CHAPTER 3
ALTERNATIVES FOR CONTINUED OPERATION OF LOS ALAMOS NATIONAL LABORATORY

3.0 ALTERNATIVES FOR CONTINUED OPERATION OF LOS ALAMOS NATIONAL LABORATORY

This chapter describes proposed alternatives for the continued operation of Los Alamos National Laboratory (LANL). These alternatives provide the basis for analysis of potential impacts in this environmental impact statement. Site-wide activities, activities that would occur in specific technical areas, and activities proposed to occur at each Key Facility are described for each alternative. Some activities are common to all alternatives; others vary among the alternatives.

This *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (LANL SWEIS) evaluates potential environmental impacts associated with continued operation of LANL. The three alternatives described in this chapter, the No Action Alternative, a Reduced Operations Alternative, and an Expanded Operations Alternative, provide the basis for this evaluation. As the names of the alternatives imply, each considers operating LANL at different activity levels. Under the No Action Alternative, LANL would continue to be operated at currently approved levels (see Section 3.1 of this chapter), implementing those projects, including new construction, for which National Environmental Policy Act (NEPA) analyses have been completed. Under the Reduced Operations Alternative, many capabilities would remain unchanged, others would be eliminated or reduced in activity level, and most projects that have been approved based on completed NEPA analyses would go forward. The Expanded Operations Alternative, which NNSA has selected as its Preferred Alternative, proposes an increase in activity levels for some capabilities, as well as several new projects. These proposed activities and projects are evaluated in Appendices G, H, I, and J. Many capabilities would remain unchanged, even under the Expanded Operations Alternative.

Alternatives for Continued Operation of Los Alamos National Laboratory

No Action Alternative—Operations would continue at current levels consistent with previous decisions such as the *1999 LANL Site-Wide Environmental Impact Statement* Record of Decision (ROD), other RODs, and Findings of No Significant Impact.

Reduced Operations Alternative—Construction of the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility would be cancelled, thereby limiting pit production. Operations would be reduced at high explosives processing and testing facilities and eliminated at the Los Alamos Neutron Science Center and Pajarito Site.

Expanded Operations Alternative (Preferred Alternative)—Selected operations would increase, including plutonium pit production. Other projects proposed and analyzed in this SWEIS would be implemented.

The Expanded Operations Alternative in the 1999 *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (*1999 SWEIS)* (DOE 1999a) is the basis for the No Action Alternative in this new Site-Wide Environmental Impact Statement (SWEIS). Under the *1999 SWEIS* Expanded Operations Alternative, the U.S. Department of Energy (DOE) anticipated expanding operations at LANL as the need arose to the highest reasonably foreseeable levels, including full implementation of pit manufacturing up to 50 pits per year under single-shift operations (80 pits per year using multiple shifts). As a result of constraints at the

time the Record of Decision (ROD) was issued, however, including project delays and operational limitations for the Chemistry and Metallurgy Research Building (instituted to ensure that the operational risks [including seismic and human health risks] were maintained at an acceptable level), DOE determined that additional study of methods for implementing the 50 pits per year (or 80 pits per year) production capacity was warranted. In effect, DOE postponed a decision to expand pit manufacturing beyond a level of 20 pits per year. The impacts analysis in the *1999 SWEIS* Expanded Operations Alternative, however, is based on full implementation of pit production of 80 pits per year. That impacts analysis is also the basis for all of the alternatives analyzed in this SWEIS, although impacts in certain resource areas are distinguishable.

This chapter is organized by alternative; projects at the site-wide, technical area (TA), or Key Facility level are described within each alternative as appropriate. Key Facilities are described by their capabilities and the activity level at which each capability would be implemented. To the largest extent possible, projects and activities are evaluated at the Key Facility level because this is the most basic and descriptive level. A number of proposed projects described in the No Action and Expanded Operations Alternatives, however, are not tied to a Key Facility; instead, they are either site-wide or TA-related. Site-wide projects are described in Sections 3.1.1 and 3.3.1. Projects that would occur in a specific TA are described in Sections 3.1.2 and 3.3.2. Capabilities, activity levels, and proposed changes to Key Facilities are described in Sections 3.1.3, 3.2, and 3.3.3.

Technical Area (TA)

Geographically distinct administrative unit established for the control of LANL operations. There are currently 49 active TAs; 47 in the 40 square miles of the LANL site, one at Fenton Hill, west of the main site, and one comprising leased properties in town.

The No Action Alternative discussion in Section 3.1 contains complete descriptions of the capabilities of each Key Facility, as well as tables presenting the activity levels for each capability under each of the three alternatives. Discussions of the Reduced and Expanded Operations Alternatives in Sections 3.2 and 3.3, respectively, only discuss the changes from the No Action Alternative.

Evaluations and descriptions of each alternative implicitly include continued and evolving scientific, engineering, technology research and development (R&D), and support services throughout LANL, including those at the Key Facilities. Given the nature of R&D, specific activities are expected to vary and evolve over time; however, these changes can be sufficiently characterized to permit analysis of their consequences within the context of the alternatives. In addition, activity levels identified for each capability should be considered the maximum operating levels for which impacts are analyzed. Proposed new activities or increases in activity levels above those analyzed would require further NEPA compliance analysis.

In addition to operations associated with the capabilities described for each alternative, routine maintenance, construction, and support activities are required to maintain the availability and viability of LANL operations on an ongoing basis. DOE NEPA Implementing Procedures (Title 10 *Code of Federal Regulations* [CFR] Part 1021, Subpart D) list classes of actions called categorical exclusions that DOE has determined do not individually or collectively have a significant effect on the human environment and therefore do not require environmental

assessments (EAs) or environmental impact statements (EISs). These actions include activities related to facility operations, safety and health, site characterization and environmental monitoring, and environmental remediation and waste management. Representative activities that can be categorically excluded, provided they meet certain criteria, include routine maintenance; facility repairs; plant rearrangements; building modifications; seismic upgrades; roof replacement and repairs; replacement or upgrading of pumps, piping, and electrical components; and exterior work on the facility and grounds. In addition, certain operations found to be associated with insignificant environmental impacts based on DOE experience may be categorically excluded. After documenting that a proposed activity or project meets the categorical exclusion criteria, any of these routine activities may be implemented without additional NEPA analysis. Categorically excluded activities would proceed regardless of decisions made about the level of LANL operations and are not detailed across the alternatives discussions. Appendix L includes summaries of activities routinely performed at LANL that typically receive categorical exclusions.

An updated probabilistic seismic hazard analysis providing an improved understanding of the seismic characteristics of LANL was completed in 2007 (LANL 2007a): this is discussed in more detail in Chapter 5, Section 5.12.3. LANL's *Engineering Standards Manual ISD 341-2* (LANL 2007c) was revised to incorporate natural phenomena hazard mitigation requirements for new structural designs and for renovation, replacement, modification, maintenance and rehabilitation projects. These requirements are applicable to construction projects under all alternatives.

3.1 No Action Alternative

The No Action Alternative reflects implementation of decisions made by DOE and the National Nuclear Security Administration (NNSA) based on the *1999 SWEIS* (DOE 1999a) and other analyses performed in accordance with DOE's NEPA process. In the *1999 SWEIS* ROD, DOE announced its decision to implement the Expanded Operations Alternative described in the *1999 SWEIS*, with a level of plutonium pit manufacturing of 20 pits per year. Therefore, the current No Action Alternative continues implementation of the *1999 SWEIS* Expanded Operations Alternative as modified in the ROD. The No Action Alternative also includes implementation of decisions made on actions evaluated in other EISs and EAs completed since 1999; these other NEPA implementing documents are summarized in Chapter 1, Section 1.5. For the purposes of this SWEIS, the construction and operation of the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility is included within the No Action Alternative in keeping with the bounding approach for impact analysis. However, NNSA is engaged in a programmatic review process that includes a reconsideration of its 2004 decision regarding that portion of the Chemistry and Metallurgy Research Replacement Facility through preparation of the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* (*Complex Transformation SPEIS*) (see earlier discussion of this document in Chapter 1). In addition to other actions for which DOE has completed NEPA reviews, many actions have been implemented at LANL based on reviews and determinations that they met conditions in DOE NEPA Implementing Procedures for being categorically excluded from further NEPA compliance evaluation.

