facility, Building 4 (PF-4) at TA-55 would be upgraded to provide a capability to produce up to 80 pits/year to the stockpile. The changes to PF-4 to achieve this capability are assumed to be equivalent to the operations, processes, and technology and safety systems planned for a Greenfield CPC. As such, the potential hazards and accidents postulated for a Greenfield CPC would be applicable to the upgraded PF-4. However, for three of the accidents (Beyond Evaluation Basis Earthquake and Fire, Fire in a single building, and the Fire-induced release in the CRT Storage Room), the material-at-risk for the 50/80 Alternative would be approximately two-thirds as large as for the Greenfield CPC. The potential consequences and risks from accidents for the 50/80 Alternative are presented in Tables C.4-3a and C.4-4a.

Table C.4-3a — CPC Radiological Accident Frequency and Consequences at LANL for the 50/80 Alternative

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0 × 10 ⁻⁵	58.6	0.07	29,614	17.8	951	1
Fire in a single building	1.0 × 10 ⁻⁴	41.8	0.05	18,492	11.1	1,474	1
Explosion in a feed casting furnace	1.0 × 10 ⁻²	73.2	0.0878	32,400	19.4	2,580	1
Nuclear Criticality	1.0 × 10 ⁻²	0.00014	8.40x10 ⁻⁸	0.0372	2.23x10 ⁻⁵	0.00278	1.67x10 ⁻⁶
Fire-induced release in the CRT Storage Room	1.0 × 10 ⁻²	3.3	0.002	1,447	0.9	115	0.13

Table C.4-3a — CPC Radiological Accident Frequency and Consequences at LANL for the 50/80 Alternative (continued)

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Radioactive material spill	1×10^{-2}	0.146	8.76×10^{-5}	64.8	0.0389	5.16	0.003

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.4-4a — Annual Cancer Risks for CPC at LANL for the 50/80 Alternative

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	7.0×10^{-7}	1.78×10^{-4}	1×10^{-5}
Fire in a Single Building	5.0×10^{-6}	1.1×10^{-3}	1×10^{-4}
Explosion in a Feed Casting Furnace	8.78×10^{-4}	0.19	1×10^{-2}
Nuclear Criticality	8.40×10^{-10}	2.23×10^{-7}	1.67×10^8
Fire-induced Release in the CRT Storage Room	2.0×10^{-5}	9.0×10^{-3}	1.3×10^{-3}
Radioactive Material Spill	8.76×10^{-7}	3.89×10^{-4}	3.1×10^{-5}

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

C.4.3 Nevada Test Site Alternative

Table C.4-5 — CPC Radiological Accident Frequency and Consequence – NTS

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	1.99	0.00119	788	0.473	1,770	1
Fire in a single building	1.0×10^{-4}	0.918	0.000551	354	0.212	984	1
Explosion in a feed casting furnace	1.0×10^{-2}	1.08	0.000648	414	0.248	1,150	1
Nuclear Criticality	1.0×10^{-2}	1.89×10^{-6}	1.13×10^{-9}	0.000309	1.85×10^{-7}	0.00124	7.44×10^{-7}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	0.0717	0.000043	27.6	0.0166	76.8	0.0922

Table C.4-5 — CPC Radiological Accident Frequency and Consequence – NTS (continued)

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Radioactive material spill	1×10^{-2}	0.00215	1.29×10^{-6}	0.829	0.000497	2.31	0.00139

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.4-6 — Annual Cancer Risks for CPC - NTS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	1.19×10^{-8}	4.73×10^{-6}	1×10^{-5}
Fire in a Single Building	5.51×10^{-8}	2.12×10^{-5}	1×10^{-4}
Explosion in a Feed Casting Furnace	6.48×10^{-6}	2.48×10^{-3}	1×10^{-2}
Nuclear Criticality	1.13×10^{-11}	1.85×10^{-9}	7.44×10^{-9}
Fire-induced Release in the CRT Storage Room	4.3×10^{-7}	1.66×10^{-4}	9.22×10^{-4}
Radioactive Material Spill	1.29×10^{-8}	4.97×10^{-6}	1.39×10^{-5}

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

C.4.4 Pantex Site Alternative

Table C.4-7 — CPC Radiological Accident Frequency and Consequences – Pantex

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0×10^{-5}	23.1	0.0277	9,840	5.9	1,550	1
Fire in a single building	1.0×10^{-4}	11.4	0.00684	4,610	2.77	988	1
Explosion in a feed casting furnace	1.0×10^{-2}	13.3	0.00798	5,400	3.24	1,160	1
Nuclear Criticality	1.0×10^{-2}	3.17×10^{-5}	1.90×10^{-8}	0.00446	2.68×10^{-6}	0.00126	7.56×10^{-7}
Fire-induced release in the CRT Storage Room	1.0×10^{-2}	0.888	0.000533	360	0.216	77.2	0.0926
Radioactive material spill	1×10^{-2}	0.0266	0.000016	10.8	0.00648	2.32	0.00139

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.4-8 — Annual Cancer Risks for CPC – Pantex

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	2.77x10 ⁻⁷	5.9x10 ⁻⁵	1x10 ⁻⁵
Fire in a Single Building	6.84x10 ⁻⁷	2.77x10 ⁻⁴	1x10 ⁻⁴
Explosion in a Feed Casting Furnace	7.98x10 ⁻⁵	3.24x10 ⁻²	1x10 ⁻²
Nuclear Criticality	1.90x10 ⁻¹⁰	2.68x10 ⁻⁸	7.56x10 ⁻⁹
Fire-induced Release in the CRT Storage Room	5.33x10 ⁻⁶	2.16x10 ⁻³	9.26x10 ⁻⁴
Radioactive Material Spill	1.6x10 ⁻⁷	6.48x10 ⁻⁵	1.39x10 ⁻⁵

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

C.4.5 Savannah River Site Alternative

Table C.4-9 — CPC Radiological Accident Frequency and Consequences - SRS

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0 × 10 ⁻⁵	3.39	0.00203	17,500	10.5	1,580	1
Fire in a single building	1.0 × 10 ⁻⁴	1.57	0.000942	7,890	4.73	1,070	1
Explosion in a feed casting furnace	1.0 × 10 ⁻²	1.83	0.0011	9,250	5.55	1,260	1
Nuclear Criticality	1.0 × 10 ⁻²	3.42x10 ⁻⁶	2.05x10 ⁻⁹	0.00728	4.37x10 ⁻⁶	0.00146	8.76x10 ⁻⁷
Fire-induced release in the CRT Storage Room	1.0 × 10 ⁻²	0.122	7.32x10 ⁻⁵	617	0.37	83.7	0.1
Radioactive material spill	1 × 10 ⁻²	0.00367	2.20x10 ⁻⁶	18.5	0.0111	2.51	0.00151

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.4-10 — Annual Cancer Risks for CPC - SRS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Non-involved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	2.03x10 ⁻⁸	1.05x10 ⁻⁴	1x10 ⁻⁵
Fire in a Single Building	9.42x10 ⁻⁸	4.73x10 ⁻⁴	1x10 ⁻⁴
Explosion in a Feed Casting Furnace	1.1x10 ⁻⁵	5.55x10 ⁻²	1x10 ⁻²
Nuclear Criticality	2.05x10 ⁻¹¹	4.37x10 ⁻⁸	8.76x10 ⁻⁹
Fire-induced Release in the CRT Storage Room	7.32x10 ⁻⁷	0.37 x10 ⁻⁷	1x10 ⁻³
Radioactive Material Spill	2.20x10 ⁻⁸	1.11x10 ⁻⁴	1.51x10 ⁻⁵

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

C.4.6 Y-12 Alternative

Table C.4-11 — CPC Radiological Accident Frequency and Consequences - Y-12

Accident	Frequency	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Beyond Evaluation Basis Earthquake and Fire	1.0 × 10 ⁻⁵	219	0.263	295,000	177	857	1
Fire in a single building	1.0 × 10 ⁻⁴	173	0.208	152,000	91.2	4,760	1
Explosion in a feed casting furnace	1.0 × 10 ⁻²	203	0.244	178,000	107	5,580	1
Nuclear Criticality	1.0 × 10 ⁻²	0.000301	1.81x10 ⁻⁷	0.117	7.02x10 ⁻⁵	0.00544	3.26x10 ⁻⁶
Fire-induced release in the CRT Storage Room	1.0 × 10 ⁻²	13.5	0.0081	11,900	7.14	372	0.446
Radioactive material spill	1 × 10 ⁻²	0.406	0.000244	357	0.214	11.2	0.00672

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.4-12 — Annual Cancer Risks for CPC – Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Beyond Evaluation Basis Earthquake with Fire	2.63x10 ⁻⁶	1.77x10 ⁻³	1x10 ⁻⁵
Fire in a Single Building	2.08x10 ⁻⁵	9.12x10 ⁻³	1x10 ⁻⁴
Explosion in a Feed Casting Furnace	2.44x10 ⁻³	1.07	1x10 ⁻²
Nuclear Criticality	1.81x10 ⁻⁹	7.02x10 ⁻⁷	3.26x10 ⁻⁸
Fire-induced Release in the CRT Storage Room	8.1x10 ⁻⁵	7.14x10 ⁻²	4.46x10 ⁻³
Radioactive Material Spill	2.44x10 ⁻⁶	2.14x10 ⁻³	6.72x10 ⁻⁵

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

C.4.7 Chemical Accident Frequency and Consequences – CPC

The chemicals selected for evaluation are based on the aqueous feed preparation process, as noted in each table, and are considered the most hazardous of all the chemicals used in this process. Determination of a chemical’s hazardous ranking takes into account quantities available for release, protective concentration limits (ERPG-2) and evaporation rate. The most hazardous chemical used in an alternative method, the pyrochemical processing method is also analyzed as noted in the tables.

This section presents the impacts of potential chemical accidents at each of the five CPC site alternatives. The tables show the name of the chemical and the quantity released during a severe accident. The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in ppm. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite.

Table C.4-13 — Chemical Accident Frequency and Consequences at Los Alamos

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm) ^b	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.85	4.5	8.76	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.05	10.4	10 ⁻⁴
Formic acid	1,500	10	0.215	0.54	1.06	10 ⁻⁴

^a At site boundary, approximately 1.2 miles from release .

Table C.4-14 — Upgrade 80 Chemical Accident Frequency and Consequences

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	3,420	6	0.5	1.46	2.85	10 ⁻⁴
Hydrofluoric acid	340	20	0.4	3.1	6.42	10 ⁻⁴
Hydrochloric acid	384	20	2.1	118	264	10 ⁻⁴

^a At site boundary, approximately 1.2 miles from release.

Table C.4-15 — Chemical Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.86	4.55	<0.1	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.05	<0.1	10 ⁻⁴
Formic acid	1,500	10	0.215	0.54	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7.

Table C.4-16 — Chemical Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.85	4.49	0.48	10 ⁻⁴
Hydrofluoric acid	550	20	0.5	5.1	0.55	10 ⁻⁴
Formic acid	1,500	10	0.22	0.56	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles.

Table C.4-17 — Chemical Accident Frequency and Consequences at SRS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.17	0.189	<0.01	10 ⁻⁴
Hydrofluoric acid	550	20	0.12	0.21	<0.01	10 ⁻⁴
Formic acid	1,500	10	0.1	0.02	0	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.

Table C.4-18 — CPC Chemical Accident Frequency and Consequences at Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.28	0.5	0.01	10 ⁻⁴
Hydrofluoric acid	550	20	0.35	2.0	0.016	10 ⁻⁴
Formic acid	1,500	10	0.08	0.07	0	10 ⁻⁴

^a At site boundary, approximately 1.3 miles from release.

C.5 RADIOLOGICAL ACCIDENT SCENARIOS - CUC

This section presents the estimated impacts of accidents that could occur at a Consolidated Uranium Center (CUC). The scenarios described here define the bounding envelope of accidents—that is, any other reasonably foreseeable accident at the CUC would be expected to have similar or smaller consequences. These accident analyses are conservative, with little or no credit taken for existing preventative and mitigating features in each building or operation analyzed or the safety procedures that are mandatory at NNSA sites.

C.5.1 Accident Scenarios

From the safety documents obtained through the process described in Section C.3.1, Table C.5-1 identifies the accident scenarios and source terms (release rates and frequencies) that were developed for the CUC (Tetra Tech 2007).

Table C.5-1 — Potential CUC Accident Scenarios

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Metal Fabrication Complex			
Local fire	$10^{-2} - 10^{-4}$	N/A, No radiological consequences	
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Major fire	$10^{-4} - 10^{-6}$	EU = 17.9 kg (sum of metal and chips) DU = 452 kg (sum of metal and chips)	Release height = ground level Release duration = 1 hour
Aircraft Crash – Initiator for major fire	$1.5 \times 10^{-5} - 2.2 \times 10^{-5}$	See major fire	
Tanker Truck Accident – Initiator for major fire	$10^{-4} - 10^{-6}$	See major fire	
Earthquake	$10^{-2} - 10^{-4}$	Same as criticality	
High Winds	$10^{-2} - 10^{-4}$	Same as earthquake	
Rain/Snow	$10^{-2} - 10^{-4}$	Same as earthquake	
Assembly			
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Explosion	$10^{-4} - 10^{-6}$	2 kg EU (sum of metal and chips) 0.04 kg DU (sum of metal and chips)	Release height = 7.6 m Release duration = 1 hour
Fire	$10^{-4} - 10^{-6}$	Same as explosion	Release height = 7.6 m Release duration = 2 hours
Earthquake	$10^{-2} - 10^{-4}$	Bounded by fire	
Wind	$10^{-1} - 10^{-2}$	None	
Flood	$10^{-2} - 10^{-4}$	None	
Aircraft crash	$\sim 2 \times 10^{-5}$	Bounded by fire	
Manufacturing QE			
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Local fires	$10^{-2} - 10^{-4}$	No radiological releases	
Large Building Fire	$10^{-4} - 10^{-6}$	2.6 kg EU 54 kg DU 172 kg Th	Release height = <10 m Release duration = 1 hour
Aircraft Crash – Initiator for large building fire	$4.5 \times 10^{-5} - 5.0 \times 10^{-5}$	See large building fire	
Tanker Truck explosion – Initiator for large building fire	$10^{-4} - 10^{-6}$	See large building fire	
Earthquake	$10^{-2} - 10^{-4}$	Bounded by criticality	
Wind	$10^{-2} - 10^{-4}$	Bounded by criticality	
Rain/Snow	$10^{-2} - 10^{-4}$	Bounded by criticality	
EU Warehouse			
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions

Table C.5-1 — Potential CUC Accident Scenarios (continued)

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Warehouse (continued)			
Fire	$10^{-4} - 10^{-6}$	EU = 22.6 kg DU = 20.1 kg U-233 = 0.0066 kg Th = 0.13 kg (represents sum of metals, oxides, and combustibles) Pu = 1.0×10^{-6} kg Np-237 = 1.6×10^{-5} kg	Release height = 4 m Release duration = 1 hour
Aircraft crash – Initiator of fire	1.2×10^{-5}	Same as fire	
Earthquake-induced loss of confinement	$10^{-2} - 10^{-4}$	EU = 1.3 kg DU = 0.06 kg Th = 0.03 kg (the above all represent the sum of metals, oxides, and combustibles)	Release height = ground level Release duration = 15 min
Wind	$10^{-2} - 10^{-4}$	Bounded by criticality, fire	
Flood	$10^{-2} - 10^{-4}$	Bounded by criticality	
Lightning	$10^{-4} - 10^{-6}$	Bounded by fire	
HEUMF			
Design-basis fires ¹	$10^{-2} - 10^{-4}$	EU = 2.58 kg DU = 0.55 kg	Release height = 11.3 m Release duration = 1 hour
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Earthquake	$10^{-2} - 10^{-4}$	None	
Wind	$10^{-2} - 10^{-4}$	None	
Rain/Snow	$10^{-2} - 10^{-4}$	None	
Flood	$10^{-2} - 10^{-4}$	Bounded by criticality	
EU Operations			
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Uranium Solution Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	3.25×10^{18} fissions
Local fires	$10^{-2} - 10^{-4}$	8 kg EU (includes aqueous and organic solutions)	Release height = ground level Release duration = 15 min
Large fire	$10^{-4} - 10^{-6}$	14.8 kg EU (includes metals, oxides, aqueous and organic solutions)	Release height = “roof level” Release duration = 1 hour
Explosions	$10^{-2} - 10^{-4}$	None – localized effects	
Aircraft crash	$10^{-4} - 10^{-6}$	37.8 kg EU (includes metals, chips, oxides, and aqueous and organic solutions)	Release height = “roof level” Release duration = 15 min

¹ The source term for a design-basis fire at the HEUMF has been identified as the bounding (largest possible) source term, and reasonably bounds the source term that might result from any aircraft crash.

Table C.5-1 — Potential CUC Accident Scenarios (continued)

Accident	Frequency	Source Term or Hazard	Notes/Assumptions
EU Operations (continued)			
Earthquake-induced fire	$10^{-2} - 10^{-4}$	Same as large fire	
Wind	$10^{-2} - 10^{-4}$	Bounded by earthquake	
Rain/Snow	$10^{-2} - 10^{-4}$	Bounded by earthquake	
Lightning	$10^{-2} - 10^{-4}$	Same as local fire	
Analytical Laboratory			
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Large fire	$10^{-2} - 10^{-4}$	0.06 kg EA (includes solutions, metals, oxides, etc.)	
Aircraft crash	1.4×10^{-5}	Same as large fire	
Machine Shop Special Materials			
Large fire	$10^{-4} - 10^{-6}$	96.6 kg DU (includes metals, fines, and oxides)	Release height = ground level Release duration = 1 hour
Inadvertent water leak into furnace	$10^{-2} - 10^{-4}$	32 kg DU	Release height = ground level Release duration = "short" (assume 15 min)
Machine Shop DU/Binary			
Large fire	$10^{-4} - 10^{-6}$	31.3 kg DU (includes bulk metal, chips, and fines)	Release height = "elevated" Release duration = 1 hour
Uranium Metal Criticality	$10^{-2} - 10^{-4}$	See Tables C.5-2 through C.5-4	1.0×10^{18} fissions
Earthquake	$10^{-2} - 10^{-4}$	Bounded by large fire	
High wind/tornado	$10^{-2} - 10^{-4}$	Bounded by large fire	
Rain/Snow	$10^{-2} - 10^{-4}$	Bounded by large fire	

Source: Tetra Tech 2007.

Table C.5-2 — Source Term (Ci) released to the environment following a Uranium Metal Criticality (1.0×10^{18} fissions)

Radionuclide	Half Life	Curies released
Kr-83m	1.8 hr	8.00E+00
Kr-85m	4.5 yr	7.50E+00
Kr-84	1.7 yr	8.00E-05
Kr-87	76.3 min	4.95E+01
Kr-88	2.8 hr	3.25E+01
Kr-89	3.2 min	2.10E+03
Xe-131m	11.9 day	4.10E-03
Xe-133m	2.0 day	9.00E-02
Xe-133	5.2 day	1.35E+00
Xe-135m	15.6 min	1.10E+02
Xe-135	9.1 hr	1.80E+01
Xe-137	3.8 min	2.45E+03
Xe-138	14.2 min	6.50E+02
I-131	8.1 day	4.35E-02
I-132	2.3 hr	5.50E+00
I-133	0.8 hr	8.00E-01
I-134	52.6 min	2.25E+01
I-135	6.6 hr	2.35E+00

Source: Tetra Tech 2007.

Table C.5-3 — Source Term (Ci) -- Uranium Solution Criticality (3.28×10^{18} fissions)

Radionuclide	Half Life	Curies released
Kr-83m	1.8 hr	5.25E+01
Kr-85m	4.5 yr	4.92E+01
Kr-84	1.7 yr	5.25E-04
Kr-87	76.3 min	3.25E+02
Kr-88	2.8 hr	2.13E+02
Kr-89	3.2 min	1.38E+04
Xe-131m	11.9 day	2.69E-02
Xe-133m	2.0 day	5.90E-01
Xe-133	5.2 day	8.86E+00
Xe-135m	15.6 min	7.22E+02
Xe-135	9.1 hr	1.18E+02
Xe-137	3.8 min	1.61E+04
Xe-138	14.2 min	4.26E+03
I-131	8.1 day	7.13E-01
I-132	2.3 hr	9.02E+01
I-133	0.8 hr	1.31E+01
I-134	52.6 min	3.69E+02
I-135	6.6 hr	3.85E+01

Source: Tetra Tech 2007.

Table C.5-4 — Estimated direct radiation dose from an unshielded criticality accident

Downwind Distance (m)	Direct Radiation Dose (rem)	
	Uranium metal criticality	Uranium solution criticality
100	5.7	18.6
200	0.88	2.9
300	0.25	0.81
350	0.14	0.47
400	0.088	0.29
450	0.056	0.18
500	0.036	0.12
550	0.024	0.079
600	0.016	0.053
650	0.011	0.036
700	0.0077	0.025
750	0.0054	0.018
800	0.0039	0.013
850	0.0028	0.0091
900	0.0020	0.0066
950	0.0015	0.0048
1000	0.0011	0.0036

Source: Tetra Tech 2007.

C.5.2 Estimated Health Effects

Table C.5-5 identifies the accidents that are analyzed in this SPEIS for the CUC. Tables C.5-6 through C.6-17 show the consequences and risks of the postulated set of accidents for a noninvolved worker and the public (MEI and the general population living within 50 miles of the site), for the site alternatives for the CUC.

Table C.5-5 — Uranium Operations Accidents

Operation	Accident	Frequency	Source Term	Notes/Assumptions
EU Metal Fabrication	Major fire	$10^{-4} - 10^{-6}$	EU = 17.9 kg (sum of metal and chips) DU = 452 kg (sum of metal and chips)	Release height = ground level Release duration = 1 hour
Assembly	Explosion	$10^{-4} - 10^{-6}$	2 kg EU (sum of metal and chips) 0.04 kg DU (sum of metal and chips)	Release height = 7.6 m Release duration = 1 hour
EU Warehouse	Fire	$10^{-4} - 10^{-6}$	EU = 22.6 kg DU = 20.1 kg U-233 = 0.0066 kg Th = 0.13 kg (the above all represent the sum of metals, oxides, and combustibles) Pu = 1.0×10^{-6} kg Np-237 = 1.6×10^{-5} kg	Release height = 4 m Release duration = 1 hour
HEUMF	Design-basis fires	$10^{-2} - 10^{-4}$	EU = 2.58 kg DU = 0.55 kg	Release height = 11.3 m Release duration = 1 hour
EU Operations	Aircraft crash	$10^{-4} - 10^{-6}$	37.8 kg EU (includes metals, chips, oxides, and aqueous and organic solutions)	Release height = "roof level" Release duration = 15 min

Source: Tetra Tech 2007.

Table C.5-6 — CUC Radiological Accident Frequency and Consequences at Los Alamos, TA-55^a

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	$10^{-4} - 10^{-6}$	0.213	1.28×10^{-4}	94.5	5.67×10^{-2}	7.53	4.52×10^{-3}
Explosion	$10^{-4} - 10^{-6}$	0.0209	1.25×10^{-5}	9.3	5.58×10^{-3}	0.612	3.67×10^{-4}
Fire in EU Warehouse	$10^{-4} - 10^{-6}$	0.249	1.49×10^{-4}	110	6.6×10^{-2}	8.33	5.0×10^{-3}
Design-basis fires for HEU Storage	$10^{-2} - 10^{-4}$	0.0267	1.6×10^{-5}	12	7.2×10^{-3}	0.637	3.82×10^{-4}
Aircraft crash	$10^{-4} - 10^{-6}$	0.132	7.92×10^{-5}	75.5	4.53×10^{-2}	0.8	4.8×10^{-4}

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.5-7 — Annual Cancer Risks for CUC at Los Alamos, TA-55

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	1.28×10^{-8}	5.67×10^{-6}	4.52×10^{-7}
Explosion	1.25×10^{-9}	5.58×10^{-7}	3.67×10^{-8}
Fire in EU Warehouse	1.49×10^{-8}	6.6×10^{-6}	5.0×10^{-7}
Design-basis fires for HEU Storage	1.6×10^{-7}	7.2×10^{-5}	3.82×10^{-6}
Aircraft crash	7.92×10^{-9}	4.53×10^{-6}	4.8×10^{-8}

^a CPC operations at TA55; at site boundary, approximately 1.2 miles from release.

^b Based on a projected future population (year 2030) of approximately 552,115 persons residing within 50 miles of LANL TA55 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.5-8 — Potential Accident Consequences – CUC at Los Alamos, TA16^a

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
EU Metal Fabrication	0.798	4.79×10^{-4}	60.3	3.62×10^{-2}	7.53	4.52×10^{-7}
Assembly	0.0768	4.61×10^{-5}	5.95	3.57×10^{-3}	0.612	3.67×10^{-8}
EU Warehouse	0.926	5.56×10^{-4}	70.6	4.24×10^{-2}	8.33	5.0×10^{-7}
HEUMF	0.0961	5.77×10^{-5}	7.7	4.62×10^{-3}	0.637	3.82×10^{-6}
EU Operations	0.158	9.48×10^{-5}	68.2	4.09×10^{-2}	0.8	4.8×10^{-8}

^a LANL Option 2 Uranium Operations would be at TA16. At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007.

Table C.5-9 — Annual Cancer Risks for CUC at Los Alamos, TA-16

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	4.79×10^{-8}	3.62×10^{-6}	0.00452
Explosion	4.61×10^{-9}	3.57×10^{-7}	0.000367
Fire in EU Warehouse	5.56×10^{-8}	4.24×10^{-6}	0.005
Design-basis fires for HEU Storage	5.77×10^{-7}	4.62×10^{-5}	0.000382
Aircraft crash	9.48×10^{-9}	4.09×10^{-6}	0.00048

^a LANL Option 2 Uranium Operations would be at TA16. At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007.

Table C.5-10 — CUC Radiological Accident Frequency, Consequences, and Risks at NTS

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.00314	1.88 x 10 ⁻⁶	1.21	0.000726	3.36	0.00202
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.000309	1.85x10 ⁻⁷	0.119	0.0000714	0.252	0.000151
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.00366	2.20x10 ⁻⁶	1.41	0.000846	3.63	0.00218
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.000398	2.39x10 ⁻⁷	0.155	0.000093	0.243	0.000146
Aircraft crash ^d	10 ⁻⁴ – 10 ⁻⁶	0.0071	4.26x10 ⁻⁶	2.28	0.00137	2.13	0.00128

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

^d NTS has controlled airspace over approximately 8000 square miles. Aircraft accidents are extremely unlikely and, therefore, are usually excluded from further analysis at the NTS. This accident is included as a comparison to other CUC sites.

Source: Tetra Tech 2007.

Table C.5-11 — Annual Cancer Risks for CUC at NTS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	1.88 x 10 ⁻¹⁰	7.26 x 10 ⁻⁸	2.02 x 10 ⁻⁷
Explosion	1.85 x 10 ⁻¹¹	7.14 x 10 ⁻⁹	1.51 x 10 ⁻⁸
Fire in EU Warehouse	2.20 x 10 ⁻¹⁰	8.46 x 10 ⁻⁸	2.18 x 10 ⁻⁷
Design-basis fires for HEU Storage	2.39 x 10 ⁻⁹	9.3 x 10 ⁻⁷	1.46 x 10 ⁻⁶
Aircraft crash	4.26 x 10 ⁻¹⁰	1.37 x 10 ⁻⁷	1.28 x 10 ⁻⁷

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007.

Table C.5-12 — CUC Radiological Accident Frequency and Consequences at Pantex

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.0388	0.0000233	15.8	0.00948	3.38	0.00203
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.00383	2.30x10 ⁻⁶	1.56	0.000936	0.283	0.00017
Fire in EU Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.0454	0.0000272	18.4	0.011	3.77	0.00226
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.00494	2.96x10 ⁻⁶	2.01	0.00121	0.303	0.000182
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.0719	0.0000431	26.4	0.0158	2.68	0.00161

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007.

Table C.5-13 — Annual Cancer Risks for CUC at Pantex

Accident	Maximally Exposed Offsite Individual ^a	Offsite Population ^{a,b}	Noninvolved Worker ^{a,c}
Major fire	2.33×10^{-9}	9.48×10^{-7}	2.03×10^{-7}
Explosion	2.30×10^{-10}	9.36×10^{-8}	1.7×10^{-8}
Fire in EU Warehouse	2.72×10^{-9}	1.1×10^{-6}	2.26×10^{-7}
Design-basis fires for HEU Storage	2.96×10^{-8}	1.21×10^{-5}	1.82×10^{-6}
Aircraft crash	4.31×10^{-9}	1.58×10^{-6}	1.61×10^{-7}

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007.

Table C.5-14 — Potential Accident Consequences – CUC at SRS

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	$10^{-4} - 10^{-6}$	0.00535	3.21×10^{-6}	27	0.0162	3.66	0.0022
Explosion	$10^{-4} - 10^{-6}$	0.000528	3.17×10^{-7}	2.67	0.0016	0.313	0.000188
Fire in EU Warehouse	$10^{-4} - 10^{-6}$	0.00625	3.75×10^{-6}	31.5	0.0189	4.11	0.00247
Design-basis fires for HEU Storage	$10^{-2} - 10^{-4}$	0.000682	4.09×10^{-7}	3.45	0.00207	0.344	0.000206
Aircraft crash	$10^{-4} - 10^{-6}$	0.011	6.60×10^{-6}	47.3	0.0284	1.28	0.000768

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters. Source: Tetra Tech 2007.

Table C.5-15 — Annual Cancer Risks for CUC at SRS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	3.21×10^{-10}	1.62×10^{-6}	2.2×10^{-7}
Explosion	3.17×10^{-11}	1.6×10^{-7}	1.88×10^{-8}
Fire in EU Warehouse	3.75×10^{-10}	1.89×10^{-6}	2.47×10^{-6}
Design-basis fires for HEU Storage	4.09×10^{-9}	2.07×10^{-5}	2.06×10^{-6}
Aircraft crash	6.60×10^{-10}	2.84×10^{-6}	7.68×10^{-8}

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007.

Table C.5-16 — UPF or Upgraded Facilities, Radiological Accident Frequency and Consequences at Y-12

Accident	Frequency (per year)	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
		Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Major fire	10 ⁻⁴ – 10 ⁻⁶	0.592	0.000355	520	0.312	16.3	0.00978
Explosion	10 ⁻⁴ – 10 ⁻⁶	0.0577	0.0000346	51.2	0.0307	1.18	0.000708
Fire in UPF Warehouse	10 ⁻⁴ – 10 ⁻⁶	0.689	0.000413	608	0.365	17.4	0.0104
Design-basis fires for HEU Storage	10 ⁻² – 10 ⁻⁴	0.0734	0.000044	66.1	0.0397	1.08	0.000648
Aircraft crash	10 ⁻⁴ – 10 ⁻⁶	0.259	0.000155	665	0.399	0.388	0.000233

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007.

Table C.5-17 — Annual Cancer Risks for CUC at Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Major fire	3.55 x 10 ⁻⁸	3.12 x 10 ⁻⁵	9.78 x 10 ⁻⁷
Explosion	3.46 x 10 ⁻⁹	3.07 x 10 ⁻⁶	7.08 x 10 ⁻⁸
Fire in UPF Warehouse	4.13 x 10 ⁻⁸	3.65 x 10 ⁻⁵	1.04 x 10 ⁻⁶
Design-basis fires for HEU Storage	4.4 x 10 ⁻⁷	3.97 x 10 ⁻⁴	6.48 x 10 ⁻⁶
Aircraft crash	1.55 x 10 ⁻⁸	3.99 x 10 ⁻⁵	2.33 x 10 ⁻⁸

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007.

C.5.3 Involved Worker Impacts

Workers in the facility where the accident occurs would be particularly vulnerable to the effects of the accident because of their location. For all of the accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. However, prediction of latent potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be precisely defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident itself.

C.5.4 CUC Chemical Accident Frequency and Consequences

The chemicals selected for evaluation are based on the aqueous feed preparation process, as noted in each table, and are considered the most hazardous of all the chemicals used in this process. Determination of a chemical's hazardous ranking takes into account quantities available for release, protective concentration limits (ERPG-2) and evaporation rate. This section presents

the impacts of potential chemical accidents at each of the five CUC site alternatives. The tables show the name of the chemical and the quantity released during a severe accident. The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in parts per million. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at 1,000 meters (3,281 feet) from the accident is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded offsite. Conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations (Tetra Tech 2007).

Table C.5-18 — Chemical Accident Frequency and Consequences at Los Alamos

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm) ^b	
Nitric acid	10,500	6	0.85	4.5	8.76	10 ⁻⁴

^a Site boundary is at a distance of 1.2 miles.

Table C.5-19 — Chemical Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.86	4.55	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7 miles.

Table C.5-20 — Chemical Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.85	4.49	0.48	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles.

Table C.5-21 — Chemical Accident Frequency and Consequences at SRS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.17	0.189	<0.01	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.

Table C.5-22 — Chemical Accident Frequency and Consequences at Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Nitric acid	10,500	6	0.28	0.5	0.01	10 ⁻⁴

^a Site boundary is at a distance of approximately 1.3 miles.

C.6 ACCIDENT SCENARIOS—A/D/HE CENTER

This section presents the estimated impacts of accidents that could occur at an A/D/HE Center. The scenarios described here define the bounding envelope of accidents—that is, any other reasonably foreseeable accident at the A/D/HE Center would be expected to have similar or smaller consequences. These accident analyses are conservative, with little or no credit taken for existing preventative and mitigating features in each building or operation analyzed or the safety procedures that are mandatory at NNSA sites.

C.6.1 Radiological Accident Scenarios

Facilities and operations at Pantex were analyzed to identify all hazards and potential accidents associated with the facilities and process systems, components, equipment, or structures and to establish design and operational means to mitigate these hazards to prevent potential accidents. The results of these analyses are contained in SARs and other safety basis documentation (see Section C.3.1).

For each facility and operation at Pantex, DOE has developed a safety analysis report. In addition, other facility-specific safety analyses have been performed and documented (e.g., process hazards reviews, hazards analysis documents, and justifications for continued operations). These documents were also utilized for the identification of potential accidents at Pantex. The next step of the screening process involved the identification of representative accidents that contribute to the risk to public and worker health from A/D/HE Center operations that would be similar to the operations currently performed at Pantex. Ideally, a complete evaluation of A/D/HE Center risks would include all potential accident scenarios. However, this type of an approach is impractical. Therefore, the purpose of this step in the screening process was to identify a subset of accident scenarios that contribute a large fraction of the total risk from A/D/HE Center operations. This step of the screening process involved the grouping of potential accidents based on both the magnitude of the frequency of occurrence and the magnitude of the expected consequence. Once the accidents were grouped, the accidents corresponding to the highest risk in each group were chosen for further analysis. For the accidents described below, which were identified as risk significant, consequence assessments were performed for the A/D/HE Center at the 5 site alternatives. Table C.6-1 presents the source terms for these accidents.

Scenario 1: Explosive Driven Plutonium and Tritium Dispersal from an Internal Event.

Nuclear weapons may be made with either conventional or insensitive HE, depending upon weapon design. Scenario 1 represents the accidental detonation of conventional HE in the presence of plutonium due to an internally initiated event. HE is present with radioactive materials in facilities where nuclear explosives work occurs. Initiators for this scenario include accidental actuation of an electro-explosive device during disassembly and handling accidents. Insensitive HE is a negligible risk contributor because it is not susceptible to ignition under the conditions existing during assembly or disassembly operations. Insensitive HE is, thus, not a credible explosive source for this scenario.

Scenario 1 is comprised of three individual cases in which an accidental HE detonation is postulated to be initiated by an internal event. These cases differ in where the accidental detonation occurs; i.e., in a nuclear weapons assembly and disassembly cell, a bay, or a special purpose building. An HE detonation during assembly or disassembly would lead to the dispersal of radioactive material. Weapons are designed so that, in the event of an accidental detonation, there will be no significant nuclear reactions. Positive measures are engineered into nuclear explosives to preclude a nuclear yield from an accidental HE detonation.

The frequency of Scenario 1 is estimated to be 1.1×10^{-5} per year. It is, thus, *extremely unlikely* (frequency of occurrence is less than 10^{-4} per year but greater or equal to 10^{-6} per year). The derivation of this frequency involves summing of probabilities of different initiating events in different facilities. Explosive driven plutonium dispersal from an internal event can result from operations conducted in bays, cells, or special purpose facilities. The probability per operation that an operational error could cause an explosive driven plutonium and tritium release was estimated for each facility using data from available safety analyses (Tetra Tech 2007).

Scenario 2: Tritium Reservoir Failure from an Internal Event. This scenario represents the release of tritium due to a reservoir failure during normal operations. Initiators for this scenario include an inadvertent squib valve actuation during weapon operations.

This type of event has occurred at Pantex, and the frequency of this event is strongly dependent on the number of weapon operations being performed. For the 2,000 weapons activity level, this scenario is *anticipated* (frequency greater than or equal to 10^{-2} per year). For the 500 weapons activity level, this event is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year). This scenario is dominated by handling accidents during weapon operations (Tetra Tech 2007).

Scenario 3: Pit Breach from an Internal Event. This scenario represents a pit breach, with resultant plutonium release, during normal operations. Initiators that contribute to this scenario include a pit drop due to a handling accident and a pit breach due to a forklift accident (Pantex 1996a, DOE 1994w). This scenario is dominated by handling accidents in bays and special purpose facilities. The overall likelihood of this scenario occurring is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year) (Tetra Tech 2007).

Scenario 4: Multiple Tritium Reservoir Failure from an External Event or Natural Phenomena. This scenario represents the release of tritium from reservoir failures caused by a fire in the tritium storage vault. The fire could be initiated by a seismic event or aircraft crash.

The dominant event in this scenario is a seismic event initiated fire in the warehouse surrounding the tritium storage vault. For a release to occur, the protective vault fire door would have to be open and the fire protection system disabled by the seismic initiator. The overall likelihood of this scenario occurring is *not reasonably foreseeable* (frequency of occurrence is less than 10^{-6} per year) (Tetra Tech 2007).

Scenario 5: Fire Driven Dispersal Involving Stored Pits from an External Event or Natural Phenomena. This scenario represents a pit breach, resulting in a plutonium release, initiated by a seismic event or aircraft accident. The overall likelihood of this scenario occurring is *extremely unlikely* (frequency of occurrence is less than 10^{-4} per year but greater or equal to 10^{-6} per year) (Tetra Tech 2007).

Scenario 6: Plutonium and Tritium Dispersal from an External Event or Natural Phenomena. This scenario represents a tritium or plutonium release, without an explosion, caused by a seismic event or aircraft crash. Initiators include an aircraft impact initiated fire in a nuclear explosive facility and a seismic collapse of a special purpose facility (Pantex 1993a). This scenario is dominated by seismic events resulting in structural failure of special purpose buildings containing nuclear explosives. Many stockpile support activities (e.g., testing and maintenance) are performed in older facilities without the structural strength of the storage magazines. Thus, these facilities are more vulnerable to external events and natural phenomena. The overall likelihood of this scenario occurring is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year) (Tetra Tech 2007).

Table C.6-1 — Representative A/D/HE Accident Source Terms

Scenario	Pu Release (Ci)	Tritium Release (Ci)
Scenario 1	400	3.0×10^5
Scenario 2	0	2.0×10^5
Scenario 3	1.8×10^{-5}	0
Scenario 4	0	4.0×10^7
Scenario 5	50	0
Scenario 6	1.2×10^{-2}	3.0×10^5

Source: Tetra Tech 2007.

Table C.6-2 — Potential Consequences of A/D/HE Accidents at LANL

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	73.8	0.0886	5,580	3.35	696	0.835
Scenario 2	0.0529	3.17×10^{-5}	4	2.4×10^{-3}	0.499	2.99×10^{-4}
Scenario 3	4.42×10^{-6}	2.65×10^{-9}	0.000334	2.00×10^{-7}	4.17×10^{-5}	2.50×10^{-8}
Scenario 4	1.31	7.86×10^{-4}	545	0.327	7.94	4.76×10^{-3}
Scenario 5	1.37	8.22×10^{-4}	570	0.342	8.3	4.98×10^{-3}
Scenario 6	0.0102	6.12×10^{-6}	4.23	2.5×10^{-3}	0.0615	3.69×10^{-5}

^a At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.6-3 — Annual Cancer Risks for A/D/HE Accidents at LANL

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Individual Noninvolved Worker ^c
Scenario 1	8.86x10 ⁻⁶	3.35x10 ⁻⁴	8.35x10 ⁻⁵
Scenario 2	3.17x10 ⁻⁷	2.4x10 ⁻⁴	2.99x10 ⁻⁶
Scenario 3	2.65x10 ⁻¹¹	2.00x10 ⁻⁹	2.50x10 ⁻¹⁰
Scenario 4	7.86x10 ⁻¹⁰	3.27x10 ⁻⁷	4.76x10 ⁻⁹
Scenario 5	8.22x10 ⁻⁸	3.42x10 ⁻⁵	4.98x10 ⁻⁷
Scenario 6	6.12x10 ⁻⁸	2.54x10 ⁻⁵	3.69x10 ⁻⁷

^a At site boundary, approximately 0.5 miles from release.

^b Based on a projected future population (year 2030) of approximately 712,238 persons residing within 50 miles of TA-16 location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.6-4 — Potential Consequences of A/D/HE Accidents at NTS

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	0.29	0.000174	112	0.0672	311	0.373
Scenario 2	0.000208	1.25x10 ⁻⁷	0.08	0.000048	0.223	0.000134
Scenario 3	1.74x10 ⁻⁸	1.04x10 ⁻¹¹	6.70x10 ⁻⁶	4.02x10 ⁻⁹	1.86x10 ⁻⁵	1.12x10 ⁻⁸
Scenario 4	0.043	2.58E-05	17.7	0.0106	26.3	0.0316
Scenario 5	0.045	0.000027	18.5	0.0111	27.5	0.033
Scenario 6	0.000333	2.00x10 ⁻⁷	0.137	8.22x10 ⁻⁵	0.204	0.000122

^a At site boundary, 13.7 miles from release.

^b Based on a projected future population (year 2030) approximately 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.6-5 — Annual Cancer Risks for A/D/HE Accidents at NTS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
	Latent Cancer Fatalities	Latent Cancer Fatalities	Latent Cancer Fatalities
Scenario 1	1.74x10 ⁻⁸	6.72x10 ⁻⁶	3.73x10 ⁻⁵
Scenario 2	1.25x10 ⁻⁹	4.8x10 ⁻⁷	1.34x10 ⁻⁶
Scenario 3	1.04x10 ⁻¹³	4.02x10 ⁻¹¹	1.12x10 ⁻¹⁰
Scenario 4	2.58x10 ⁻¹¹	1.06x10 ⁻⁸	3.16x10 ⁻⁸
Scenario 5	2.7x10 ⁻⁹	1.11x10 ⁻⁶	3.3x10 ⁻⁶
Scenario 6	2.00x10 ⁻⁹	8.22x10 ⁻⁷	1.22x10 ⁻⁶

^a At site boundary, approximately 13.7 miles from release.

^b Based on a projected future population (year 2030) approximately 60,138 persons residing within 50 miles of NTS location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.6-6 — Potential Consequences of A/D/HE Accidents at Pantex

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	3.59	0.00215	1,460	0.876	312	0.374
Scenario 2	0.00257	1.54x10 ⁻⁶	1.04	0.000624	0.224	0.000134
Scenario 3	2.15x10 ⁻⁷	1.29x10 ⁻¹⁰	8.73x10 ⁻⁵	5.24x10 ⁻⁸	1.87x10 ⁻⁵	1.12x10 ⁻⁸
Scenario 4	0.453	0.000272	208	0.125	25.2	0.0302
Scenario 5	0.474	0.000284	218	0.131	26.3	0.0316
Scenario 6	0.00352	2.11x10 ⁻⁶	1.61	0.000966	0.195	0.000117

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.6-7 — Annual Cancer Risks for A/D/HE Accidents at Pantex

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Scenario 1	2.15x10 ⁻⁷	8.76x10 ⁻⁵	3.74x10 ⁻⁵
Scenario 2	1.54x10 ⁻⁸	6.24x10 ⁻⁶	1.34x10 ⁻⁶
Scenario 3	1.29x10 ⁻¹²	5.24x10 ⁻¹⁰	1.12x10 ⁻¹⁰
Scenario 4	2.72x10 ⁻¹⁰	1.25x10 ⁻⁷	3.02x10 ⁻⁸
Scenario 5	2.84x10 ⁻⁸	1.31x10 ⁻⁵	3.16x10 ⁻⁶
Scenario 6	2.11x10 ⁻⁸	9.66x10 ⁻⁶	1.17x10 ⁻⁶

^a At site boundary, approximately 2.2 miles from release.

^b Based on a projected future population (year 2030) approximately 386,706 persons residing within 50 miles of Pantex location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.6-8 — Potential Consequences of A/D/HE Accidents at SRS

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	0.495	0.000297	2,490	1.49	339	0.407
Scenario 2	0.000354	2.12x10 ⁻⁷	1.79	0.00107	0.243	0.000146
Scenario 3	2.96x10 ⁻⁸	1.78x10 ⁻¹¹	0.000149	8.94x10 ⁻⁸	2.03x10 ⁻⁵	1.22x10 ⁻⁸
Scenario 4	0.065	0.000039	368	0.221	12.1	0.00726
Scenario 5	0.068	4.08x10 ⁻⁵	385	0.231	12.6	0.00756
Scenario 6	0.000504	3.02x10 ⁻⁷	2.85	0.00171	0.0936	5.62x10 ⁻⁵

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.6-9 — Annual Cancer Risks for A/D/HE Accidents at SRS

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Scenario 1	2.97x10 ⁻⁸	1.49 x10 ⁻⁴	4.07x10 ⁻⁵
Scenario 2	2.12x10 ⁻⁹	1.07x10 ⁻⁵	1.46x10 ⁻⁶
Scenario 3	1.78x10 ⁻¹³	8.94x10 ⁻¹⁰	1.22x10 ⁻¹⁰
Scenario 4	3.9x10 ⁻¹¹	2.21x10 ⁻⁷	7.26x10 ⁻⁹
Scenario 5	4.08x10 ⁻⁹	2.31x10 ⁻⁵	7.56x10 ⁻⁷
Scenario 6	3.02x10 ⁻⁹	1.71x10 ⁻⁵	5.62x10 ⁻⁷

^a At site boundary, approximately 6.7 miles from release.

^b Based on a projected future population (year 2030) of 985,980 persons residing within 50 miles of SRS location.

^c At a distance of 1,000 meters.

Source: Tetra Tech 2007

Table C.6-10 — Potential Consequences of A/D/HE Accidents at Y-12

Accident	Maximally Exposed Individual ^a		Offsite Population ^b		Noninvolved Worker ^c	
	Dose (rem)	Latent Cancer Fatalities	Dose (Person-rem)	Latent Cancer Fatalities	Dose (rem)	Latent Cancer Fatalities
Scenario 1	54.7	0.0656	48,100	28.9	1,500	1
Scenario 2	0.0392	2.35x10 ⁻⁵	34.4	0.0206	1.08	0.000648
Scenario 3	3.28x10 ⁻⁶	1.97x10 ⁻⁹	0.00288	1.73x10 ⁻⁶	9.02x10 ⁻⁵	5.41x10 ⁻⁸
Scenario 4	2.3	0.00138	5,390	3.23	4.11	0.00247
Scenario 5	2.41	0.00145	5,630	3.38	4.3	0.00258
Scenario 6	0.0179	1.07x10 ⁻⁵	41.8	0.0251	0.0319	1.91x10 ⁻⁵

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

Table C.6-11 — Annual Cancer Risks for A/D/HE Accidents at Y-12

Accident	Maximally Exposed Individual ^a	Offsite Population ^b	Noninvolved Worker ^c
Scenario 1	6.56x10 ⁻⁶	2.89x10 ⁻³	1x10 ⁻⁴
Scenario 2	2.35x10 ⁻⁷	2.06x10 ⁻⁴	6.48x10 ⁻⁶
Scenario 3	1.97x10 ⁻¹¹	1.73x10 ⁻⁸	5.41x10 ⁻¹⁰
Scenario 4	1.38x10 ⁻⁹	3.23x10 ⁻⁶	2.47x10 ⁻⁹
Scenario 5	1.45x10 ⁻⁷	3.38x10 ⁻⁴	2.58x10 ⁻⁷
Scenario 6	1.07x10 ⁻⁷	2.51x10 ⁻⁴	1.91x10 ⁻⁷

^a At site boundary, approximately 1.3 miles from release.

^b Based on a projected future population (year 2030) of approximately 1,548,207 persons residing within 50 miles of Y-12 location.

^c At 1000 meters from release.

Source: Tetra Tech 2007

C.6.2 Chemical Accident Scenarios

Chlorine has been identified as the hazardous chemical dominating the risk from non-radiological releases for an A/D/HE Center (DOE 1996). Chlorine is the only chemical with the potential for significant adverse offsite consequences. Since chlorine is not carcinogenic, the consequences of exposure to chlorine (primarily acute effects) differ from the consequences of exposure to radionuclides (potential latent cancers). This difference precludes a direct comparison between the risk and consequences associated with hazardous chemical releases and radionuclide releases.

A useful measure of potential human health effects resulting from exposure to non-carcinogenic chemicals is the hazard index. In its most general form, a hazard index is a ratio of the actual exposure of a human receptor to an established exposure limit. If this ratio is appreciably less than unity, no adverse human health effects are expected. If the hazard index is close to unity, some adverse human health effects may occur; and if the hazard index is substantially greater than unity, severe health effects can result.

Numerous exposure limits are available to form a hazard index. Since exposure to an accidental chlorine release is an unlikely, short-duration event, chronic exposure limits are inapplicable. Instead, Emergency Response Planning Guidelines (ERPG) values will serve to develop hazard indices for chlorine exposure.

Scenario 7: Chlorine Release. The rooms in which chlorine gas would be used would be equipped with a chlorine sensor alarm system that consists of an alarm siren and flashing light located outside the building. The sensor system would be set to activate this alarm at a chlorine concentration of 1.0 part per million in the air. The rooms would also be ventilated with a floor-level exhaust fan and contain an elevated fresh air inlet.

A release of chlorine to the environment due to an earthquake is an unlikely event. Should an earthquake occur with sufficient magnitude to damage a facility that uses chlorine, could release the contents from a maximum of four chlorine cylinders in use. Other chlorine cylinders are not ordinarily expected to contribute to a release initiated by an earthquake. However, in the unlikely event that a chlorine cylinder is stored without its valve cap in place or is substandard structurally when delivered, it is conservatively postulated that Scenario 7 could involve a release from up to six chlorine cylinders. The magnitude of this chlorine release could be as high as 408 kilograms (900 pounds) (Tetra Tech 2007).

Workers in the vicinity of a chlorine release could be exposed to chlorine concentrations in excess of EPRG3 and threshold levels. No long-term adverse health effects are expected for workers who promptly evacuate the area. For any persons incapable of evacuating the area of the chlorine plume, no serious or irreversible health impacts are expected from EPRG1 or EPRG2 exposures since the exposure duration is less than 1 hour. Persons incapable of evacuating an area with EPRG3 concentrations may experience adverse health impacts depending upon the actual chlorine concentrations encountered and the exposure duration. However, chronic lung disease, electrocardiographic changes, and death have occurred in humans exposed to high concentrations of chlorine as a consequence of industrial accidents (Calabrese 1991).

Tables C.6-12 through C.6-16 depict the potential impacts of conservative modeling of chemical release over the period of 1-hour was based on a spill and subsequent pool with evaporation resulting calculated down-wind concentrations.

Table C.6-12 — Chlorine Accident Frequency and Consequences at LANL

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Chlorine	408.23	3	2.8	17.4	32.5	10 ⁻⁴

^a Site boundary is at a distance of 1.2 miles.
Source: Tetra Tech 2007

Table C.6-13 — Chlorine Accident Frequency and Consequences at NTS

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Chlorine	408.23	3	2.7	17	<0.1	10 ⁻⁴

^a Site boundary is at a distance of 13.7 miles.

Source: Tetra Tech 2007.

Table C.6-14 — Chlorine Accident Frequency and Consequences at Pantex

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Chlorine	408.23	3	2.8	17.5	1.8	10 ⁻⁴

^a Site boundary is at a distance of 2.2 miles.

Source: Tetra Tech 2007

Table C.6-15 — Chlorine Accident Frequency and Consequences at SRS

Chemical Released	Quantity Released (kg)	ERPG-2 ^a		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Chlorine	408.23	3	1.8	15	<0.2	10 ⁻⁴

^a Site boundary is at a distance of 6.7 miles.

Source: Tetra Tech 2007

Table C.6-16 — Chlorine Accident Frequency and Consequences at Y-12

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration ^a		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary (ppm)	
Chlorine	408.23	3	2.3	16	4.5	10 ⁻⁴

^a Site boundary is at a distance of approximately 1.3 miles.

Source: Tetra Tech 2007

C.7 Transportation Radiological Accidents

The offsite transportation accident analysis considers the impacts of accidents during the transportation of radiological materials. Under accident conditions, impacts to human health and the environment may result from the release and dispersal of radioactive material. Accidents that could potentially breach the shipping container are represented by a spectrum of accident severities and radioactive release conditions. Historically, most transportation accidents involving radioactive materials have resulted in little or no release of radioactive material from the shipping container. Consequently, the analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. This accident analysis calculates the probabilities and consequences from this spectrum of accidents.

To provide NNSA and the public with a reasonable assessment of radioactive waste transportation accident impacts, two types of analyses were performed. An accident risk assessment was performed that takes into account the probabilities and consequences of a

spectrum of potential accident severities using a methodology developed by the NRC (NRC 1977; Fischer et al. 1987; Sprung et al. 2000). For the spectrum of accidents considered in the analysis, accident consequences in terms of collective dose to the population within 80 kilometers (50 miles) were multiplied by the accident probabilities to yield collective dose risk using the RADTRAN 5.6/RadCat 2.3 computer code (Weiner 2006).

The impacts for specific alternatives were calculated in units of dose (rem or person-rem). Impacts are further expressed as health risks in terms of estimated latent cancer fatalities in exposed populations. The health risk conversion factor of 0.0006 LCF/person-rem was derived from the Interagency Steering Committee on Radiation Standards report (ISCOR 2002), A Method for Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE).

The risk analyses consider a spectrum of accidents of varying severity. Each first determines the conditional probability that the accident will be of a specified severity. Then, based on the accident environment associated with each severe accident, each models the behavior of the material being shipped and the response of the packaging. The models estimate the fraction of each species of radioactive material that might be released for each of the severe accidents being considered. Results of the RADTRAN runs are provided in Table C.7-1.

Table C.7-1 — Results of RADTRAN Accident Runs for a Single Shipment

RADTRAN Run No.	Dose Risk (person-rem)	RADTRAN Run No.	Dose Risk (person-rem)
1	-	9b	4.8×10^{-6}
2a	3.5×10^{-8}	10	2.9×10^{-11}
2b	-	11a	-
3	9.3×10^{-12}	11b	1.5×10^{-4}
4a	6.2×10^{-9}	12a	-
4b	-	12b	2.3×10^{-6}
5	1.8×10^{-11}	13a	4.4×10^{-9}
6	2.2×10^{-11}	13b	6.3×10^{-6}
7	-	14	2.3×10^{-11}
8	-	15a	1.2×10^{-5}
9a	1.6×10^{-8}	15b	3.2×10^{-6}

“-” = no RADTRAN run needed.
Source: DOE 2003d.

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Appendix D
SUMMARY OF PUBLIC SCOPING DOCUMENTS

Appendix D

SUMMARY OF PUBLIC SCOPING COMMENTS

D.1 PUBLIC SCOPING PROCESS

As a preliminary step in the development of an environmental impact statement (EIS), regulations established by the Council on Environmental Quality (CEQ) (40 CFR 1501.7) and the U.S. Department of Energy (DOE) require “an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.” The purpose of this scoping process is: (1) to inform the public about a proposed action and the alternatives being considered, and (2) to identify and/or clarify issues that are relevant to the EIS by soliciting public comments.

On October 19, 2006, the National Nuclear Security Administration (NNSA), a semi-autonomous agency within DOE, published a Notice of Intent (NOI) in the *Federal Register* announcing its intent to prepare a *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (71 FR 61731). During the *National Environmental Policy Act* (NEPA) process, there are opportunities for public involvement (see Figure D.1-1). The NOI listed the issues initially identified by DOE for evaluation in the Complex Transformation¹ Supplemental Programmatic Environmental Impact Statement (SPEIS). Public citizens, civic leaders, and other interested parties were invited to comment on these issues and to suggest additional issues that should be considered in this SPEIS. NNSA accepted comments during the 90-day public scoping period via U.S. mail, e-mail, facsimile, and in person at public scoping meetings.

NNSA held public scoping meetings near each of the nine sites potentially affected by the alternatives and in Washington, DC. Meetings were held as shown on Figure D.1-2:

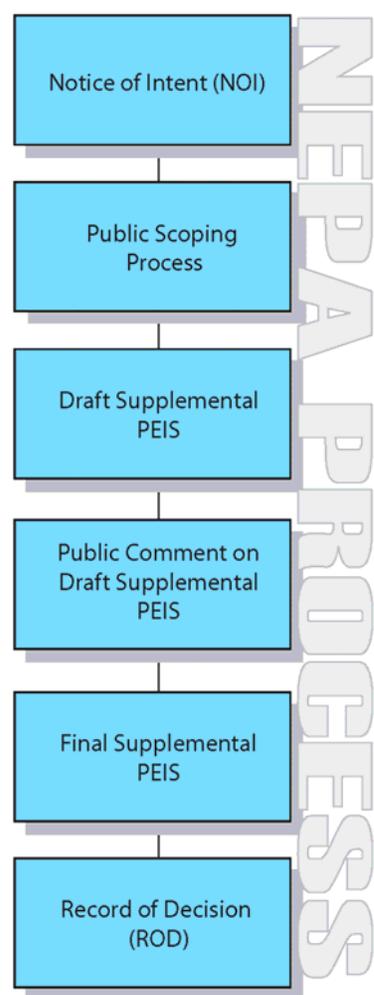


Figure D.1-1

¹ In the NOI, this supplement was referred to as the “Complex 2030” SPEIS.

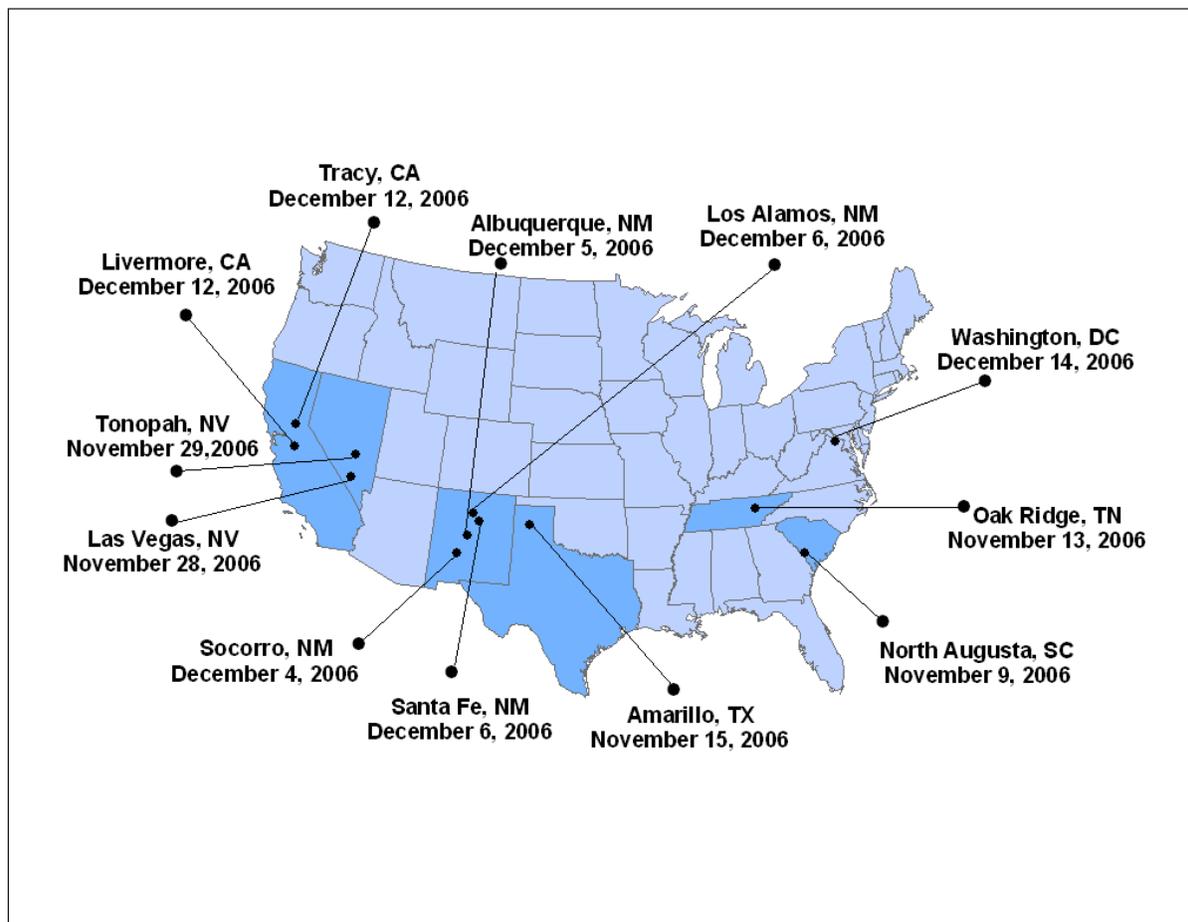


Figure D.1-2 — Public Scoping Meeting Locations and Dates

DOE chose an interactive format for the scoping meetings. Each meeting began with an open house session where the public could speak to DOE representatives followed by a presentation by a DOE representative who explained the background, purpose and need for agency action, the alternatives, and the NEPA process. Following the presentation, members of the public were given the opportunity to provide oral comments. These oral comments were recorded, and a transcript for each meeting was produced.

D.2 ISSUE IDENTIFICATION AND COMMENT DISPOSITION

Comments received during the scoping period were systematically reviewed by DOE. Where possible, comments on similar or related topics were grouped under comment issue categories as a means of summarizing the comments. Table D.2-1 lists topics (“bins”) used to categorize comments. More than 33,000 comment documents were received from individuals, interested groups, and Federal, state, and local officials during the public scoping period.

Table D.2-1 — Comment Bin List

Topics and Subtopics	
1.	Policy
	A. Existing Treaties - general
	B. Presidential Directives, Public law, and current policies
	C. Nuclear Posture Review
	D. Comprehensive Test Ban Treaty
	E. Treaty on the Non-Proliferation of Nuclear Weapons
	F. Moscow Treaty
	G. International Policies
	H. Nuclear Waste Policy Act
2.	NEPA Process
	A. General NEPA process
	B. Whether to prepare a new PEIS versus a supplemental PEIS
	C. Stakeholder involvement
	D. Scoping process – notification
	E. Length of scoping period, number and location of scoping meetings
	F. Scoping meeting format and scoping meeting fact sheets
	G. Scoping comments
	H. Availability of information
	I. NEPA compliance
	J. NEPA conflict-of-interest
3.	Programmatic Purpose and Need
	A. Purpose and need - general
	B. Relationship to Stockpile Stewardship and Management
	C. Question the need for Complex Transformation
4.	Programmatic No Action Alternative
	A. No Action Alternative – general
	B. No Action Alternative needs to be a true no action
	C. Viability of the No Action Alternative
	D. Justification of the No Action Alternative
5.	Programmatic Alternatives
	A. Programmatic Alternatives – general
	B. Development of Programmatic Alternatives
	C. Programmatic Proposed Action: Distributed Centers of Excellence
	D. Programmatic Alternative 2: Consolidated Nuclear Production Center
	E. Programmatic Alternative 3: Capability-Based
6.	Project-Specific Alternatives
	A. High Explosives R&D
	B. Tritium R&D
	C. NNSA Flight Test Operations
	D. Major Hydrodynamic Test Facilities
	E. Major Environmental Test Facilities
7.	Other Alternatives
	A. Other Alternatives – general
	B. Transportation of nuclear materials
	C. Disarmament, Dismantlement, Decommissioning alternatives
	D. Reduce stockpile alternatives
	E. Downsizing-in-place alternatives
	F. Responsible curatorship alternatives
	G. Alternatives that comply with NPT
	H. Comprehensive Test Ban Treaty alternatives

Table D.2-1 — Comment Bin List (continued)

Topics and Subtopics	
I.	Security alternatives
J.	Safety alternatives
K.	Alternatives involving policy
L.	Test readiness alternatives
M.	Site alternatives
N.	Nonproliferation alternatives
O.	Cleanup alternatives
P.	New Triad
Q.	Alternatives promoting peace
R.	Future of the nuclear weapons complex
8.	Reliable Replacement Warhead
A.	RRW – general
B.	Opposition to RRW
C.	RRW and pit production
D.	RRW – analysis
E.	Relationship between RRW and Complex Transformation
F.	Question the need for RRW
9.	Cost and Schedule
A.	Cost-effectiveness of existing nuclear weapons complex
B.	Better use of resources
C.	Factors that could increase proposed costs
D.	Cost of cleanup
E.	Cost of each of the alternatives
F.	Cost-Benefit Study
G.	Timeline
10.	Candidate Sites
A.	Candidate sites – general
B.	LANL
C.	LLNL
D.	NTS
E.	TTR
F.	Pantex
G.	SNL/NM
H.	SRS
I.	Y-12
11.	Additional Analysis
A.	Additional analysis – general
B.	Nuclear weapons activities
C.	Special nuclear material
D.	Environmental analysis
12.	Kansas City Plant
A.	KCP – general
B.	Objection to the exclusion of KCP
C.	NEPA analysis for KCP
13.	Waste Isolation Pilot Plant
A.	WIPP – general
B.	WIPP as a candidate site
C.	Future of WIPP
D.	Support for WIPP as a candidate site
E.	Opposition to WIPP
14.	Sabotage and terrorism

Table D.2-1 — Comment Bin List (continued)

Topics and Subtopics	
A.	Sabotage and terrorism-general
B.	Evaluation of sabotage and terrorism
C.	Suggested actions to protect against sabotage and terrorism
D.	LANL
E.	Pantex
F.	LLNL
15.	Resources
A.	Land Use
B.	Visual Resources
C.	Site Infrastructure
D.	Air Quality and Noise
E.	Water Resources
F.	Geology and Soils
G.	Biological Resources
H.	Cultural and Archaeological Resources
I.	Socioeconomics
J.	Environmental Justice
K.	Health and Safety
L.	Transportation
M.	Waste Management
N.	Facility Accidents
16.	General/Miscellaneous
A.	General support for Complex Transformation
B.	Support for the No Action Alternative
C.	Support for CNPC
D.	Support for the Capability-Based and Reduced Operations Alternative
E.	Support for siting at LANL
F.	Support for siting at LLNL
G.	Support for siting at NTS
H.	Support for siting at Pantex
I.	Support for siting at SRS
J.	Support for siting at Y-12
K.	Opposition to Complex Transformation
L.	Opposition to siting at LANL
M.	Opposition to siting at LLNL
N.	Opposition to siting at NTS
O.	Opposition to siting at SRS
P.	Opposition to siting at Pantex
Q.	Opposition to siting at SNL
R.	Opposition to siting at Y-12
S.	Divine Strake Environmental Assessment
T.	Other projects and sites
U.	Moral and ethical issues
V.	Proliferation and nonproliferation
W.	Criticism of the current administration and policy
X.	International relations/policy
Y.	Nuclear weapons
Z.	Nuclear power
AA.	War on Terror
BB.	IAEA Inspections in the U.S.[Consider renaming as IAEA Inspections in the U.S.]

Each comment document was read carefully. Scoping comments were identified and summarized. Each comment document was assigned a document number and was assigned to an appropriate issue category. Table D.2-2, provided at the end of this appendix, summarizes the comments received that fall within the scope of this SPEIS and also directs the reader to sections of this SPEIS that address these issues. In addition Table D.2-2 lists the comment documents which were assigned to that issue category.

Many comments were outside the scope of this SPEIS. These comments fell into the following general categories: (1) concerns about cost and schedule overruns; (2) moral/ethical issues; (3) the use of nuclear weapons; and (4) alternate uses of Federal funds. These comments are addressed, only to the extent they relate to the background discussion in Chapter 1: Introduction, and Chapter 2: Purpose and Need. Detailed design safety questions that are not covered in the Complex Transformation SPEIS would be covered in site-specific, tiered EISs.

D.3 SCOPING PROCESS RESULTS

More than 33,000 comment documents were received from individuals, interested groups, and Federal, state, and local officials during the public scoping period. In addition, approximately 350 individuals made oral comments during public meetings. Some commentators who spoke at the public meetings also prepared written statements. When the oral comments and written comments were identical, comments submitted by an individual commentator were counted once. Table D.3-1 provides a summary of the number of scoping comments received.

Table D.3-1 — Scoping Documents Received

Document Type	Number Received
Individual Scoping Documents	1,207
Campaign 1	1,160
Campaign 2	6
Campaign 3	99
Campaign 4	115
Campaign 5	9
Campaign 6	38
Campaign 7	11,676
Campaign 8	381
Campaign 9	6
Campaign 10	138
Campaign 11	33
Campaign 12	17
Campaign 13	7
Campaign 14	21
Campaign 15	18,830
Campaign 16	3
Campaign 17	10
Campaign 18	6
Campaign 19	115
Campaign 20	15
Total Scoping Comment Documents Received	33,892

A comment is a distinct statement or question about a particular topic or a specific issue. Most of the oral and written public statements submitted during the EIS scoping period contained multiple comments on various issues.

A majority of the comment documents received were form letters or e-mail campaigns. A form letter is defined as a standard letter submitted by numerous individuals. An e-mail campaign has the same concept as a form letter, but is submitted via electronic mail. Twenty different form letters/e-mail campaigns were submitted during the scoping period. All contained comments similar to those summarized in Table D.2-2 except campaign letters 11 and 13, which addressed the regional socioeconomic benefits of the Y-12 National Security Complex in Tennessee and support for that site’s mission. A majority of the form letters/e-mail campaigns received were from Campaigns 1, 7, and 15. Table D.3-2 provides a summary of these documents.

Table D.3-2 — Summary of Campaigns 1, 7, and 15

Document	Summary
Campaign 1 (Postcard)	Commentors stated the proposed action to build more nuclear weapons is dangerous and unnecessary. Commentors also stated that the U.S. cannot produce nuclear weapons while insisting other countries not pursue nuclear capabilities; the U.S. should meet its obligations under the Non-Proliferation Treaty to pursue disarmament; and resources should be spent on cleaning pollution from past production.
Campaign 7 (E-mail Campaign)	Commentors wrote to express opposition to the proposed Complex Transformation plan. Commentors stated that the nuclear weapons complex is unnecessary and expensive and that new studies conclude that nuclear warheads will last at least 100 years. Commentors endorsed the proposal’s stated aim of downsizing the nuclear weapons infrastructure.
Campaign 15 (E-mail Campaign)	Commentors stated that the EIS is too limited and should include an assessment of an alternative that would abandon plans to build nuclear weapons and make reductions in the nuclear stockpile. Commentors suggested that DOE prepare a nonproliferation impact assessment to determine how the proposals would affect the goal of stopping the spread of nuclear weapons.

In addition to the form letters/e-mail campaigns, NNSA received approximately 1,200 individual scoping documents. Scoping meeting transcripts from 17 meetings were also included in the comment analysis.

A summary of the major comments received during the scoping period and responses to these comments follows:

Comment: The majority of the comments expressed opposition to the nuclear weapons program and U.S. national security policies. Many of the comments stated that the U.S. is violating the Nuclear Non-proliferation Treaty (NPT). Many of the comments stated that NNSA should assess an additional alternative - disarmament in compliance with the NPT - and not design or build new nuclear weapons.

Response: The security policies of the U.S. require the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on

a treaty on general and complete disarmament under strict and effective international control." Actions by the U.S., including its moratorium on nuclear testing accompanied by significant reductions in its strategic force structure, nuclear weapons stockpile, and production infrastructure, constitute significant progress toward these goals. However, unless and until there are significant changes in national security policy, NNSA is required to design, produce, and maintain the nuclear weapons stockpile pursuant to requirements established by the President and funded by Congress. In conjunction with the 2001 NPR, President Bush set an objective of "...achieving a credible nuclear deterrent with the lowest-possible number of nuclear warheads consistent with our national security needs..." In recognition of this objective and the reduction in the U.S. stockpile since the end of the Cold War, this SPEIS qualitatively evaluates changes in the alternatives that would be appropriate if the stockpile is reduced below the level called for by the Moscow Treaty. Accordingly, this SPEIS analyzes alternatives that satisfy requirements of the existing national security policy framework, as well as a capability-based alternative that, while not capable of meeting current requirements, could meet those requirements if the stockpile were reduced below the level called for by the Moscow Treaty.

Comment: Commentors stated that the reliable replacement warhead (RRW) was not needed and should not be pursued.

Response: RRW refers to possible future warhead designs that could replace existing "legacy" warheads. The RRW would not affect the proposed action of this SPEIS related to restructuring SNM facilities, or the proposed action to restructure R&D facilities. The proposed actions are independent of whether an RRW is developed. Because the environmental impacts analyzed are based on the maintenance of the legacy weapons that are currently in the stockpile, a conservative estimate of the environmental impacts is provided in this SPEIS. If RRW is approved as part of the national strategy for providing a nuclear deterrent, it would enable a shift to fewer hazardous operations. However, a production capacity for plutonium and highly-enriched uranium components, as well as for weapons assembly and disassembly, will be required for the foreseeable future with or without implementation of RRW. Chapter 2 provides a discussion of the RRW's possible impact on the nuclear weapons stockpile and decisions about the Complex facilities.

Comment: Commentors stated that NNSA should develop a fair and objective statement for the purpose and need that takes into account the broader missions of NNSA that include preventing proliferation, ensuring the effectiveness of the NPT, and developing strategies to ensure the peaceful denuclearization of existing and threshold nuclear states, and the underlying legal obligations and treaty commitments.

Response: The fundamental principle underlying NNSA's evaluation of alternatives is that the Stockpile Stewardship Program (SSP) must continue to support existing and reasonably foreseeable national security requirements. This is NNSA's obligation

and responsibility under the *Atomic Energy Act*² and the *National Nuclear Security Administration Act*.³ This SPEIS does not analyze alternatives to U.S. national security policy. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for executing the SSP, which is based on requirements established by national security policy including the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. NNSA continues work in other areas, including those identified in comments. Nuclear weapons knowledge has and will continue to enable nonproliferation; however, they are not dealt with in this SPEIS.

Comment: Commentors asked why NNSA was not assessing a consolidated nuclear production center (one site for plutonium, enriched uranium, and weapons assembly/disassembly) as a reasonable alternative for transforming the Complex.

Response: A consolidated nuclear production center (CNPC) alternative was added as a reasonable alternative and is discussed in Section 3.5 of this SPEIS. NNSA decided to analyze this alternative in order to assess the potential impacts of consolidating major nuclear weapons and SNM production missions at one site.

Comment: Commentors stated that pits will last up to 100 years and potentially longer; therefore, there is no need for new pit production capacity.

Response: This SPEIS addresses the environmental effects of both possessing and utilizing a pit production capacity in the event decisions are made to produce pits. While the current state of knowledge is that there may not be a need to produce pits in the near future because of the plutonium's longevity, NNSA cannot be certain that other issues associated with pits, other than the aging of plutonium materials, would never arise. Accordingly, prudent management requires that NNSA maintain a capacity to produce pits as long as this nation maintains its nuclear stockpile. A small pit fabrication capability is currently being maintained at LANL and is part of the No Action Alternative evaluated in this SPEIS.