3.1.1 Site-Wide Projects

Proposed projects not associated with a specific TA or Key Facility are identified in **Table 3–1** and described in this section. Table 3–1 also shows site-wide actions associated with the Expanded Operations Alternatives that are discussed in Section 3.3.1. There are no new site-wide activities proposed under the Reduced Operation Alternative.

Table 3–1 Site-Wide Projects and Activities

Project	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Security Needs	Security-Perimeter Project: - Build new access control stations at the intersection of Jemez Road and Diamond Drive and near the intersection of Camp May Road and West Jemez Road (mostly completed by the end of 2006). - Construct a road connecting West and Camp May Roads. Implement Nuclear Materials Safeguards and Security Upgrades Project Phase II to upgrade security systems at TA-55.	Same as No Action Alternative	Same as No Action Alternative, plus: - *Implement Security-Driven Transportation Modifications* (see Appendix J): – Construct traffic control stations and modify roadway to control access to Pajarito Road between TA-48 and TA-63. – Construct a vehicle and pedestrian bridge across Ten Site Canyon and a roadway from TA-63 to TA-35. – Construct commuter bus parking lots at TA-48 and TA-63. - Auxiliary Actions include: – Construct a vehicle bridge across Mortandad Canyon from TA-35 to TA-60; connect to paved road along the length of Sigma Mesa. – Construct a vehicle bridge across Sandia Canyon from TA-60 to TA-61; create intersection with East Jemez Road.
Remediation and Closure Activities	Continue remediation of potential release sites. Remediate and close MDA H.[a]	Same as No Action Alternative	Same as No Action Alternative, plus: - Implement *MDA Remediation, Canyon Cleanups and Other Consent Order Actions* [b, c] (see Appendix I). - Perform activities such as groundwater monitoring as necessary to support closure of the Los Alamos County Landfill.
Land Conveyance and Transfer	Convey or transfer previously identified parcels of LANL land to Los Alamos County, the New Mexico Department of Transportation, and the Department of the Interior in trust for the Pueblo of San Ildefonso.	Same as No Action Alternative	Same as No Action Alternative
Electrical Power System Upgrades	Construct new power line between Norton and new Southern TA Substations and from the Southern TA Substation to the new Western TA Substation. Construct new 115-kilovolt electrical substation along the Pajarito Corridor West. Upgrade Eastern TA Substation. Uncross Reeves and Norton-Los Alamos power lines.	Same as No Action Alternative	Same as No Action Alternative

Project	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Wildfire Hazard Reduction	Implement ecosystem-based management program for approximately 10,000 acres (4,000 hectares) of LANL land. Includes prescribed fire, mechanical and manual forest thinning, access road construction, and fuel breaks.	Same as No Action Alternative	Same as No Action Alternative
Disposition of Flood and Sediment Retention Structures	Remove aboveground portion of Pajarito Canyon flood retention structure and stabilize sides. Grade streambed and reseed banks. Remove aboveground portions of steel diversion wall at TA-18.	Same as No Action Alternative	Same as No Action Alternative
Trails Management Program	Repair, maintain, improve, and close, as necessary, publicly used trails on the LANL site.	Same as No Action Alternative	Same as No Action Alternative
Off-Site Source Recovery Project	Continue to receive and store certain excess and unwanted sealed sources containing plutonium-239 and other actinides.	Same as No Action Alternative	Same as No Action Alternative, plus: - Implement *Increase in Type and Quantity of Sealed Sources Managed at LANL by the Off-Site Source Recovery Project*: – Increase scope of project to accept additional types and quantities of sealed sources, including nonactinide beta-gamma emitters (see Appendix J).
Management of Construction Fill	Transport and store up to 150,000 cubic yards per year of soil excavated from Chemistry and Metallurgy Research Replacement Facility, and other construction projects, at TA-16 or TA-61 borrow areas.	Same as No Action Alternative	Same as No Action Alternative

TA = technical area; MDA = material disposal area; Consent Order = Compliance Order on Consent entered into by DOE, the University of California as the management and operating contractor, and the State of New Mexico.

[a] Remediation of MDA H is discussed in Section 3.1.2.4 as a TA project.

[b] Activities required to comply with the Consent Order are evaluated under the Expanded Operations Alternative because they do not meet the No Action Alternative definition found in Section 3.1 of this SWEIS. As explained in Chapter 1, Section 1.4 of this SWEIS, the decisionmaker does not need to select an entire alternative, but can select among the proposed alternatives for each project or activity.

[c] NNSA is including impacts associated with Consent Order implementation in the SWEIS in order to more fully analyze the impacts resulting from Consent Order compliance. NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in the SWEIS.

Notes: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS. To convert cubic yards to cubic meters, multiply by 0.76456.

3.1.1.1 Security Needs

Under the No Action Alternative, security operations and projects, including those initiated as a result of heightened security concerns related to the attacks of September 11, 2001, and the 2004 operational standdown at LANL, would continue. Projects approved and partially implemented include the Security Perimeter Project and Nuclear Materials Safeguards and Security Upgrades.

The Security Perimeter Project was first evaluated in the *Environmental Assessment for Proposed Access Control and Traffic Improvements at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2002k). Proposed changes to project implementation have been reviewed in subsequent NEPA documents: the *Supplement Analysis, Security Perimeter Project* (DOE 2003a), *the NEPA Compliance Review for Proposed Modifications to the Security Perimeter Project at Los Alamos National Laboratory* (NNSA 2004a), and most recently, the *NEPA Compliance Review Addendum for Proposed Modifications to the Security Perimeter Project at Los Alamos National Laboratory* (NNSA 2005a). This project initially proposed changes to traffic patterns around LANL, including the construction of bypass roads and the addition of access control stations to screen and limit access to LANL. Project modifications include not constructing the bypass roads and changing locations and designs for the access control stations. To date, four staffed access control stations have been completed, two along Pajarito Road, one at the intersection of Jemez Road and Diamond Drive (that intersection was redesigned to prevent vehicles from entering TA-3 without passing through the station), and another at the intersection of Camp May Road and West Jemez Road. West Jemez Road was redesigned at that point to facilitate vehicle screening and related activities. Together, these four access control stations will allow security personnel to restrict access to the site during times of heightened security; under normal security conditions, roads around the perimeter of LANL would remain open to the public. In addition, a road connecting West and Camp May roads will be constructed, largely following the route of an existing unpaved service road across TA-62.

The overall objective of the Nuclear Materials Safeguards and Security Upgrades Project is to upgrade and replace the existing physical security system to address new protection strategy requirements and the deteriorating physical security infrastructure. This project involves activities categorically excluded from further NEPA evaluation and is being implemented in two phases. In Phase I, which is already completed, the data and communications backbone for the central and secondary alarm stations security system was installed. In Phase II, the security system at TA-55 will be upgraded to provide an effective, responsive security system to address design-basis threats and other requirements. Phase II includes upgrades or replacements of existing exterior physical security systems and installation of interior intrusion detection, assessment, delay, access control, and security communications equipment to support the new protection strategy for TA-55. These systems will be integrated with the security control system installed in Phase I.

3.1.1.2 Remediation and Closure Activities

Remediation and cleanup efforts at LANL are regulated by and coordinated between NMED and DOE. Until recently, investigations and corrective measures in compliance with the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act were carried out in accordance with LANL's Hazardous Waste Facility Permit. But on March 1, 2005, the

corrective action program specified in the permit was replaced by a Compliance Order on Consent (Consent Order). For the No Action Alternative, environmental investigations and restoration efforts would be implemented as they were prior to the Consent Order. Although not included in the No Action Alternative, NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in this SWEIS.