Comment: Commentors asked why KCP was not being considered in this SPEIS, and stated that NNSA was not representing the full cost of Complex Transformation by excluding alternatives involving activities currently performed by KCP.

Response: Following the Non-nuclear Consolidation Environmental Assessment (DOE/EA-0792, 1993), NNSA decided to consolidate most non-nuclear operations to improve efficiency. In the SSM PEIS (1996), NNSA further considered alternatives with respect to non-nuclear operations, including relocating those capabilities to the NNSA national laboratories. The decision was made (61 FR 68014; December 26, 1996) to retain the existing facilities at the KCP. This was the environmentally preferable alternative, posed the least technical risk, and was the lowest cost alternative.

² 42 U.S.C. 2011 et seq.

³ Title 32, *National Defense Authorization Act for Fiscal Year 2000*, Public Law 106-65

Because the non-nuclear operations at KCP are essential and do not duplicate the work at other sites, no proposal for combination or elimination of these missions was formulated. A recent analysis has concluded that transferring these KCP non-nuclear operations to a site other than one within the immediate Kansas City area would not be cost-effective (SAIC 2007). Consequently, the non-nuclear operations would remain at either the current KCP or a new facility in the Kansas City area, and would neither affect nor be affected by the decisions regarding the alternatives in this SPEIS.

Comment: Commentors requested an analysis of the risks and impacts of terrorist attacks on NNSA facilities.

Response: With respect to intentional destructive acts, substantive details of attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Depending on the malevolent, terrorist, or intentional destructive acts, impacts may be similar to or would exceed accident impact analyses prepared for the SPEIS. A separate classified appendix to this Draft SPEIS has been prepared that evaluates the underlying facility threat assumptions with regard to malevolent, terrorist, or intentional destructive acts. The methodology for the analysis in this classified appendix is discussed in Appendix B. These data provide NNSA with information upon which to base, in part, decisions supported by this SPEIS.

Comment: Support for the continuation of the NNSA flight test mission at the Tonopah Test Range was received from the Tonopah community. Commentors demanded evidence of a compelling reason to move this mission from Tonopah.

Response: A detailed impact analysis was prepared for the NNSA flight testing alternatives and is presented in Section 5.15.4.2 of the SPEIS. The analysis discusses the potential socioeconomic impacts to the Tonopah community of NNSA flight testing alternatives.

Comment: Commentors expressed opposition to any new nuclear facilities. There was specific opposition to expanding pit production at LANL, as well as the proposed consolidated plutonium center (CPC). Commentors stated that the LANL Site-Wide EIS should follow the Complex Transformation SPEIS.

Response: NNSA added analysis of an alternative that would upgrade facilities at LANL for a smaller pit production capacity (up to 80 pits per year) than the baseline capacity (125 pits per year, single shift) of the proposed CPC (see Section 3.4.1.2). NNSA is evaluating increasing its current capacity to produce nominally 20 pits per year at LANL in a site-wide EIS (LANL 2006a). It is expected that a final LANL Site-wide EIS will be issued prior to completion of this SPEIS.

Comment: Commentors stated that a site near the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, should be considered as a reasonable location for a CPC.

Response: In order to determine the reasonable site alternatives for a CPC, all existing, major DOE sites were initially considered as a potential host location for a CPC. Sites that do not maintain Category I/II SNM were eliminated from consideration, as were sites that did not conduct major NNSA program activities. WIPP did not meet these siting criteria. Other DOE sites were not considered reasonable locations because they do not satisfy certain criteria such as population encroachment, mission compatibility, or synergy with the site's existing mission. Following this process, NNSA decided that Los Alamos, NTS, Pantex, SRS, and Y-12 constitute the range of reasonable site alternatives for a CPC.

As a result of the scoping process, NNSA made the following significant changes to the scope of the Complex Transformation SPEIS:

- A consolidated centers of excellence (CCE) alternative was added as a reasonable alternative (see Section 3.5). NNSA would consolidate plutonium, uranium, and weapon assembly/disassembly functions into a CNPC at one site or into Consolidated Nuclear Centers (CNCs) at two sites.
- A discussion was added of effects on the Complex of an even smaller nuclear weapons stockpile than the current level envisioned under the Moscow Treaty (see Section 5.11).
- A discussion was added of the RRW's possible impact on the nuclear weapons stockpile and decisions about Complex Transformation. An analysis was added to determine what, if any, changes to the Complex would be required if the RRW were to be developed (see Chapter 2).
- A more detailed analysis of the potential impacts of NNSA flight testing was added in order to inform the public and NNSA of the potential socioeconomic impacts to the Tonopah community from the alternatives (see Section 5.15.4.2).
- An analysis of a smaller pit production facility (50 to 80 pits per year) was added (see Section 3.4.1.2).
- A more detailed explanation of why the Kansas City Plant non-nuclear operations are not included in this SPEIS was added (see Section 3.2.10).

Table D.2-2 — Summary of Scoping Comments

Topic 1. Policy

Subtopic	Comment Summary	Documents	SPEIS Reference
Existing Treaties - general	<p>Commentors believe that the current nuclear 'deterrence' policy has failed and has placed the world on the brink of nuclear winter.</p> <p>Enduring and legally binding U.S. Treaty Obligations must inform the domain of reasonable alternatives for analysis. As part of the supreme law of the land, U.S. treaty obligations are far more dispositive than the strategic ramblings of now discredited and departed senior Pentagon bureaucrats.</p> <p>As one of his first official acts, after taking office in January 1977, President Jimmy Carter asked the Secretary of Defense for an analysis of the implications of mutual U.S. and Soviet reductions in the number of strategic nuclear delivery vehicles to 200-250. If the President of the U.S. could find such a greatly reduced nuclear force to be sufficiently reasonable, at the height of the Cold War, to merit commissioning a Pentagon study of it, surely it is objectively reasonable for NNSA today – 16 years after the dissolution of the Soviet empire that prompted deployment of U.S. nuclear weapons in such vast quantities – to analyze the implications of comparable and even smaller nuclear forces for the future configuration of the U.S. nuclear weapons complex.</p> <p>Commentors state that DOE should consider the 1996 World Court decision that nuclear weapons are illegal; the proposed action therefore violates this determination and is unlawful.</p>	2, 6, 104, 138, 196, 263, 348, 1209, 1220	Chapter 2
Presidential Directives, Public Law, and Current Policies	<p>Commentors state that DOE should take into consideration an adverse change in the American political climate as part of the global political climate due to expanding U.S. nuclear arsenal and wait until the next administration to continue with the project. DOE should adopt new policies that will favor disarmament and a 'no-first-use' policy.</p> <p>Commentors expressed concern that the U.S. has halted progress in the development of the Fissile Material Cutoff Treaty (FMCT) and that the artificial enrichment with plutonium or uranium will violate</p>	Campaign 18, 4, 67, 104, 111, 263, 281, 511, 320, 378, 516, 781, 1218, 947, 1152, 1190	Chapter 2, Chapter 3, Section 2.1.4, Chapter 5, Section 10.4

Topic 1. Policy

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>the current fissile material ban being negotiated by the Conference on Disarmament.</p> <p>Commentors also support a fissile materials treaty to prevent the creation and transportation of HEU and plutonium.</p>		
Nuclear Posture Review	<p>The December 2001 Nuclear Posture Review is not a sufficient basis for the purpose and need for agency action. It does not comprise an act of law or even a formal policy directive, and in no way establishes or constrains the domain of future stockpile requirements that may be considered reasonable. The theory advanced in the NPR that a weapons stockpile provides deterrent value is flawed and undermines nonproliferation work.</p>	2, 6, 1048, 1090, 1220	Sections 2.1, 2.1.2
Comprehensive Test Ban Treaty	<p>Commentors stated that the Complex Transformation plan goes against the NPT and would result in the end of the Comprehensive Test Ban Treaty. Complex Transformation is a step toward rejecting ratification of CTBT and is preventing ratification; ratification of the CTBT should be considered.</p>	104, 263, 333, 335, 1137, 1220, 263, 690, 1210, 4	Section 2.1.3
Treaty on the Non-Proliferation of Nuclear Weapons	<p>Commentors stated that the NOI is false in stating that the number of weapons to be produced would be consistent with international arms-control agreements. They are not consistent with the NPT. Commentors stated that accelerating nuclear weapons manufacture is a violation of the NPT as well as Article IV of the Constitution, and will further the global proliferation of nuclear weapons. Commentors believe the U.S. should be complying with NPT and denuclearizing our arsenal. Commentors suggested that the SPEIS should discuss existing treaty limitation concerning proliferation of nuclear material/weapons (including U.S. efforts to limit proliferation) and analyze how the proposed action will/will not jeopardize existing international agreements. Commentors stated that the U.S. should commit to the elimination of nuclear weapons no later than Transformation.</p>	Campaign 4, Campaign 5, Campaign 6, Campaign 7, Campaign 10, Campaign, 12, Campaign 14, Campaign 15, Campaign 17, Campaign 18, 1, 2, 3, 4, 5, 6, 7, 9, 10, 18, 20, 22, 23, 24, 30, 31, 37, 57, 59, 60, 63, 65, 67, 71, 75, 80, 81, 83, 85, 87, 88, 91, 92, 94, 96, 102, 103, 104, 105, 107, 110, 111, 113, 126, 128, 132, 133, 134, 138, 141, 145, 152, 153, 164, 190, 196, 199, 204, 207, 208, 210, 234, 216, 217, 220, 260, 263, 281, 285, 286, 300, 303, 316, 318, 319, 320, 324, 326, 330, 333, 335, 338, 339, 343, 348, 355, 358, 360, 361, 363, 367, 371, 373, 378, 379, 380, 391, 394, 396, 399, 401, 402, 403, 404, 405, 406, 408, 410, 411, 413,	Chapter 2, Sections 2.1.3, 2.1.4, 2.1.5, 2.1.6

Topic 1. Policy

Subtopic	Comment Summary	Documents	SPEIS Reference
		414, 418, 423, 424, 425, 427, 428, 430, 437, 438, 434, 439, 444, 446, 454, 458, 464, 472, 476, 479, 488, 492, 497, 510, 524, 529, 530, 540, 536, 544, 550, 560, 585, 586, 587, 589, 571, 577, 596, 595, 597, 603, 607, 608, 615, 618, 619, 621, 626, 627, 634, 635, 636, 644, 649, 660, 674, 675, 686, 689, 695, 696, 697, 701, 716, 719, 721, 716, 723, 725, 732, 734, 737, 740, 741, 747, 749, 751, 753, 758, 760, 761, 762, 764, 765, 767, 769, 780, 843, 850, 860, 854, 872, 876, 878, 906, 898, 899, 902, 1087, 1099, 1188, 1123, 1126, 1128, 1143, 1208, 1209, 1210, 1217, 1218, 1219, 1222, 1223	
Moscow Treaty	Commentors stated that DOE must comply with Moscow Treaty. The Strategic Offensive Reductions Treaty commits us to the reduction of our strategic nuclear arsenal from the estimated 5,000 to at least 2,200 in the next six years. In this case it seems the Moscow Treaty is a flawed treaty that provides a minimal benefit that is insufficient to mitigate the negative implications of the proposed action.	Campaign 18, 145, 164, 263, 516, 898, 769, 943, 1004, 1181, 1190, 1211, 1212	Section 2.1.5
International Policies	Commentors criticized that the U.S. is legally obligated to adhere to the requirements of customary international law, such as START I and II, and is violating international law and treaties and should support a fissile materials treaty to prevent creation and transport of HEU and plutonium.	4, 426, 445, 138, 752, 524, 883, 904, 837, 823, 1101, 1009, 1059, 1043, 1046, 1047, 1050, 1178, 1190, 1194, 1153, 1208, 1211, 1212, 1219, 1210, 1215, 1222, 1223, 263, 313, 320, 383, 450, 482	Sections 2.1.2, 2.1.3, 2.1.4, 2.1.5; the proposed action would not violate any existing international law.
Nuclear Waste Policy Act	Transformation contradicts intent of NWPA and project operations must be in compliance to protect public health.		Section 10.3

Topic 2. NEPA Process

Subtopic	Comment Summary	Documents	SPEIS Reference
General NEPA process	<p>Commentor expressed opinion regarding the limitation of the NEPA process. Another commentor suggested that NNSA give a basic introduction of what is planned for people who are not technically proficient in the NEPA process.</p>	6, 1219	Section 1.5, 1.6
Whether to prepare a new PEIS versus a supplemental PEIS	<p>Commentor stated that supplementing the aging and flawed SSM-PEIS of 1996 may not be the best strategy for NEPA review of “complex transformation.” The original SSM-PEIS was very far from comprehensive in its coverage : non-nuclear component manufacturing ,tritium production and recycling, and weapons-usable fissile material storage and disposition, all activities intrinsic to the operations of the U.S. nuclear weapons complex were segmented from the original proposal for a comprehensive post-cold war “Reconfiguration PEIS” and subsequently analyzed in separate NEPA documents supporting a series of staggered and haphazard restructuring decisions throughout the decade of the 1990’s.</p> <p>Commentor stated that the SSM PEIS focused by default on a narrow range of remaining “decisions” about the “reconfigured” complex, some of which had already in effect been made years earlier while others turned out to be far less consequential than originally advertised by NNSA’s predecessor DOE Defense Programs.</p> <p>The NOI is rife with evidence of rampant illegal segmentation of NEPA analysis in a manner that obstructs formulation of reasonable programmatic alternatives and analysis of cumulative and connected impacts.</p> <p>Commentors also stated that since the previous PEIS, Complex programs will have changed. A new PEIS is required, covering all aspects of the plan to develop 'replacement' nuclear weapons and facilities to provide opportunity of a review of the whole system.</p> <p>Commentors also suggested that tailoring the inclusion or exclusion of major and very costly proposed projects to suit the parochial interests of particular sites, or the immediate programmatic goals of NNSA as currently defined, defeats the purpose of a NEPA</p>	2, 4, 5, 9, 716, 1218	Chapter 1, Sections 1.5, 1.6, 2.0, 2.1, 2.5, Chapter 3

Topic 2. NEPA Process

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>programmatic analysis, by creating “facts on the ground” that arbitrarily foreclose consideration of reasonable consolidation and location alternatives.</p>		
Stakeholder involvement	<p>Commentors stated that DOE involve all stakeholders in the decision-making process including the Western Shoshone people in the central decision-making process, and request that International Atomic Agency (IAEA) and other international law experts formally submit comments to this proposed action.</p> <p>Commentors suggest polling long-time residents of Nevada concerning safe storage of radioactive waste in Nevada.</p> <p>One commentor stated that tables should be set up for the display of NGO literature and be in a prominent location where people can easily access provided information.</p> <p>Commentors also suggested that DOE speak with the communities, including Native American Tribes, surrounding the proposed sites and along transportation corridors regarding their current traditional and foreseeable future use of land and resources.</p>	215, 263, 763, 1208, 1223, 1179	<p>Section 1.6, Chapter 2</p> <p>Tables were provided to NGOs at scoping meetings.</p> <p>DOE conducts public meetings allowing the public to participate in the decision-making process.</p>
Scoping process – notification	<p>Commentors stated that the public comment period is only publicized and convenient to those who are educated. Public hearing notices should be published 45 days before the first hearing and should appear in the appropriate newspapers the Sunday before the hearings and also on the day before each hearing.</p>	9, 1179, 1209	Section 1.6
Length of scoping period, number and location of scoping meetings	<p>Commentors requested that the public comment period be extended from 60 days to 180 days and additional meetings be added. Commentors suggested that future hearings and meetings be properly and widely advertised and held in locations that are easily accessible to the public (i.e., via public transportation and all through the day and night to accommodate various work schedules). Commentor suggested discussing the logistics of meetings with community members in advance.</p> <p>Specific comments on locations of public meetings included changing the venue for the Los Alamos meetings, meetings should also be held in Espanola and Pojoaque, NM; additional public hearings for SRS should be held at the state capital, additional</p>	Campaign 19, 4, 5, 9, 47, 53, 191, 207, 215, 296, 315, 325, 500, 745, 763, 1048, 1044, 1048, 1050, 1083, 1216, 1218, 1125, 1134, 1179, 1209	Section 1.6

Topic 2. NEPA Process

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>meetings should also be held in Nevada, Utah, eastern California, Salt Lake City/St. George, near Livermore, and near Kansas City. Meetings should also be held at major population centers such as San Diego, CA; Phoenix, AZ; New York City, NY, Boise, ID; Las Vegas, NV, etc. In addition, meetings should also be conducted in areas downwind, down gradient, and along shipping routes</p> <p>One commentor had specific concerns about how the first public hearings were held in Clark County, as opposed to the actual proposed site of Tonopah.</p>		
<p>Scoping meeting format and scoping meeting fact sheets</p>	<p>Commentors suggested that a combination of an "open house" with roundtable discussions to allow for the possibility of real negotiations and questions/answers from both sides and a facilitated hearing is the best way to maximize the solicitation of scoping comments and inform the public of the proposed action with longer time for the public to speak. Some commentors stated that the poster session was insufficient. Commentors also suggested the use of a court reporter at hearings.</p> <p>Another commentor had a specific comment regarding an incomplete sentence on a fact sheet handed out during the scoping meetings and requested that the sentence be completed.</p> <p>Commentor questioned when the public would be able to sign up to speak.</p> <p>Commentor requested that detail on special security requirements be provided to the public and public leaders.</p> <p>Commentor requested that daycare be provided during scoping meetings.</p> <p>Commentor asked why RRWs are not on any other fact sheets other than the fact sheet entitled "Getting the Job Done."</p> <p>Commentor suggested being consistent with the use of "security" on fact sheets.</p>	<p>4, 5, 9, 167, 215, 303, 641, 763, 1048, 1050, 1146, 1212, 1213, 1217</p>	<p>Sections 1.6, 2.5</p>

Topic 2. NEPA Process

Subtopic	Comment Summary	Documents	SPEIS Reference
Scoping comments	<p>Commentor suggested that DOE provide the opportunity to comment both in private and in public and that DOE report how many Complex Transformation scoping comments state that the proposed Transformation will result in proliferation, a decrease in proliferation, or will have no effect.</p> <p>Other commentors requested an explanation of the impacts the scoping comments from the public would have.</p>	4, 5, 146	Section 1.6
Availability of information	<p>Commentors stated that insufficient information is provided to the public and that NNSA seems to be prejudicing the outcome of Complex Transformation by not providing handouts for all scenarios proposed.</p> <p>Commentors requested that DOE release secure documents and all previous tiered NEPA documents available on the project website and make all reference documents for the SPEIS available on the internet and on CD format.</p> <p>Commentors also stated that DOE should provide a complete listing and presentation of all documents upon which it intends to rely for the Complex Transformation along with all references, and related site-specific EAs and EISs.</p>	Campaign 19, 4, 5, 6, 9, 48, 263, 1209, 1218, 1225	<p>Chapter 2, 12</p> <p>The Administrative Record will be available to the public. NNSA has made every effort to provide the reader with sufficient information to satisfy NEPA requirements. Release of sensitive information is an issue of law and national security.</p>
NEPA compliance	<p>Commentors believe that the project is not compliant with NEPA and its implementing regulations and it is speculated that DOE is intentionally circumventing meaningful NEPA compliance.</p> <p>Comments submitted regarding compliance with NEPA included concern about the chronological release of the LANL SWEIS and Complex Transformation process. The LANL SWEIS NEPA process should follow (not precede) the Complex Transformation NEPA process as the outcome of the LANL SWEIS may substantially determine NNSA's pit production strategy. In addition, the commentor objected to the declared intention to press ahead with an EIS and ROD covering modernization of Y-12 capabilities even as the Complex Transformation SPEIS gets underway. Under at least some reasonable scenarios for deep reduction in the nuclear stockpile, it would make economic, security, and logistical sense to consolidate a portion or all of these</p>	2, 4, 6, 18	Chapter 1, Sections 1.5.2, 1.5.4.2

Topic 2. NEPA Process

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>activities at LANL, or at some other site or sites closer to the geographic center of a future complex in the southwestern triangle formed by Pantex, SNL, and LANL.</p> <p>Commentors objected to the arbitrary and counter-productive exclusion of options for consolidating uranium, secondary, and case fabrication activities currently performed at Y-12 in Oak Ridge, TN.</p> <p>Commentors stated that the CMRR decision appears to prejudice both the current LANL SWEIS and Complex Transformation.</p>		
NEPA conflict-of-interest	Commentors suggested that DOE has a conflict-of-interest with projects at LANL that would prejudice the present SPEIS decision-making process.	6	Section 1.5.4.2

Topic 3. Programmatic Purpose and Need

Subtopic	Comment Summary	Documents	SPEIS Reference
Purpose and need - general	<p>Commentors suggested that the SPEIS develop a fair and objective statement of the “Purpose and Need for the Proposed Action” that is based on more than the 2001 NPR. The purpose and need must also consider the NPT and International Court of Justice in the Hague opinion. The purpose and need should take into account the broader missions of the NNSA that include preventing proliferation, ensuring the effectiveness of NPT and developing strategies for ensuring the peaceful denuclearization of existing and threshold nuclear states and the legal obligations and treaty commitments that underpin them. The purpose and need must clearly state and include the full ramifications of the proposed project and how it will better secure the health and safety of the American people.</p> <p>Commentors also stated that the construction of the CPC is unjustified and questioned the purpose of the 125 certified pits. Commentor suggested that JASON’s review data should be considered and be included in the purpose and need.</p> <p>Commentors also suggested that the purpose and need should clarify the meaning of “modernization activities, changing character”, and developing a “responsive infrastructure.”</p>	2, 4, 9, 190, 215, 263, 323, 491, 690, 715, 769, 781, 1048, 1149, 1162, 1218, 1225	<p>Section 1.4 Chapter 2, Sections 2.1, 2.1.4, 2.1.5, 2.1.7, 2.2.2, 2.3.3, 2.3.4, 2.5.6, 3.1, 3.3.1, 3.4.1</p> <p>As NNSA dismantles more retired nuclear weapons, the number of pits in storage does increase.</p>
Relationship to Stockpile Stewardship and Management	<p>Commentors questioned why we are presently renewing our nuclear weapons under the Stockpile Stewardship Program, making our warheads last over 100 years. Has the 'no new plutonium sites' policy in the 1996 Final SSM PEIS changed?</p> <p>Commentors also questioned if any of the sites (Pantex, NTS, and Y-12) considered by the 1996 SSM PEIS were found NOT to be reasonable candidates for plutonium handling missions and had become plutonium sites since 1996?</p>	73, 92, 105, 111, 1220	<p>Chapter 2, Section 2.2.2</p> <p>NNSA is not proposing to create a new nuclear site in this SPEIS.</p> <p>This SPEIS has only proposed alternatives.</p>
Question the need for Complex Transformation	<p>Commentors questioned the need for Complex Transformation when a nuclear weapons arsenal already exists and weapons that have been NNSA certified are available. Commentors stated that the SPEIS needs to explore the need for the proposed action and how it will better secure health and safety of the American people.</p>	Campaign 1, Campaign 2, Campaign 5, Campaign 7, Campaign 8, Campaign 9, Campaign 10, Campaign 14, Campaign 16, Campaign 17,	Chapter 2, Sections 2.1, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.2.2, 2.3.1, 2.3.2, 2.3.3.2, 2.3.3, 2.4, 3.3.1

Topic 3. Programmatic Purpose and Need

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>Commentors stated that building up our nuclear capabilities makes no sense when our biggest threat is from non-state terrorist groups and the proliferation of weapons to other states. The U.S. cannot produce nuclear weapons while insisting other countries not pursue nuclear capabilities</p> <p>Numerous commentors stated that DOE must prove that the plutonium pit-aging phenomenon is occurring and problematic and explain why there is a need to expand pit production over existing capabilities when the number of pits is already oversized and unneeded.</p> <p>Commentors stated that consolidation and downsizing of the complex is not dependent on Complex Transformation and questioned how having a responsive infrastructure will help strengthen the global nonproliferation regime.</p> <p>Commentors stated that the U.S. should proceed with nuclear disarmament because there is no need to be armed with nuclear weapons.</p>	<p>Campaign 12, Campaign 18, 1, 2, 4, 5, 6, 10, 22, 31, 32, 48, 57, 66, 67, 68, 75, 76, 80, 96, 97, 99, 104, 107, 108, 110, 111, 128, 145, 146, 149, 153, 191, 193, 204, 207, 209, 211, 215, 263, 265, 266, 268, 272, 275, 277, 320, 323, 326, 327, 328, 330, 331, 333, 336, 340, 342, 343, 348, 354, 355, 359, 361, 368, 369, 380, 390, 391, 392, 402, 403, 406, 411, 413, 422, 423, 427, 428, 430, 431, 437, 440, 441, 443, 444, 445, 450, 491, 529, 535, 538, 540, 541, 548, 550, 552, 567, 571, 586, 587, 588, 589, 591, 593, 634, 652, 682, 684, 686, 687, 690, 693, 695, 697, 700, 723, 725, 743, 763, 765, 769, 770, 771, 781, 787, 798, 800, 801, 807, 810, 827, 820, 822, 828, 843, 845, 859, 861, 889, 907, 953, 962, 965, 972, 973, 974, 976, 1045, 1048, 1054, 1056, 1087, 1095, 1097, 1099, 1100, 1103, 1107, 1111, 1112, 1113, 1123, 1132, 1137, 1138, 1142, 1143, 1153, 1155, 1181, 1188, 1190, 1191, 1200, 1205, 1206, 1208, 1209, 1210, 1213, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1220, 1222, 1223, 1224</p>	

Topic 4. Programmatic No Action Alternative

Subtopic	Comment Summary	Documents	SPEIS Reference
No Action Alternative - general	Commentors suggested including an 'amended' no action alternative which aims to not expand the nuclear pit fabrication capacity of the U.S.	Campaign 5, Campaign 9, 52, 686, 693, 894, 1218, 1223	Section 3.3.1, 3.4.1.6
No Action Alternative needs to be a true no action	Commentor stated that the “No Action” Alternative must be genuine. We object to the current NOI’s definition of “No Action” Alternative which actually incorporates a host of activities and proposed actions that a direct bearing on the future structure of the weapons complex under review. We strongly urge that analysis of major new projects covered by the ongoing Y-12 and LANL Site Wide EIS’s be placed on hold and made subordinate to the analysis and outcomes of the SPEIS process. To do otherwise would severely compromise the integrity and utility of the SPEIS, which would then be compelled to wrap itself around site-specific decisions and projects that will effectively predetermine and artificially constrain the consideration of programmatic alternatives for the complex as a whole.	2	Chapter 3
Viability of the No Action Alternative	This SPEIS must present a credible analysis of the No Action Alternative including the "viability" of the No Action Alternative for meeting existing pit production requirements necessary to satisfy requirements of stockpile stewardship inventories.	47, 904, 910, 937, 1057, 1213, 1216	Section 3.4.1.6
Justification of the No Action Alternative	Commentors requested a description of how the reduced operations and no action alternatives differ to require analyses in a complex-wide SPEIS as neither includes construction of a CPC, consolidation of SNM and elimination of duplicate facilities, flight testing, reduction of production capacities at Pantex, Y-12, and SRS, and dismantlement activities. In addition, DOE must provide legal justification for choosing or not choosing the No Action Alternative in the Draft SPEIS.	5, 1218	Section 3.1, 3.3, 3.6, Chapter 3

Topic 5. Programmatic Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
<p>Programmatic Alternatives - general</p>	<p>The current proposal only has three options and is too limited; there should be more alternatives. The alternatives presented in the NOI are also unresponsive to key members of Congress and to the NPT.</p> <p>Commentors also stated that any alternative that contemplates developing weapons of mass destruction poses an unacceptable risk to the environment, country, species and the planet. Proposed alternatives threaten human health.</p> <p>Commentors also suggested that each alternative include an analysis of the potential for a new international arms race and the local, regional, and international impacts; how nuclear weapons increase global security; how proposed action will impact specifically Middle Eastern peace and security; who will benefit from a reciprocal reaction from other states; who will be impacted internationally, as well as locally, regionally, and nationally by proposed activity; who will benefit from the proposed alternatives; and the environmental and human health impacts both nationally and internationally from the arms race that would be instigated by a reciprocal action from other states.</p>	<p>Campaign 15, Campaign 17, 6, 555, 1216, 1135, 1153, 1154, 1210, 1217, 1218, 1223</p>	<p>Chapters 3, 5, Sections 2.1.4, 2.4 3.1, Sections 5.x.11 for all sites</p>
<p>Development of Programmatic Alternatives</p>	<p>Commentors questioned the development of the alternatives and stated that transformation is not a consolidation plan, it is a revitalization plan. It goes from 8 sites to 8 sites. Consider a real consolidation plan.</p> <p>Commentors expressed the concern that the nuclear weapons produced by Complex Transformation will be used in the future with negative consequences.</p> <p>One commentor stated that all major nuclear weapons sites are to be retained in NNSA's plan, an assumption which the House Appropriations Committee and the Secretary of Energy's SEAB have opposed. NNSA offers only two alternatives: (1) a somewhat reduced level of manufacturing expansion accompanied (by) some consolidation within sites and elimination of unspecified duplicate facilities; and (2) implementation of plans in place today, involving</p>	<p>6, 9, 104, 747, 1208, 1209, 1217, 1219, 1220, 1222, 1223</p>	<p>Chapter 3, Section 3.5, Appendix C</p>

Topic 5. Programmatic Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>manufacturing expansion as well. The same commentor also stated that NNSA's plans to build thousands of new warheads in the RRW program over the next quarter century, which have not been endorsed by the DoD or approved by Congress, while at the same time maintaining and extending the working life of existing warheads until the new RRWs could take their place, appears to underlie the choice of alternatives in the Complex Transformation Plan. It should be unnecessary to remind NNSA that alternatives proposed by DOE's own SEAB is a reasonable alternative. The same commentor also stated that the NEPA history of radiographic hydrotesting is an object lesson in what must be avoided this time around. The Supplemental PEIS must include a comprehensive and detailed presentation of the full suite of presently planned and "reasonably foreseeable" hydrotesting capabilities, and "reasonable" alternatives thereto, over the full time period covered by the analysis.</p> <p>The set of "reasonable alternatives" for analysis for this and indeed all aspects of the SPEIS, is bounded not by what the proposing agency itself "desires" or "prefers" but by what an objective informed observer would regard as economically, technically, and environmentally reasonable in light of a reasonably foreseeable range of future nuclear weapons requirements. These alternatives in turn must be bounded by a "decent respect for the opinions of mankind."</p> <p>Even in the case of possibly legitimate fears of impending WMD attack, U.S. first use of nuclear weapons in a "preemptive strike" would likely result in a disproportionate, overwhelming, and indiscriminate use of military force in violation of international humanitarian law. We therefore find it entirely reasonable to insist that the range of reasonable alternatives for the 2030 nuclear weapons complex must embrace options that not only include very deep nuclear stockpile reductions, but also exclude NNSA complex support for weapons and capabilities required to implement illegal preemptive and preventive nuclear attacks.</p> <p>Commentors also stated that national security is enhanced by this</p>		

Topic 5. Programmatic Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>project through consolidation at one site.</p> <p>NNSA fails to name or consider any alternative which realistically treats environmental, economic, and geopolitical realities which the average citizen can recognize as being of great importance.</p> <p>All the alternatives fall short of a feasible long-term sustainable plan for facilitating the health and safety of U.S. citizens.</p>		
<p>Programmatic Proposed Action: Distributed Centers of Excellence</p>	<p>Commentors stated that this alternative directly contradicts the NPT obligation and needs to be proven that the CPC is necessary in light of our obligation to comply with the NPT to reduce the nuclear arsenal. Commentors suggested that this alternative be eliminated.</p> <p>Numerous commentors made suggestions regarding the analysis of this alternative. These include: discussion of the facilities and industrial processes that are involved with the CPC; define baseline capacity; question if the CPC is a design-build project and why; explain the rationale for the order of the baseline CPC schedule and why the need to approve the mission in 2008, will the decision be made before the ROD, questions whether this decision is prejudice, and will the decision to proceed with the CPC be made in the ROD?; what will the site decision be based on?; when analyzing CPC include analysis on environmental justice, environmental safety threats, and regional cumulative impacts; and requested that decisions on the replacement UPF be deferred pending evaluation of the consolidated complex.</p> <p>Commentors also expressed specific questions regarding the CPC:</p> <ul style="list-style-type: none"> • How will the CPC enhance deterrence when resumed industrial-scale nuclear weapons production could encourage other countries to follow the U.S.’s lead? • What is the ratio of pits produced to certified pits expected to be for the CPC? Is the ratio expected to be different for different pits? How is this ratio estimated? Does a baseline capacity mean 125 pits produced or certified pits? • At which site will the CPC cause the most environmental impacts and need the most mitigation measures? 	<p>Campaign 5, 4, 5, 330, 792</p>	<p>Chapters 2, 5, 6, 13, Sections 1.5, 1.5.3, 3.1, 3.4, 3.16</p>

Topic 5. Programmatic Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
Programmatic Alternative 2: Consolidated Nuclear Production Center	Commentor stated that in light of its lower security overhead and environmental advantages the CNPC proposal is objectively reasonable and must be analyzed for a range of stockpile sizes including very low levels of nuclear forces.	2	Section 3.5
Programmatic Alternative 3: Capability-Based	<p>Commentors stated that a drawback of Alternative 3 is that the production capacity would not be sufficient to meet current national security objectives. Commentors requested the specific definition of “nominal level” as well as the justification for this determination.</p> <p>Another commentor suggested the elimination of plutonium production and surveillance and research and development for this alternative.</p> <p>Commentor is concerned that under this alternative the removal of Category I/II SNM from LANL would have instant ramifications on the site and result in the cancellation of more than a billion dollars in new construction projects listed and analyzed in the LANL SWEIS.</p>	5, 6, 1210, 1215	Sections 2.3.3.2, 3.4.1.4, 3.5, 3.6

Topic 6. Project-Specific Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
High Explosives R&D	<p>Commentors were concerned about the effects this alternative would have on the environment and requested that environmental, socioeconomic, demolition, and transportation impacts at all sites be evaluated and provide a baseline for each of these resources.</p> <p>Commentor expressed concern that DOE has predetermined that HE production, pressing, and machining will be located at Pantex.</p> <p>Commentors had specific questions regarding HE R&D:</p> <ul style="list-style-type: none"> • How many HE R&D experiments are conducted annually and will any alternatives reduce the number of HE R&D experiments? • Will downsizing of HE R&D require new buildings? 	4, 104, 1219	Sections 3.2.5, 3.8, 3.15, 5.10, 5.17, Chapter 5
Tritium R&D	<p>Commentors requested the necessity of this alternative especially if the production of nuclear weapons is abandoned. Commentors were also concerned about effects this alternative would have on the environment and requested that environmental, socioeconomic demolition and transportation impacts at all sites be evaluated and provide a baseline for each of these resources. Commentors also requested that environmental impacts at sites with increased activity due to consolidation of Tritium R&D at some sites be analyzed and to consider the production of tritium and the commercial use of nuclear power reactors for tritium production.</p> <p>Commentors had specific questions regarding Tritium R&D:</p> <ul style="list-style-type: none"> • How many Tritium R&D experiments are conducted annually and will any alternatives reduce the number of Tritium R&D experiments? • Will downsizing of Tritium R&D require new buildings? • Will the downsizing of Tritium R&D have any effect on the location of a CPC? • Do the properties of tritium change? 	4, 1210, 1219	Chapter 3, Sections 2.1.4, 3.8, 3.9, 5.10, 5.17
NNSA Flight Test Operations	Commentors were concerned about effects this alternative would have on the environment and requested that environmental,	4, 47, 104, 1197, 1219	Sections 3.10, 3.10.1, 5.15, 5.15.5, 5.17

Topic 6. Project-Specific Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>socioeconomic, demolition, and transportation impacts at all sites be evaluated and provide a baseline for each of these resources.</p> <p>Commentors also had specific questions regarding flight test operations:</p> <ul style="list-style-type: none"> • How many flight tests are conducted annually and will any alternatives reduce the number tests? • Will the number of tests be reduced under this alternative? • Will the selection of a location for the flight tests have any effect on the location of a CPC? • What are the required geological conditions needed to successfully support all flight testing requirements? • Is it legal to perform these tests on Native American lands? <p>Commentors suggested evaluation of the relocation of the flight test operations without transformation of the whole complex. Commentors were also concerned that flight test operations may stir up radioactive dust from previous ground testing.</p>		<p>The CPC, which is a programmatic decision, has no bearing on the Flight Test Program, which is a project-specific decision.</p>
<p>Major Hydrodynamic Test Facilities</p>	<p>Commentors were concerned about the effects major hydrodynamic test facilities would have on the environment and the impacts of leaving waste from the tests on and in the ground. Commentors suggested that the SPEIS include a comprehensive and detailed presentation of presently planned and reasonably foreseeable hydrotesting capabilities and reasonable alternatives thereto over the full 30-year period covered by the analysis and also requested that environmental, socioeconomic, demolition, and transportation impacts at all sites be evaluated and provide a baseline for each of these resources. Commentors also suggested that the impacts from LANL, DARHT, and LLNL’s Site 300 hydrotesting activities be analyzed, list all materials and amounts by isotope used in all types of hydrotesting including non-fissile radioactive isotopes.</p> <p>Commentors requested that DOE explain why LANL performed at least one hydrotest for a speculative RRW design while at the same time it is far behind on hydrotests designed to baseline the safety and reliability of existing nuclear weapons.</p>	<p>2, 4, 104, 1219</p>	<p>Sections 3.11, 3.11.1, 3.11.1.2, 3.11.1.3, 3.11.2.1, 3.11.2.3, 5.16, 5.16.3, 5.17</p>