3.1.1.3 Land Conveyance and Transfer

As discussed in Chapter 2 of this SWEIS, LANL began conveying land to Los Alamos County and transferring land to the Department of the Interior (to be held in trust for the Pueblo of San Ildefonso) in 2002, as directed by Public Law 105-119. DOE anticipates conveying or transferring additional land before the end of 2012, the deadline prescribed in the Defense Authorization Act, which extended the deadline from 2007 as originally established in Public Law 105-119. Tracts identified for future conveyance and transfer are (LANL 2006a):

- A-4, to be conveyed to Los Alamos County, is part of the airport along NM 501 located east of the Los Alamos townsite, close to the East Gate Business Park.
- A-8, A-10, and A-11 are tracts to be conveyed to Los Alamos County and are part of the DP Road tract, located between the western boundary of TA-21 and the major Los Alamos townsite commercial districts.
- A-13, to be conveyed to Los Alamos County, is currently the DOE Los Alamos Site Office location. This tract is located within the Los Alamos townsite between Los Alamos Canyon and Trinity Drive.
- A-14, the Rendija Canyon tract, to be conveyed to Los Alamos County, is located north of the Los Alamos townsite's Barranca Mesa residential subdivision.
- A-18, to be conveyed to Los Alamos County, and B-3, to be transferred to the U.S. Department of the Interior in trust for the San Ildefonso Pueblo, are located east of the Los Alamos townsite and include much of Pueblo Canyon.
- C-1, C-2, C-3, and C-4 are tracts to be conveyed to the State of New Mexico Department of Transportation and are part of the White Rock tract, a complex area that incorporates the alignments and intersections of NM 4 and NM 502 and the easternmost part of Jemez Road.

3.1.1.4 Electrical Power System Upgrades

The power systems at LANL are being upgraded to increase site infrastructure reliability to meet current and future needs. The *Environmental Assessment for Electrical Power System Upgrades at Los Alamos National Laboratory* (DOE 2000a) assesses proposed electrical power system upgrades, including construction and operation of a new 115-kilovolt power transmission line that would originate at the Norton Substation and terminate at a new DOE-administered Western TA Substation. The transmission line from the Norton Substation to the point where it reaches the new Southern TA Substation near NM 4 will be operated at 115 kilovolts, but will be built to 345-kilovolt specifications to provide redundant service to LANL and the Los Alamos townsite.

Construction of the new Southern TA switchyard and the portion of the new power line from the new Southern TA Substation to the Western TA Substation has been completed. Refurbishment of the Eastern TA Substation is complete. The project to uncross the two existing transmission lines is expected to be complete by 2010. Construction of the portion of the new power line from the Norton Substation to the Southern TA Substation is in the design phase. A new substation will also be installed along Pajarito Corridor West at TA-50. See Chapter 4, Section 4.8.2.1, for more detail about these upgrades.

3.1.1.5 Wildfire Hazard Reduction Project Plan

Five major wildfires have ignited in the local area outside the LANL boundaries over the past 50 years. Such wildfires pose a serious threat to LANL buildings, structures, and utilities. A Wildfire Hazard Reduction and Forest Health Improvement Program was proposed in late 2001 to protect LANL from wildfires. The proposed activities were evaluated in the *Environmental Assessment for the Wildfire Hazard Reduction and Forest Health Improvement Program at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2000e). Initial fuel-reduction treatments were implemented through the Cerro Grande Rehabilitation Project using *Wildfire Hazard Reduction Project Plan* (LANL 2001b) guidance. About 10,000 acres (4,000 hectares), roughly 35 percent of LANL, were treated under this program from 2001 through 2005. Plans for future wildfire risk reduction activities such as monitoring for regrowth of fuel sources, tree thinning, and prescribed fire are described in the *Management Review Draft, LANL Wildland Fire Management Plan* (LANL 2005g).

3.1.1.6 Disposition of Flood and Sediment Retention Structures

The *Environmental Assessment for the Proposed Future Disposition of Certain Cerro Grande Fire Flood and Sediment Retention Structures at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2002j) evaluates removal of certain flood and sediment retention structures that were constructed as part of NNSA's emergency response actions for the Cerro Grande Fire of 2000. These structures were built to address changes in local watershed conditions that resulted from the fire. Watershed conditions are expected to return to a prefire status or approximate the prefire condition 3 to 8 years after the fire. After the watershed recovers, these structures would no longer be necessary to protect LANL facilities and the businesses and homes located downstream. This project will remove part of the aboveground portion of the Pajarito Canyon flood retention structure, including gabions installed along the downstream channel. The streambed will be graded, the remaining sides of the flood retention structure will be stabilized, and the banks will be reseeded. The area will be monitored and maintained to prevent slope erosion and damage to the floodplain and downstream wetlands. This project will also include removal of the aboveground portions of the steel diversion wall at TA-18. A Clean Water Act Section 404 Dredge and Fill Permit from the U.S. Army Corps of Engineers and a Section 401 Water Quality Certification from the New Mexico Environment Department will be required for removal of these structures. Any sediment removed will be characterized and either reused onsite, or if contaminated, disposed of in accordance with regulatory requirements. Best management practices involving stormwater controls will be implemented during removal activities as required by LANL's Construction Stormwater Permit Program.

3.1.1.7 Trails Management Program

NNSA and LANL staff recently began work on a Trails Management Program to address resource issues through improved and active stewardship. This program was evaluated in the *Environmental Assessment for the Proposed Los Alamos National Laboratory Trails Management Program, Los Alamos, New Mexico* (DOE 2003b). The program goal is to balance recreational trail use with environmental, cultural, safety, security, and social concerns. The program first established the Trails Assessment Working Group, which began meeting in December 2003 to formulate a plan for repair, construction, and implementation of environmental and cultural resources protection, safety, and security measures throughout the trail network. An inventory of all trails was started in 2005; further assessments would include end-state conditions and post-repair or post-construction assessments. The Working Group is also considering how community volunteers could contribute to the program.

3.1.1.8 Off-Site Source Recovery Project

The Off-Site Source Recovery Project has the responsibility to identify and as needed, to recover and store excess and unwanted sealed radiological sources on behalf of NNSA in cooperation with the U.S. Nuclear Regulatory Commission (NRC). From 1979 through 1999, DOE recovered excess and unwanted radioactive sealed sources containing plutonium-239 and beryllium on a case-by-case basis as requested by NRC. Since 1999, the Off-Site Source Recovery Project has assisted NNSA in managing actinide-bearing sealed sources and, in one case, strontium-90-bearing items that were recovered after being identified as potential threats to national security.

The LANL component of the current program disposes of recovered sources or places them in secure storage until a disposal path is available. Under the No Action Alternative, the Off-Site Source Recovery Project would continue to manage the same types and quantities of sealed sources as it has in the past. Sources containing actinide isotopes would be brought to LANL and safely stored if there were no other reasonable option to safely disposition the sources such as reuse or disposal. The Off-Site Source Recovery Project currently operates at the Chemistry and Metallurgy Research Building Key Facility, Pajarito Site Key Facility, Solid Radioactive and Chemical Waste Key Facilities, and Plutonium Facility Complex Key Facility. Activities related to this project are described as part of the specific capabilities of those Key Facilities.

3.1.1.9 Management of Construction Fill

Excavation during construction projects can result in large amounts of soil that cannot be immediately used for that project or in the immediate area. Uncontaminated construction fill is currently stored in two borrow areas at LANL, TA-61 and TA-16. This material can be used as backfill in other construction or remediation projects.

Excavation in TA-55 for the Chemistry and Metallurgy Research Replacement Facility (see Section 3.1.3.1) is expected to result in up to approximately 150,000 cubic yards of uncontaminated fill. The size of this excavation would bound excavation for other construction projects in this SWEIS. There is no capacity for storage of this amount of material at TA-55, and the fill would need to be transported by truck to the existing borrow areas or a similar to-be-

determined location. At 10 cubic yards per truck load, there would be a total of 15,000 round trips between the TA-55 construction site and the destination borrow area over a period of 1 year.

Security concerns will determine the routing and timing of truck trips. One route would be west on Pajarito Road to Diamond Drive, and then either west on West Jemez Road to TA-16 or east on East Jemez Road to TA-61. An alternate route is east on Pajarito Road to NM 4, north to East Jemez Road, west on East Jemez either to TA-61 or to Diamond Drive and west on West Jemez Road to TA-16. The latter route would be the longest distance; from TA-55 to TA-16 would be approximately 20 miles.

3.1.2 Technical Area Projects

Under the No Action Alternative, changes will take place in a number of TAs. New facility construction; modification of existing structures; and facility or area upgrades would be undertaken to address security issues, building conditions, and increases or decreases in activities and personnel. These changes could result from programmatic initiatives, specific technical projects, implementation of corrective actions, or responses to environmental or other external concerns such as the Cerro Grande Fire.