Topic 6. Project-Specific Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>Commentors suggested that the consolidation of hydrotesting be addressed without transformation of the whole complex and also consider ramping down hydrodynamic testing at all sites.</p> <p>Commentors stated that it seems that NNSA has predetermined the large-scale hydrotesting facility will be located at NTS.</p> <p>Commentors also had specific questions regarding major hydrodynamic test facilities:</p> <ul style="list-style-type: none"> • Is DARHT a large-scale hydrotest facility? • Is moving the location of these sub-critical experiments being considered? • Will any alternative reduce the number of hydrotest experiments? How many experiments are conducted annually? • Will consolidating hydrotesting require new buildings? If so, what are the projected costs? 		
Major Environmental Test Facilities	<p>Commentors were concerned about effects this alternative would have on the environment and requested that environmental, socioeconomic, demolition, and transportation impacts at all sites be evaluated and provide a baseline for each of these resources.</p> <p>Commentors requested that an explanation be provided regarding consolidating environmental test facilities which are contradictory with removing SNM.</p> <p>Commentors question the necessity in future event that production of nuclear weapons is abandoned.</p>	4, 104, 1219	Sections 3.12.1, 5.17

Topic 7. Other Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
Other Alternatives – general	Commentors suggested that DOE identify other alternatives.	5, 774	Sections 3.1
Transportation of nuclear materials	Include an alternative which involves little to no transport of nuclear materials.	1210	Section 3.5.1
Disarmament, dismantlement or decommissioning alternatives	<p>Commentors requested an option for disarmament or decommissioning of nuclear warheads and the elimination of the production of nuclear weapon components, the use of the volatile, toxic substances involved in weapons production.</p> <p>Commentors stated that NNSA needs to provide an alternative/plan that will put the warhead complex on a reasonable path toward dismantlement, while also maximizing security, minimizing costs and impacts, retaining a declining nuclear arsenal, and maximizing administrative freedom to pursue paths toward further nuclear disarmament by future administrations.</p>	<p>Campaign 5, Campaign 9, Campaign 12, Campaign 18, 4, 5, 6, 24, 26, 63, 65, 67, 68, 75, 79, 78, 111, 129, 138, 263, 286, 292, 300, 303, 316, 317, 318, 326, 333, 344, 348, 354, 355, 361, 368, 384, 387, 389, 391, 392, 397, 393, 400, 404, 406, 409, 413, 427, 428, 431, 440, 441, 443, 454, 457, 466, 469, 471, 472, 477, 519, 524, 540, 541, 549, 551, 552, 554, 559, 561, 564, 567, 571, 584, 585, 586, 588, 592, 599, 601, 602, 608, 613, 631, 636, 639, 644, 645, 652, 662, 664, 665, 672, 673, 674, 675, 688, 690, 704, 719, 725, 727, 732, 735, 737, 752, 754, 761, 762, 766, 769, 771, 772, 781, 811, 825, 829, 850, 855, 883, 887, 906, 938, 986, 1032, 1041, 1046, 1068, 1076, 1162, 1209, 1210, 1211, 1212, 1215, 1217, 1218, 1220, 1222, 1223, 1224</p>	Sections 2.3.1, 2.3.2, 2.6, 3.15, Chapter 3
Reduce stockpile alternatives	Commentors suggested including an option to reduce the current stockpile. Some commentors also suggested an alternative that requires the minimum amount of maintenance on our existing stockpile while simultaneously phasing out our nuclear weapons.	<p>Campaign 12, Campaign 15, Campaign 18, 2, 31, 111, 303, 332, 338, 339, 343, 354, 358, 360, 368, 396, 408, 418, 423, 425, 434, 438, 444, 445, 541, 544, Campaign 18, 571, 581, 569, 594, 872, 639, 643, 677, 678, 697, 710, 734, 735, 737, 738, 741, 749, 781, 825, 826, 830,</p>	Sections 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.6, 2.6.3, 3.1

Topic 7. Other Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
		850, 938, 952, 1032, 1126, 1219, 1210, 1153, 1154, 1183, 1185, 1190, 1195, 1217, 1220, 1223	
Downsizing-in-place alternatives	<p>Commentor questioned whether downsizing of ETFs/ HE R&D/Tritium R&D/ hydrotesting will have an effect on the location selection of a CPC.</p> <p>Some comments received supported the proposal's stated aim for downsizing the nuclear weapons infrastructure.</p> <p>Commentors expressed that downsizing facilities in one place might cause increased activities at other sites. Commentors requested that the SPEIS include environmental impacts of increased activities as a result of downsizing facilities in one place.</p> <p>Commentors suggested that DOE provide an alternative with a consolidated network with refined capability with smaller size and maximum production.</p>	Campaign 7, 4, 673, 877, 1210	Chapters 3, 5, Sections 3.4.1, 5.17
Responsible curatorship alternatives	<p>Commentors requested that DOE include an alternative that evaluates a “Responsible Curatorship” case for the full range of reasonable stockpile sizes, that is built on the premise that no new or replacement nuclear components will be fabricated for the entire period covered by the SPEIS, and that pit and secondary refurbishment operations will be kept to the minimum level consistent with continued reliability and safety.</p>	Campaign 19, 2, 4, 6, 9, 32, 129, 529, 544, 747, 1083, 1218, 1219, 1220, 1222, 1223	Chapter 3, Section 3.15
Alternatives that comply with the NPT	<p>Numerous commentors suggested alternatives that comply with the NPT. Commentors stated that an alternative should be added which would comply with [“comply with” or “satisfy” rather than “meet”?] the NPT by reducing current operations at active facilities to those necessary to perform critical storage, disassembly, dismantlement, and disposition missions. This alternative will put the warhead complex on a reasonable path toward dismantlement, while also maximizing security, minimizing costs and impacts, retaining a declining nuclear arsenal, and maximizing administrative freedom to pursue paths toward further nuclear disarmament by future administrations</p> <p>Under an alternative that complies with the NPT, there would be no</p>	6, 367, 1056, 1095, 1134, 1135, 1212, 1220	Section 2.1.4, Chapter 3

Topic 7. Other Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	need to make pits; therefore, there is no need for a consolidated pit production facility, no need to operate LANL's TA-55 facilities for pit production, and no need for a CMRR.		
Comprehensive Test Ban Treaty alternatives	Commentor suggested to be consistent with the CTBT define and evaluate an alternative that involves the complete cessation of NNSA weapons activities at NTS and the elimination of any underground nuclear experiments, wherever located.	2	Section 2.1.3
Security alternatives	Commentors suggested including an option to secure current weapons inventory.	Campaign 12, 281, 320, 458, 464, 465, 111, 639, 781	Section 2.3.5
Safety alternatives	Commentors suggested analyzing an option to store toxic materials like plutonium and HEU as safely as possible.	672	Sections 2.3.5, 3.5, 3.7
Alternatives involving policy	<p>Commentors suggested that DOE must analyze for an alternative where nuclear deterrence is not the cornerstone of U.S national security policy and for an alternative in which the U.S. complies with Article IV of the U.S. Constitution.</p> <p>Commentors also suggested another way to increase our nation's security such as providing an alternative that aims to reduce the role of nuclear weapons in U.S. security strategies.</p>	Campaign 12, 5, 111, 570, 571	Section 2.3.5, Chapters 2, 3
Test readiness alternative	Commentors stated the test readiness alternative should include an analysis which includes answers to issues relating to environmental impacts of maintaining test readiness; ability to certify the design of a nuclear weapon without testing; national and international environmental and public health impacts from past nuclear weapons testing; and the projected costs of compensation under the Radiation Exposure Compensation Act.	5	Chapter 3
Site alternatives	<p>Numerous commentors suggested alternative uses for candidate sites:</p> <ul style="list-style-type: none"> • Consider lowering production at LANL and forget about the rest of the other potential locations. • Provide an alternative where LANL is used for better benefits than creating more nuclear weapon systems, consolidating plutonium, etc. • The current production level of 20 pits per year at LANL is sufficient for maintaining deterrence. 	2, 4, 9, 24, 30, 31, 32, 75, 264, 692, 747, 879, 1218, 1224, 1217, 1222	Sections 1.5.4.2, 2.3.3.2, 2.5, 3.1, 3.4.1.6, 3.6, 3.7.2, 3.15, Chapters 2, 3

Topic 7. Other Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Commentor urged that analysis of major new projects covered by the ongoing Y-12 and LANL SWEIS be placed on hold and made subordinate to the analysis and outcomes of this SPEIS. • Removal of nuclear materials/waste from LLNL • It would make economic, security, and logistical sense to consolidate a portion or all activities at LANL, Pantex and/or Sandia (southwestern triangle). • Suggest stopping the CMRR project since this building would become obsolete by the new consolidated plutonium facility. Instead co-locate future production capacity and radiological chemistry materials research workout. • DOE should consider the alternatives of joint operations of new LLNL facilities with other federal agencies such as DHS, FBI, NASA. • Convert nuclear weapons labs to facilities that promote technologies that meet human needs. • Analyze plutonium at existing Category I/II SNM sites, uranium at Y-12, A&D at Pantex, and tritium at SRS as an alternative without the so-called transformation and with existing facilities that could be downsized and consolidated. • Alternative missions for present day weapons sites must also be considered. • Develop alternative options for the research conducted at our national labs that would benefit our planet. • Define alternative consolidation plans for specific areas including hydrodynamic testing, strategic computing, environmental testing, flight testing, fissile material operations and storage, non-nuclear component fabrication, HE and detonator fabrication and testing and tritium operations and R&D. • Terminate all bomb development related tests and analyze the safest and secure locations to conduct maintenance tests. 		
Nonproliferation alternative	<p>Commentors suggested that NNSA develop an alternative that focuses on nonproliferation. Include an alternative that excludes NNSA complex support for weapons and capabilities required to implement illegal preemptive and preventive nuclear attacks on other states that might in the future seek to arm themselves with</p>	<p>Campaign 5, Campaign 9, 2, 63, 213, 368, 387, 850, 734, 768, 1166, 1209, 1210, 1221, 1223, 68</p>	<p>Sections 1.2, 2.1.3, 2.1.4, 2.3.1, 2.3.2</p>

Topic 7. Other Alternatives

Subtopic	Comment Summary	Documents	SPEIS Reference
	weapons of mass destruction.		
Cleanup alternatives	Commentors suggested that resources and expertise of national laboratories should be directed toward cleanup.	Campaign 4, Campaign 5, Campaign 6, Campaign 9, Campaign 12, Campaign 18, 1, 55, 164, 260, 287, 300, 303, 317, 318, 333, 368, 372, 380, 471, 499, 501, 525, 540, 541, 552, 555, 584, 585, 631, 681, 691, 747, 768, 781, 811, 861, 897, 962, 998, 1059, 1104, 1111, 1208, 1210, 1217, 1218, 1220, 1221, 1222, 1223, 1224	Chapter 2, Chapter 3, Section 3.15
New Triad	Commentors suggest providing alternatives that support the "New Triad" and the balance it brings concerning enemies and allies and discusses what the effects are of not having met the needs of this New Triad.	4	Section 2.3.1
Alternatives promoting peace	<p>Commentors suggested that DOE should pursue more diplomatic alternatives, pursue the process of scientific conversion of military production to peaceful uses.</p> <p>Commentors also suggested an alternative where security is provided through conflict resolution and mediation.</p>	Campaign 4, Campaign 6, 592, 1216	Section 3.15, Chapters 2, 3
Future of the nuclear weapons complex	Commentors stated that the EIS should cover a range of alternatives that future presidents and Congress would face regarding our nuclear weapons Bombplex and abandon plans to build new nuclear weapons.	12, 57, 223, 326, 343, 358, 360, 396, 408, 418, 423, 425, 434, 444, 525, 710, 747, 749, 781, 938, 944, 1209, 1224, 1217, 1222, 1223	Section 3.1

Topic 8. Reliable Replacement Warhead

Subtopic	Comment Summary	Documents	SPEIS Reference
RRWs - general	A commentor expressed that the RRW program must be viewed as optional.	2	Sections 2.5, 2.5.1, 2.5.9
Opposition to RRWs	Commentors oppose the RRW because the RRW is not a legitimate element of the scope in this process and could imperil national security by substituting untested designs for already tested ones. Commentors also state that the RRW will promote nuclear proliferation.	4, 22, 32, 128, 168, 326, 1104, 1205, 1210	Section 2.5
RRWs and pit production	Commentors requested a discussion about the life cycle management of existing pits inventories and how new production will fit into existing management and disposition systems and questioned if different margins are expected for different pit sizes.	4, 26, 27, 587	Sections 2.5, 3.4.1
RRW - analysis	Commentors submitted comments associated with the type of analysis that should be included regarding the RRW. These included: <ul style="list-style-type: none"> • Clarify the role of the RRW program as currently envisioned in Complex Transformation. • Analyze the environmental impacts for all RRW design concepts in the draft SPEIS. 	5, 1218	Section 2.5
Questions regarding the RRW	Commentors submitted comments with questions on the RRW. These included: <ul style="list-style-type: none"> • How long will it take to produce an RRW to respond to geopolitical change? And why aren't current ones suited for this considering most types are understood to be variable yield? • Will our needs for a responsive infrastructure and war be the same in 2030 as they are now? • How would RRW, as new warheads be used towards emerging threats? Would they have a new military mission compared to existing U.S. nuclear weapons and if so this seems contrary to congressional intent? • Why are new weapons designs not mentioned in stockpile management activities on the fact sheets or under the proposed action? • What is the true need for new design nuclear weapons and for the production of 125 pits per year? • Will there be a time when there will be both RRW warheads 	4, 503	Section 2.5

Topic 8. Reliable Replacement Warhead

Subtopic	Comment Summary	Documents	SPEIS Reference
	and the warheads they are replacing in the stockpile?		
Relationship between the RRW and Complex Transformation	<p>Commentors questioned the relationship between the development of RRWs and alternatives for Complex Transformation.</p> <p>Commentors stated that if the complex must be reformed with or without new RRW designs, how can the RRW be the "enabler" for the project. Justification for the project seems to be a moving target therefore it is hard to discern if this SPEIS is for support of the existing stockpile, new design nuclear weapons, or some combination of the two.</p> <p>Commentors stated that expanded pit production is primarily about RRW pits for new nuclear weapons design and is the driver for the 125 pits per year desired level of production.</p>	4, 1219	Sections 2.5, 2.3.1
Question the need for RRWs	Numerous commentors questioned the need for RRWs and the need to replace refurbished warheads with RRW warheads when a recent report indicates that the existing stockpile is not degrading.	4, 516, 603, 876, 942, 947, 1064, 1065, 1190, 1192, 1211, 1046, 1058, 1216	Section 2.5

Topic 9. Cost and Schedule

Subtopic	Comment Summary	Documents	SPEIS Reference
Cost-Effectiveness of Existing Nuclear Weapons Complex	Several comments were received regarding concern about the cost of the project and questioned anticipated costs, costs of accidents, and remediation efforts. Commentors also questioned the cost-effectiveness of Complex Transformation when DOE claims that the SSP is not failing after spending 90 billion dollars. Why then is the Program not adequate for maintaining the stockpile? How can increased costs for Complex Transformation be justified? Explain why the existing nuclear complex can't be made more cost effective. What needs to be changed to update it?	Campaign 2, Campaign 5, Campaign 4, Campaign 6, Campaign 7, Campaign 9, Campaign 10, Campaign 17, Campaign 18, 3, 4, 9, 10, 31, 75, 104, 107, 109, 110, 203, 208, 210, 303, 329, 335, 344, 351, 355, 367, 368, 391, 395, 402, 430, 432, 437, 445, 460, 525, 567, 584, 674, 689, 690, 693, 740, 727, 731, 732, 735, 738, 753, 752, 754, 765, 845, 860, 951, 955, 401, 1084, 790, 1089, 1100, 1126, 1218, 1142, 1143, 1149, 1161, 1162, 1200, 1209, 1210, 1220, 1223, 1217, 1218, 1219, 1222, 1223	Chapter 2, Section 3.1
Better Use of Resources	Numerous commentors provided suggestions for better use of resources. These include: <ul style="list-style-type: none"> • Funds should be spent on maintaining safety and security at existing sites • Funds should be spent on dismantlement • Funds should be spent on infrastructure 	Campaign 1, Campaign 19, 1, 5, 12, 19, 66, 67, 74, 77, 80, 96, 104, 109, 110, 126, 132, 133, 138, 153, 191, 368, 390, 541, 380, 320, 585, 684, 691, 692, 723, 740, 747, 758, 769, 783, 894, 1081, 1104, 1111, 1117, 1188, 1137, 1200, 1205, 1206, 1208, 1209, 1057, 1205, 1209, 1210, 1212, 1211, 1218, 1224, 1220, 1222	Chapter 2, Section 3.1
Factors that could increase proposed costs	Commentors expressed concern regarding factors that could increase proposed costs and requested additional discussion. Factors included: <ul style="list-style-type: none"> • Security • Increased mitigation and environmental restoration 	4, 1218, 1217, 1223	Chapter 2, Section 3.1
Cost of cleanup	Commentors questioned the cost of the current cleanup that is needed.	1213	Chapter 2, Section 3.1

Topic 9. Cost and Schedule

Subtopic	Comment Summary	Documents	SPEIS Reference
<p>Cost of each of the alternatives</p>	<p>Commentors submitted comments on the cost of each of the alternatives and questioned if construction and operation costs would be the same at each candidate site. Commentors requested a discussion of the cost of siting the CPC at each of the candidate sites.</p> <p>A specific comment was submitted regarding TTR and remediation costs of associated with moving testing operation from TTR would be cost effective compared to keeping the testing at TTR. [Edit – words missing.]</p> <p>It was also suggested that transition to lower cost of operations for NNSA, without so-called transformation of the complex, be analyzed.</p>	<p>4, 9, 685</p>	<p>Chapter 2, Section 3.1</p>
<p>Cost-Benefit Study</p>	<p>Commentors requested the inclusion of a cost-benefit analysis of different alternatives (ETF/JFTP [joint flight testing program?]/HE R&D/Tritium R&D/Hydrodynamic Testing costs; an estimated breakout of all costs of downsizing-in-place and/or eliminating specific activities at sites performing Environmental Testings/JFTP/HE R&D/ Tritium R&D/Hydrodynamic Testing) including SNM consolidation without transformation and SNM consolidation as part of transformation.</p> <p>The cost-benefit analysis should also be based on a life cycle budget for the project including not only the cost of construction, but operation, decommissioning and waste disposal</p>	<p>4, 5</p>	<p>Chapter 2, Section 3.1</p>
<p>Timeline</p>	<p>Commentor submitted questions regarding the timeline of the proposal. These included:</p> <ul style="list-style-type: none"> • Is the schedule different for each site? • Explain rationale for the order of the baseline CPC schedule? Why approve the Mission Need (CD-0) in 2008? Will it be before the ROD? Isn't that prejudicial? Will the decision to proceed with the CPC be made in the ROD? 	<p>4</p>	<p>Chapters 2 and 3</p>

Topic 10. Candidate Sites

Subtopic	Comment Summary	Documents	SPEIS Reference
Candidate sites - general	<p>Commentors submitted comments regarding candidate sites that were general in nature. While many commentors provided comments on specific sites, other comments stated:</p> <ul style="list-style-type: none"> • DOE must consider the psychological impact of living in a state with four sites devoted to nuclear weapons activities, as well as being the birthplace of the atomic bomb, and the site of its first detonation. • In order to comply with the 'no new plutonium sites' determination, plutonium activities should be placed at sites which currently have facilities with a history of safe plutonium operations. • Consider the synergistic impact of the location of two of the nation's nuclear weapons laboratories (LANL, SNL/NM) located within 60 miles of one another in New Mexico. • Discuss the reduction of NNSA sites. • The SEAB 2005 report contradicts the criteria for candidate site consideration (i.e., population encroachment) in the NOI stating that the majority of sites are bordered by residential and/or commercial communities. • Find financial means to make reparations to those communities whose soil, air and water have been contaminated. 	Campaign 12, 4, 5, 73, 111, 540, 792, 1218, 1208	Sections 2.3.4, 3.14, 4.1, 4.1.9, 4.6.9, 5.5.15, 5.9.15
LANL (New Mexico)	<p>Commentors submitted comments regarding the siting of "Complex Transformation" at LANL, these included:</p> <ul style="list-style-type: none"> • New studies need to be conducted to analyze the social, environmental, economic, and health impacts associated with an expansion at LANL. • Concern about safety from toxic wastes for residents residing upwind of Los Alamos. • Explain how NNSA came up with the 40% reduction of nuclear facility space at LANL. • Concern for safety and liability issues especially since security and environmental responsibility at LANL is lacking. • Provide justification for increasing the production at LANL from ~20 ppy to 200 ppy at a cost of ~ \$4 billion. • LANL's mission should be redirected to cleanup and securing the existing stockpile and waste. 	Campaign 12, 2, 4, 5, 6, 73, 77, 111, 146, 209, 327, 333, 781, 792, 1128, 1215, 1217, 1218	Sections 1.1, 1.2, 1.5.3, 1.5.4.2, 2.3.3.2, 3.11.1.2, 3.4.1.5, 3.4.1.6, 3.7, 4.1, 4.1, 5.1, 5.1.4, 5.1.12, 10.6, Chapters 2, 4

Topic 10. Candidate Sites

Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Explain why LANL was selected as a candidate site when its location is not favorable (on top of a windswept mountain, on an earthquake fault, in a wildfire zone, and at the source of a watershed that serves 10 million people). • Discuss containment methods for DARHT and explain if they conform to the DARHT EIS ROD. • Provide a discussion on facilities containing SNM and the management of these facilities by another group if by 2022 LANL is not expected to operate facilities containing Category I/II SNM. • Concern regarding LANL’s future direction. • The decision to locate a CPC at LANL is prejudicial and premature until a decision regarding the CMRR is made. • Concern regarding LANL’s chances of actually producing 10 certified W88 pits when it has yet to produce a certified pit. • LANL’s current weapons-related plutonium infrastructure should be more than sufficient to meet the needs of maintaining the U.S. nuclear stockpile. • Suggest performing another more updated EIS. • Concern about DOE's poor decision-making as shown in the decisions regarding the FXR facility the DARHT facility. <p>Some commentors also submitted comments in reference to the LANL SWEIS.</p>		
LLNL (California)	<p>Commentors submitted comments regarding the siting of “Complex Transformation” at LLNL, these included:</p> <ul style="list-style-type: none"> • Complex Transformation plan should terminate high explosives tests at Site 300 and concentrate on cleanup there and the main site. Address issues of encroachment to surrounding recreational and residential areas of pollutants from explosive testing. • LLNL would not be a suitable location because of its dense population, small facility and transportation and storage problems. LLNL is also a Superfund Site. • Direction from Congress to remove weapons usable material from LLNL. • Complex Transformation would add to the already existing 	4, 9, 32, 1219, 1220, 1222	Sections 3.2.2, 3.3.1, 3.7.2, 3.8.1.1, 3.9.5.3, 3.13.2, 3.15, 4.2, Chapter 10

Topic 10. Candidate Sites

Subtopic	Comment Summary	Documents	SPEIS Reference
	2-mile plume that extends to the City of Tracy. <ul style="list-style-type: none"> • Discuss the closure of LLNL. • Discuss the role of the National Ignition Facility mega laser in Complex Transformation. • Concern regarding continued tritium operations. • Suggest phasing out operations at LLNL and move to LANL and make LLNL an alternative energy plant. • Concern regarding documentation by Tri-Valley CAREs showing the threat at least three-quarters of a million curies of tritium have come out of the twin stacks of Building 331. • Evaluate a proposal to place a National Bio and Agro Defenses Laboratory at LLNL. 		
NTS (Nevada)	Commentors submitted comments regarding the siting of “Complex Transformation” at NTS, these included: <ul style="list-style-type: none"> • NPR indicates concern over current 2-3 yr. nuclear test readiness at NTS which may not achieve the stated goal of a "responsive" complex. • Need to be very clear and explicit regarding assembly and disassembly of nuclear weapons at NTS as it is a new activity and not analyzed in the NTS SWEIS. • Discuss plan for an Advanced Hydrotest Facility. • Clarify how the mission of the NTS is to be realigned. • Evaluate to what extent the NTS would be a consolidation site. • Missions at NTS related to sub-critical tests are inconsistent with the proposed action. • NTS is an unsuitable location for siting the proposed CPC. • Discuss impacts, if sited at NTS, the proposed action would have on Yucca Mountain. • Consider impacts to Nellis Air Force Base, Area 5 and Area 3. • Concern in DOE’s poor decision-making as shown in the decisions regarding the AHF at NTS. 	2, 4, 215,587, 1048	Sections 2.1.2, 2.3.1, 3.2.3, 3.4.1, 3.12.3, 3.14.3, 6.2.3, Chapter 2, 3, 4
TTR (Nevada)	Commentor suggested that TTR be considered as a site for consolidation.	793	Section 3.5.1, 3.10.1
Pantex (Texas)	Commentors submitted comments regarding the siting of “Complex Transformation” at Pantex, these included: <ul style="list-style-type: none"> • Examine integrating test flight operations with existing DoD test capabilities such as TTR. 	4, 6, 73, 792, 1125, 1207, 1224	Sections 3.2.3, 3.10.4, 3.15, 4.5, 5.5.12

Topic 10. Candidate Sites

Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Consider the dangers of airports in the area or consider moving location of flight paths so they are not over Pantex. • Pantex is not ready for W88 production because of shortage of existing resources. • Dismantlement should be given priority over weapons programs. • Stated that Pantex should not be considered a reasonable candidate site when Pantex has public access to fence lines that are only a short walk from the border of the site. 		
SNL (New Mexico)	<p>Commentor submitted comments requesting the following discussion for SNL/NM be included:</p> <ul style="list-style-type: none"> • Discuss the role SNL will play in certifying the plutonium pits. • Discuss the increased potential for tritium releases. • Discuss the increase in explosive components testing and the release of toxic contaminants. • Discuss if SNL will be operating its thermal treatment unit and what toxic pollutants will be released. • Discuss the potential for tritium accidents that can occur at SNL. • Suggest preparing a more updated EIS and specifically address water consumption rates. 	1217	Sections 3.2.6, 3.9.1.4, 3.12.1.3, 5.13, Chapters 2, 4
SRS (South Carolina)	<p>Commentors submitted comments regarding the siting of “Complex Transformation” at SRS, these included:</p> <ul style="list-style-type: none"> • Clarify if the SRS SNM is included in the consolidation. Is consolidation aimed at both weapons and non-weapons related SNM? • Consider that the attitude at SRS concerning support for Complex Transformation at SRS does not reflect the opinion of the entire state. 	4, 405	Section 3.7.1.3, Chapter 3
Y-12 (Tennessee)	<p>Commentors submitted comments regarding the siting of “Complex Transformation” at Y-12, these included:</p> <ul style="list-style-type: none"> • Objection to the counter-productive exclusion of options for consolidating uranium, secondary, and case fabrication activities currently performed at Y-12 and the declared intention to press ahead with an EIS and ROD covering modernization of Y-12 capabilities even as the Complex Transformation SPEIS is underway. 	2, 73, 208, 322, 792, 795, 1129	Sections 1.5.4.2, 3.2.9, 3.5.1.1, 4.9, 5.9.12, Chapter 10

Topic 10. Candidate Sites

Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none">• Concern about soil, water, and air pollution caused by Y-12.• Concern about the construction of the HEU Facility in reference to the proposed construction of the CNPC at Y-12.• Suggested that environmental cleanup of the site be included as a key component.• Expressed support for Y-12 remaining the weapons' complex center of excellence for uranium and other SNM.• Expressed concern about beryllium toxins in Oak Ridge.• Stated that Y-12 should not be considered a reasonable candidate site when Y-12 has public access to fence lines that are only a short walk from the border of the site.		

Topic 11. Additional Analysis

Subtopic	Comment Summary	Documents	SPEIS Reference
Additional analysis – general	<p>Comments were received requesting that additional analysis be conducted. General comments included:</p> <ul style="list-style-type: none"> • Site-specific EIS evaluations and impact mitigation strategies for all potential CPC sites must be completed in the Draft SPEIS. • Separate impact studies should be conducted for downwind and down gradient communities. • SPEIS must list the number of augmentation weapons, reliability-reserve weapons and weapons to fulfill NATO commitments. 	4, 536	Sections 2.3, 4.x.4.11 for all sites, Chapter 5
Nuclear weapons activities	<p>Commentors submitted comments regarding additional analysis pertaining to nuclear weapons activities. These included:</p> <ul style="list-style-type: none"> • Analysis of historical, current, and international consequences due to U.S. nuclear weapons activities, including who have been impacted internationally, as well as locally, regionally, and nationally by the proposed future activities; who have benefited from the past nuclear weapons activities; how U.S. nuclear weapons have increased global security; and environmental and health impacts (nationally and internationally) from Cold War arms race. • Include analysis of possible use of one weapon currently in stockpile, an advanced concept, or RRW from smallest nuclear weapon to largest. • Include analysis showing the number of DOE-sponsored hydrodynamic shots at each site that are devoted to in whole or part of nuclear weapons development and for those that are strictly for maintenance. • SPEIS must list the number of augmentation weapons, reliability-reserve weapons and weapons to fulfill NATO commitments. • Clarify reliable or usable nuclear stockpile of weapons. • Study the phase-out of duplicative facilities. 	5, 9, 263, 1219, 1222	Sections 2.1, 2.2, 2.5, .5, 3.7, 3.8, 3.9, 3.11, 3.12, Chapter 5
Special nuclear material	<p>Amount of SNM declared as surplus should increase as disarmament advances. Discuss how materials would be immobilized in forms that are difficult to assess and retrieve under the NPT Compliance/Disarmament Alternative.</p>	9	Section 6.2.4, 6.3.4

Topic 11. Additional Analysis

Subtopic	Comment Summary	Documents	SPEIS Reference
Environmental analysis	<p>Commentors submitted comments regarding the analysis of environmental impacts. These included:</p> <ul style="list-style-type: none"> • DOE should provide a thorough analysis of the environmental effects of dismantling international anti-proliferation treaty and disarmament efforts with special attention to the U.S.'s effect on the international community as the world's superpower. • Include analysis focusing on global environmental effects from developing new nuclear weapons and furthering the nuclear arms race. • Due to increased rains a study of global warming and the increased flash floods needs to be done. Past studies will not be adequate if we are facing more storms and more runoff during the summer. 	Campaign 18, 31, 75, 339, 1128	Chapter 5

Topic 12. Kansas City Plant

Subtopic	Comment Summary	Documents	SPEIS Reference
KCP - general	The KCP should be relocated to Albuquerque to save travel between sites and facilities	574	Section 1.5.4.2
Objection to exclusion of KCP	<p>Commentors object to the exclusion of KCP, as it blatantly seeks to prejudice and preempt the consideration of cost-effective complex consolidation options that would redistribute remaining KCP missions and capabilities to LANL and SNL where some 10% of KCP employees are already assigned. Commentors also state that the full cost of Complex Transformation is not being represented by the exclusion of KCP.</p> <p>Commentor also objects to the exclusion of an analysis of further non-nuclear consolidation and production modernization at the KCP as it seeks to prejudice the consideration of cost-effective complex consolidation options that would redistribute remaining KCP missions and capabilities to LANL and SNL.</p>	2, 4	Sections 2.3.4, 3.2.10, Chapter 1, 2
NEPA analysis for KCP	Commentor questions where and what is the status of the separate NEPA analysis that the Complex Transformation NOI cites for KCP.	4	Section 3.2.10

Topic 13. Waste Isolation Pilot Plant

Subtopic	Comment Summary	Documents	SPEIS Reference
WIPP – general	Commentors submitted comments that were general in nature regarding WIPP. These included: <ul style="list-style-type: none"> • Commentors questioned what other WIPPs or extensions of WIPP are being considered for Complex Transformation. • Commentor suggested that WIPP or WIPP substitutes and TRU waste final disposition need to be considered and analyzed. • Not one site in the complex has been cleaned up because of WIPP. • Include an analysis on impacts of transportation of waste, not only to WIPP, but also to subsequent disposal facilities. 	4, 5, 1218	Sections 5.10, 5.11, 10.5.5
WIPP as a candidate site	Commentor requested an explanation as to why WIPP/Carlsbad was not considered as a site for Complex Transformation.	1218	Sections 3.1, 3.2, 3.3
Future of WIPP	Commentors questioned the plans for future waste disposal after WIPP is closed.	4, 5	Section 10.5.5
Support for WIPP as a candidate site	A commentor expressed support for Carlsbad because it has remote location to promote security, has the community support for nuclear weapons production, has two national labs, and has complete radiological monitoring capabilities.	1218	Sections 3.1, 3.2, 3.3, 10.5.5
Opposition to WIPP	Commentor expressed opposition to WIPP being redeveloped or maintained in NM or any other state. Another commentor expressed opposition to siting a Complex Transformation facility at WIPP/Carlsbad.	216, 1218	Sections 3.1, 3.2, 3.3, 10.5.5

Topic 14. Sabotage and Terrorism

Subtopic	Comment Summary	Documents	SPEIS Reference
Sabotage and terrorism – general	<p>Commentor expressed concern about possible safety breaches at Y-12.</p> <p>Commentor stated that production of nuclear weapons and consolidation of storage of nuclear materials at one site would provide one target that is more susceptible to terrorist acts.</p>	33, 71, 96, 104, 221, 286, 320, 374, 405, 450, 562, 525, 526, 723, 731, 845, 955, 1102, 1210, 1176, 1210, 1222, 1223	Section 1.1.2, Appendix H
Evaluation of sabotage and terrorism	<p>Commentors generally expressed the opinion that Complex Transformation could be targets for sabotage and/or terrorism (intentional destructive acts).</p> <p>Commentors suggested that the SPEIS address safety issues and security risks if security is breached, calculate human error risks, and analyze the possibility of construction of an improvised nuclear device made from stolen or diverted plutonium or HEU.</p> <p>Several commentors expressed concern with risks associated with shipment of nuclear materials. Analyze terrorist attack associated with transportation of nuclear materials.</p> <p>Commentors requested that the SPEIS consider the additional security and emergency response capabilities that may be needed by the local governments immediately adjacent to facilities.</p>	Campaign 7, Campaign 14, Campaign 19, 4, 5, 9, 31, 184, 191, 294, 329, 383, 405, 460, 516, 636, 725, 770, 861, 1083, 1188, 1187, 1209, 1213, 1217, 1218, 1219	Section 21.1.2, .3.5, Sections 5.x.12 for all sites, Appendix C, Appendix H
Suggested actions to protect against sabotage and terrorism	<p>Commentors expressed a concern over the possibility of sabotage and/or terrorism. Commentors provided suggested actions to protect against sabotage and/or terrorism. These included:</p> <ul style="list-style-type: none"> • Commentors expressed the need to consider possibility of accidental or intentional detonations of nuclear devices by accident or terrorist attack. • One commentor urged that tighter oversight and more token enforcement be applied at all levels of the mission. • Commentor requested an analysis of whether existing programs can be used to meet unanticipated events, instead of Complex Transformation. • Commentor suggested that a security assessment be done to provide input on the various ways the material will be made vulnerable including storage, transportation, loading/unloading, packaging, processing, etc. 	4, 5, 9, 10, 322, 466, 568, 1044, 1213, 1216	Sections 1.1.2, 2.3.5, Chapter 2, Appendix C, Appendix H

Topic 14. Sabotage and Terrorism

Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Commentor suggested that an evaluation of the complex-wide safety and security problems be conducted and include plans to address these issues. • Commentor requested an explanation of the insecurity of current plutonium operations and the need for increased security. • Provide detailed analysis of expected increased safety that will occur. As a baseline, provide potential impacts of maintaining the current level of security and safety along with the impacts of upgrading current security. • Suggestion to perform an investigation into each police officer's background for terrorist activities or corruption; abuse of U.S. citizen, motorists and visitors; and the potential threat to U.S. security before storage of any nuclear material at one site. 		
LANL	<p>Some commentors had specific concerns on the risk at LANL. Some LANL facilities are relatively vulnerable to attack from the ground; most are vulnerable from the air. A commentor also stated that Complex Transformation threatens the LANL community with increased risk of warhead production.</p> <p>Another commentor stated that transportation of larger amounts of plutonium makes LANL a target for a terrorist attack.</p>	4, 6, 10, 320, 538	Sections 5.1.12, 5.2, Appendix H
Pantex	<p>Commentors had specific concerns on the risks at Pantex. Given the proximity of the airport to Pantex, constant air traffic, and addition of more dangerous operations, the consequences of a terrorist attack should be evaluated</p>	Campaign 20, 954, 1224	Appendix H
LLNL	<p>Commentors had specific concerns on the risks at LLNL. LLNL's plutonium should be moved only once and should not be used in new nukes. Moving plutonium twice is not safe or secure.</p>	4, 9	Section 3.7.2

Topic 15. Resources

Subtopic	Comment Summary	Documents	SPEIS Reference
Land Use			
Land use - general	<p>Commentor requested existing square footages and proposed square footages for all facilities (existing, proposed and proposed to be eliminated) and analyze environmental impacts at sites with increased activity due to consolidation of SNM at some sites.</p> <p>Another commentor suggested that cumulative impacts section include local renovation, expansion, and development information in the ROI. Commentor also suggested that all candidate sites complete a Land Use Management Plan EIS.</p>	4, 1225	Sections 3.4, 3.5, 3.6, 4.x.1 for all sites, 4.x.3 for all sites, 5.12
LANL	<p>Commentors provided specific comments on LANL land use. These included:</p> <ul style="list-style-type: none"> • Provide impacts of SNM on land use. • Provide impacts to pueblos and sites where facilities are to be developed. 	1217, 1219	Section 5.1.1
Pantex	<p>Commentors provided specific comments on Pantex land use. These included:</p> <ul style="list-style-type: none"> • Will the land area of Pantex need to be expanded? • Complete a full analysis of land use. 	330, 1212	Section 5.5.1
Visual Resources			
NTS	<p>Commentor requested that the SPEIS include an assessment of mitigation measures (use of existing facilities/infrastructure, "dark sky" measures, logical improvements and use of appropriate screening/structure colors) that can be included to abate cumulative visual impacts. Commentor also expressed concern on cumulative visual impacts to public land users' experiences.</p>	173	Section 5.3.1, 5.3.2
Site Infrastructure			
Site Infrastructure - general	<p>Commentor stated that specific information on supplier plans to meet expectations of increased demand on site infrastructure resources must be provided in detail.</p>	1225	Section 4.x.3 for all sites
LANL	<p>Commentors provided specific comments on LANL site infrastructure. These included:</p> <ul style="list-style-type: none"> • TA-55 remains without adequate continuous power supply. • Entire LANL site lacks a secure electrical power grid. • Concern that infrastructure and operation budget has been scaled back to account for future missions activities with 	6	Sections 4.1.3, 4.1.12