Major changes anticipated for the TAs are identified in **Table 3–2** and described in this section.

3.1.2.1 Technical Area 3

TA-3 is the most populated area at LANL, with numerous buildings that support a variety of Key Facilities. As the center of technical, administrative, and physical support activities for LANL, TA-3 is the location of a number of new buildings and in-progress construction and office consolidation projects. The National Security Sciences Building, an eight-story building with approximately 275,000 square feet (25,500 square meters) of office, meeting, and light laboratory space, and its associated structures are under construction; the main building and parking structure have been completed and are in use. The existing building that was replaced by the National Security Sciences Building is planned to be demolished (NNSA 2001). Under the No Action Alternative, the Information Management Office Building, which would add approximately 15,000 to 18,000 square feet (1,400 to 1,700 square meters) of office space on two stories, was planned for the northeast corner of the intersection of Diamond Drive and Pajarito Road. Funding and location issues, however, have put this project on hold. Three additional two-story office buildings, each about 70 by 100 feet (21 by 30 meters) would provide about 15,000 to 17,000 gross square feet (1,400 to 1,600 square meters) of office space. Two of the buildings would be built due west of the existing Wellness Center; the third would be constructed near the northeast corner of the intersection of Mercury and Bikini Atoll Roads.

One general infrastructure project that would be completed at TA-3 under the No Action Alternative is the installation of two new combustion turbine generators, as evaluated in the *Environmental Assessment for the Installation and Operation of Combustion Turbine Generators at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2002l). This EA analyzed installation and operation of two new simple-cycle, gas-fired combustion turbine generators, each with an approximate output of 20 megawatts of electricity (rated at an elevation of 7,400 feet [2,220 meters]), as standalone structures within the Co-Generation Complex (Power Plant) at

TA-3. The installation site is immediately adjacent to existing structures and vehicle parking areas. No undeveloped areas would be involved. The first unit became operational in September 2007. There is presently no timetable for installing the second unit. See Chapter 4, Section 4.8.2.1 for more information about this project.

Table 3–2 Technical Area Projects and Activities

Activities	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-3			
Installation of Combustion Turbine Generators	Install two 20-megawatt combustion turbine generators.	Same as No Action Alternative	Same as No Action Alternative
National Security Sciences Building	Demolish old building	Same as No Action Alternative	Same as No Action Alternative
Physical Science Research Complex Project	No activity	No activity	Construct the Physical Science Research Complex (see Appendix G).
Information Management Office Building Project	Construct Information Management Office Building	Same as No Action Alternative	Same as No Action Alternative
Replacement Office Buildings Project	Construct three office buildings.	Same as No Action Alternative	Construct up to 9 additional office buildings (see Appendix G).
TA-18			
TA-18 Closure Project, Including Remaining Operations Relocation and Structure DD&D	Continue certain Pajarito Site activities and store only Security Category III and IV materials. No DD&D activities would occur.	Remove all nuclear materials from the Pajarito Site. Shut the site down and place in surveillance and maintenance mode.	Remove all nuclear materials from the Pajarito Site. DD&D all buildings except a historic cabin and other historic properties from the Manhattan Project and Cold War eras that have been designated for long-term retention (see Appendix H).
TA-21			
TA-21 Structure DD&D Project	Deactivate tritium facilities and place in surveillance and maintenance mode.	Same as No Action Alternative	DD&D of structures located within the boundaries of TA-21 (see Appendix H).
TA-54			
MDA H Closure	Remediate and close MDA H in accordance with the Consent Order.	Same as No Action Alternative	Same as No Action Alternative
TA-62			
Science Complex Project	No activity	No activity	Construct and operate Science Complex (see Appendix G).
TA-72			
Remote Warehouse and Truck Inspection Station Project	No activity	No activity	Construct and operate Remote Warehouse and Truck Inspection Station (see Appendix G).

TA = technical area; DD&D = decontamination, decommissioning, and demolition; MDA = material disposal area; Consent Order = Compliance Order on Consent entered into by DOE, the University of California as the management and operating contractor, and the State of New Mexico.
Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

3.1.2.2 Technical Area 18

Activities occurring in TA-18 are being discontinued in accordance with the ROD (67 *Federal Register* [FR] 79906) for the *Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory (TA-18 EIS)* (DOE 2002i). TA-18 and the Pajarito Site Key Facility are used synonymously in this SWEIS because activities occurring in TA-18 are those assigned to the Pajarito Site Key Facility as defined in this SWEIS and because they are geographically identical. Closure of the Pajarito Site Key Facility is identified in this section because the Key Facility is within TA-18, but activities to implement closure are described in the Pajarito Site Key Facility sections of this Chapter (see Sections 3.1.3.9, 3.2.3, and 3.3.3.5).

3.1.2.3 Deactivation and Decontamination of Technical Area 21 Buildings

Historically, there have been two primary research areas in TA-21 – DP West and DP East. Buildings in DP West are primarily abandoned and deteriorating, with little process equipment present. DP West has been in LANL's decontamination and decommissioning program since 1992, and about half the facilities have been demolished. DP East still houses offices and some tritium facilities, but the remaining tritium work is moving to either the Weapons Engineering Tritium Facility in TA-16 or to Sandia National Laboratories in Albuquerque, New Mexico (*Final Environmental Assessment for the Proposed Consolidation of Neutron Generation Tritium Target Loading Production* [DOE 2005b]). The facilities will be deactivated as funding becomes available. Some buildings in DP East still contain equipment from current and recent operations that may contain accountable quantities of radioactive material. Most of this material would be removed during deactivation. Following deactivation, the tritium buildings will be placed in surveillance and maintenance mode along with the DP West buildings.

Decontamination, Decommissioning, and Demolition (DD&D)

Actions taken at the end of the useful life of a building or structure to reduce or remove substances that pose a substantial hazard to human health or the environment, retire it from service, and ultimately eliminate all or a portion of the structure.

3.1.2.4 Technical Area 54 Material Disposal Area H Closure

Material disposal area (MDA) H, located within TA-54, is a fenced site about 0.3 acres (0.12 hectares) in size that consists of nine inactive vertical inground shafts. Between 1960 and 1986, the site was used for burial of classified containerized and noncontainerized solid wastes, some of which were contaminated with radioactive, hazardous, and high explosives constituents. MDA H subsurface shafts contain primarily radioactive metal, most of which is either known or presumed to be depleted uranium. Investigations and studies for remediation of MDA H have been completed, and now NNSA needs to implement a corrective measure to comply with the legal requirements of the Atomic Energy Act of 1954, as amended, and the Compliance Order on Consent (Consent Order) entered into by DOE, the University of California as the management and operating contractor, and the State of New Mexico. As discussed in the following paragraphs, NNSA has completed its evaluations and is awaiting a decision from the New Mexico Environment Department.

The *Environmental Assessment for the Proposed Corrective Measures at Material Disposal Area H within Technical Area 54 at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2004e) evaluated five corrective measure options—three containment options and two excavation and removal options. For options involving in-place containment of wastes, physical controls (engineered barriers such as caps and containment barriers) and institutional controls (such as access restrictions) would be required for generations to come. As a result, long-term environmental stewardship requirements would be incorporated into any containment option.

The corrective measure option preferred by NNSA and recommended to the State of New Mexico for implementation in the *Corrective Measures Study Report for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54* (LANL 2003d) was replacement of the existing surface with an engineered evapotranspiration cover. Final selection of a corrective measure option was made by the New Mexico Environment Department in November 2007.

3.1.3 Key Facilities

3.1.3.1 Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Building, located within TA-3, is an actinide chemistry and metallurgy research facility. The only building currently in this Key Facility is the Chemistry and Metallurgy Research Building, a three-story, multiple-user facility in which specific wings are associated with different activities. It is the only LANL facility with full capabilities for performing special nuclear material analytical chemistry, materials characterization, and actinide R&D.