Topic 15. Resources

Subtopic	Comment Summary	Documents	SPEIS Reference
	subsequent inadequate reinvestment in HVAC and fire systems. <ul style="list-style-type: none"> • Concern that LANL still lacks ventilation and monitoring systems at PF-4 which will continue to function following serious accidents. LANL was still insisting on applying this same loose approach to its proposed new CMRR facility. • LANL does not have infrastructure to support Complex Transformation operations. 		
Pantex	Commentors provided specific comments on Pantex site infrastructure. These included: <ul style="list-style-type: none"> • Provide discussion of facilities that will be used and any modifications or new facilities that will be needed for the storage of SNM. • Provide water and utility needs be for the various combinations of current work. 	330	Sections 3.7.3, 5.5.3, 5.5.4, 5.12.3
SRS	Commentors stated that SRS has modern infrastructure with large-scale plutonium experience and national lab with core competency in plutonium R&D and is capable of handling operations dealing with Complex Transformation construction and operation.	922, 928, 929, 930, 931, 932, 933, 934, 935, 936, 912, 913, 915, 916, 918, 919, 920, 1212	Section 3.2.8
Y-12	Commentor stated that investment in the modernization of Y-12 must continue to ensure safe, secure working conditions.	1129	Section 3.3.1
Air Quality and Noise			
Air Quality and Noise - general	Commentors provided comments on air quality and noise that were general in nature. These included: <ul style="list-style-type: none"> • Incorporate plants and all other parts of the ecosystems that may be damaged by ozone. • NNSA must publish and make publicly available prior to the issuance of the Draft SPEIS a comprehensive list of "duplicative facilities." The Draft SPEIS must analyze the various alternatives for eliminating such duplicative facilities. 	525, 1225	Sections 3.8, 3.9, 3.11, 3.12 4.x.7 for all sites
LANL	Commentors provided specific comments on LANL air quality and noise. These included: <ul style="list-style-type: none"> • LANL must be required to reevaluate and broaden their air sampling programs. • Complex Transformation will increase dangerous air emissions. • Concern that no air quality studies, health studies or EJ studies have been performed downwind from LANL even though LANL has violated the CAA through its emissions. 	206, 536, 1128, 1218, 1221	Sections 4.1.4, 5.1.4,

Topic 15. Resources

Subtopic	Comment Summary	Documents	SPEIS Reference
Water Resources			
LANL	<p>Commentors provided specific comments on LANL water resources. These included:</p> <ul style="list-style-type: none"> • Expressed concern that chemicals and radionuclides have been found in plumes close to drinking water sources near Los Alamos and springs that feed the Rio Grande, which is a drinking water source and the largest source for irrigation water in NM. • Provide explanation on how NNSA proposes to remediate the aquifer under LANL. • Stated that data collected from groundwater wells at LANL is unreliable and that DOE is not in compliance with DOE Order 450.1 Environmental Protection Program, which requires LANL to have a groundwater surveillance monitoring program in place by December 31, 2005. • Expressed concern that proposed activities would increase water usage above the amount allotted to it from the regional aquifer. • Concern that groundwater contaminants from current operations have moved off-site and are contaminating the drinking water supply wells for Los Alamos County and the Buckman Wellfield, where over 40% of Santa Fe's drinking water supply is located. 	Campaign 12, 5, 48, 67, 96, 111, 206, 300, 320, 324, 536, 538, 507, 590, 684, 781, 1056, 1104, 1217, 1218, 1221, 1223	Sections 4.1.5, 5.1.5
LLNL	<p>Commentors provided specific comments on LLNL water resources. Commentor expressed concern about the serious problem of uranium in the water table. Another commentor questioned how many years before the water on the earthquake fault will be affected around LLNL.</p>	1219, 1220	Sections 4.2.4, 4.2.5, 4.2.6
NTS	<p>Commentors provided specific comments on NTS water resources. These included:</p> <ul style="list-style-type: none"> • Provide detail regarding the contamination of groundwater with physical data and show that the statement that "much of the radioactivity exclusive from tritium, remains captured in the original cavity, and thus not available to leach into the groundwater" is valid. • Concern that U-238 and tritium will be used in test shots because use of U-238 and tritium are not included in water 	215, 587, 1048, 1219	Section 4.3.5

Topic 15. Resources

Subtopic	Comment Summary	Documents	SPEIS Reference
	permit. <ul style="list-style-type: none"> • Concern regarding DOE’s ability to accurately characterize groundwater contamination and migration within the 300-square miles under NTS. 		
TTR	Commentors provided specific comments on TTR water resources. These included: <ul style="list-style-type: none"> • Expressed that water is not an issue in the TTR area and that there is enough to support the complex. • There is commitment to protect the aquifer. 	534, 1212, 1213	Sections 4.4.4, 4.4.5
Pantex	Commentors provided specific comments on Pantex water resources. These included: <ul style="list-style-type: none"> • Concern about the project’s impact on the water supply of the Ogallala Aquifer in reference to agriculture and potable water. • Concern about severe water shortage in Texas. • Concern about ecological effects to scarce water resources in the Great Basin. • Concern about impacts on water resources. • Stated that water impacts must be examined individually and cumulatively for each alternative. • Provide long-term ecological effects of leaving radioactive and chemical contaminants that may pollute water resources while other facilities are being built. 	153, 325, 388, 475, 700, 701, 757, 892, 893, 789, 1205, 1206, 1051, 1212, 1219, 1217, 1222, 1223, 1224	Sections 4.5.5, 4.5.7, 5.5.4, 5.5.7
SNL	Commentor questioned the anticipated impact on downstream cities when the aquifer is dried up.	1215	Section 4.6.5
WSMR	Commentor is concerned about the water supply contamination from WSMR activities.	1218	Section 4.7.5
SRS	Commentors provided specific comments on SRS water resources. These included: <ul style="list-style-type: none"> • Determine/ensure compliance of operations with current NPDES permit (i.e., Hg effluents). • Expressed concern on the Jasper-Beaufort Water District, which is measuring around 600pCi/L of tritium in the drinking water, which is a direct result of the current inventory and stockpiles of weapons-grade nuclear materials. • Concern about existing groundwater contamination as a result of tank residues. • Concern about cleanup/remediation of aquifer near SRS. 	405, 511, 572, 783, 1208, 1209	Sections 4.8.5, 10.5, 10.6.5

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> Concern about danger of further contamination of SC or GA water supply due to releases by SRS. 		
Water Resources			
Water Resources – general	Commentor stated that the groundwater around Rocky Flats is polluted, and needs to be cleaned up.	1217	Section 4.6.5
SRS	Commentor expressed concern about previous contamination of SRS and expressed a specific concern regarding the threat posed by tank residues to groundwater.	404	Section 5.8.5, 5.8.11
Geology and Soils			
Geology and Soils - general	Commentors expressed concern for the loss of fertile soils used for agriculture.	947	Sections 4.x.6 for all sites
LANL	<p>Commentors provided specific comments on LANL geology and soils. These included:</p> <ul style="list-style-type: none"> Concern for the approximately 50,000 drums of TRU waste stored in tents at TA-54, one mile upwind from White Rock; an earthquake could cause drums to rupture and release approximately 1/4 of above-ground TA-54 radioactivity. Seismic issues at LANL need to be adequately analyzed as most environmental assessments appear to be in significant error. 	6, 281, 947, 1177, 1217, 1218	Section 4.1.6, 4.1.6.3, 4.1.13, 5.1, 5.1.14, Chapter 7, Section 9.1
LLNL	Commentors expressed concern for the 7 million people that live in a 50-mile radius of LLNL where the main site is 200 feet from earthquake faults and Site 300 has a fault running through it.	9, 300, 320, 692	Sections 4.2, 5.2, 4.2.6.3
NTS	<p>Commentors provided specific comments on NTS geology and soils. These included:</p> <ul style="list-style-type: none"> Need to determine the existing soil contamination data throughout NTS, surrounding areas, and areas downwind. Soil analysis data should contain the inventory of radionuclides present at various depths to a depth of at the very least 20 cm. Concern that the NTS area has experienced 620 earthquakes in the last 20 years with the largest a magnitude of 5.6. An earthquake with a magnitude of 7 is possible. Discuss how design of facilities can be built to prevent damage and radiological releases. NTS should not be considered for plutonium operations and SNM consolidation because of seismic activity. 	47, 215, 587, 1048, 1221	Sections 4.3, 4.3.6.2, 4.3.11, 5.3, 10.5, 10.6

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Subtopic	Comment Summary	Documents	SPEIS Reference
SRS	Commentors expressed concern regarding location of SRS, which is located within proximity to a fault line responsible for the Charleston earthquake of 1868.	1208	Sections 4.8, 4.8.6
Y-12	Commentors stated that fractured limestone with caverns, fissures, sinkholes make recovery from project construction and operations impossible.		Sections 4.9, 5.9
Biological Resources			
Biological Resources - General	Commentors suggested that DOE consider the ecology and environment and characterize any changes to the Complex in order to take remedial action, if necessary. Commentors also expressed concern regarding explosive testing effects on T&E species.	459, 1225, 1189	Sections 4.x.7 for all sites, 5.x.7 for all sites
NTS	Commentor suggested that DOE explore whether various plants and animals within and near NTS have radionuclide concentrations.	1048, 215	Section 4.3.7
Cultural and Archaeological Resources			
Native American resources	Commentors suggested that an assessment of the possible endangerment of the Native Americans and other indigenous people be considered. Numerous commentors were concerned about activities occurring on Native American lands or taking advantage of indigenous/aboriginal people and stated that Native Americans have been wiped out from nuclear material contamination.	104, 538, 1111, 1216, 1217	Sections 5.x.8 for all sites
Western Shoshone	Commentors stated that the SPEIS must include an explanation of how U.S. government and Shoshone Nation Agreement in the Treaty of Ruby Valley of 1872 can be ignored. The SPEIS must also include how gradual encroachment (as the ICC alleged and was upheld by the Supreme Court) is a plausible reason for taking of Shoshone land when that is the ruling of only one Nation (the US). The IACHR and UNCERD decisions that the U.S. was unjust in the taking of land need to be considered.	9, 215, 763, 1048, 1223	Section 4.3.8
LANL	Commentors stated that the Jemez Mountain range is the ancestral homeland to the surrounding Sovereign Pueblo Nations and should be considered in the analysis of LANL.	538, 1056	Sections 4.x.8 for all sites, 5.x.8 for all sites
Socioeconomic Resources			
Socioeconomic Resources - general	Commentors provided comments on socioeconomic resources that were general in nature. These included: <ul style="list-style-type: none"> • Define the size of the workforce and the socioeconomic impacts to all proposed sites for the consolidated plutonium 	4, 327, 328, 376, 616, 747, 1125, 1208, 1209, 1210, 1217, 1218, 1224, 1125	Sections 4.2.9 for all sites, 5.x.9 for all sites

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>center, assembly/disassembly, hydrodynamic testing and sub-critical testing.</p> <ul style="list-style-type: none"> • Create jobs and security through devising cleanup activities. • Consider the impacts to American exports abroad as a result of the use and development of nuclear weapons. • Consider whether the community is tied too closely to a dangerous and unstable industry and thus unable to attract other jobs, investments, and residents. • Concern that decision to support project are based on financial reasons (no other opportunity for local area employment) versus making decisions based on health. • Perform careful studies of the economies, populations, and tax structures of existing nuclear communities compared to similar but non-nuclear communities. • Concern that Complex Transformation would devastate real estate values and businesses. • Stated that New Mexico dependence on nuclear industry is not entirely true. • Provide an analysis of economic impacts to businesses from a nuclear incident. • Socioeconomic scope must be broader and include more factors relating to regional socioeconomic characteristics. • Perform assessment of socioeconomic impacts to local communities. • Provide information on how many jobs will be lost from consolidation to one site. • Consider benefits from direct and indirect jobs, taxes and payments in lieu of taxes (PILT). • Consider whether too much of the land in the community would be taken up by the project and not be available for other economic uses and whether the jobs created would be relatively few and unstable jobs done for the most part by contractors. • Overall socioeconomic impact to local communities should be included as an evaluation criterion for deciding on a specific site. • Realistic estimates of increased/decreased workforce, identification of support industries and businesses that would 		

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Subtopic	Comment Summary	Documents	SPEIS Reference
	be added/reduced, as well as indirect impacts to county infrastructure should be included.		
LANL	Commentors provided specific comments on LANL socioeconomic resources. These included: <ul style="list-style-type: none"> • Stated that budgeted \$155 billion will benefit New Mexico with jobs and status and economic development. Benefit would be marginal. • Stated that for the past 20 years NM has received more net federal spending per capita, much military, yet social, environmental, and economic well-being have declined. Complex Transformation claims the budgeted 155 billion dollar project will benefit NM with jobs and status and economic development. How will it be different from past funding? • Concern about the Santa Fe tourism industry. 	10, 84, 146	Sections 5.1.9
NTS	Commentors were concerned about how the employment profile would be affected since weapons assembly and disassembly would be a new activity at NTS and given the stated need to reduce the nuclear stockpile and update stockpile weapons. It should be assumed that the workforce for NTS would come from Nye County.	1048, 1125, 215	Sections 4.3.9, 5.3.9
TTR	Commentors provided specific comments on TTR socioeconomic resources. These included: <ul style="list-style-type: none"> • Stated that the loss of 100-150 jobs will reduce resources and services in Tonopah and other Northern Nye and Esmeralda County communities. Commentor requests that the ROI take into account not only Tonopah but surrounding rural communities. • Expressed concern that closing TTR would significantly impact local community. Tonopah does not have the economic base to retain citizens within the community if jobs at TTR are lost. 50 percent of volunteers/organization members are County/State/TTR employees and 50 percent of the Tonopah Volunteer Fire Department are TTR employees. Mitigation measures should be presented for both adverse and beneficial impacts. • Consider that funds required to keep TTR operational are lower 	724, 793, 858, 1125, 1197, 1196, 1213	Sections 4.4.9, 5.4.9, 5.15.4.2

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>than facility upgrades at other sites.</p> <ul style="list-style-type: none"> Address impacts from continuation of operations at NTS and TTR using workforce primarily outside of Nye County; continuation and/or addition of operations using more workforce and resources from Nye County; and discontinuation or reduction of operations at NTS and TTR. 		
SNL	<p>Commentor stated that for the past 20 years NM has received more net federal spending per capita, much military, yet social, environmental, and economic well-being have declined. Complex Transformation claims the budgeted 155 billion dollar project will benefit NM with jobs and status and economic development. How will it be different from past funding? Another commentor expressed concern about the tourism industry in Santa Fe.</p>	84, 146	Sections 5.6.9
Pantex	<p>Commentor stated that Pantex is a valuable economic asset for the region.</p>	1212	Sections 4.5.9, 5.5.9
SRS	<p>Commentors stated that SRS employees fill a variety of community service positions and that the CPC will employ over 2,500 people.</p>	923, 924, 1209	Sections 4.8.9, 5.8.9
Y-12	<p>Commentors supported the operations at Y-12 and stated that Y-12 has a tremendous economic impact on the region.</p>	463, 940, 941, 917, 918, 1198	Section 4.9.9, 5.9.9
Environmental Justice			
Environmental Justice - general	<p>Commentors provided comments on environmental justice resources that were general in nature. These included:</p> <ul style="list-style-type: none"> Stated that the poorest communities bear most impacts. Studies to ensure the poor/minority/disabled populations aren't suffering the brunt of emissions must be included. Environmental justice analysis for transportation routes and disposal areas, private and public, needs to be included. Provide an EJ analysis in case pueblos have to be abandoned for all options including LANL. Include analysis of impacts to young children and women; health impacts related to exposure to radiation and other contaminants generated during the proposed activities (i.e., cancer fatalities, non-cancer effects, non-fatal instances of cancer, and psychological impacts); health impacts from the entire life cycle (including transportation); and health impacts from pathways used by indigenous people. 	Campaign 2, Campaign 8, 5, 76, 451, 536, 678, 715, 646, 653, 943, 1068, 1152, 1156, 1178, 1190, 1191, 1217	Sections 4.x.10 for all sites, 5.x.10 for all sites, 5.10

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Subtopic	Comment Summary	Documents	SPEIS Reference
LANL	Commentors stated that operations at LANL are a major violation of environmental justice. New Mexico has the second highest minority population in the country and it is not possible that LANL activities would have no effect on these populations. Environmental justice issues in NM must be analyzed.	5, 260, 1056, 1221	Sections 4.1.10, 5.1.10
NTS	Commentors stated that the SPEIS should consider potential impacts on eastern Nevada, southern Nevada, western Utah, areas previously subject disproportionately to exposure to radiation from above and vented underground nuclear weapons tests.	302	Sections 4.3.9, 5.3.9
SNL	Commentors stated that DOE must analyze for the many environmental justice issues in NM.	5	Sections 4.6.9, 5.6.9
SRS	Commentor requested that an assessment of impacts from high levels of tritium in Savannah River to subsistence fishermen/women (i.e., especially those women who are pregnant and subsist on a diet primarily consisting of fish from the Savannah River) be included. Commentor also suggested that DOE consider adverse impacts to at-risk (minority or low-income) populations.	1209	Section 5.8.10
Health and Safety			
Health and Safety - general	<p>Several commentors provided comments on health and safety that were general in nature. These included:</p> <ul style="list-style-type: none"> • Concern about daily risks associated with operations. • Include the results of epidemiologic studies of radiation health of workers and communities, updating its Comprehensive Epidemiologic Resource program of the early 1990's. • Commentors expressed that the government should not consider the production of new nuclear weapons while we still are struggling to address past risks to the health of those living near or working in the weapons complex. • Suggested that cancer incidence published by the BEIR VII report for its cancer estimates since the report provides the most recent scientific assessment by the National Research Council. • Stated that nuclear weapons production poses a significant health hazard for workers and a human health risk assessment should be included in the SPEIS. • Requested that lethal dose of nuclear weapons in relation to human life be included. 	Campaign 18, Campaign 20, 3, 4, 6, 31, 38, 39, 47, 96, 104, 111, 125, 129, 138, 145, 152, 153, 157, 190, 191, 203, 209, 210, 214, 268, 303, 324, 332, 337, 340, 344, 367, 386, 390, 395, 398, 405, 421, 422, 440, 460, 478, 504, 525, 541, 543, 557, 562, 564, 593, 571, 578, 594, 599, 611, 663, 668, 671, 673, 674, 675, 678, 684, 698, 715, 719, 743, 747, 751, 767, 777, 781, 789, 811, 812, 872, 877, 954, 1083, 1101, 1102, 1104, 1126, 1128, 1135, 1152, 1156, 1183, 1202, 1208, 1209, 1210, 1212, 1217, 1218, 1219, 1215, 1222, 1223	Sections 5.x.11 for all sites, Chapter 6, Appendix C

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Concern about increased incidence of cancer in surrounding communities due to increased exposure to radioactive materials from Complex Transformation. • Evaluate impacts to the worker, community, and environmental health from daily operations, emissions, and potential accidents associated with plutonium pit manufacturing. • Concern that the CPC would have similar or more detrimental effects on the environment and to surrounding communities than did Rocky Flats Plant. • Provide analysis of long-term environmental and public health effects of plutonium pit production. 		
LANL	<p>Commentors provided specific comments on LANL health and safety. These included:</p> <ul style="list-style-type: none"> • Concern about health and safety issues at LANL. • Concern over elevated levels of americium in the northern foothills of Sangre de Cristo Mountains downwind from LANL. • Radioactive debris associated with uranium mining in NM continues to be a significant source of sickness and premature death. • LANL has a poor history of providing adequate health and safety to workers and the community. • Concern about increased incidence of cancer in surrounding communities due to increased exposure to radioactive materials from increased operations at LANL. 	6, 209, 536, 538, 684, 777, 1216, 1218, 1221, 1223	Sections 4.1.7, 5.1, 5.1.11
LLNL	<p>Commentor expressed concern about increased risk to public health as the population has grown significantly in the area surrounding the site.</p> <p>Commentor expressed concern about additional tritium activity.</p>	27, 692	Sections 5.12, 5.13, 5.14
NTS	<p>Commentors expressed concern for worker and the surrounding community's exposure to weapons assembly and disassembly activities and suggested that health implications for workers and the surrounding communities be addressed.</p>	4, 215, 302, 587, 1048, 1213	Section 5.3.11
Pantex	<p>Commentors requested that worker, community and environmental health impacts from daily CPC operations and emissions be evaluated and also to provide impacts to the Pantex region and</p>	64, 184, 167, 330, 700, 884, 885, 1224	Section 5.5.11

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Subtopic	Comment Summary	Documents	SPEIS Reference
	nation if there were to be a nuclear detonation at Pantex. Commentors suggested that Pantex expansion needs to be conducted in a way that will not impair the health and safety of area residents or have adverse effects on the environment.		
SNL	Commentor requested that each facility be identified and a description of what levels will increase at each facility that will be involved in the new Complex Transformation and provide the risks to the public.	1217	Sections 5.13, 5.14, 5.16, 5.17
SRS	Commentor expressed concern that there is currently no monitoring of any radionuclide releases from SRS. Commentor suggested that a characterization study should be performed to account for the number of people who have been affected physically (health-wise) and who have died as a result of what is occurring at SRS.	1209	Sections 4.8.4, 4.8.5, 4.8.11
Transportation			
Transportation - general	Several commentors provided comments on transportation that were general in nature. These included: <ul style="list-style-type: none"> • Concern for the potential for release of materials during transportation accidents that would threaten the environment and human health/safety. • Suggested that the transportation of plutonium should not occur until it is decided that it will not be moved again. • Consider transportation issues in/out of facilities and the need to bolster local security and emergency response capabilities. • Assess environmental and security risks associated with transportation of SNM as well as transport of nuclear bombs and bomb components. • Explain how ongoing transfers of SNM will not prejudice decisions yet to be made under the Complex Transformation SPEIS. 	Campaign 14, 4, 104, 153, 329, 376, 383, 451, 546, 571, 606, 672, 674, 861, 725, 754, 1044, 1188, 1209, 1210, 1220	Sections 1.5.4.1, 5.x.13 for all sites, 5.10
LANL	Commentors provided specific comments on LANL transportation. These included: Commentor suggested that quantities of hazardous materials shipped through the local airports be included.	1225	Section 5.1.12
LLNL	Impact analysis on traffic volumes and congestion of California highway system traffic analysis should be prepared.	945	Section 5.212

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Subtopic	Comment Summary	Documents	SPEIS Reference
NTS	<p>Commentors suggested considering the transportation of SNM and weapons into and out of NTS and its impacts to the surrounding region including Nevada highways and communities.</p> <p>Commentor suggested that the SPEIS assess cumulative impacts and risks to NV highways and communities from transportation of materials and wastes due to current NTS activities, the Yucca Mountain repository program, and Complex Transformation.</p> <p>Commentors suggested that rail transport of SNM at NTS offers security advantages over highway transport.</p>	4, 173, 215, 302, 546, 587, 1048, 1213	Sections 5.3.13, 5.10
TTR	Commentor stated that transportation routes at TTR are well maintained due to the rural location, accidents are at a minimum.	534	4.4.12
Pantex	Given the proximity of the airport to Pantex, constant air traffic, and addition of more dangerous operations, the consequences of accidents should be evaluated.	167, Campaign 20, 884, 954, 789, 1224	Section 5.10
SNL	<p>Commentors provided specific comments on SNL transportation. These included:</p> <ul style="list-style-type: none"> • Several questions regarding how materials will be transported, how much will be transported, who will be notified, and can safety be guaranteed. • Provide information on how the production of more nuclear weapons will affect the storage dump at KAFB. • Stated that use of Interstate 3 for transport of nuclear materials is not acceptable and questioned if DOE has been a party to the proposal to build Interstate 3. • 	1210, 1217	Sections 5.8.12, 5.17
SRS	Commentor questioned whether there will be international traffic in nuclear materials through the Port of Savannah as part of Complex Transformation or other DOE programs.	1209	
Waste Management			
Waste Management - general	<p>Several commentors provided comments on waste management that were general in nature. These included:</p> <ul style="list-style-type: none"> • Concern about the storage location of the significant amount of waste generated from tritium production when the current 	Campaign 12, Campaign 20, 4, 5, 103, 104, 111, 153, 303, 376, 401, 428, 433, 450, 516, 525, 544, 552, 553, 578, 562, 570,	Section 5.x.14 for all sites, 6.3.2

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>storage sites remain radioactive and environmental threats.</p> <ul style="list-style-type: none"> • SPEIS needs to include its current plans for disposing of radioactive waste and account for new research showing that synthetic zircons used to contain plutonium-rich materials are much less durable than previously thought. • Consider storing all waste on-site. • Clarify how plutonium storage, handling, production, destruction, or use is interchangeable in GNEP and Complex Transformation. • Include an analysis of the environmental and human health impacts and the costs of decommissioning, cleaning up, and waste disposal for all facilities which DOE proposes to construct, as well as existing facilities that will be demolished as a result of the proposal and how this is "economically sustainable." • Storage at Yucca Mountain needs to be addressed. • What are some of the specific factors related to disposal of hazardous wastes on- and off-site (volumes, types, how, where, impacts)? • A plan for long-term storage and mobilization should be developed. 	<p>674, 684, 712, 735, 741, 789, 954, 1208, 1209, 1210, 1211, 1218, 1217, 1218, 1220, 1222, 1223, 1224,</p>	
LANL	<p>Commentors provided specific comments on LANL waste management. These included:</p> <ul style="list-style-type: none"> • Resuming pit production will significantly contribute to existing risks associated with waste management (generation, disposal, and storage). • Concern for use of 'transportainers' as temporary vaults of fissile material at TA-55. • Comment on impacts from improper waste storage at LANL, including what would happen in event of a large fire or weather event. • Explain the effects caused by rejected pits to the waste stream. • The SPEIS must analyze for the impacts of LANL becoming the second transuranic waste disposal facility in NM. • Address how NNSA proposes to deal with the huge nuclear waste dump on the Pajarito Plateau. • Explain how NNSA intends to deal with the 12,500 drums of 	<p>Campaign 12, 5, 6, 67, 111, 260, 300, 324, 769, 781, 947, 1218, 1221, 1223</p>	<p>Sections 5.1.14</p>

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<p>nuclear waste at Area G buried before 1971 that are currently contaminating the aquifer under LANL.</p> <ul style="list-style-type: none"> • LANL has inadequate waste storage practices with waste stored in temporary areas i.e., tents in fire-prone areas. 		
LLNL	<p>Commentors expressed concern that the LLNL site has been environmentally contaminated for years and cleanup is far from over.</p>	692, 1222	Section 5.2.14
NTS	<p>Commentors questioned if the radioactive material from weapons assembly and disassembly would be disposed of or stored at NTS.</p> <p>Commentors suggested that the nature of management of SNM be described (where and how, what volume, and the radioactive inventories that could be anticipated) be incorporated into the document, and for the document to also evaluate to what extent NTS would be a consolidation site.</p> <p>Commentors also suggested that disposal of material associated with sub-critical testing be addressed.</p>	4, 215, 302, 587, 1048	Section 5.3.14
Pantex	<p>Commentors requested a discussion of emissions and waste streams generated; facilities needed; disposal options; and waste processing or storage at Pantex.</p> <p>Commentors also expressed concern about safety with regards to waste management at Pantex.</p> <p>Commentors stated that the proposed expanded operations would generate 25,000 cubic meters of TRU and WIPP only has space for 17,130 cubic meters, the excess would have to be left on-site, either in Area G or in the canyons that flow into the Rio Grande.</p>	388, 330, 789, 1217, 1224	Sections 5.5.14, 10.5.5
SNL	<p>Commentor expressed concern on the ability of the current Hazardous Waste Management Facility at SNL to handle the increased quantities of RCRA hazardous waste (up from ~53K kilos) and infrastructure related wastes (~175K kilos/yr) and questioned how the facilities will be decontaminated.</p> <p>Another commentor expressed concern for mixed waste dumps found on land planned for housing projects.</p>	1216, 1217	Section 5.17

Topic 15. Resources

Subtopic	Comment Summary	Documents	SPEIS Reference
SRS	<p>Commentors requested that DOE assess incremental impact of managing TRU, LLW, and HLW due to the siting of the project at SRS.</p> <p>Another commentor requested that the need for plutonium storage facilities apart from the current KAMS facility must be examined from an environmental, security, and cost perspective</p>	572, 1188, 1209	Section 5.8.14
Y-12	<p>Commentor suggested considering the disposition of the radioactive materials and how they will be staged, stored, or used in manufacturing at Y-12.</p>	463, 1147, 1210	Section 5.9.14
Facility Accidents			
	<p>Commentors provided comments regarding the analysis of facility accidents that were general in nature. Commentors were generally concerned about the danger of facility accidents. Other commentors suggested:</p> <ul style="list-style-type: none"> • Including the basis for its estimates of the probabilities of accidents so that the public can comment upon the reasonableness of the estimates. • Including information on the ability of the nuclear weapons complex to respond to a problem with a deployed warhead. • For severe accident consequences (i.e., large fires involving plutonium or facility-wide plutonium spill) a part of the risk analysis between alternatives should be a comparison of the consequences, given that the event occurs. • Providing a reasonable scenario of an unanticipated event. • The SPEIS should include an estimate of the consequences to the present national nuclear posture in the case that a severe event (i.e., facility wide plutonium spill) would occur, and an evaluation of whether the entire site would have to be abandoned or closed, or whether parts of operation could be continued in some locations, etc. 	3, 4, 138, 562, 770, 1218, 1209	Sections 5.x.12 for all sites, Appendix C, Appendix H
LANL	<p>Commentors provided specific comments on facility accidents at LANL and their concern regarding the occurrence of facility accidents at LANL. Some commentors suggested:</p> <ul style="list-style-type: none"> • Provide a description of consequences of major spills at LANL or major fires in terms of cancer deaths. 	3, 781, 1223	Sections 5.1.5, 5.1.9, 5.1.10, 5.1.11, 5.1.12, Appendix C

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Subtopic	Comment Summary	Documents	SPEIS Reference
	<ul style="list-style-type: none"> • Extending accident analysis radius to include impacts on Albuquerque for all alternatives including LANL. • Providing a detailed analysis of the consequences of severe plutonium releases on the Rio Grande, on the economy and society of nearby communities, of NM, and of states near NM for all alternatives including LANL. • Including an estimate of consequences to economy and society of NM in case of severe event for all alternatives including LANL. 		

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
General support for Complex Transformation	Commentors provided statements in support of the Complex Transformation proposal.	6, 73, 576, 580, 1209, 1218, 166, 171, 331, 305, 310, 311, 366, 416, 539, 545, 568, 576, 580, 759, 794, 775, 784, 960, 1208, 1209, 1218, 1222	Comment noted.
Support for the No Action Alternative	Commentor supports the No Action Alternative	1220	Comment noted.
Support for CNPC	Commentors provided statements in support of a CNPC as it would offer advantages in environmental impact, security, cost, shipping, waste management, and technical support.	73, 535, 539, 941	Comment noted.
Support for the Capability-Based and Reduced Operations Alternative	Commentors provided statements in support of the Capability-based and Reduced Operations alternative as it has significant advantages over DCE and CNPC alternatives, including no new facility construction, no increase in Pu production, reduction in # of sites with Category I/II SNM, reductions in production capacity at certain sites, and continued D&D.	460, 322	Comment noted.
Support for siting at LANL	Commentors provided statement in support of siting at LANL because pit production would provide legitimacy for LANL.	6, 49	Comment noted.
Support for siting at LLNL	Commentors provided statement in support of siting at LLNL because LLNL has the best combination of scientific capabilities and scientific staff in the United States and it has a long, thoroughly demonstrated track record of accomplishments that are second to none.	201, 1221, 1222	Comment noted.
Support for siting at NTS	Commentor provided statements in support of consolidating SNM to fewer locations, nuclear storage, HE R&D, and hydrotesting at NTS.	44, 534, 576, 1213	Comment noted.
Support for siting at Pantex	Commentor provided statements in support of keeping site plutonium functions where storage and handling capability already exists.	64, 202, 282, 493, 506, 884, 885, 1067, 1201, 1202, 1203, 1204, 1212, 1218	Comment noted.
Support for siting at SRS	Commentor provided statements in support of siting at SRS. Nearly 90 percent of the land at SRS is open and free of the encroachment issues compared to	36, 73, 199, 288, 290, 299, 304, 331, 364, 365, 366, 419, 420, 459, 523, 522, 523, 632, 657, 730, 755, 792,	Comment noted.

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
	other DOE sites and SRS has the established infrastructure to support operations of Complex Transformation.	912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 926, 927, 928, 929, 930, 931, 932, 933, 934, 936, 948, 958, 959, 960, 961, 1055, 1208, 1209	
Support for siting at Y-12	Commentors provided statements in support of siting Complex Transformation at Y-12 because Y-12 is acknowledged as America’s center of uranium excellence.	Campaign 11, Campaign 13, 46, 90, 98, 199, 205, 206, 222, 223, 226, 261, 298, 416, 417, 518, 520, 521, 532, 547, 580, 628, 630, 640, 661, 706, 707, 709, 711, 713, 714, 733, 736, 739, 742, 759, 773, 775, 784, 788, 795, 856, 871, 873, 874, 875, 880, 881, 956, 786, 788, 969, 956, 1088, 1122, 1147, 1170, 1198, 1211	Comment noted.
Opposition to Complex Transformation	Commentors provided general statements in opposition to the Complex Transformation proposal.		Comment noted.
<p>Campaign 3, Campaign 4, Campaign 6, Campaign 7 Campaign 8, Campaign 10, Campaign 15, Campaign 16, 1, 10, 11, 12, 13, 17, 21, 22, 23, 25, 50, 51, 52, 54, 55, 56, 57, 58, 59, 60, 61, 62, 67, 80, 94, 95, 157, 158, 159,160,161,162, 165, 168, 170, 172, 174,175,176, 177, 178,180, 179, 181, 182, 183, 185, 186, 187, 189, 190, 192, 193, 194, 195, 196, 197, 199, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 262, 278, 279, 280, 281 330, 536, 1048, 104, 63, 65, 66, 68, 74, 72, 69, 71, 75, 76, 216, 219, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 283, 284, 285, 286, 287, 291, 292, 332, 334, 335, 336, 337, 338, 340, 341, 346, 347, 349, 351, 352, 353, 354, 355, 356, 357, 359, 361, 368, 387, 390, 391, 392, 394, 395, 397, 400, 401, 402, 403, 406, 407, 409, 410, 411, 412, 413, 414, 421, 422, 427, 428, 430, 429, 431, 432, 433, 436, 437 , 440, 441, 442, 443, 445, 541, 542, 543, 544, 549, 550, 551, 553, 554, 555, 546, 140, 141, 142, 143, 144, 145, 293, 297, 300, 301, 306, 307, 308, 309, 312, 313, 315, 316, 317, 318, 319, 321, 323, 370, 371, 372, 373, 374, 375, 378, 379, 380, 381, 382, 383, 384, 446, 447, 448, 449, 450, 452, 453, 454, 455, 456, 457, 461, 462, , 1082467, 468, 469, 470, 471, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 492, 495, 496, 497, 498, 499, 500, 501, 502, 504, 585, 588, 589, 591, 592, 593, 572, 575, 577, 578, 579, 581, 582, 583, 584, 556, 557, 559, 560, 561, 562, 564, 565, 567, 569, 570, 594, 111, 113, 114 115, 116, 117, 118, 120, 596, 597, 598, 595, 598, 599. 600, 662, 664, 665, 666, 667, 668, 669, 670, 672, 673, 674, 675, 676, 846, 847, 848, 849, 850, 851, 852, 853, 855, 857, 860, 854, 677, 678, 679, 680, 681, 682, 683, 686, 687, 688, 689, 690, 691, 726, 725, 727, 729, 732, 734, 148, 149, 151, 152, 154, 153, 125, 129, 130, 137, 138, 139, 146, 147, 723, 738, 740, 743, 744, 746, 747, 748, 751, 752, 753, 754, 756, 758, 524, 525, 526, 527, 528, 529, 533, 535, 540, 508, 509, 510, 514, 515, 601, 602, 603, 604, 605, 606, 608, 609, 610, 611, 612, 613, 614, 615, 617, 618, 619, 620, 621, 622, 623, 625, 626, 629, 631, 633, 635, 636, 637, 638, 639, 642, 644, 645, 646, 647, 649, 651, 653, 656, 658, 659, 660, 876, 878, 888, 889, 891, 892, 893, 894, 906, 907, 897, 898, 899, 900, 901, 902, 903, 904, 905, 760, 762, 764, 765, 766, 767, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 966, 970, 971, 972, 975, 976, 977, 978, 979, 980, 951, 953, 955, 957, 963, 964, 1077, 1078, 1079, 1080, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 1081, 1085, 1086, 1090, 1091, 1093, 1096, 1097, 1098, 785, 787, 790, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 1105, 1106, 1107, 1109, 1110, 1112, 1113, 1114, 1115, 1116, 1117, 1119, 1120, 770, 771, 772, 777, 781, 782, 783, 1123, 1126, 1130, 1131, 1133, 1134, 1136, 1137, 1138, 1139, 1140, 1141, 1145, 1148, 1149, 1150, 1151, 1153, 1154, 1151, 1157, 1158, 1159, 1160, 1161, 1163, 1164, 1165, 1166, 1205, 1210, 1219, 937, 943, 944, 945, 947, 949, 950, 906,908, 909, 910, 911, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1041, 1041, 1043, 1045, 1046, 1047, 1049, 1050, 1052, 1053, 1054, 1056, 1057, 1059, 1060, 1061, 1064, 1065, 1068, 1069, 1070, 1071, 1167, 1168, 1169, 1171, 1172, 1173, 1175, 1176, 117, 1178, 1180, 1181, 1182, 1184, 1186, 1189, 1191, 1192, 1194, 1199 1212, 1211, 1213, 1224, 1217, 1220, 1219, 1215, 1221, 1216, 1222, 1223</p>			

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
Opposition to siting at LANL	Commentors provided statements in opposition to siting at LANL. Statements included general statement of opposition. Other commentors opposed because of: <ul style="list-style-type: none"> • Commentors support of increased cleanup. • LANL has had chronic safety and security issues and history of environmental contamination. • LANL's proximity to populated areas. • LANL's violations of the Clean Air Act. • Instances of contaminated groundwater and stormwater. 	3, 6, 259, 260, 264, 590, 616, 624, 682, 777, 1128, 1218, 1220	Comment noted.
Opposition to siting at LLNL	Commentors provided statements in opposition to siting at LLNL. Statements included general statement of opposition.	9, 26, 156, 164	Comment noted.
Opposition to siting at NTS	Commentors provided statements in opposition to siting at NTS. Statements included general statement of opposition.	47, 155, 587	Comment noted.
Opposition to siting at SRS	Commentors provided statements in opposition to siting at SRS. Statements included general statement of opposition. Other commentors opposed because: <ul style="list-style-type: none"> • SRS has poor soil characteristics. • SRS is located above a major aquifer and located near an important river system. • Commentor supports accelerated dismantlement activities of aging stockpile weapons. • SRS has relatively high earthquake risk. 	405, 572, 1208, 1218	Comment noted.
Opposition to siting at Pantex	Commentors stated that DOE should not include Pantex as a candidate site for consolidation, relocation, or elimination.	64, 169, 289, 494, 507, 757, 1051, 1224	Comment noted.
Opposition to siting at SNL	Commentors stated that DOE should not include SNL as a candidate site for consolidation, relocation, or elimination.	512, 1215, 1216	Comment noted.

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
Opposition to siting at Y-12	Commentors stated that DOE should not include Y-12 as a candidate site for consolidation, relocation, or elimination.	187, 342, 398, 607, 809, 1210, 942	Comment noted.
Divine Strake Environmental Assessment	Commentor submitted comments on the preparation of the Divine Strake Environmental Assessment being prepared at NTS.	263	The Divine Strake Environmental Assessment is a NEPA analysis being prepared independent of the Complex Transformation SPEIS.
Other projects and sites	<p>Commentors provided comments on other projects or sites. Comments included:</p> <ul style="list-style-type: none"> • Construction of a biological weapons complex. • National Bio and Agro Defenses- hydrodynamic testing in relation to the City of Tracy in California. • Issues at Yucca Mountain. • Cumulative and synergistic impacts of GNEP and Transformation on one community and environment should be incorporated into one single NEPA analysis. 	29, 385, 735, 1219, 1220, 1223	Comments on other projects and sites are beyond the scope of this SPEIS. The GNEP PEIS addresses use of nuclear energy for the commercial generation of electricity. This SPEIS deals with the weapons complex as related to national security. Cumulative impacts are discussed in Chapter 6 of this SPEIS.
Moral and ethical issues	<p>Commentors provided comments regarding general moral/ethical implications of the Complex Transformation proposal. Comments included:</p> <ul style="list-style-type: none"> • The support of sustainable interactions among people and the Earth. • Request for the consideration of karmic forces when following through with the transformation. • Complex Transformation regresses in reasserting America's moral heritage and imperils the pursuit of "Life, Liberty, and the Pursuit of Happiness." • Lyrics to "What a Wonderful Life." • Suggest teaching diversity and non-violence as alternatives to building nuclear weapons and promote peace. 	Campaign 8, 9, 10, 11, 24, 40, 65, 66, 70, 76, 204, 218, 228, 268, 276, 317, 351, 390, 421, 429, 515, 544, 555, 582, 584, 595, 670, 672, 850, 854, 681, 690, 721, 734, 829, 796, 998, 1003, 1217, 1222, 1223	Comment noted.
Proliferation and nonproliferation	Commentors submitted comments stating that Complex Transformation increases global proliferation of nuclear weapons and hinders nonproliferation	31, 18, 6, 5, 3, 741, 9, Campaign 18, 65, 67, 80, 81, 85,87, 88, 701, 91, 75, 153, 303, 315, 332, 338, 344, 348, 349, 355, 356, 359, 361, 367, 387,	Comment noted.

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
		393, 401, 402, 404, 405, 406, 413, 424, 427, 433, 437, 439, 440, 441, 442, 443, 444, 525, 543, 549, 551, 554, 559, 560, 567, 586, 591, 593, 571, 577, 559, 111, 569, 663, 668, 669, 671, 673, 674, 675, 860, 686, 697, 701, 704, 705, 710, 715, 717, 718, 720, 725, 732, 738, 743, 747, 748, 751, 760, 761, 762, 765, 767, 771, 781, 787, , 803, 812, 817, 824, 883, 962, 1104, 815, 1105, 1218, 1208, 1209, 1210, 1046, 1217, 1220, 1222, 1223	
Criticism of the current administration and policy	Commentors submitted comments criticizing the current administration and demanding a change in nuclear weapons policy.	4, 263, 571, 1222	The change in nuclear weapons policy and the current administration is beyond the scope of this SPEIS.
International relations/policy	Commentors submitted comments suggesting the Complex Transformation would increase danger of war with foreign countries and impact relations with foreign countries.	Campaign 4, Campaign 6, Campaign 14, 69, 76, 104, 128, 135, 132, 149, 263, 413, 515, 564, 639, 671, 747, 781, 1104, 1117, 1134, 1144, 1045, 1152, 1175, 1212, 1217, 1220, 1223, 1215, 1217, 1218, 1219	Comments dealing with international policy and relations with foreign countries are beyond the scope of this SPEIS.
Nuclear weapons	<p>Commentors submitted comments regarding nuclear weapons and weapons of mass destruction.</p> <p>Commentor questioned what new threats would emerge that would require the production of new nuclear weapons. Other commentors provided suggestions regarding nuclear weapons. These comments suggested:</p> <ul style="list-style-type: none"> • Addressing how NNSA is upholding its mission to reduce global danger of nuclear weapons by creating a new nuclear weapons production complex. • Considering the increased threat of other countries getting and using nuclear weapons as a direct result of our resuming nuclear weapons 	Campaign 14, 263, 460, 555, 735, 781, 861, 898, 952, 1135, 1188, 1218, 1223	Chapter 2

Topic 16. General

Subtopic	Comment Summary	Documents	Response/SPEIS Reference
	<p>production.</p> <ul style="list-style-type: none"> • Eliminating all tactical nuclear weapons that have the purpose of being used on the battlefield. • Committing to further reductions in the number of nuclear weapons. 		
Nuclear power	<p>Commentors provided statements regarding nuclear power and skepticism of the consideration to expand nuclear energy.</p> <p>One commentor suggested that materials used for nuclear power not be used for the development of nuclear weapons.</p> <p>Commentors also suggested an alternative that researches non-nuclear, renewable energy.</p>	<p>Campaign 4, Campaign 6, 8, 77, 203, 214, 263, 310, 333, 386, 435, 555, 562, 570, 575, 699, 747, 851, 1208, 1209, 1215, 1218, 1219, 1220, 1222, 1223, 1224, 1225</p>	<p>This SPEIS deals with the weapons complex as related to national security not nuclear power.</p>
War on Terror	<p>Commentors submitted comments regarding what role U.S. nuclear weapons will have on the current war on terror.</p> <p>Commentors are concerned that the proposed project will invoke international fears of a U.S. first strike.</p> <p>Commentors also requested that DOE assess impacts of restarting a nuclear war.</p>	<p>4, 303, 735, 819, 838, 1218, 1219, 1223</p>	<p>Chapter 2, Chapter 3</p>
IAEA Inspections in the U.S.	<p>Commentors stated that the U.S. should lead the way and be an example for other countries when dealing with nuclear weapons.</p> <p>One commentor questioned why the U.S. has not allowed IAEA weapons inspections; the consequences and benefits of allowing such inspections to take place; how such inspections by IAEA would support positive U.S. foreign relations; and who would benefit from the U.S. continuing to keep IAEA from inspecting the nuclear weapons arsenal.</p>	<p>1, 5, 16, 17, 68</p>	<p>Chapter 2</p>

Appendix E
ADDITIONAL PROJECT DETAILS

Appendix E

ADDITIONAL PROJECT DETAILS

This appendix includes additional project details specific to project sites discussed in Chapter 4 of the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS).

WATER CONTAMINATION ISSUES IN THE RIO GRANDE, FROM THE COLORADO BORDER TO THE MIDDLE-RIO GRANDE

EXECUTIVE SUMMARY

Public meetings held by the U.S. Department of Energy (DOE), National Nuclear Security Administration in 2006 identified public concerns regarding contamination of the Rio Grande. The Rio Grande has been a source for drinking water supply since the earliest settlements. Land practices in the upper and middle Rio Grande basins have contributed to contamination of soils, surface water and groundwater resources. Contaminant pathways into the Rio Grande and onto public lands are poorly understood and continue to be a focus of ongoing research. While contamination from DOE activities in the upper and middle Rio Grande basins has occurred, it has not caused exceedances of regulatory standards off DOE property.

Since the 1920s, the Federal government has intervened in the management of flows to assist in delivery of water to communities for drinking water supply, irrigation, industrial and agricultural uses. Communities in New Mexico traditionally utilize groundwater resources as community potable water sources. However, drought conditions and over-mining groundwater resources has prompted many to seek surface water resources to replace or augment their community drinking water source. The Rio Grande is the fifth largest river in North America. Its flows are sustained by surface water runoff and San Juan-Chama Project water. The San Juan-Chama Project, initiated in 1962 and managed by the U.S. Bureau of Reclamation, transfers water from the San Juan River basin in southern central Colorado to the Rio Grande basin in northern central New Mexico through a system of diversion structures and tunnels. Recent changes to San Juan-Chama Project agreements has enabled communities the opportunity to directly access San Juan-Chama water from the Rio Grande. Although several communities have expressed an interest in developing direct access to the San Juan-Chama water, three diversion projects are in various stages of development.

1 **E.1 INTRODUCTION**
2

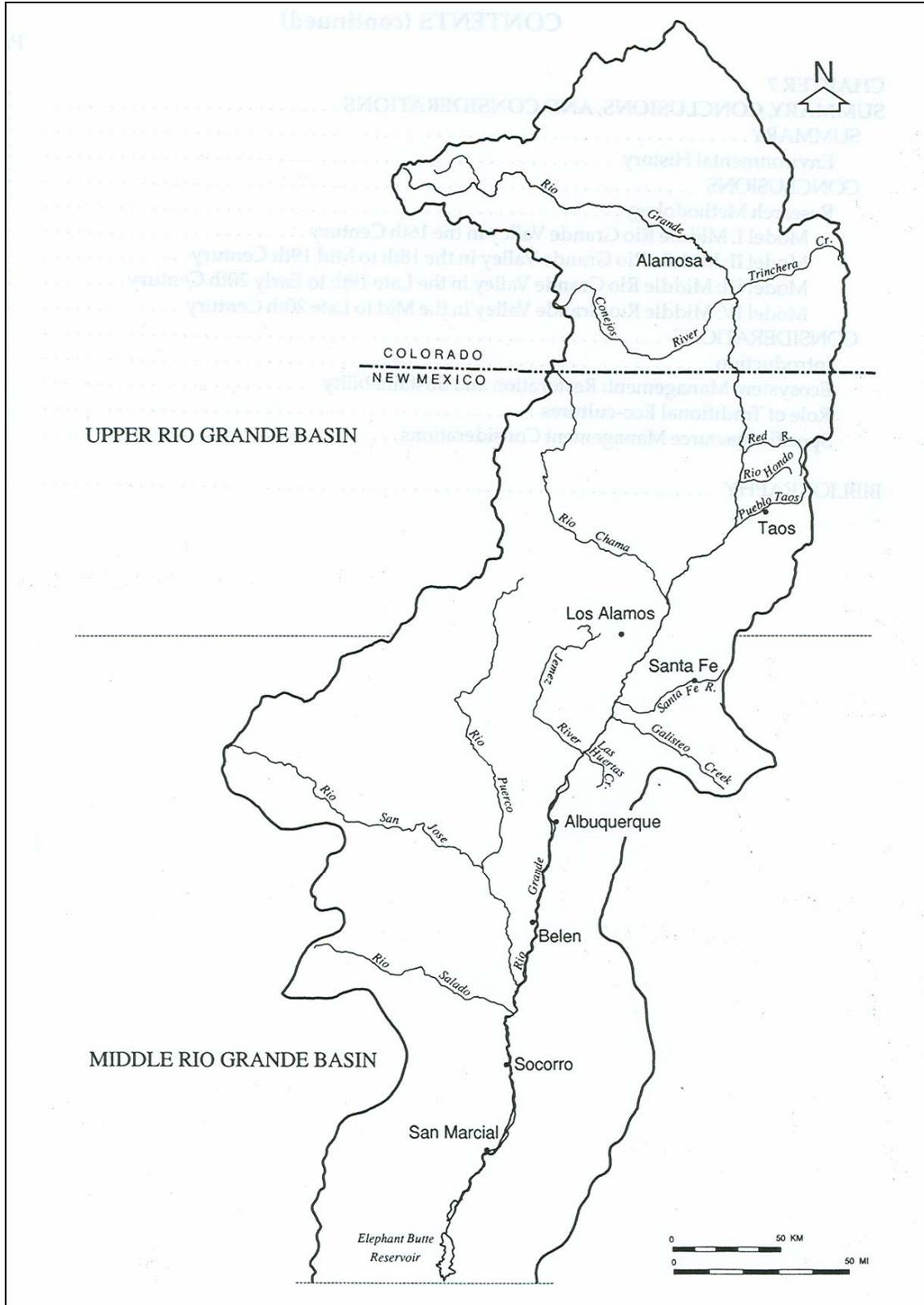
3 In 2006, the U.S. Department of Energy (DOE), National Nuclear Security Administration
4 (NNSA) undertook an effort to analyze the environmental impacts of the continued
5 transformation of the United States' nuclear weapons complex by implementing the NNSA's
6 vision of the complex as it would exist in the future, otherwise known as Complex 2030 (DOE
7 2006a). Scoping meetings held for the Complex Transformation project in 2006 identified
8 several areas of concern in New Mexico, one of them being concern over water issues. In this
9 paper, water issues in northern New Mexico are examined based upon existing research
10 conducted by various agencies and groups. No new studies were completed for this analysis.
11

12 This paper focuses upon the Rio Grande and its major tributaries in northern New Mexico, from
13 the Colorado border to Albuquerque, in central New Mexico (Figure E.1-1). The Rio Grande is
14 the fifth largest river in North America. It flows 1,885 miles from southern Colorado to extreme
15 southern Texas, where the river empties into the Gulf of Mexico (USDA 1998). The discharge
16 area of the Rio Grande in New Mexico is estimated at 27,760 square miles, with direct tributary
17 drainage area of 24,760 square miles (USDA 1998). Rio Grande headwater elevations range
18 from 8,000 to 12,000 feet and flatten to between 5,225 to 4,450 feet in the middle Rio Grande
19 Valley, near Albuquerque (USDA 1998). For the purposes of this discussion, the tributaries in
20 the upper and middle Rio Grande basins are Red River, Rio Hondo, Rio Pueblo de Taos, Rio
21 Chama, Santa Fe River, Jemez River, and the Santa Fe River. Predominant communities along
22 these tributaries are the Town of Taos, Cities of Española, Los Alamos, Santa Fe and
23 Albuquerque, Pueblo of Taos, Ohkay Owingeh Pueblo (formerly San Juan Pueblo), Pojoaque
24 Pueblo, Tesuque Pueblo, San Ildefonso Pueblo, Picuris Pueblo, Cochiti Pueblo, Santa Ana
25 Pueblo, and Sandia Pueblo.

26 **E.2 HISTORY OF ACTIVITIES**
27

28 The Rio Grande has been a source of water for generations. At the time of first European
29 contact, there were more than 50,000 Pueblos living in over 100 villages in the middle and upper
30 basins of the Rio Grande (USDA 1998). Irrigation ditch agriculture was limited at this time, but
31 intensified as larger populations settled the areas. Acequia systems took root as conveyors for
32 drinking water, bathing, washing clothes, irrigation, and watering livestock (USDA 1998). As
33 irrigation intensified, river flow in the Rio Grande was severely reduced or even halted.
34 Reduced flows in the Rio Grande have been recorded since 1925.
35

36 In 1923, Federal legislation established conservancy districts to address surface water issues.
37 These conservancies were tasked with regulating stream flow, developing or reclaiming sources
38 of water, and generating electrical energy. In 1928, a plan to develop various water control
39 measures was announced, which called for the construction of dams and diversions along the Rio
40 Grande. From 1930 to 1934, six diversion dams, the El Vado dam and storage reservoir on the
41 Chama River, 250 miles of main irrigation canals, 350 miles of drainage canals, and 190 miles of
42 levees was completed (USDA 1998). Between 1935 and 1975, the Middle Rio Grande
43 Conservancy District, the U.S. Army Corps of Engineers (ACOE) and the U.S. Bureau of
44 Reclamation (BOR) constructed and presently manages six major dams on the upper and middle
45 Rio Grande drainages to control floods, store water, and catch sediment (Table E.2-1).



Source: USDA 1998.

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Figure E.1-1 — Geographic Layout of Streams, Mountain Ranges and Communities Along the Rio Grande

Table E.1-1 — Upper and Middle Rio Grande Dams and Reservoirs

Name	Stream	Year Completed
Flood Control- Water Storage		
El Vado	Chama	1936
Jemez Canyon	Jemez	1953
Abiquiu	Chama	1963
Heron	Willow	1963
Galisteo	Galisteo	1970
Cochiti	Rio Grande	1975
Irrigation Diversion- Rio Grande		
Cochiti		1936
Angostura		1936
Isleta		1936
San Acacia		1936

Source: USDA 1998.

The San Juan-Chama project was initiated in 1962 (BOR 2006). The San Juan-Chama Project diverts water from the upper tributaries of the San Juan River, through the Continental Divide, and into the Rio Grande Basin. It consists of a two storage dams, two reservoirs, three diversion dams, six carriage facilities, five tunnels and the Azotea Creek and Willow Creek Conveyance Channels for transmountain movement of water, originating in Archuleta County in southern central Colorado and Rio Arriba County in northern central New Mexico (BOR 2006). The San Juan-Chama Project provides an average annual diversion of about 110,000 acre-feet of water (BOR 2006). The primary purposes of the San Juan-Chama Project are to furnish a water supply to the upper and middle Rio Grande valley for municipal, domestic, and industrial uses. The San Juan-Chama Project is also authorized to provide supplemental irrigation water and incidental recreation and fish and wildlife benefits. The BOR is the agency responsible for the San Juan-Chama Project.

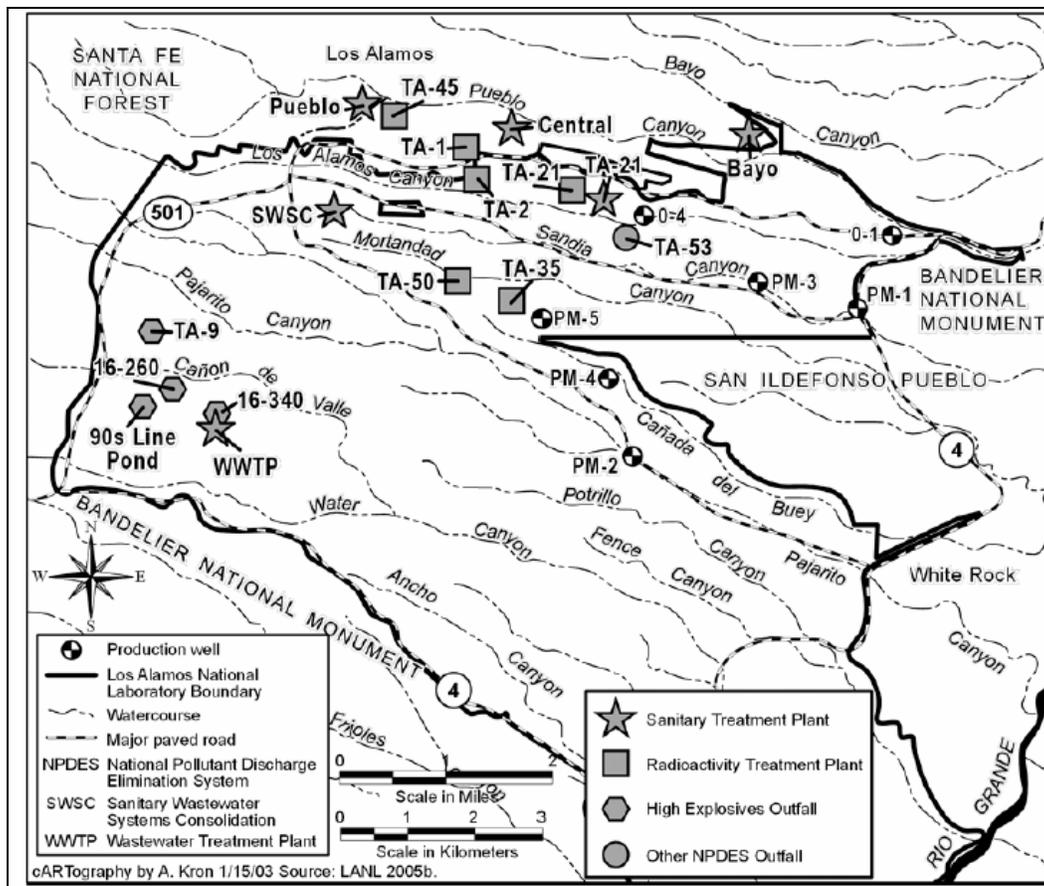
E.3 LOS ALAMOS NATIONAL LABORATORY

Los Alamos National Laboratory (LANL) was established in 1943 with the mission to research and develop the world's first atomic bomb. The mission of LANL has continued to evolve as our Nation's needs change. Improvements in laboratory practices and establishment of environmental regulations fostered stewardship of the environment. LANL sits atop Pajarito Plateau in north central New Mexico, approximately 40 miles northwest of Santa Fe. The Pajarito Plateau consists of a series of east-west oriented mesas separated by deep canyons with perennial and intermittent streams. LANL is bounded on the west by the Jemez Mountains and on the east by the Rio Grande.

From 1943 to the present, operations at LANL have generated, treated, stored and disposed of solid wastes, hazardous wastes, and hazardous wastes mixed with radioactive wastes. Solid, hazardous, and radioactive waters were disposed of in numerous septic systems, surface impoundments, pits, trenches, shafts, landfills, waste piles, and other sites located throughout LANL. The types of hazardous and solid wastes that have been handled and disposed of include chlorinated and non-chlorinated solvents, high explosives, metals, polychlorinated biphenyls (PCBs), nitrates, and radionuclides (NMED 2005a). Over the last 50+ years, the wastes from LANL began to migrate down the complicated mesa-and-canyon geography, toward the Rio

1 Grande (Buske 2003). Past LANL activities have resulted in contamination of sediments both
 2 onsite and downstream, primarily transported by effluent discharges from LANL outfalls and
 3 stormwater runoff (DOE 2006b). Figure E.3-1 shows the major liquid release sources at LANL.
 4 Current LANL operations are stringently controlled to minimize the amount of contamination
 5 introduced into the local canyons. LANL has 21 outfalls currently permitted which discharge
 6 into six local canyons. Five canyon that previously received LANL discharges are no longer
 7 receiving nay industrial effluent L Pueblo, Cañada del Buey, Guaje, Chaquehui, and Ancho
 8 Canyons. Total effluent discharges from LANL decreased by about 50 percent over the past five
 9 years (DOE 2006b).

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14 **Figure E.3-1 — Major Liquid Release Sources at LANL**

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16 The Cerro Grande Wildfire in 2000 revealed how dramatically changing conditions can suddenly
 17 flush contaminants from LANL towards the Rio Grande. Springs on the flanks of the Sierra de
 18 los Valles supply base flow into upper reaches of some of the canyons (Guaje, Los Alamos,
 19 Pajarito, Cañon del Valle, and Water Canyons), but the amount is insufficient to maintain surface
 20 flow across the plateau before it is depleted by evaporation, transpiration, and infiltration.
 21 Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a
 22 year in some drainages (Purtymun 1995). Spring discharge in lower Pajarito and Ancho
 23 Canyons is of sufficient volume to support perennial flow into White Rock Canyon and the Rio
 24 Grande (Purtymun 1995). Table E.3-1 shows the surface water and sediment contamination

1 attributable to LANL operations (DOE 2006b). Other possible sources of surface water impacts
2 are isolated spills, former photographic processing facilities, highway runoff, and residual Cerro
3 Grande Fire ash (DOE 2006b).

4
5 **Table E.3-1 — Surface Water and Sediment Contamination Attributed to LANL Operations**

Contaminant	Onsite	Offsite	Significance	Trends
Radionuclides in sediments	Higher than background in sediments because of LANL contributions in Pueblo, DP, Los Alamos, Pajarito and Mortandad Canyons	Yes, in Los Alamos, Acid, and Pueblo Canyons; and slightly elevated in the Rio Grande and Cochiti Reservoir.	Sediments below health concern, except onsite along a short distance of Mortandad Canyon; exposure potential is limited.	Increased transport of contaminated sediments in Pueblo Canyon in response to post-fire flooding and increased urbanization.
Radionuclides in surface water	Higher than background in runoff in Pueblo, DP, Los Alamos, and Mortandad Canyons.	Yes, in Los Alamos and Pueblo Canyons.	Minimal exposure potential because storm events are sporadic. Mortandad Canyon surface water is 60 percent of Derived Concentration Guide.	Flows in Pueblo Canyon occurring more often after the Cerro Grande Fire. Flows in other LANL canyons recovered to near pre-fire levels.
Polychlorinated biphenyls in sediments	Detected in sediment in nearly every canyon.	Yes, particularly in Los Alamos and Pueblo Canyons.	Wildlife exposure potential in Sandia Canyon. Elsewhere, findings included LANL and non-LANL sources.	None
Polychlorinated biphenyls in surface water	Detected in Sandia Canyon runoff and base flow above New Mexico Water Quality Standards.	No.	Wildlife exposure potential in Sandia Canyon. Elsewhere, findings included LANL and non-LANL sources.	None
Dissolve copper in surface water	Detected in many canyons above New Mexico acute aquatics life standards.	Yes, in Los Alamos Canyon.	Origins uncertain; probably multiple sources.	None
High explosive residues and Barium in surface water	Detections near or above screening values in Cañon de Valle base flow and runoff.	No.	Minimal potential for exposure,	None
Benzo(a)pyrene	Detections near or above industrial screening levels in Los Alamos Canyon.	Yes, in Los Alamos and Acid Canyons.	Origins uncertain; probably multiple sources.	None

6 Source: DOE 2006b

7
8 Three zones of groundwater occur on the Pajarito Plateau: (1) perched alluvial groundwater in
9 canyon bottoms, (2) zones of intermediate depth perched groundwater whose location is
10 controlled by availability of recharge and by subsurface changes in permeability; and (3) the
11 regional aquifer beneath Pajarito Plateau (DOE 2006b). Alluvial water is groundwater that
12 occurs in canyon-floor sediments. Perched intermediate groundwater is water that has moved
13 downward from the surface and becomes trapped above tight geologic formations, such as
14 basalts and clay-rich rocks. The regional groundwater is the deep reliable source of drinking
15 water for residents of Los Alamos, Española, Santa Fe and neighboring Pueblos. The regional

1 aquifer discharges to springs along the Rio Grande. The knowledge base of recharge, discharge,
2 and how waterborne contaminants interact with and move through geology into perched water
3 zone and the regional aquifer below LANL is growing. Models are being improved based upon
4 updated data for groundwater and surface water from LANL and NMED (DOE 2006b).

5
6 Perched water bodies are important elements of the hydrogeology of LANL for several reasons.
7 There is a probability that the zones can intercept contaminants that are being transported
8 downward through the vadose zone. The perched water can be a permanent or long-term
9 residence for contaminants because the chemical makeup of the geology may result in
10 adsorption. Perched water can also serve as a place where dilution occurs lowering the
11 concentration of contaminants. There is a possibility that perched zones may be intersected by
12 streams in the lower parts of the canyons, resulting in lateral flow under the influence of gravity
13 out of the canyon walls into the aquifer, and subsequently the Rio Grande (DOE 2006b). Little
14 contamination reaches the deep regional aquifer because it is separated from the perched
15 groundwater by hundreds of feet of dry rock (DOE 2006b). Results of groundwater monitoring
16 show the presence of LANL-produced contamination, above water quality standards, in the
17 alluvial groundwater and in some perched intermediate groundwater in Mortandad, Los Alamos,
18 Cañon del Valle DP and possibly Pueblo Canyons (LANL 2006). Groundwater in Mortandad
19 Canyon area is contaminated with tritium, perchlorate, chloride, and nitrate at levels below
20 drinking water standards (NMED 2005b).

21
22 A separate study, conducted by George Rice for Concerned Citizens for Nuclear Safety (CCNS),
23 found that contamination from LANL is likely to reach the Rio Grande (Rice 2004). Citing data
24 from NMED and LANL, Rice models groundwater transport from LANL to the Rio Grande. He
25 concluded that although the travel time of contaminants varies, it is possible for contaminants
26 from LANL to reach the Rio Grande in 61 years or less (Rice 2004).

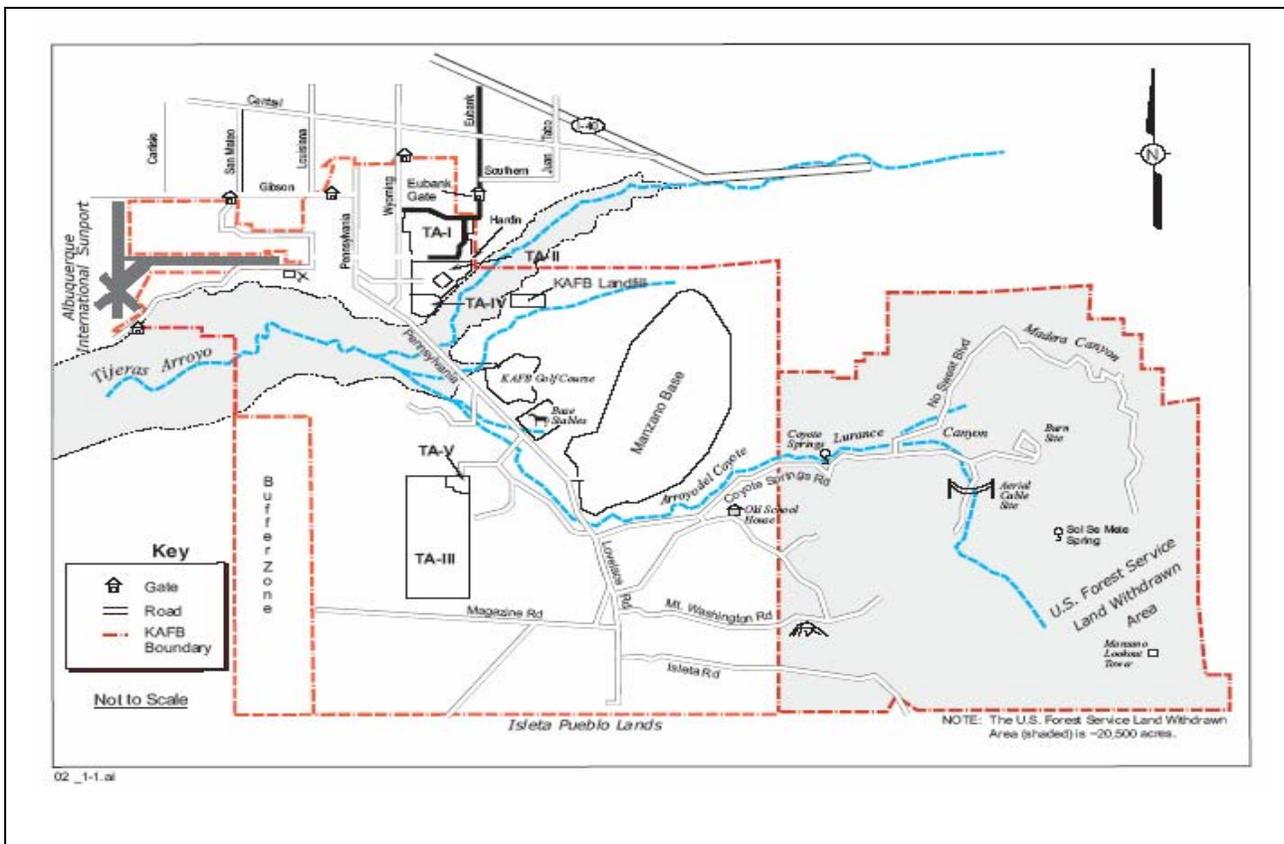
27
28 Further groundwater studies conducted jointly by The RadioActivitst Campaign (TRAC) and the
29 CCNS indicated that radioactive waste has migrated from LANL via groundwater pathways to
30 springs seeping into the Rio Grande, albeit at levels far too low to be considered a public health
31 concern (Buske 2003). Low levels of radioactive cesium-137 (Cs-137) from LANL have been
32 detected in groundwater seeping into Pajarito Stream, which flows into the Rio Grande (Buske
33 2003). This is the first report of radioactivity entering the Rio Grande directly connected with
34 LANL activities. Additional analysis is necessary to adequately characterize and identify the
35 pathway and extent of contamination.

36 **E.4 SANDIA NATIONAL LABORATORY**

37
38 Sandia National Laboratory (SNL) is located on Kirtland Air Force Base (KAFB) in
39 Albuquerque, New Mexico, along the eastern portion of the Sandia Mountains in the southeast
40 quadrant of the city. SNL began in 1945 as a part of the Manhattan Project, which produced the
41 world's first nuclear weapon (SNL/NM 2006). SNL's enduring mission is to provide science
42 and engineering support for the nuclear weapons stockpile (SNL/NM 2006).

43
44 SNL is situated at the base of the Sandia Mountains. The Sandia Mountains form a 13-mile long
45 escarpment distinguished by steep cliffs, pinnacles, and narrow canyons. Tijeras Canyon divides
46 the Sandia Mountains to the north from the Manzanita Mountains to the south. Sediments

1 transported from the canyons and draws of these mountains have formed coalescing alluvial fans,
 2 called bajadas. These bajadas slope west across KAFB and are dissected by the Tijeras Arroyo,
 3 smaller arroyos and washes. Tijeras Arroyo traverses across SNL in a southwestern direction,
 4 and discharges to the Rio Grande approximately 8 miles west of the KAFB boundary (Figure
 5 E.4-1). The major surface drainages at SNL are Tijeras Arroyo and Arroyo del Coyote. With
 6 the exception of two short sections of channel with intermittent flow (spring fed), these drainages
 7 flow only during storm events. Tijeras Arroyo is the only substantial outlet for surface water
 8 exiting KAFB. Arroyo del Coyote joins Tijeras Arroyo approximately 2 miles up stream where
 9 Tijeras Arroyo leaves KAFB, northwest of the KAFB Golf Course.
 10



11 Source: SNL/NM 2006

12 **Figure E.4-1 — Map of SNL**

13
 14 **E.4.1 Surface Water Monitoring**

15
 16 The surface water system on KAFB is a reflection of the dry high-desert climate of the area.
 17 Surface water flows through several major and many minor unnamed arroyos, primarily during
 18 summer monsoon events. With the exception of flow from two springs, there are no perennial
 19 streams or other surface water bodies at KAFB. Several unnamed arroyos and drainages to the
 20 south of Arroyo del Coyote dissipate as the topographic relief decreases to the west. Storm
 21 water in this area either evaporates or infiltrates into the soil. Therefore, there is no hydrologic
 22 surface connection from these areas to Tijeras Arroyo or the Rio Grande.
 23

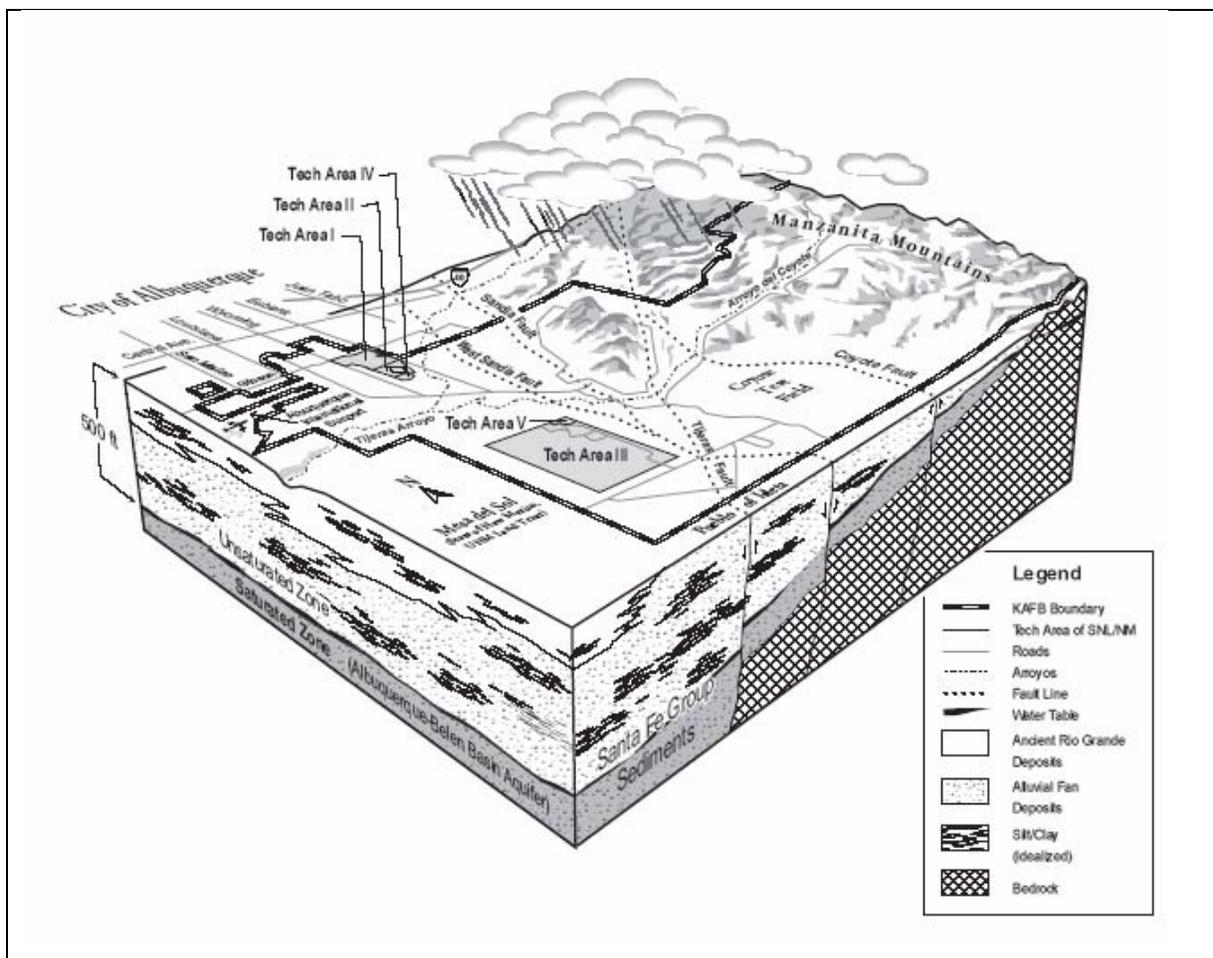
1 Surface discharges are releases of water and water based compounds made to roads, open areas
2 or impoundments. Surface discharges are only made with the approval of the Internal Surface
3 Discharge Program. Proposed discharges are evaluated for potential contaminants and
4 concentration levels to determine if the discharge complies with strict water quality guidelines
5 for surface releases. Uncontaminated water discharges must also be approved since large
6 volumes of water discharged in areas of prior contamination could increase infiltration rates and
7 move contaminants deeper into the soil column.