Although most capabilities and operating levels projected in the *1999 SWEIS* ROD (see Appendix A) for the Chemistry and Metallurgy Research Building are being retained as capabilities in this SWEIS, two important issues affect the capabilities and activity levels for this Key Facility. First, because of seismic concerns, DOE has administratively restricted operations and reduced the amount of nuclear material that can be used and stored in the building to levels lower than those projected in the *1999 SWEIS* ROD. Therefore, several capabilities are either operating at reduced levels or are not active. Second, as discussed later in this section, the Chemistry and Metallurgy Research Building has been identified for replacement and demolition. The impact analyses in this SWEIS are based on capabilities, activities, and operating levels presented in this section, regardless of whether they are administratively reduced or restricted and whether those activities would occur in the Chemistry and Metallurgy Research Building, its replacement facility, or both during a transition period.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–3** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–3 Chemistry and Metallurgy Research Building Capabilities and Activity Levels [a]

Capability	*No Action Alternative* [b]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [c]
Analytical Chemistry	Support actinide research and processing activities by processing approximately 7,000 samples per year.	Same as No Action Alternative	Support actinide research and processing activities by processing approximately 11,000 samples per year.[a]
Uranium Processing	Recover, process, and store LANL's highly enriched uranium inventory.	Same as No Action Alternative	Same as No Action Alternative
Destructive and Nondestructive Analysis	Evaluate up to 10 secondary assemblies per year through destructive and nondestructive analysis and disassembly.	Same as No Action Alternative	Same as No Action Alternative
Nonproliferation Training	Conduct nonproliferation training using special nuclear material.	Same as No Action Alternative	Same as No Action Alternative
Actinide Research and Development (Actinide Research and Processing in the *1999 SWEIS*)	Characterize approximately 100 samples per year using microstructural and chemical metallurgical analysis. Perform compatibility testing of actinides and other metals to study long-term aging and other material effects. Analyze transuranic waste disposal related to validation of WIPP performance assessment models. Perform transuranic waste characterization. Analyze gas generation such as could occur in transuranic waste during transportation to WIPP. Demonstrate actinide decontamination technology for soils and materials. Develop actinide precipitation method to reduce mixed wastes in LANL effluents. Process up to 900 pounds (400 kilograms) of actinides per year between TA-55 and the CMR Building.	Same as No Action Alternative	Same as No Action Alternative, plus: - Receive, disassemble, and analyze assemblies and components used to measure radiological effects on different materials. - Conduct Performance Demonstration Program to test nondestructive analysis and nondestructive examination equipment. - Develop small-scale (less than 2 pounds [1 kilogram] per year) actinide processing capability. - Perform gas-solid interfacial studies using surface-science instrumentation and associated techniques. - Investigate physical and mechanical properties of plutonium metal alloys.
Fabrication and Processing (Fabrication and Metallography in the *1999 SWEIS*)	Process up to 5,000 curies of neutron sources per year (both plutonium-238 and beryllium and americium-241 and beryllium sources). Process neutron sources other than sealed sources. Stage a total of up to 1,000 plutonium-238 and beryllium and americium-241 and beryllium neutron sources in Wing 9 floor holes. Produce 1,320 targets per year for isotope production. Separate fission products from irradiated targets. Support fabrication of metal shapes using highly enriched uranium (as well as related uranium processing activities), with an annual throughput of approximately 2,200 pounds (1,000 kilograms).	Same as No Action Alternative	Same as No Action Alternative, plus: - As a part of the Isotope Production Program, produce up to 100 curies per year of industrial or medical radioisotopes. - Produce up to 9 pounds (4 kilograms) per year of americium oxide. - Fabricate metal alloys. - Study and perform fabrication methods and effects of actinide materials thermomechanical processing. - *Increase types and quantities of sealed sources stored for the Off-Site Source Recovery Project* (see Appendix J).

Capability	*No Action Alternative* [b]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [c]
Large Vessel Handling	Process up to two large vessels from the Dynamic Experiments Program annually.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
Replacement of CMR Building	Construct and operate a CMRR Facility in TA-55 and conduct DD&D of the CMR Building. Wing 9 hot cell operations and certain other capabilities would be eliminated. The CMRR Facility would replace the CMR Building as the Key Facility.	Construct and operate only the radiological laboratory, administrative and support facility portion of the CMRR Facility; continue to down scope and consolidate operations within the existing CMR Building in performance of minimal mission support work.	Same as No Action Alternative, plus: - Reconstruct Wing 9 hot cell capabilities in proposed new *Radiological Sciences Institute* in TA-48 (see Section 3.3.3.7 and Appendix G).

WIPP = Waste Isolation Pilot Plant; TA = technical area; DD&D = decontamination, decommissioning, and demolition; CMR = Chemistry and Metallurgy Research, CMRR = Chemistry and Metallurgy Research Replacement Facility.

[a] Activity levels shown cannot be met while work is performed in the Chemistry and Metallurgy Research Building due to seismic concerns that restrict the level of operations and limit the allowable amount of nuclear materials. Full operations would be achievable upon movement of all activities into the new Chemistry and Metallurgy Research Replacement Facility.

[b] DOE 1999a.

[c] LANL 2004c, 2006a.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Analytical Chemistry. Analytical chemistry capabilities involve the study, evaluation, and analysis of radioactive materials. These activities support R&D associated with various nuclear materials programs, many of which are performed at other LANL locations on behalf of, or in support of, other sites across the DOE complex (such as the Hanford Site, Savannah River Site, and Sandia National Laboratories). Sample characterization activities include assay and determination of isotopic ratios of plutonium, uranium, and other radioactive elements; major and trace elements in materials; the content of gases; constituents at the surface of various materials; and methods to characterize waste constituents in hazardous and radioactive materials.

Uranium Processing. Uranium processing capabilities encompass many types of operations that are essential for uranium product stewardship, including uranium processing (casting, machining, and reprocessing operations, including R&D of process improvements and uranium and uranium compounds characteristics) and highly enriched uranium handling and storage. The Chemistry and Metallurgy Research Building also provides limited backup to support nuclear materials management needs for TA-55 activities, as well as pilot-scale unit operations to back up uranium technology activities at the Sigma Complex (described in Section 3.1.3.2), other LANL facilities, and other DOE sites.

Destructive and Nondestructive Analysis. Destructive and nondestructive analysis involves analytical chemistry, metallographic analysis, neutron- or gamma-radiation-based measurement, and other measurement techniques. These activities support weapons quality component

surveillance, nuclear materials control and accountability, special nuclear material standards development, R&D, environmental restoration, and waste treatment and disposal.

Nonproliferation Training. Measurement technologies are used at the Chemistry and Metallurgy Research Building and other LANL facilities to train international inspection teams for the International Atomic Energy Agency. Such training might use special nuclear material.

Actinide Research and Development. Actinide research and processing at the Chemistry and Metallurgy Research Building typically involves solids or small quantities of solution. Research involving highly radioactive materials or remote handling, however, may use the hot cells in Wing 9 of the Chemistry and Metallurgy Research Building to minimize personnel exposure to radiation or other hazardous materials. Actinide research and processing can include separation of medical isotopes from targets, neutron source processing, and material characteristics research, including the behavior or characteristics of materials in extreme environments such as high temperatures or pressures.

The primary mission to study long-term aging and other material effects is achieved through microstructural and chemical metallurgical analysis and compatibility testing of actinides and other metals. This R&D is conducted in hot cells on pits exposed to high temperatures.

Fabrication and Processing. The Chemistry and Metallurgy Research Building has facilities to fabricate and analyze a variety of parts, including targets and weapons components used for various research and experimental tasks. Fabrication and processing at this building involve a variety of materials, including hazardous and nuclear materials. Much of the work is performed to support highly enriched uranium processing, R&D, pilot operations, and casting. Some metal recycling is conducted through these processes. In addition, materials to support these activities and the Off-Site Source Recovery Project are stored in the Wing 9 hot cell areas.

Large Vessel Handling. This capability would not begin until the Chemistry and Metallurgy Research Replacement Facility is operating. Large (6 to 8 feet [1.8 to 2.4 meters] in diameter) experimental vessels from the Dynamic Experiments Program would be cleaned and materials would be recovered for reuse or disposal. Large-vessel handling operations would begin with unloading and opening the vessel. The vessels would then be emptied and the contents would be sorted and packaged. Depending on the condition and quality of the special nuclear material recovered from the vessels, the material could be processed for reuse or prepared for disposal as transuranic waste. Other vessel contents would be disposed of as either low-level radioactive waste or transuranic waste. The empty vessel would be cleaned for disposal as low-level radioactive waste.