8
9 Past surface water sampling results from 1998 and 1999 analysis have shown a presence of
10 metals such as zinc, magnesium, and iron elevated above the benchmark values. No unusual
11 characteristics were observed in 2001, 2002, and 2003. No monitoring was required in 2000.
12 Monitoring results in 2004 identified elevated levels of total suspended solids (TSS) and
13 magnesium. Albuquerque's semiarid climate with sparse vegetative cover and high erosion rates
14 naturally produce high TSS levels. SNL has reduced TSS levels in developed areas through best
15 management practices, such as retention and detention ponds, landscaping conducive to
16 infiltration and lining of storm drain channels for erosion reduction. All monitoring points show
17 elevated levels of magnesium even though they are separated by several miles and collect runoff
18 from several different drainages. The presence of zinc, magnesium and iron may be due to
19 natural conditions associated with rocks and soils derived from the igneous/metamorphic
20 complex of the Manzanita Mountains.

21 22 **E.4.2 Groundwater Monitoring**

23
24 Water resources at SNL are characterized through an extensive network of wells and monitoring
25 stations. The network supports an active environmental monitoring program covering
26 groundwater, surface water and air. The Groundwater Protection Program (GWPP) and the
27 Environmental Restoration (ER) Project collect groundwater data at SNL. Both programs
28 coordinate to monitor wells throughout SNL. The GWPP establishes baseline water quality and
29 groundwater flow information, determines if any impact from SNL operations is affecting
30 groundwater quality, and maintains compliance with local, state, and federal regulations. The
31 ER Project conducts groundwater monitoring in six project areas: Chemical Waste Landfill
32 (CWL), the Mixed Waste Landfill (MWL), Technical Area V (TA-V), Tijeras Arroyo
33 Groundwater (TAG, formerly Sandia North) Investigation, Canyons Area, and Drain and Septic
34 Systems (DSS).

35
36 The groundwater beneath the western portion of KAFB is part of an interconnected series of
37 water-bearing geologic units within the Albuquerque Basin that form the Albuquerque-Belen
38 aquifer (Figure E.4-2.). Groundwater beneath the eastern portion of KAFB occurs in limited
39 quantities in fractured bedrock. Over 170 wells are used to monitor and supply water to KAFB
40 and the surrounding areas of the City of Albuquerque. Although water levels may fluctuate over
41 the course of the year in response to seasonal recharge and groundwater withdrawal, the overall
42 level of the regional aquifer within the basin continues to decline at about one foot per year
43 (SNL/NM 2006).



Source: DOE 1999

Figure E.4-2 — Conceptual Diagram of Groundwater Systems Underlying KAFB

In 2005, the GWPP reported the detection of trace amounts of VOCs, elevated nonmetal inorganic compounds, and levels of manganese and iron at the MAC¹ (SNL/NM 2006). None of the VOCs exceeded MCL standards. Elevated concentrations of non-metal inorganic compounds (e.g., chloride, sulfate, fluoride, etc.) are attributable to natural sources in the local area (SNL/NM 2006). No perchlorate was detected at concentrations above the action level (SNL/NM 2006). Additionally, analysis for radionuclide activity, when uncorrected, shows values above the MCL. However, removing the natural sources from the analysis, results in radioactivity levels below the MCLs (SNL/NM 2006).

The groundwater beneath the SNL and adjacent areas is the source of drinking water for SNL, KAFB, adjacent portions of the City of Albuquerque, and the Pueblo of Isleta. Groundwater quality can be influenced by the presence of contaminants in the soil column above the

¹ The U.S. EPA regulates drinking water constituents by setting a maximum contaminant levels (MCLs). The New Mexico Water Quality Control Commission (NMWQCC) regulates drinking water constituents by establishing maximum allowable concentrations (MACs).

1 groundwater, as well as the groundwater itself. These influences are of major concern to the ER
 2 Project, which is investigating the nature and extent of groundwater contamination from past
 3 activities. All known groundwater contamination is the result of past activities that occurred
 4 before the enactment of environmental regulatory laws. The ER Project monitors sites of known
 5 or potential groundwater contamination. Measurements of indicate that some contaminants
 6 exceed regulatory limits (Table E.4-1). Investigations or remediation of these sites is on-going.
 7 The following discussion on groundwater contaminants is based on 2005 monitoring and
 8 assessment data (SNL/NM 2006).
 9

10 **Table E.4-1 — ER Project Groundwater Monitoring Results from Calendar Year 2005**

Sample	Concentration	Period
Chloride MAC = 250 mg/L	446 mg/L	August 2005
Sulfate MAC 600 mg/L	1910 mg/L	August 2005
Fluoride MCL + 4.0 mg/L MAC = 1.6 mg/L	2.17 mg/L	August 2005
	1.67 mg/L	August 2005
	1.68 mg/L	August 2005
	2.52 mg/L	August 2005
	1.62 mg/L	November 2004
	1.76 mg/L	March 2005
	2.07 mg/L	June 2005
Manganese MAC = 0.2 mg/L	1.95 mg/L	September 2005
	3.23 mg/L	August 2005
Iron MAC = 1.0 mg/l	3.23 mg/l	August 2005
	3.57 mg/l	August 2005
Uranium- 234 DOE Drinking Water Guideline = 20.0 pCi/L	22.1 pCi/L	August 2005
Total Chromium MCL = 0.1 mg/l MAC = 0.05 mg/l	0.236 mg/l	November 2004
	0.0644 mg/l	April 2005
Trichloroethene (TCE) MCL = 5 µg/L	17.4/ 17.5 µg/L (dup)	November/December 2005
	17.5/ 17.1 µg/L (dup)	March 2005
	17.0 µg/L	May/June 2005
	15.3 µg/L	August/September 2005
Hexachlorobenzene MCL = 1 µg/L	92.9 µg/L	May/June 2005
Pentachlorophenol MCL = 1 µg/L	67.4 mg/L	May/June 2005
Nitrate (as Nitrogen) MCL = 10 mg/L	11.1/11.0 mg/L (dup)	November/December 2004
	10.6/11.0 mg/L (dup)	March 2005
	11.2 mg/L (dup)	August/September 2005
PERCHED SYSTEM WELLS		
TCE MCL = 5 µg/L	7.35/7.43 mg/L (dup)	October 2004
	5.66/6.16 µg/L (dup)	January 2005
	7.82 µg/L	July/August 2005
	5.32/5.6 µg/L	January 2005
NPN (as Nitrogen) MCL = 10 mg/L	25.1 mg/L	October 2004
	20.1 mg/L	January 2005
	18.9 mg/L	April/May 2005

**Table E.4-1 — ER Project Groundwater Monitoring Results from Calendar Year 2005
(continued)**

Sample	Concentration	Period
	24.5 mg/L	July/August 2005
	10.3 mg/L	October 2004
	27.1/23.2 mg/L (dup)	October 2004
	21.2/21.7 mg/L (dup)	January 2005
	22.3 mg/L	April/May 2005
	18.3/25.9 mg/L (dup)	July/August 2005
REGIONAL AQUIFER WELLS		
NPN (as Nitrogen) MCL = 10 mg/L	20.2 mg/L	October 2004
	21.9 mg/L	January 2005
	26.4 mg/L	April/May 2005
	20.3/20.6 mg/L	July/August 2005
NPN MCL = 10 mg/L	22.0 mg/L	November 2004
	11.5 mg/L	November 2004
	11.1 mg/L	March 2005
	11.4 mg/L	September 2005
Gross Alpha MCL = 15 pCi/L	28.3 pCi/L (cor, 3.04 pCi/L)	August 2005
	32.2 pCi/L (cor, 3.14 pCi/l)	August 2005

* Elevated chromium is thought to be a result of corrosion of the stainless steel well screens used in the sample wells. The stainless steel corrosion produce is in a particulate form, and as such, is unlikely to migrate into groundwater.

Dup = duplicate sample

Cor = Corrected gross alpha accounts for natural uranium levels in the surrounding environment

Source: SNL/NM 2006

Studies by the New Mexico Bureau of Mines and Mineral Resources and the USGS have concluded that the volume of water-producing zone within the Albuquerque Aquifer is much less than earlier studies had estimated (NMMMR 1992; USGS 1993, 1995). USGS estimated the aquifer is being depleted at a rate that is twice that of the recharge to the aquifer from the Rio Grande and other sources (USGS 1995). As a result, the reliance on the regional Albuquerque Aquifer as the sole drinking water source for the City, including SNL and KAFB facilities, is unsustainable.

E.5 COMMUNITIES ALONG THE RIO GRANDE

Most communities use groundwater for drinking water sources. Predominant communities along the upper and middle Rio Grande basins are the Town of Taos, Cities of Española, Los Alamos, Santa Fe and Albuquerque, Pueblo of Taos, Ohkay Owingeh Pueblo (formerly San Juan Pueblo), Pojoaque Pueblo, Tesuque Pueblo, San Ildefonso Pueblo, Picuris Pueblo, Cochiti Pueblo, Santa Ana Pueblo, and Sandia Pueblo. Surface water contamination issues are of particular importance to area Pueblos, as many use local surface water sources for sacred and traditional ceremonies, including immersion in and ingestion of untreated surface waters.

Recent challenges to drinking water resources, such as drought conditions, ground subsidence, and contamination issues, are forcing communities to seek alternative sources to replace or augment their present drinking water sources. In 2006, the BOR converted the original water service contracts for the San Juan-Chama Project, enabling individual communities to access directly their allotments of San Juan-Chama water (OSE 2006). Seven communities in the upper

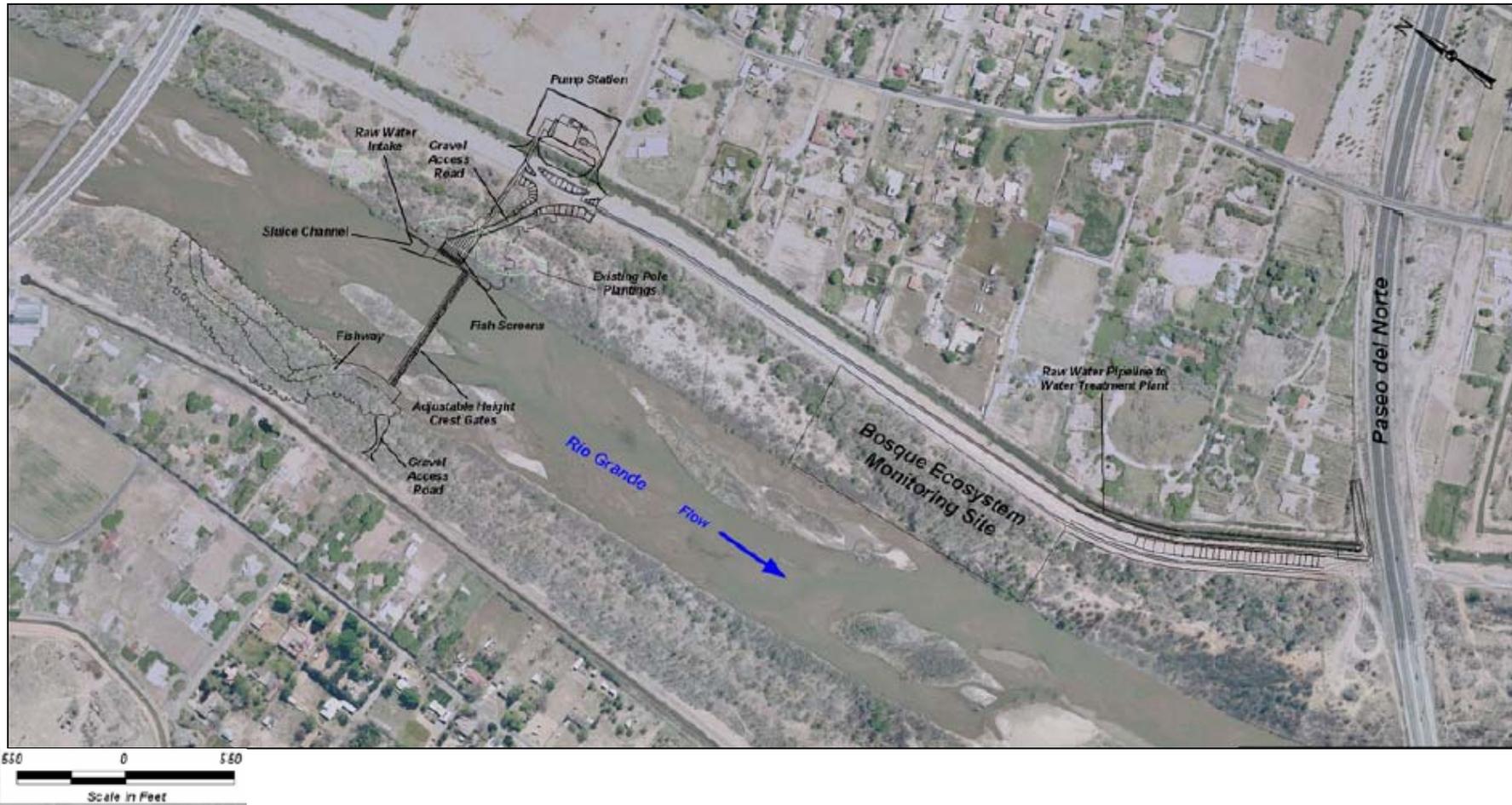
1 and middle Rio Grande basins have expressed an interest in direct access to San Juan-Chama
2 water delivered by the Rio Grande: the City of Santa Fe, City of Española, Town of Taos, Santa
3 Fe County, Los Alamos County, Village of Los Lunas, and the Village of Taos Ski Valley. At
4 this time, none of the Pueblos have expressed an interest in pursuing similar projects. The City
5 of Albuquerque and the USFS, on behalf of the City of Santa Fe, Santa Fe County, and Las
6 Campanas Limited Liability Corporation (Las Campanas), are pursuing diversions on the Rio
7 Grande to access San Juan-Chama surface water for community drinking water. Each project is
8 described below.

9
10 **E.5.1 City of Albuquerque Drinking Water Supply Project (CABQ and USBR**
11 **2004)**

12
13 The City of Albuquerque proposes to protect the aquifer for use as a drought reserve, and
14 facilitate the combined use of ground water and surface water (CABQ 1997). The project would
15 use the City of Albuquerque's allocation of its San Juan-Chama water, 48,200 acre-feet per year.
16 Taking into account system losses, it is estimated that approximately 94,000 acre-feet per year
17 will be available for use. Half of this amount, 47,000 acre-feet per year, will be the City of
18 Albuquerque's San Juan-Chama water and the other half will be native Rio Grande surface
19 water. After the San Juan-Chama water is fully consumed, the native Rio Grande water,
20 approximately 47,000 acre-feet per year, would be returned to the Rio Grande following
21 treatment. The return flow location is the City of Albuquerque's Southside Water Reclamation
22 Plant in the south valley.

23
24 Several projects are necessary to complete the infrastructure requirement for the Drinking Water
25 Supply Project. These projects, collectively referred to as the San Juan-Chama Drinking Water
26 Project, are proposed to reduce the dependency on groundwater resources (CABQ 2005). The
27 San Juan-Chama Drinking Water Project consists of four elements: diverting surface water from
28 the Rio Grande; transporting the raw water to a new water treatment plant; treating the raw water
29 to drinking water standards; and distributing the treated, potable water to the community. The
30 construction of a diversion to utilize about 97,000 acre-feet per year of San Juan-Chama and Rio
31 Grande surface water is in progress- scheduled for completion in 2007. Figure E.5-1 shows the
32 diversion structure. The North I-25 Industrial Recycling and Northside Non-Potable Surface
33 Water Reclamation Projects have been completed. The Southside Water Reclamation Plant is
34 designed to provide safe use of surface water directly for municipal water supply and is
35 scheduled to be completed in 2008.

36
37 With the implementation of the San Juan-Chama Drinking Water Project, the City of
38 Albuquerque projects the need for pumping groundwater would be substantially reduced to
39 approximately 730,000 acre-feet per year by 2060 (CABQ and USBR 2004), which would
40 reduce aquifer drawdown from 3-5 ft/yr to 1-3 feet per year (Stomp 2006). For the period 1994
41 to 2020, the USGS projects the overall annual aquifer withdrawal for the City to range between
42 98,700 acre-feet per year to 177,000 acre-feet per year (32,178.37 – 57,705.89 million
43 gallons/year) (USGS 1995). Implementation of the San Juan-Chama Drinking Water Project is
44 projected to supply approximately 70-percent of the City of Albuquerque's future water use
45 (CABQ 1997).



Source: CABQ and USBR 2004

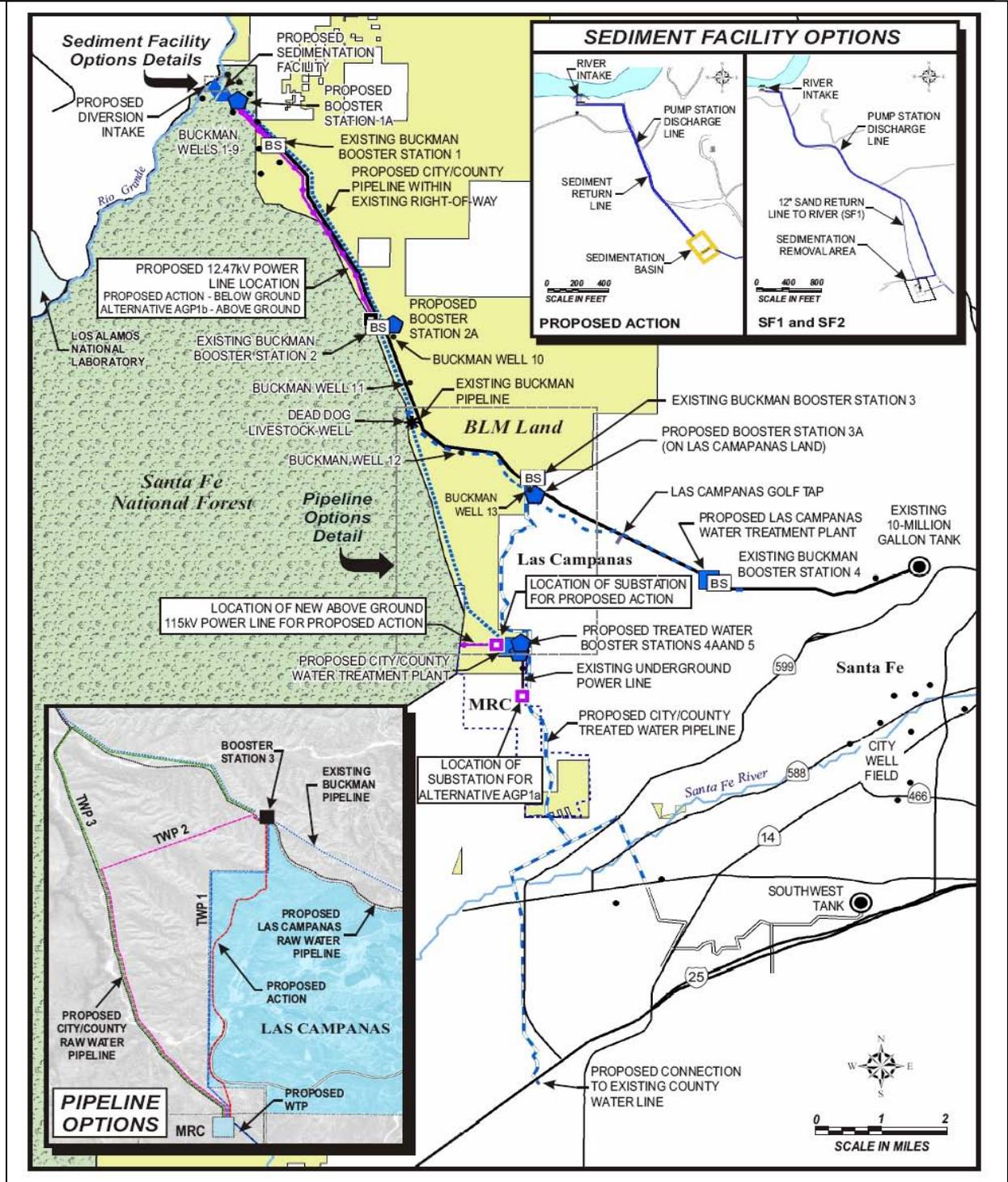
Figure E.5-1 — Map of Paseo del Norte Diversion Structure for the CABQ Drinking Water Supply Project

E.5.2 U.S. Forest Service Buckman Water Diversion Project (USFS 2004)

As demonstrated by drought conditions in 1996, 2000, and 2002, continuing water shortages in the City of Santa Fe and Santa Fe County resulted in a critical and immediate need for water. Presently, the City and County utilize groundwater resources from the Buckman Well Field for community drinking water sources. However, the well field cannot provide a reliable and sustainable source of water. Well yields have been reduced; hydraulic heads in the confined ground water aquifer near the well field have undergone substantial declines; and depletions of nearby streams could cause limitations to pumping. At current well production levels, undesirable consequences to ground water levels and continued depletion of nearby streams are expected to occur unless an alternate reliable water supply is found. In addition to ground water concerns, storage levels in the City's two surface water reservoirs located on the Santa Fe River, a tributary of the Rio Grande, fluctuate widely depending on seasonal and annual runoff conditions and potable water demand. These reservoirs receive surface water runoff from the Santa Fe Canyon watershed above the City. Overall Santa Fe River reservoir capacities cannot provide the necessary dependability to provide the water quantities needed to sustain the Santa Fe region during drought conditions.

The proposed Buckman Water Diversion Project (Buckman Project) is designed to address the immediate need for a sustainable means of accessing water supplies for the applicants, the City of Santa Fe, New Mexico (City), Santa Fe County (County), and Las Campanas Limited Partnership (Las Campanas). Most of the water to be diverted would be derived from the San Juan-Chama Project, which is a U.S. Bureau of Reclamation (Reclamation) inter-basin water transfer project that supplies water from the greater Colorado River basin to the Rio Grande basin through a tunnel system. The remainder would be native water rights owned by the parties and diverted from the Rio Grande. The proposed point of diversion is located on the east bank of the Rio Grande in northern New Mexico, about 15 miles northwest of the City of Santa Fe. It is located about 3 miles downstream from where Route 4 crosses the Rio Grande at the Otowi Bridge, which is where streamflow data have been recorded by the U.S. Geological Survey (USGS) for more than a century. In addition to the diversion, the project would involve treatment and conveyance of water through pipelines that would generally follow roads and existing utility corridors.

The facilities necessary to implement the Buckman Project include a diversion structure on the eastern bank of the Rio Grande, sediment separation facilities, booster stations, storage and treatment facilities, water conveyance pipelines, Buckman Road improvements, and power upgrades. The locations of facilities associated with the Proposed Action and other alternatives are illustrated on Figure 7. Two new water treatment plants would be required, where the raw water would be processed to safe drinking water standards. The Las Campanas treatment plant would be located on Las Campanas land and operated by Las Campanas. The City and County treatment plant would be located on U.S. Bureau of Land Management land leased to the City, just west of Caja del Rio Road. New treated water pipelines would be installed from the treatment plants to convey water into the existing Las Campanas and City and County water distribution systems.



Source: USFS 2004

Figure E.5-2 — Map of Proposed Buckman Water Diversion Project

Estimated water diversion quantities are based on annual demand projections that extend to the year 2010 for the City and County, while the demand for Las Campanas is projected through community build out (1,717 homes). These projections translate to approximately 8,730 acre-feet per year, currently estimated to be 5,230 acre-feet per year for the City; 1,700 ac-ft/yr for the County; and 1,800 ac-ft/yr for Las Campanas. The proposed diversion facility is sized for a combined net peak diversion of approximately 28.2 cubic feet per second, which meets the combined peak needs of the City, County, and Las Campanas.

The USFS is coordinating with Federal and state agencies to address environmental concerns. The final environmental impact statement will be released in 2007. Upon release, the public will be given an opportunity to provide comments on the document.

E.5.3 City of Española Drinking Water Project (BOR and CE 2002)

The City of Española is facing tremendous challenges in its ability to provide potable water with good groundwater resources in sufficient quantities to meet even basic demand requirements of the local communities. Since 1986, the City has been forced to abandon seven of the thirteen groundwater production wells, due to either contamination or well failure. The contaminants include solvents, fluoride, and nitrates wither naturally occurring or from on-site wastewater disposal systems (e.g., septic systems) located throughout the Española Valley. The City of Española is exploring alternative water resources, including surface water diversion of San Juan-Chama water from the Rio Grande. The City of Española is working with the BOR to develop a project description. Engineering planning documents are being developed to facilitate the discussion of a diversion as a viable solution to the drinking water source challenges facing the City of Española.

E.6 CONCLUSION

Contaminant pathways into the Rio Grande and onto public lands are still being studied and are poorly understood due to the complex geohydrology of northern New Mexico. Area studies and LANL have confirmed that radioactive and toxic wastes of LANL origin have reached the Rio Grande. While contamination from DOE activities has occurred, it has not caused exceedances of regulatory standards off-site. Both LANL and SNL have contamination from legacy wastes created during the Cold War era, prior to modern environmental laws and regulations. Contamination of surface water and groundwater has been documented at LANL and SNL. The results from ongoing environmental monitoring programs at LANL and SNL were consistent with historical measurements and did not exceed Federal or state standards.

Communities and Pueblos in the upper and middle Rio Grande basins traditionally use groundwater sources for community drinking water. Many Pueblos use surface waters for traditional and ceremonial uses. The three largest communities in the upper and middle Rio Grande basins are seeking alternative drinking water supply resources. Presently, they all utilize groundwater aquifers and the primary drinking water source. Challenges from drought conditions, contaminants (naturally occurring and human-caused), and land subsidence, has heightened the need for communities to provide a sustainable water supply. The City of Albuquerque has initiated construction on diversion structure and the necessary infrastructure to

facilitate the use of surface water from the Rio Grande. The City of Albuquerque will use 48,200 acre-feet per year of San Juan-Chama water and approximately 47,000 acre-feet per year of native Rio Grande surface water. After the San Juan-Cham water is fully consumed, the native Rio Grande water, approximately 47,000 acre-feet per year, would be returned to the Rio Grande. The USFS is completing the environmental impact statement for the proposed Buckman Project, which would supply 3,500 acre-feet per year of surface water from the Rio Grande to the City of Santa Fe, Santa Fe County and Las Campanas subdivision in Santa Fe County. The USFS is expected to issue the final environmental impact statement in 2007. The City of Española has expressed an interest in developing a surface water diversion on the Rio Grande and is presently developing preliminary planning documents to further explore this option.

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Appendix F
PROJECT NOTICES

Appendix F PROJECT NOTICES

This appendix includes project notices in relation to, or used as reference materials, in the preparation of the *Complex Transformation¹ Supplemental Programmatic Environmental Impact Statement*. These notices are not intended to be an all-inclusive list. Chapter 12 of this SPEIS provides an all-inclusive list of the references used to prepare this EIS.

The following are included as part of this appendix:

- *Notice of Intent to Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement - Complex 2030*
- *Notice of Intent to Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement - Complex 2030 (Correction)*
- *Change in Scoping Meeting Schedule for the Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement - Complex 2030*

¹ In the Notice of Intent (71 FR 61731, October 19, 2006), this vision was referred to as “Complex 2030” and the supplement was called the “Complex 2030 SPEIS”. NNSA thinks that the term “Complex Transformation” more accurately reflects the vision and has renamed the supplement as the “Complex Transformation SPEIS”.

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DEPARTMENT OF ENERGY

Notice of Intent To Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030

AGENCY: National Nuclear Security Administration, Department of Energy.

ACTION: Notice of intent.

SUMMARY: The National Nuclear Security Administration (NNSA), an agency within the U.S. Department of Energy (DOE or Department), announces its intent to prepare a *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030* (Complex 2030 SEIS or SEIS, DOE/EIS-0236-S4), pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*), the Council on Environmental Quality's (CEQ's) and DOE's regulations implementing NEPA (40 CFR parts 1500–1508 and 10 CFR part 1021, respectively). The SEIS will analyze the environmental impacts from the continued transformation of the United States' nuclear weapons complex by implementing NNSA's vision of the complex as it would exist in 2030, which the Department refers to as Complex 2030, as well as alternatives. Since the end of the Cold War, there continue to be significant changes in the requirements for the nation's nuclear arsenal, including reductions in the number of nuclear weapons. To fulfill its responsibilities for certifying the safety and reliability of nuclear weapons without underground testing, DOE proposed and implemented the Stockpile Stewardship and Management (SSM) Program in the 1990s. Stockpile Stewardship includes activities required to maintain a high level of confidence in the safety and reliability of nuclear weapons in the absence of underground testing, and in the capability of the United States to resume nuclear testing if directed by the President. Stockpile Management activities include dismantlement, maintenance, evaluation, repair, and replacement of weapons and their components in the existing stockpile.

NNSA's proposed action is to continue currently planned modernization activities and select a site for a consolidated plutonium center for long-term research and development, surveillance, and pit¹ manufacturing; consolidate special nuclear materials throughout the complex; consolidate,

relocate, or eliminate duplicative facilities and programs and improve operating efficiencies; identify one or more sites for conducting NNSA flight test operations; and accelerate nuclear weapons dismantlement activities. This Notice of Intent (NOI), the initial step in the NEPA process, informs the public of NNSA's intention to prepare the Complex 2030 SEIS, announces the schedule for public scoping meetings, and solicits public input. Following the scoping period, NNSA will prepare and issue a draft of the Complex 2030 SEIS that will describe the Complex 2030 proposal, the alternatives analyzed, and potential impacts of the proposal and the alternatives.

This NOI also announces that NNSA has cancelled the previously planned *Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility* (DOE/EIS-0236-S2).

DATES: NNSA invites comments on the scope of the Complex 2030 SEIS. The public scoping period starts with the publication of this NOI in the **Federal Register** and will continue through January 17, 2006. Scoping comments received after this date will be considered to the extent practicable. NNSA will hold public scoping meetings to discuss issues and receive oral and written comments on the scope of the Complex 2030 SEIS. The locations, dates, and times for these public scoping meetings are listed below and will be announced by additional appropriate means. NNSA requests federal agencies that desire to be designated as cooperating agencies on the SEIS to contact NNSA's Office of Transformation at the address listed under **ADDRESSES** by the end of the scoping period.

North Augusta, South Carolina, North Augusta Community Center, 495 Brookside Avenue. November 9, 2006, 11 a.m.—3 p.m., 6 p.m.—10 p.m.

Oak Ridge, Tennessee, Oak Ridge City Center Club Room, 333 Main Street. November 13, 2006, 11 a.m.—3 p.m., 6 p.m.—10 p.m.

Amarillo, Texas, Amarillo Globe-News Center, Education Room, 401 S. Buchanan. November 15, 2006, 11 a.m.—3 p.m., 6 p.m.—10 p.m.

Las Vegas, Nevada, Cashman Center, 850 Las Vegas Boulevard North (at Washington). November 28, 2006, 11 a.m.—3 p.m., 6 p.m.—10 p.m.

Tonopah, Nevada, Tonopah Convention Center, 301 Brougner Avenue. November 29, 2006, 6 p.m.—10 p.m.

Socorro, New Mexico, Macey Center (at New Mexico Tech), 801 Leroy Place. December 4, 2006, 6 p.m.—10 p.m.

Albuquerque, New Mexico, Albuquerque Convention Center, 401 2nd St. NW. December 5, 2006, 11 a.m.—3 p.m., 6 p.m.—10 p.m.

Los Alamos, New Mexico, Mesa Public Library, 2400 Central Avenue. December 6, 2006, 10:30 a.m.—2:30 p.m.

Santa Fe, New Mexico, Genoveva Chavez Community Center, 3221 Rodeo Road. December 6, 2006, 6 p.m.—10 p.m.

Livermore, California, Robert Livermore Community Center, 4444 East Avenue. December 12, 2006, 11 a.m.—3 p.m.

Tracy, California, Tracy Community Center, 950 East Street. December 12, 2006, 6 p.m.—10 p.m.

U.S. Department of Energy, 1000 Independence Avenue, SW., Room 1E-245, Washington, DC. December 14, 2006, 1 p.m.—5 p.m.

NNSA officials will be available to informally discuss the Complex 2030 proposal during the first hour. Following this, NNSA intends to hold a plenary session at each scoping meeting in which officials will explain the Complex 2030 proposal and the SEIS, including preliminary alternatives. The meetings will provide the public with an opportunity to provide oral and written comments to NNSA on the scope of the SEIS. Input from the scoping meetings will assist NNSA in preparing the draft SEIS.

ADDRESSES: General questions concerning the NOI can be asked by calling toll-free 1-800-832-0885 (ext. 63519), e-mailing to Complex2030@nnsa.doe.gov, or writing to Theodore A. Wyka, Complex 2030 SEIS Document Manager, Office of Transformation, U.S. Department of Energy, NA-10.1, 1000 Independence Avenue, SW., Washington, DC 20585. Written comments on the scope of the SEIS or requests to be placed on the document distribution list can be sent to the Complex 2030 SEIS Document Manager. Additional information regarding Complex 2030 is available on Complex2030PEIS.com.

For general information on the DOE NEPA process, please contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586-4600 or 1-800-472-2756. Additional information regarding DOE NEPA activities and access to many DOE NEPA documents are available on the Internet through the DOE NEPA Web site at <http://www.eh.doe.gov/nepa>.

SUPPLEMENTARY INFORMATION:

¹ A pit is the central core of a nuclear weapon typically containing plutonium-239 that undergoes fission when compressed by high explosives.

Background: The early days of the nuclear weapons complex after World War II saw a rapid build-up of capability and capacity to support the growth of the stockpile to fight the Cold War. By the 1960s, the United States had built a large stockpile of nuclear weapons, and the nation began to focus on improving, rather than expanding, the stockpile. NNSA's predecessor agencies began to consolidate operations and close some production facilities. In the 1980s, facilities were shut down across the nuclear weapons complex, including certain facilities at the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; the Rocky Flats Plant in Colorado; the Fernald Site in Ohio; the Hanford Reservation in Washington; and elsewhere.

Prior DOE NEPA Reviews: DOE completed a Nuclear Weapons Complex Reconfiguration ("Complex-21") Study in January 1991, which identified significant cost savings that could be achieved by further downsizing of the nuclear weapons complex.

DOE then initiated a programmatic EIS (Reconfiguration PEIS) examining alternatives for reconfiguring the nuclear weapons complex. However, in December 1991, the Department decided to separate proposals for transforming non-nuclear production from the Reconfiguration PEIS because (1) proposals to consolidate non-nuclear facilities might not require preparation of an EIS, and (2) proposals and decisions regarding transformation of non-nuclear production would neither significantly affect nor be affected by proposals and decisions regarding transformation of nuclear production. On January 27, 1992, the Department issued an NOI (57 FR 3046) to prepare an environmental assessment (DOE/EA-0792) for the consolidation of non-nuclear production activities within the nuclear weapons complex. Following the collapse of the Soviet Union, the United States reduced the budget for the nuclear weapons program. President George H. W. Bush imposed a moratorium in 1992 on underground nuclear testing.

On September 14, 1993, DOE published a Finding of No Significant Impact (FONSI) regarding its proposal to consolidate non-nuclear component production (58 FR 48043). This proposal included termination of non-nuclear production missions at the Mound Plant in Ohio, the Pinellas Plant in Florida, and the Rocky Flats Plant in Colorado. The electrical and mechanical manufacturing functions were consolidated at the Kansas City Plant. Detonators and beryllium capabilities for technology and pit support were

consolidated at Los Alamos National Laboratory (LANL) in New Mexico, and neutron generator production was relocated to Sandia National Laboratories in New Mexico.