Replacement of Chemistry and Metallurgy Research Building. Because of the age and condition of the Chemistry and Metallurgy Research Building, NNSA decided to replace the building rather than upgrade it to meet structural requirements to address seismic concerns and code requirements for operation as a nuclear facility. As part of its decisionmaking process, NNSA prepared the *Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico* (*CMRR EIS*) (DOE 2003d). The *CMRR EIS* evaluates potential impacts of the proposed relocation of analytical chemistry and materials characterization activities and associated R&D

capabilities that currently exist primarily at the Chemistry and Metallurgy Research Building to a newly constructed Chemistry and Metallurgy Research Replacement Facility, as well as the continued performance of those operations and activities at the new facility for the next 50 years. The *CMRR EIS* ROD (69 FR 6967) announced NNSA's decision to replace the Chemistry and Metallurgy Research Building with a new facility in TA-55, the Chemistry and Metallurgy Research Replacement Facility, followed by decontamination, decommissioning, and demolition (DD&D) of the existing Chemistry and Metallurgy Research Building. The replacement facility will comprise a nuclear facility portion (a Nuclear Hazard Category 2 laboratory building) and a separate radiological laboratory, administrative office, and support building.

Phased construction began in 2006. The radiological laboratory, administrative office, and support building will be constructed first and will house office space, training facilities, utility equipment, and laboratory space designed to handle small amounts of special nuclear material. Construction of the nuclear facility portion, capable of handling larger quantities of special nuclear material has been delayed until NNSA completes reconsideration of its 2004 decision to construct this facility at LANL. If located at LANL, the transition of capabilities and operations to the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility would begin at construction completion. Not all Chemistry and Metallurgy Research Building capabilities would be moved to the new facility: Wing 9 hot cell operations, medical isotope production, uranium production, surveillance activities, and other capabilities would be eliminated.

Transition of operations from one facility to the other is anticipated to occur in stages and is expected to take about 4 years to complete. During the transition period, both facilities would be operating, although at reduced levels. Activities would decrease at the Chemistry and Metallurgy Research Building while increasing at the new replacement facility. Routine onsite shipments of analytical chemistry and materials characterization samples would continue during the transition period.

The Key Facility would comprise both the Chemistry and Metallurgy Research Building and its replacement during the transition period. After the transition period, the Chemistry and Metallurgy Research Replacement Facility would become the Key Facility.

3.1.3.2 Sigma Complex

The Sigma Complex Key Facility, located in TA-3, consists of the main Sigma Building and its associated support structures, including the Beryllium Technology Facility, the Press Building, and the Thorium Storage Building. The Sigma Building contains four levels and approximately 200,000 square feet (60,960 square meters) of space.

The Sigma Complex supports a large multidisciplinary technology base in materials fabrication science. Primary activities are materials synthesis and processing, characterization of materials, and fabrication of metallic and ceramic items, including depleted uranium items used in the Stockpile Stewardship Program. Bulk depleted uranium is stored in the Sigma Building as supply and feed stock. Current activities in the Sigma Building focus on test hardware, prototype fabrication, and materials research for the DOE Nuclear Weapons Program, but also include activities related to energy, environment, industrial competitiveness, and strategic research.

Sigma Complex Key Facility capabilities include R&D on materials fabrication, coating, joining, and processing; characterization of materials; and fabrication of metallic and ceramic items. The following paragraphs describe the capabilities of this Key Facility. **Table 3–4** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–4 Sigma Complex Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Fabricate items from metals, ceramics, salts, beryllium, enriched and depleted uranium, and other uranium isotope mixtures. Fabrication techniques would include casting, forming, machining, polishing, coating, and joining.	Same as No Action Alternative	Same as No Action Alternative
Characterization of Materials	Perform research and development on properties of ceramics, oxides, silicides, composites, and high-temperature materials. Analyze up to 36 tritium reservoirs per year. Develop a library of aged nonspecial nuclear material from stockpiled weapons and develop techniques to test and predict changes. Characterize and store up to 2,500 nonspecial nuclear material samples per year, including uranium.	Same as No Action Alternative	Same as No Action Alternative
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for up to 80 pits per year. Fabricate up to 200 reservoirs for tritium per year. Fabricate components for up to 50 secondary assemblies (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium) per year. Fabricate nonnuclear components for research and development: 100 major hydrotests and 50 joint test assemblies per year. Fabricate beryllium targets. Fabricate targets and other components for accelerator production of tritium research. Fabricate test storage containers for nuclear materials stabilization.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
	No activity	No activity	No activity

DD&D = decontamination, decommissioning, and demolition.
[a] DOE 1999a.
[b] LANL 2004c, 2006a.

Research and Development on Materials Fabrication, Coating, Joining, and Processing. Materials synthesis and processing work includes R&D related to making items out of difficult-to-work-with materials. Processes include applying coatings and joining materials using plasma arc welding and other techniques. Other activities include casting, forming, machining, and polishing. Materials used in fabrication are also reprocessed (separated into pure forms for reuse or storage).

Characterization of Materials. Materials characterization work conducted at the Sigma Complex includes activities to enhance understanding of the properties of metals, metal alloys, ceramic-coated metals, and other similar combinations. Materials characterization also includes activities to improve understanding of the effects of aging, chemical attack, mechanical stresses, and other agents on these materials and their properties.

Fabrication of Metallic and Ceramic Items. Materials fabrication at the Sigma Complex includes work with metallic and ceramic materials and combinations thereof. Items are fabricated as one-of-a-kind and prototype pieces, as well as on a limited-production basis. One specific set of applications for this technology is fabrication of nonnuclear weapons components.

3.1.3.3 Machine Shops

The Machine Shops Key Facility consists of two buildings, a Nonhazardous Materials Machine Shop and a Radiological Hazardous Materials Machine Shop. These buildings are located in TA-3 and are connected to each other by a 125-foot-long (38-meter-long) corridor. The Nonhazardous Materials Machine Shop is approximately 138,000 square feet (42,060 square meters), including a 13,500-square-foot (4,120-square-meter) administrative office area. This building contains a variety of lathes, mills, and other metal-forming equipment and also houses the old beryllium shop, which is ventilated through a high-efficiency particulate air filtration system. Equipment from the beryllium shop was moved to the Sigma Complex in 2000, and beryllium operations ceased in 2001. A number of modular units have been constructed on the north side of the Nonhazardous Materials Machine Shop to provide space in which to conduct prototype mockup operations for TA-55, PF-4 Building.

The Radiological Hazardous Materials Machine Shop has a total floor space of approximately 12,500 square feet (1,160 square meters) and contains a variety of metal fabrication machines. Depleted uranium represents the bulk of the materials used in this facility, although many other potentially hazardous materials, such as lithium compounds, are used.

Activities conducted at the machine shops include machining, welding, and assembly of various materials in support of major LANL programs and projects, principally those related to weapons manufacturing.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–5** indicates activity types and levels proposed under all three alternatives for each capability.

Fabrication of Specialty Components. The primary purpose of the Machine Shops Key Facility is fabrication of specialty components. Specialty components are unique, unusual, or one-of-a-kind parts, fixtures, tools, or other equipment.

Fabrication Utilizing Unique Materials. Parts and components are fabricated using unique or exotic materials at the machine shops. Components are fabricated from depleted uranium or lithium in support of NNSA programs, for example.

Table 3–5 Machine Shops Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Fabrication of Specialty Components	Provide fabrication support for the Dynamic Experiments Program and explosives research studies. Support up to 100 hydrodynamic tests annually. Manufacture 50 joint test assembly sets annually. Provide general laboratory fabrication support as requested.	Same as No Action Alternative	Same as No Action Alternative
Fabrication Using Unique Materials	Fabricate items using unique and unusual materials such as depleted uranium and lithium.	Same as No Action Alternative	Same as No Action Alternative
Dimensional Inspection of Fabricated Components	Perform dimensional inspections of finished components. Perform other types of measurements and inspections.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
	No activity	No activity	No activity

DD&D = decontamination, decommissioning, and demolition.
[a] DOE 1999a.
[b] LANL 2004c, 2006a.

Dimensional Inspection of Fabricated Components. Dimensional inspection of the finished component is a standard step in the fabrication process. It involves numerous measurements to ensure that the component is the correct size and shape to fit into its allotted space and perform its intended function.