In October 1993, President William J. Clinton issued Presidential Decision Directive 15 (PDD-15), which directed DOE to establish the Stockpile Stewardship Program. PDD-15 significantly redirected the nuclear weapons program. Throughout the Cold War, the Department of Defense (DOD) and DOE's nuclear weapons laboratories had based a portion of their confidence in the reliability of nuclear weapons on performance data from atmospheric and underground tests. To ensure weapons reliability during the moratorium on testing, DOE proposed to invest in new scientific tools to assess the complex phenomena involved in the detonation of nuclear weapons. DOE also began to develop sophisticated tools and computer-based simulation techniques to assess various aging phenomena as nuclear weapons continued to serve well beyond their originally anticipated lifetimes. These actions enhanced research and development (R&D) and deferred spending on the production complex.

DOE concluded in October 1994 that the alternatives described in the Reconfiguration PEIS no longer contained realistic proposals for reconfiguration of the nuclear weapons complex. That conclusion was based on several factors, including: comments offered at the September-October 1993 Reconfiguration PEIS scoping meetings; the anticipation that no production of new nuclear weapons types would be required for the foreseeable future; budget constraints; and the Department's decision to prepare a separate PEIS on Storage and Disposition of Weapons-Usable Fissile Materials (DOE/EIS-0229; NOI published June 21, 1994, 59 FR 17344).

Consequently, the Department separated the Reconfiguration PEIS into two new PEISs: (1) A Tritium Supply and Recycling PEIS (DOE/EIS-0161); and (2) the SSM PEIS (DOE/EIS-0236). The Final PEIS for Tritium Supply and Recycling was issued on October 27, 1995 (60 FR 55021). In its Record of Decision (ROD) on May 14, 1999 (64 FR 26369²), DOE decided it would produce the tritium needed to maintain the nuclear arsenal at commercial light water reactors owned and operated by the Tennessee Valley Authority and

² This ROD also contains decisions for the EIS for Construction and Operation of a Tritium Extraction Facility at the Savannah River Site (DOE/EIS-0271) and EIS for the Production of Tritium in a Commercial Light Water Reactor (DOE/EIS-0288).

extract tritium at a new DOE-owned Tritium Extraction Facility at the Savannah River Site. With regard to the SSM PEIS, DOE issued an NOI on June 6, 1995 (60 FR 31291), a final SSM PEIS on November 19, 1996 (61 FR 58871), and a ROD on December 26, 1996 (61 FR 68014) announcing its decision to transform the weapons production complex by (1) reducing the weapon assembly capacity located at the Pantex Plant in Texas; (2) reducing the high-explosives fabrication capacity at Pantex; (3) reducing the uranium, secondary, and case fabrication capacity in the Y-12 National Security Complex in Tennessee; (4) reducing nonnuclear component fabrication capacity at the Kansas City Plant; and (5) reestablishing a modest interim pit fabrication capability at Los Alamos National Laboratory in New Mexico while evaluating the need for greater pit manufacturing capacity in the future.

In accordance with the decisions in the SSM PEIS, the *Non-nuclear Consolidation Environmental Assessment* (EA), and the Tritium Supply and Recycling PEIS, DOE began transforming the nuclear weapons complex to its present configuration. DOE has also prepared other EISs that facilitated the transformation of the complex. The relevant RODs for these site-wide and project-specific EISs are listed below:

- 1996 ROD for the *EIS for the Nevada Test Site and Off-Site Locations in the State of Nevada* (61 FR 65551, December 13, 1996).
- 1997 ROD for the *EIS for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (62 FR 3880, January 27, 1997).
- 1999 ROD for the Site-wide EIS for Continued Operation of the Los Alamos National Laboratory (64 FR 50797, September 20, 1999).
- 1999 ROD for the *EIS for Site-wide Operation of Sandia National Laboratories* (64 FR 69996, December 15, 1999).
- 2000 *Amended ROD for the Nevada Test Site EIS* (65 FR 10061, February 25, 2000).
- 2002 ROD for the *Site-wide EIS for the Oak Ridge Y-12 National Security Complex* (67 FR 11296, March 13, 2002).
- 2002 ROD for the *EIS for the Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory* (67 FR 79906, December 31, 2002).
- 2004 ROD for the *EIS for the Chemistry and Metallurgy Research Building Replacement Project, Los*

Alamos National Laboratory (69 FR 6967, February 12, 2004).

- 2005 ROD for the *Site-wide EIS for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic EIS* (70 FR 71491, November 29, 2005).

Nuclear Weapons Complex: The current nuclear weapons complex consists of eight major facilities located in seven states. NNSA maintains a limited capability to design and manufacture nuclear weapons; provides surveillance of and maintains nuclear weapons currently in the stockpile; and dismantles retired nuclear weapons. Major facilities and their primary responsibilities within the nuclear weapons complex are listed below:

Savannah River Site (SRS) (Aiken, South Carolina)—Extracts tritium (when the Tritium Extraction Facility becomes operational in 2007); provides loading, unloading and surveillance of tritium reservoirs. SRS does not maintain Category I/II³ quantities of special nuclear material (SNM)⁴ associated with weapons activities, but does maintain Category I/II quantities of SNM associated with other Department activities (e.g., environmental management).

Pantex Plant (PX) (Amarillo, Texas)—Dismantles retired weapons; fabricates high-explosives components; assembles high explosive, nuclear, and non-nuclear components into nuclear weapons; repairs and modifies weapons; and evaluates and performs non-nuclear testing of weapons. Maintains Category I/II quantities of SNM for the weapons program and material no longer needed by the weapons program.

Y-12 National Security Complex (Y-12) (Oak Ridge, Tennessee)—Manufactures nuclear weapons secondaries, cases, and other weapons components; evaluates and performs testing of weapon components; maintains Category I/II quantities of SNM; conducts dismantlement, storage, and disposition of nuclear weapons materials; and supplies SNM for use in naval reactors.

Kansas City Plant (KCP) (Kansas City, Missouri)—Manufactures and acquires

non-nuclear weapons components; and evaluates and performs testing of weapon components. No Category I/II quantities of SNM are maintained at the KCP.

Lawrence Livermore National Laboratory (LLNL) (Livermore, California)—Conducts research and development of nuclear weapons; designs and tests advanced technology concepts; designs weapons; maintains a limited capability to fabricate plutonium components; and provides safety and reliability assessments of the stockpile. Maintains Category I/II quantities of SNM associated with the weapons program and material no longer needed by the weapons program.

Los Alamos National Laboratory (LANL) (Los Alamos, New Mexico)—Conducts research and development of nuclear weapons; designs and tests advanced technology concepts; designs weapons; provides safety and reliability assessments of the stockpile; maintains interim production capabilities for limited quantities of plutonium components (e.g., pits); and manufactures nuclear weapon detonators for the stockpile. Maintains Category I/II quantities of SNM associated with the nuclear weapons program and material no longer needed by the weapons program.

Sandia National Laboratories (SNL) (Albuquerque, New Mexico; Livermore, California)—Conducts system engineering of nuclear weapons; designs and develops non-nuclear components; conducts field and laboratory non-nuclear testing; conducts research and development in support of the nuclear weapon non-nuclear design; manufactures non-nuclear weapon components; provides safety and reliability assessments of the stockpile; and manufactures neutron generators for the stockpile. Maintains Category I/II quantities of SNM associated with the nuclear weapons program.

Nevada Test Site (NTS) (Las Vegas, Nevada)—Maintains capability to conduct underground nuclear testing; conducts experiments involving nuclear material and high explosives; provides capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; and conducts research and training on nuclear safeguards, criticality safety and emergency response. Maintains Category I/II quantities of SNM associated with the nuclear weapons program.

Purpose and Need for the Stockpile Stewardship and Management Program: Under the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.), DOE is responsible for providing nuclear

weapons to support the United States' national security strategy. The National Nuclear Security Administration Act (Pub. L. 106-65, Title XXXII) assigned this responsibility to NNSA within DOE. One of the primary missions of NNSA is to provide the nation with safe and reliable nuclear weapons, components and capabilities, and to accomplish this in a way that protects the environment and the health and safety of workers and the public.

Changes in national security needs and budgets have necessitated changes in the way NNSA meets its responsibilities regarding the nation's nuclear stockpile. As a result of a changed security environment, unilateral decisions by the United States and international arms control agreements, the nation's stockpile is significantly smaller today and by 2012, it will be the smallest since the Eisenhower administration (1953-1961). The Treaty of Moscow will eventually lead to a level of 1,700-2,200 operationally-deployed strategic nuclear weapons.

However, nuclear deterrence will continue to be a cornerstone of United States national security policy, and NNSA must continue to meet its responsibilities for ensuring the safety and reliability of the nation's nuclear weapons stockpile. The current policy is contained in the Nuclear Posture Review, submitted to Congress in early 2002, which states that the United States will:

- Change the size, composition and character of the nuclear weapons stockpile in a way that reflects that the Cold War is over;
- Achieve a credible deterrent with the lowest possible number of nuclear warheads consistent with national security needs, including obligations to allies; and
- Transform the NNSA nuclear weapons complex into a responsive infrastructure that supports the specific stockpile requirements established by the President and maintains the essential United States nuclear capabilities needed for an uncertain global future.

Complex 2030 SEIS: NNSA has been evaluating how to establish a more responsive nuclear weapons complex infrastructure since the Nuclear Posture Review was transmitted to Congress in early 2002. The Stockpile Stewardship Conference in 2003, the Department of Defense Strategic Capabilities Assessment in 2004, the recommendations of the Secretary of Energy Advisory Board (SEAB) Task Force on the Nuclear Weapons Complex Infrastructure in 2005, and the Defense

³ Category I/II quantities of special nuclear material are determined by grouping materials by type, attractiveness level, and quantity. These grouping parameters are defined in DOE Manual 470.4-6, Nuclear Material Control and Accountability [see <https://www.directives.doe.gov>].

⁴ As defined in section 11 of the Atomic Energy Act of 1954, special nuclear material are: (1) Plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material; or (2) any material artificially enriched by plutonium or uranium 233 or 235.

Science Board Task Force on Nuclear Capabilities in 2006 have provided information for NNSA's evaluations.

In early 2006, NNSA developed a planning scenario for what the nuclear weapons complex would look like in 2030. See <http://www.nnsa.doe.gov> for

more information regarding Complex 2030 planning. The Complex 2030 planning scenario incorporates many of the decisions NNSA has already made based on the evaluations in the SSM PEIS, Tritium Supply and Recycling PEIS, and other NEPA documents. See

discussion in background above. The following table identifies which components of Complex 2030 are based on the existing SSM PEIS and Tritium PEIS RODs, including RODs for subsequent tiered EISs:

Components of Complex 2030 that reflect earlier decisions	SSM PEIS ROD	Tritium PEIS ROD
Maintain but reduce the existing weapon assembly capacity located at Pantex	X
Maintain but reduce the high-explosives fabrication capacity at Pantex	X
Maintain but reduce the existing uranium, secondary, and case fabrication capacity at the Y-12 Plant at Oak Ridge	X
Reduce the non-nuclear component fabrication capacity at the Kansas City Plant	X
Reestablish limited pit fabrication capability at Los Alamos National Laboratory while evaluating the need for a larger capability	X
Irradiate tritium producing rods in commercial light water reactors; construct and operate a new Tritium Extraction Facility at DOE's Savannah River Site	X

Types of Decisions that Would Be Based on the Complex 2030 SEIS: The decisions set forth in the Complex 2030 ROD would:

- Identify the future missions of the SSM Program and the nuclear weapons complex; and
- Determine the configuration of the future weapons complex needed to accomplish the SSM Program.

For specific programs or facilities, NNSA may need to prepare additional NEPA documents to implement the decisions announced in the ROD. The baseline that will be used for the analyses of program and facility needs in the SEIS is 1,700–2,200 operationally-deployed strategic nuclear weapons, in addition to augmentation weapons, reliability-reserve weapons and weapons required to meet NATO commitments. The numbers are consistent with international arms-control agreements. Consistent with national security policy directives, replacement warhead design concepts may be pursued under the alternatives as a means of, for example, enhancing safety and security, improving manufacturing practices, reducing surveillance needs, and reducing need for underground tests.

The SEIS will evaluate reasonable alternatives for future transformation of the nuclear weapons complex. The Proposed Action and alternatives to the Proposed Action will assume continued implementation of the following prior siting decisions that DOE made in the SSM PEIS and Tritium PEIS RODs, including RODs for subsequent tiered EISs:

- Location of the weapon assembly/disassembly operations at the Pantex Plant in Texas.
- Location of uranium, secondary, and case fabrication at the Y-12

National Security Complex in Tennessee.

- Location of tritium extraction, loading and unloading, and support operations at the Savannah River Site in South Carolina.

NNSA does not believe it is necessary to identify additional alternatives beyond those present in the SSM PEIS. Regarding the uranium, secondary, and case fabrication at Y-12, NNSA is currently preparing a Y-12 Site-wide EIS to evaluate reasonable alternatives for the continued modernization of the Y-12 capabilities. The Complex 2030 SEIS will incorporate any decisions made pursuant to the Y-12 Site-wide EIS.

While the Complex 2030 planning scenario proposes to consolidate further non-nuclear production activities performed at the Kansas City Plant, this proposal will be evaluated in a separate NEPA analysis, as was done in the 1990s. NNSA believes that it is appropriate to separate the analyses of the transformation of non-nuclear production from the SEIS because decisions regarding those activities would neither significantly affect nor be affected by decisions regarding the transformation of nuclear production activities.

The SSM PEIS ROD announced NNSA's decision to establish a small interim pit production capacity at LANL. In the 1999 LANL Site-wide EIS ROD, NNSA announced it would achieve a pit production capacity at LANL of up to 20 pits per year. The 2006 draft LANL Site-wide EIS evaluates a proposal for a production capacity of 50 certified pits annually. This proposed capacity is based on an annual production rate of 80 pits per year in order to provide NNSA with sufficient flexibility to obtain 50

certified pits. Any decisions made pursuant to the LANL Site-wide EIS will be included in the Complex 2030 SEIS.

Based upon the studies⁵ and analyses that led to NNSA's development of the Complex 2030 scenario, NNSA has developed alternatives that are intended to facilitate public comment on the scope of the SEIS. NNSA's decisions regarding implementation of Complex 2030 will be based on the following alternatives, or a combination of those alternatives.

The Proposed Action—Transform to a More Modern, Cost-Effective Nuclear Weapons Complex (Complex 2030). This alternative would undertake the following actions to continue the transformation of NNSA's nuclear weapons complex:

- Select a site to construct and operate a consolidated plutonium center for long-term R&D, surveillance, and manufacturing operations for a baseline capacity of 125 qualified pits per year at a site with existing Category I/II SNM.
- Reduce the number of sites with Category I/II SNM and consolidate SNM to fewer locations within each given site.
- Consolidate, relocate or eliminate duplicative facilities and programs and improve operating efficiencies, including at facilities for nuclear materials storage, tritium R&D, high explosives R&D, environmental testing, and hydrotesting facilities.
- Identify one or more sites for conducting NNSA flight test operations.

⁵ The Stockpile Stewardship Conference in 2003, the Department of Defense Strategic Capabilities Assessment in 2004, the recommendations of the Secretary of Energy Advisory Board (SEAB) Task Force on the Nuclear Weapons Complex Infrastructure in 2005, and the recommendations of the Defense Science Board Task Force on Nuclear Capabilities in 2006.

Existing DOD and DOE test ranges (e.g., White Sands Missile Range in New Mexico and Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

- Accelerate dismantlement activities.

The DOE sites that will be considered as potential locations for the consolidated plutonium center and consolidation of Category I/II SNM include: Los Alamos, Nevada Test Site, Pantex Plant, Y-12 National Security Complex, and the Savannah River Site. Other DOE sites are not considered

reasonable alternative locations because they do not satisfy certain criteria such as population encroachment, or mission compatibility or synergy with the site's existing mission.

Alternatives to the Proposed Action

No Action Alternative. The No Action Alternative represents the status quo as it exists today and is presently planned. It includes the continued implementation of decisions made pursuant to the SSM PEIS and the Tritium Supply and Recycling PEIS (as summarized above) and related site-specific EISs and EAs. These decisions

are contained in RODs and Findings of No Significant Impact (FONSI)s, including those discussed above, and copies can be located on the DOE NEPA Document Web page at <http://www.eh.doe.gov/nepa/documents.html>.

The No Action Alternative would also include any decisions made as a result of the new Y-12 Site-wide EIS and the LANL Site-wide EIS once these EISs are finished. NNSA expects to issue RODs on these EISs prior to publication of the draft Complex 2030 SEIS.

The No Action Alternative is illustrated in the following matrix:

Capability	Sites (no action alternative)							
	KCP	LANL	LLNL	NTS	Y-12	PX	SNL	SRS
Weapons assembly/Disassembly				X		X		
Nonnuclear components	X	X					X	
Nuclear components:								
—Pits		X						
—Secondaries and cases					X			
High explosives components						X		
Tritium Extraction, Loading and Unloading								X
High explosives R&D		X	X			X	X	
Tritium R&D		X	X					X
Large Scale Hydrotesting		X	X	X				
Category I/II SNM Storage		X	X	X	X	X	X	X

The No Action Alternative also includes continuation of environmental testing at current locations and flight-testing activities at the Tonopah Test Range in Nevada.

Reduced Operations and Capability-Based Complex Alternative

In this alternative, NNSA would maintain a basic capability for manufacturing technologies for all stockpile weapons, as well as laboratory and experimental capabilities to support stockpile decisions, but would reduce production facilities to a "capability-based" ⁶ capacity. This alternative would not have a production capacity sufficient to meet current national security objectives. This alternative would be defined as follows:

- Do not construct and operate a consolidated plutonium center for long-term R&D, surveillance, and manufacturing operations; and do not expand pit production at LANL beyond 50 certified pits per year.
- Reduce the number of sites with Category I/II SNM and consolidate SNM to fewer locations within a given site.
- Consolidate, relocate or eliminate duplicative facilities and programs and improve operating efficiencies, including at facilities for nuclear

materials storage, tritium R&D, high explosives R&D, environmental testing facilities, and hydrotesting facilities.

- Identify one or more sites for conducting NNSA flight test operations. Existing DOD and DOE test ranges (e.g. White Sands Missile Range in New Mexico and Nevada Test Site in Nevada) would be considered as potential alternatives to the continued operation of the Tonopah Test Range in Nevada.

- Production capacities at Pantex, Y-12, and the Savannah River Site would be considered for further reductions limited by the capability-based capacity.

- NNSA would continue dismantlement activities.

Proposal Not Being Considered for Further Analysis. The SEAB Task Force on the Nuclear Weapons Complex Infrastructure recommended that NNSA pursue a consolidated nuclear production center (CNPC) as a single facility for all research, development, and production activities relating to nuclear weapons that involve significant amounts (i.e. Category I/II quantities) of SNM. The CNPC, as envisioned by the SEAB Task Force, would contain all the nuclear weapons manufacturing, production, assembly, and disassembly facilities and associated weapon surveillance and maintenance activities for the stockpile weapons. The CNPC would include the plutonium activities

of the consolidated plutonium center proposed by NNSA in its Complex 2030 vision, as well as the consolidated activities of the uranium, tritium, and high explosive operations. DOE believes that creation of a CNPC is not a reasonable alternative and does not intend to analyze it as an alternative in the SEIS because of the technical and schedule issues involved in constructing a CNPC, as well as associated costs. NNSA invites and will consider comments on this matter during the scoping process.

The SEAB Task Force developed three business cases for transforming the nuclear weapons complex, two of which were characterized as high risk. Its preferred least-risk option was to establish a CNPC "quickly" by accelerating site selection, NEPA analyses, regulatory approvals, and construction. The Task Force assumed that NNSA could, under these circumstances, begin operating a CNPC in 2015, start consolidation of SNM shortly thereafter, accelerate dismantlements, and begin other major transformational activities. Until the CNPC was completed, NNSA would have to maintain, and in some cases improve, existing production and research facilities. According to the Task Force's estimates, this option would require an additional 1 billion dollars per year for weapons programs

⁶ The capability to manufacture and assemble nuclear weapons at a nominal level.

activities for the next 10 years, and lead to a net savings through 2030 of 15 billion dollars.

Accelerated construction of a CNPC would not allow NNSA to avoid immediate expenditures to restore and modernize interim production capabilities to meet essential Life Extension Program (LEP) schedules and support the existing stockpile during the next decade. LEP is the refurbishment of nuclear weapons parts and components to extend the weapon deployment life. NNSA has concluded that the SEAB Task Force underestimated the nonfinancial challenges of constructing a CNPC. A CNPC would require moving a unique and highly skilled workforce to a new location. It would require NNSA to obtain significant regulatory approvals rapidly, and to construct a unique and complex facility on a tight schedule. It would put many of the significant aspects of the weapons complex transformation into "one basket"—until the CNPC began operations, all the other facilities and activities would be delayed. NNSA's Proposed Action would achieve many of the benefits of the CNPC approach—consolidation of SNM and facilities, integrated R&D and production involving SNM, and aggressive dismantlements—in a way that addresses immediate national security needs in a technically feasible and affordable manner.

Nuclear Materials Consolidation: DOE is pursuing SNM consolidation from all DOE sites including those that comprise the nuclear weapons complex. The SEIS will look at alternatives for the storage and consolidation of nuclear materials within the nuclear weapons complex including materials needed to maintain the United States' nuclear weapons arsenal. There is a potential overlap between the SEIS and the activities of the Department's other nuclear materials consolidation activities, and DOE will ensure that there is appropriate coordination between the two activities.

Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility: NNSA issued a *Draft Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility* (MPF) on June 4, 2003 (68 FR 33487; also 68 FR 33934, June 6, 2003) that analyzed alternatives for producing the plutonium pits that are an essential component of nuclear weapons. On January 28, 2004, NNSA announced that it was indefinitely postponing any decision on how it would obtain a large capacity pit

manufacturing facility. Because the Complex 2030 SEIS will analyze alternatives for plutonium-related activities that include pit production, DOE, effective upon publication of this NOI, cancels the MPF PEIS.

Public Scoping Process: The scoping process is an opportunity for the public to assist the NNSA in determining the issues for analysis. NNSA will hold public scoping meetings at locations identified in this NOI. The purpose of these meetings is to provide the public with an opportunity to present oral and written comments, ask questions, and discuss concerns regarding the transformation of the nuclear weapons complex and the SEIS with NNSA officials. Comments and recommendations can also be communicated to NNSA as discussed earlier in this notice.

Complex 2030 PEIS Supplement Preparation Process: The SEIS preparation process begins with the publication of this NOI in the **Federal Register**. NNSA will consider all public comments that it receives during the public comment period in preparing the draft SEIS. NNSA expects to issue the draft SEIS for public review during the summer of 2007. Public comments on the draft SEIS will be received during a comment period of at least 45 days following the U.S. Environmental Protection Agency's publication of the Notice of Availability in the **Federal Register**. Notices placed in local newspapers will specify dates and locations for public hearings on the draft SEIS and will establish a schedule for submitting comments on the draft SEIS, including a final date for submission of comments. Issuance of the final SEIS is scheduled for 2008.

Classified Material: NNSA will review classified material while preparing the SEIS. Within the limits of classification, NNSA will provide the public as much information as possible to assist its understanding and ability to comment. Any classified material needed to explain the purpose and need for the action, or the analyses in the SEIS, will be segregated into a classified appendix or supplement, which will not be available for public review. However, all unclassified information or results of calculations using classified data will be reported in the unclassified section of the SEIS, to the extent possible in accordance with federal classification requirements.

Issued in Washington, DC on October 11, 2006.

Linton F. Brooks,

Administrator, National Nuclear Security Administration.

[FR Doc. E6-17508 Filed 10-18-06; 8:45 am]

BILLING CODE 6450-01-P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. IC07-538-000; FERC-538]

Commission Information Collection Activities, Proposed Collection; Comment Request; Extension

October 13, 2006.

AGENCY: Federal Energy Regulatory Commission, DOE.

ACTION: Notice.

SUMMARY: In compliance with the requirements of Section 3506(c) (2) (a) of the Paperwork Reduction Act of 1995 (Pub. L. 104-13), the Federal Energy Regulatory Commission (Commission) is soliciting public comment on the specific aspects of the information collection described below.

DATES: Comments on the collection of information are due by December 21, 2006.

ADDRESSES: Copies of the proposed collection of information can be obtained from and written comments may be submitted to the Federal Energy Regulatory Commission, Attn: Michael Miller, Office of the Executive Director, ED-34, 888 First Street NE., Washington, DC 20426. Comments may be filed either in paper format or electronically. Those parties filing electronically do not need to make a paper filing. For paper filings, the original and 14 copies of such comments should be submitted to the Office of the Secretary, Federal Energy Regulatory Commission, 888 First Street, NE., Washington, DC 20426 and refer to Docket No. IC07-538-000.

Documents filed electronically via the Internet must be prepared in WordPerfect, MS Word, Portable Document Format, or ASCII format. To file the document, access the Commission's Web site at <http://www.ferc.gov> and click on "Make an E-filing," and then follow the instructions for each screen. First time users will have to establish a user name and password. The Commission will send an automatic acknowledgement to the sender's e-mail address upon receipt of comments.

All comments may be viewed, printed or downloaded remotely via the Internet

Corrections

Federal Register

Vol. 71, No. 205

Tuesday, October, 24, 2006

This section of the FEDERAL REGISTER contains editorial corrections of previously published Presidential, Rule, Proposed Rule, and Notice documents. These corrections are prepared by the Office of the Federal Register. Agency prepared corrections are issued as signed documents and appear in the appropriate document categories elsewhere in the issue.

DEPARTMENT OF ENERGY

Notice of Intent To Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030

Correction

In notice document E6-17508 beginning on page 61731 in the issue of

Thursday, October 19, 2006, make the following correction:

On page 61731, in the second column, under the heading “**DATES**”, in the sixth line, “January 17, 2006” should read “January 17, 2007”.

[FR Doc. Z6-17508 Filed 10-23-06; 8:45 am]

BILLING CODE 1505-01-D

view. Written requests for information should be addressed to U.S. Department of Education, 400 Maryland Avenue, SW., Potomac Center, 9th Floor, Washington, DC 20202-4700. Requests may also be electronically mailed to ICDocketMgr@ed.gov or faxed to 202-245-6623. Please specify the complete title of the information collection when making your request.

Comments regarding burden and/or the collection activity requirements should be electronically mailed to ICDocketMgr@ed.gov. Individuals who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 1-800-877-8339.

[FR Doc. E6-19581 Filed 11-17-06; 8:45 am]

BILLING CODE 4000-01-P

ELECTION ASSISTANCE COMMISSION

Sunshine Act Notice

AGENCY: United States Election Assistance Commission.

ACTION: Notice of public meeting for the Technical Guidelines Development Committee.

DATE AND TIME: Monday, December 4, 2006, 9 a.m. to 5:30 p.m. EST. Tuesday, December 5, 2006, 8:30 a.m. to 2 p.m. EST.

PLACE: National Institute of Standards and Technology, 100 Bureau Drive, Building 101, Green Auditorium, Gaithersburg, Maryland 20899-8900.

STATUS: This meeting will be open to the public. There is no fee to attend, but, due to security requirements, advance registration is required. Registration information will be available at <http://www.vote.nist.gov> by November 4, 2006.

SUMMARY: The Technical Guidelines Development Committee (the "Development Committee") has scheduled a plenary meeting for December 4th & 5th, 2006. The Committee was established to act in the public interest to assist the Executive Director of the U.S. Election Assistance Commission (EAC) in the development of voluntary voting system guidelines. The Development Committee held previous meetings on July 9, 2004; January 18 and 19, 2005; March 9, 2005; April 20 and 21, 2005; September 29, 2005 and March 29, 2006. The purpose of the seventh meeting of the Development Committee will be to review and approve draft documents that will form the bases for recommendations for future voluntary voting system guidelines to the EAC. The draft documents respond to tasks

defined in resolutions passed at previous Technical Guideline Development Committee meetings.

SUPPLEMENTARY INFORMATION: The Technical Guidelines Department Committee (the "Development Committee") has scheduled a plenary meeting for December 4th & 5th, 2006. The Committee was established pursuant to 42 U.S.C. 15361, to act in the public interest to assist the Executive Director of the Election Assistance Commission in the development of the voluntary voting system guidelines. The Technical Guidelines Development Committee held their first plenary meeting on July 9, 2004. At this meeting, the Development Committee agreed to a resolution forming three working groups: (1) Human Factors & Privacy; (2) Security & Transparency; and (3) Core Requirements & Testing to gather information and public input on relevant issues. The information gathered by the working groups was analyzed at the second meeting of the Development Committee January 18 & 19, 2005. Resolutions were debated and adopted by the TGDC at the January plenary session. The resolutions defined technical work tasks for NIST that will assist the TGDC in developing recommendations for voluntary voting system guidelines. At the March 9, 2005 meeting, NIST scientists presented preliminary reports on technical work tasks defined in resolutions adopted at the January plenary meeting and adopted one additional resolution. The Development Committee approved initial recommendations for voluntary voting system guidelines at the April 20th & 21st, 2005 meeting. The Development Committee began consideration of future recommendations for voluntary voting system guidelines at the September 29, 2005 meeting. At the March 29th, 2006 meeting, the Development Committee approved draft technical guidance documents that will form the bases for recommendations for future voluntary voting system guidelines and passed an additional resolution. The Committee will review additional technical guidance documents for recommendations for future voluntary voting system guidelines at the December 4th & 5th, 2006 meeting.

CONTACT INFORMATION: Allan Eustis 301-975-5099. If a member of the public would like to submit written comments concerning the Committee's affairs at any time before or after the meeting, written comments should be addressed

to the contact person indicated above, or to Voting@nist.gov.

Thomas R. Wilkey,

Executive Director, U.S. Election Assistance Commission.

[FR Doc. 06-9310 Filed 11-16-06; 11:51 am]

BILLING CODE 6820-KF-M

ELECTION ASSISTANCE COMMISSION

Sunshine Act Notice

AGENCY: United States Election Assistance Commission.

ACTION: Notice of public meeting.

DATE AND TIME: Thursday, December 7, 2006, 10 a.m.-3p.m.

PLACE: U.S. Election Assistance Commission, 1225 New York Ave, NW., Suite 150, Washington, DC 20005. (Metro Stop: Metro Center).

AGENDA: The Commission will receive presentations on public comments received for the DRAFT Procedural Manual for Voting System Testing and Certification Program and the proposed final document will be considered for approval. The Commission will receive presentations from election officials, community interest groups, academicians and technology experts regarding the 2006 election. The Commission will elect officers for 2007 and consider other administrative matters.

This meeting will be open to the public.

FOR FURTHER INFORMATION CONTACT: Bryan Whitener, Telephone: (202) 566-3100.

Thomas R. Wilkey,

Executive Director, U.S. Election Assistance Commission.

[FR Doc. 06-9311 Filed 11-16-06; 11:51 am]

BILLING CODE 6820-KF-M

DEPARTMENT OF ENERGY

Change in Scoping Meeting Schedule for the Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030

AGENCY: National Nuclear Security Administration, Department of Energy.

ACTION: Notice of Change in Scoping Meeting Schedule.

SUMMARY: On October 19, 2006, NNSA published a Notice of Intent (NOI) to Prepare a *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030* (Complex

2030 Supplemental PEIS; DOE/EIS-0236-S4; 71 FR 61731). NNSA has changed the location of the public scoping meeting scheduled for Los Alamos, New Mexico, and has extended the time for the public scoping meeting scheduled for Livermore, California.

DATES: The NOI identified the Mesa Public Library as the location of the public scoping meeting in Los Alamos, New Mexico. NNSA will instead hold the meeting at the Hilltop House Best Western, 400 Trinity Drive, Los Alamos, New Mexico. The meeting date and time, which are unchanged, are December 6, 2006, 10:30 a.m.–2:30 p.m.

The NOI listed the time of the meeting on December 12, 2006, in Livermore, California, as 11 a.m.–3 p.m. NNSA has extended the public comment portion of the meeting until 10 p.m. The meeting starting time of 11 a.m. is unchanged, and the meeting location is unchanged: Robert Livermore Community Center, 4444 East Avenue, Livermore, California.

NNSA is not changing the location or schedule for any other public scoping meeting announced in the NOI. This includes the meeting in Tracy, California, which still will be held on December 12, 2006, from 6 p.m.–10 p.m. at the Tracy Community Center, 950 East Street.

FOR FURTHER INFORMATION CONTACT: Please direct questions regarding these changes to Mr. Theodore A. Wyka, Complex 2030 Supplemental PEIS Document Manager, Office of Transformation, National Nuclear Security Administration (NA-10.1), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585. Questions also may be telephoned, toll free, to 1-800-832-0885 (ext. 63519) or e-mailed to Complex2030@nnsa.doe.gov. Written comments on the scope of the Complex 2030 Supplemental PEIS or requests to be placed on the document distribution list can be sent to the Document Manager. Additional information regarding Complex 2030 is available at <http://Complex2030PEIS.com>.

Issued in Washington, DC, on November 14, 2006.

Thomas P. D'Agostino,

Deputy Administrator for Defense Programs, National Nuclear Security Administration.
[FR Doc. E6-19590 Filed 11-17-06; 8:45 am]

BILLING CODE 6450-01-P

ENVIRONMENTAL PROTECTION AGENCY

[EPA-HQ-OPPT-2006-0929; FRL-8103-1]

Forum on State and Tribal Toxics Action; Notice of Public Meeting

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: EPA is announcing the meeting of the Forum on State and Tribal Toxics Action (FOSTTA) to enable state and tribal leaders to collaborate with EPA on environmental protection and pollution prevention issues. Representatives and invited guests of the Chemical Information and Management Project (CIMP), the Pollution Prevention (P2) Project, and the Tribal Affairs Project (TAP), components of FOSTTA, will be meeting December 11, 2006. The meeting is being held to provide participants an opportunity to have in-depth discussions on issues concerning the environment and human health. This notice announces the location and times for the meeting and sets forth some tentative agenda topics. EPA invites all interested parties to attend the public meeting.

DATES: The meeting will be held on December 11, 2006, from 8 a.m. to 5 p.m.

Requests to participate in the meeting, identified by docket identification (ID) number EPA-HQ-OPPT-2006-0929 must be received on or before December 7, 2006.

To request accommodation of a disability, please contact the technical contact person listed under **FOR FURTHER INFORMATION CONTACT**, preferably at least 10 days prior to the meeting, to give EPA as much time as possible to process your request.

ADDRESSES: The meeting will be held at the Radisson Hotel & Suites Austin, 111 E. Cesar Chavez St., Austin, TX 78701, telephone number: (800) 333-3333, fax number: (512) 473-8399.

Requests to participate in the meeting, identified by docket ID number HQ-OPPT-2006-0929, may be submitted to the technical person listed under **FOR FURTHER INFORMATION CONTACT**.

FOR FURTHER INFORMATION CONTACT: For general information contact: Colby Lintner, Regulatory Coordinator, Environmental Assistance Division (7408M), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460-0001; telephone number: (202) 554-1404; e-mail address: TSCA-Hotline@epa.gov.

For technical information contact: Pam Buster, Environmental Assistance Division (7408M), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460-0001; telephone number: (202) 564-8817; fax number: (202) 564-8813; e-mail address: Buster.Pamela@epa.gov.

SUPPLEMENTARY INFORMATION:

I. General Information

A. Does this Action Apply to Me?

This action is directed to the public in general. This action may, however, be of interest to all parties interested in FOSTTA and in hearing more about the perspectives of the States on EPA programs and the information exchange regarding important issues related to human health and environmental exposure to toxics. Since other entities may also be interested, the Agency has not attempted to describe all the specific entities that may be affected by this action. However, in the interest of time and efficiency, the meetings are structured to provide maximum opportunity for State and EPA participants to discuss items on the predetermined agenda. At the discretion of the chair, an effort will be made to accommodate participation by observers attending the proceedings. If you have any questions regarding the applicability of this action to a particular entity, consult the people listed under **FOR FURTHER INFORMATION CONTACT**.

B. How Can I Get Copies of this Document and Other Related Information?

1. *Docket.* EPA has established a docket for this action under docket ID number EPA-HQ-OPPT-2006-0929. Publicly available docket materials are available electronically at <http://www.regulations.gov> or, if only available in hard copy, at the OPPT Docket in the EPA Docket Center (EPA/DC). The EPA/DC suffered structural damage due to flooding in June 2006. Although the EPA/DC is continuing operations, there will be temporary changes to the EPA/DC during the clean-up. The EPA/DC Public Reading Room, which was temporarily closed due to flooding, has been relocated in the EPA Headquarters Library, Infoterra Room (Room Number 3334) in the EPA West Building, located at 1301 Constitution Ave., NW., Washington, DC. The EPA/DC Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the EPA/DC Public Reading Room is (202)

Appendix G
NEPA DISCLOSURE STATEMENT

APPENDIX G

NEPA DISCLOSURE STATEMENT FOR PREPARATION OF THE *COMPLEX TRANSFORMATION SUPPLEMENTAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT*

CEQ Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term “financial interest or other interest in the outcome of the project” for purposes of this disclosure is defined in the March 23, 1981 guidance “Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations,” 46 FR 8026-18038 at Question 17a and b.

“Financial or other interest in the outcome of the project” includes “any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm’s other clients).” 46 FR 18026-18038 at 18031.

In accordance with these requirements, the offeror and any proposed subcontractors hereby certify as follows: (check either (a) or (b) to assure consideration of your proposal).

- (a) X Offeror and any proposed subcontractor have no financial or other interest in the outcome of the project.
- (b) Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests

- 1.
- 2.
- 3.

Certified by



Signature

Mark E. Smith, Vice President
Printed Name and Title

Tetra Tech, Inc.
Company

August 17, 2007
Date