3.1.3.4 Material Sciences Laboratory

This Key Facility comprises several buildings in TA-3 (3-32, 3-34, 3-1698, 3-1819, and 3-2002). The main Material Sciences Laboratory (Building-3-1698), a two-story, approximately 55,000-square-foot (5,100-square-meter) laboratory building, contains 27 laboratories, 60 offices, and 21 materials research and support areas. This Key Facility supports four major types of experimentation: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. These four areas contain operational capabilities that support materials research activities related to energy, environment, nuclear weapons, and industrial competitiveness. Collaboration with private industry is also an important feature of much of the work performed at the Material Sciences Laboratory. Given the dynamic nature of research, the types and number of experiments will continue to evolve. These changes, however, can be sufficiently characterized to allow analysis of their consequences within the context of this SWEIS.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–6** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–6 Material Sciences Laboratory Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Materials Processing	Support development and improvement of technologies for materials formulation. Support development of chemical processing technologies, including recycling and reprocessing techniques to solve environmental problems.	Same as No Action Alternative	Same as No Action Alternative
Mechanical Behavior in Extreme Environments	Study fundamental properties of materials and characterize their performance, including research on the aging of weapons. Develop and improve techniques for these and other types of studies.	Same as No Action Alternative	Same as No Action Alternative
Advanced Materials Development	Synthesize and characterize single crystals and nanophase and amorphous materials. Perform ceramics research, including solid-state, inorganic chemical studies involving materials synthesis. A substantial amount of effort in this area would be dedicated to producing new high-temperature superconducting materials. Provide facilities for synthesis and mechanical characterization of materials systems for bulk conductor applications. Develop and improve techniques for development of advanced materials.	Same as No Action Alternative	Same as No Action Alternative
Materials Characterization	Perform materials characterization activities to support materials development.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
	No activity	No activity	No activity

DD&D = decontamination, decommissioning, and demolition.
[a] DOE 1999a.
[b] LANL 2004c, 2006a.

Materials Processing. Materials processing supports formulation of a wide range of useful materials through development of materials fabrication and chemical processing technologies. Wet chemistry, thermomechanical processing, microwave processing, heavy-equipment materials processing, single-crystal growth, amorphous alloys, and powder processing are synthesis and processing techniques that represent some of the capabilities available for this research area.

Some of the laboratories housing heavy equipment for novel mechanical processing of powders and nondense materials are configured to explore net shape and zero-waste manufacturing processes. Several laboratories are dedicated to development of chemical processing technologies, including recycling and reprocessing techniques to solve current environmental problems.

Mechanical Behavior in Extreme Environments. These laboratories contain equipment for mechanical testing of materials subjected to a broad range of mechanical loadings to study their fundamental properties and characterize their performance. Laboratories utilized for this major

area of materials science include dedicated space for mechanical testing; mechanical fabrication, assembly, and machining research; metallography; and dynamic testing.

The mechanical testing laboratory offers capabilities to study multi-axial, high-temperature, and high-load behaviors of materials. Assembly areas consist of metalworking and experimental assembly areas that house a variety of electrically or hydraulically powered machines that twist, pull, or compress samples. The most energetic of these is a gas launcher, which projects a sample against an anvil at very high velocities. The Material Sciences Laboratory's dynamic materials behavior laboratory is used by researchers to study high-deformation-rate behaviors. The dynamic testing equipment allows materials to be subjected to high-rate loadings, including impact up to 1.2 miles (2 kilometers) per second. The metallography area contains equipment for sectioning, mounting, polishing, and photographing samples.

Advanced Materials Development. The various laboratories are configured for development of advanced materials for high-strength and high-temperature applications. Capabilities involve research in synthesis and characterization using ceramics, superconductors, and new materials.

Materials Characterization. The materials characterization capability aids researchers in understanding the properties and processing of materials and applying that understanding to materials development. Capabilities at these laboratories include x-ray, optical metallography, spectroscopy, and surface-science chemistry.

The x-ray laboratory allows for the study of samples at temperatures up to 4,892 degrees Fahrenheit (°F) (2,700 degrees Celsius [°C]) and pressures up to 80 kilobars. Optical characterization is conducted with the latest equipment in the metallography and ceramography support laboratory. Subnanometer to micrometer structures are characterized using electron microscopy, including chemical analysis and high-resolution electron holography. The optical spectroscopy laboratory performs ultrafast and continuous-wave, tunable-resonance Raman scattering spectroscopy; high-resolution Fourier Transform infrared absorption; and ultraviolet-visible to near-infrared absorption spectroscopy. Surface-science studies and corrosion characterization of materials are carried out in additional laboratories.

3.1.3.5 Nicholas C. Metropolis Center for Modeling and Simulation

The Nicholas C. Metropolis Center for Modeling and Simulation (Metropolis Center) is a new Key Facility and an integral part of the tri-laboratory (LANL, Lawrence Livermore National Laboratory, and Sandia National Laboratories) mission to maintain, monitor, and ensure the Nation's nuclear weapons performance through the Advanced Simulation and Computing Program. The facility is housed in a three-story, 303,000-square-foot (28,200-square-meter) structure in TA-3 and has been in operation since 2002. High-performance, complex computing operations are performed at this facility. Together with the Laboratory Data Communication Center, Central Computing Facility, and Advanced Computing Laboratory, the Metropolis Center forms the center for high-performance computing at LANL.

Under the No Action Alternative, the Metropolis Center computing platform would operate at up to 50 teraflops.[1] Computer operations are performed 24 hours a day, with personnel occupying

[1] *A teraflop is a trillion floating point operations per second.*

the control room to support computer operation activities during prime business hours and other times as necessary. Operations consist of office-type activities, light laboratory work such as computer and support equipment assembly and disassembly, and computer operations and maintenance. The Metropolis Center has capabilities to enable remote-site users access to the computing platform, and its co-laboratories and theaters are equipped for distance operations to allow collaboration between weapons designers and engineers across the DOE weapons complex.

The following paragraph describes the capabilities of this Key Facility. **Table 3–7** indicates activity levels proposed under all three alternatives.

Computer Simulations. Computer simulations have become the only means of integrating the many complex processes that occur in the nuclear weapon lifespan. Large-scale calculations are now the primary tools for estimating nuclear yield and evaluating the safety of aging weapons in the nuclear stockpile. Continued certification of aging stockpile safety and reliability depends upon the ability to perform highly complex, three-dimensional computer simulations.

Table 3–7 Nicholas C. Metropolis Center for Modeling and Simulation Capabilities and Activity Levels

Capability	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Computer Simulations	Perform complex three-dimensional computer simulations to estimate nuclear yield and aging effects to demonstrate nuclear stockpile safety. Apply computing capability to solve other large-scale, complex problems.	Same as No Action Alternative	Same as No Action Alternative, plus: Operate computing platform at higher computational capabilities.
Construction/Upgrades/DD&D			
Metropolis Center Increased Level of Operations	No activity	No activity	Install additional processors to increase functional capability. This expansion would involve addition of mechanical and electrical equipment, including chillers, cooling towers, and air-conditioning units (see Appendix J).

DD&D = decontamination, decommissioning, and demolition.
Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

3.1.3.6 High Explosives Processing Facilities

High Explosives Processing Facilities are located in six TAs: TA-8, TA-9, TA-11, TA-16, TA-22, and TA-37. This Key Facility includes production and assembly buildings, analytical laboratories, explosives storage magazines, and a building to treat wastewater contaminated with explosives. Activities under the No Action Alternative would require an estimated 82,700 pounds (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives annually (this is an indicator of overall activity levels in this Key Facility).

The following paragraphs describe the capabilities of this Key Facility. **Table 3–8** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–8 High Explosives Processing Facilities Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Volume of Explosives Required (indicator of overall activity levels)	High-explosives processing activities would use approximately 82,700 pounds (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives annually.	High-explosives processing activities would use approximately 66,160 pounds (30,000 kilograms) of explosives and 2,330 pounds (1,060 kilograms) of mock explosives annually, a 20 percent reduction in activity levels from the No Action Alternative.	Same quantity of explosives as the No Action Alternative, plus: Increase to 5,000 pounds (2,270 kilograms) of mock explosives.[b]
High Explosives Synthesis and Production	Perform high explosives synthesis and production research and development. Produce new materials for research, stockpile, military, security-interest, and other applications. Formulate, process test, and evaluate explosives.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
High Explosives and Plastics Development and Characterization	Evaluate stockpile returns and materials of specific interest. Develop and characterize new plastics and high explosives for stockpile, military, and security interest improvements. Improve predictive capabilities. Research high explosives waste treatment methods.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
High Explosives and Plastics Fabrication	Perform stockpile surveillance and process development. Supply parts to the Pantex Plant for surveillance and stockpile rebuilds and joint test assemblies. Fabricate materials for specific military, security-interest, hydrodynamic, and environmental testing.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
Test Device Assembly	Assemble test devices. Perform radiographic examination of assembled devices to support stockpile-related hydrodynamic tests, joint test assemblies, environmental and safety tests, and R&D activities. Support up to 100 major hydrodynamic test device assemblies annually.	Reduce activity levels by 20 percent from the No Action Alternative, including supporting up to 80 major hydrodynamic test device assemblies annually.	Same as No Action Alternative
Safety and Mechanical Testing	Conduct safety and environmental testing related to stockpile assurance and new materials development. Conduct up to 15 safety and mechanical tests annually.	Reduce activity levels by 20 percent from the No Action Alternative, including conducting up to 12 safety and mechanical tests annually.	Same activities as No Action Alternative, plus: Increase up to 500 safety and mechanical tests conducted annually.[c]

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Research, Development, and Fabrication of High-Power Detonators	Continue to support stockpile stewardship and management activities. Manufacture up to 40 major product lines per year. Support DOE-wide packaging and transport of electro-explosive devices.	Reduce activity levels by 20 percent from the No Action Alternative, including manufacturing up to 32 major product lines per year.	Same as No Action Alternative
Construction/Upgrades/DD&D			
Engineering and Science Applications Consolidation Project	Complete construction of TA-16 Engineering Complex. Remove or demolish vacated structures that are no longer needed.	Same as No Action Alternative	Same as No Action Alternative

R&D = research and development; DD&D = decontamination, decommissioning, and demolition; TA = technical area.
[a] DOE 1999a.
[b] LANL 2004c.
[c] LANL 2006a.

High Explosives Synthesis and Production. Activities under this capability include explosive manufacturing capacity such as synthesizing new explosives and manufacturing pilot-plant quantities of raw and plastic-bonded explosives. These operations allow the LANL contractor to develop and maintain expertise in explosive materials and processes that is essential for long-term maintenance of stockpile weapons and materials.

High Explosives and Plastics Development and Characterization. Activities included in this capability provide characterization data for explosives applications in nuclear weapons technology. Information on the initiation and detonation properties of high explosives coupled with non-high explosives component information for modeling is essential to weapons design and safety analysis. A wide range of plastic and composite materials is used in nuclear weapons such as adhesives, potting materials, flexible cushions and pads, thermoplastics, and elastomers. A thorough understanding of the chemical and physical properties of these materials is necessary to effectively model weapons behavior.

High Explosives and Plastics Fabrication. High explosives powders are typically compacted into solid pieces and machined to final specified shapes. Some small pieces are pressed into final shapes, and some powders, based upon their properties, are melted into stock pieces. Fabrication of plastic materials and components is a core capability associated with high explosives processing, and a wide variety of plastic and composite materials may be fabricated.

Test Device Assembly. This capability 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, this Key Facility conducts explosives testing support and radiography examinations of the final assemblies.

Safety and Mechanical Testing. Capabilities exist for measuring mechanical properties of explosives samples, including tensile, compression, and creep properties (change of materials shapes over time). Test assemblies can be instrumented with strain or pressure gauges or other diagnostic equipment.

Research, Development, and Fabrication of High-Power Detonators. This capability includes activities such as detonator design; printed circuit manufacture; metal deposition and joining; plastic materials technology development; explosives loading, initiation, and diagnostics; laser production; and explosives systems design, development, and manufacture safety. Detonators, cables, and firing systems for tests are built as part of this capability.

Construction, Upgrades, and DD&D. Under all three alternatives, the Engineering and Science Applications Consolidation would be completed. This consolidation was evaluated in the *Environmental Assessment for the Proposed TA-16 Engineering Complex Refurbishment and Consolidation at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2002e), and involves constructing or remodeling TA-16 Engineering Complex offices, laboratories, and shops. Operations and personnel would be consolidated from facilities in TA-3, TA-8, TA-11, TA-50, and other areas of TA-16. Six new buildings (two office buildings, two machine shops, a crafts support building, and a calibration laboratory) would be constructed, and two other existing TA-16 Engineering Complex buildings would be remodeled. Some vacated structures would be removed or demolished. Existing Engineering Complex roads, parking, fencing, and utilities would be modified or upgraded. Proposed construction sites are located in areas that were once occupied by buildings or structures, are within existing paved parking areas, or are in areas immediately adjacent to existing buildings and parking areas.

3.1.3.7 High Explosives Testing Facilities

The major High Explosives Testing Facilities buildings are located in TA-15 and include the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility. These buildings are used primarily for R&D, test operations, and detonator development and testing related to the DOE Stockpile Stewardship Program. Building types include preparation and assembly facilities, bunkers, analytical laboratories, high explosives storage magazines, and office areas. Firing sites are located in five TAs (TA-14, TA-15, TA-36, TA-39, and TA-40). All of the firing sites are in remote locations within canyons and specialize in experimental studies of the dynamic properties of materials under high-pressure and -temperature conditions. The firing sites, which occupy approximately 22 square miles (57 square kilometers) of land area, represent more than half of LANL's total 40 square miles (104 square kilometers).

The No Action Alternative includes about 1,800 experiments per year, 100 of which would be characterized as major hydrodynamic tests. Up to 6,900 pounds (3,130 kilograms) of depleted uranium would be expended in experiments annually. Firing site activities would include expenditures of materials that are considered to be useful indicators of overall test activity.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–9** indicates activity types and levels proposed under all three alternatives for each capability.

Hydrodynamic Tests. Hydrodynamic tests are dynamic integrated systems tests of mockup nuclear packages during which high explosives are detonated and resulting motions and reactions of materials and components are observed and measured. Explosively generated pressures and temperatures cause some materials to behave hydraulically (like a fluid). Surrogate materials such as depleted uranium replace actual weapons materials in the mockup nuclear weapons

package to ensure there is no potential for a nuclear explosion. Most hydrodynamic tests are conducted at TA-15; others are conducted at TA-36.

Table 3–9 High Explosives Testing Facilities Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Volume of Materials Required (indicator of overall activity levels)	Conduct about 1,800 experiments per year. Use up to 6,900 pounds (3,130 kilograms) of depleted uranium in experiments annually.	Reduce activity levels by 20 percent from the No Action Alternative: - Conduct about 1,440 experiments per year. - Use up to 5,500 pounds (2,500 kilograms) of depleted uranium in experiments annually.	Same as No Action Alternative
Hydrodynamic Tests	Develop containment technology. Conduct baseline and code development tests of weapons configurations. Conduct 100 major hydrodynamic tests per year.	Reduce activity levels by 20 percent from the No Action Alternative. Conduct approximately 80 major hydrodynamic tests per year.	Same as No Action Alternative
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics and equation of state and motion for nuclear weapons materials, including some special nuclear material experiments.	Reduce activity levels by 20 percent from the No Action Alternative: No experiments would use special nuclear material.	Same as No Action Alternative
Explosives Research and Testing	Conduct tests to characterize explosive materials.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
Munitions Experiments	Support the U.S. Department of Defense with R&D on conventional munitions. Conduct experiments to study external-stimuli effects on munitions.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
High Explosives Pulsed-Power Experiments	Conduct experiments using explosively driven electromagnetic power systems.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
Calibration, Development, and Maintenance Testing	Perform experiments to develop and improve techniques to prepare for more involved tests.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
Other Explosives Testing	Conduct advanced high explosives or weapons evaluation studies.	Reduce activity levels by 20 percent from the No Action Alternative.	Same as No Action Alternative
Construction/Upgrades/DD&D			
Dynamic Experimentation Consolidation Project [c]	Complete construction of 15 to 25 new structures (offices, laboratories, and shops) within the Two-Mile Mesa Complex to replace about 59 structures currently used for dynamic experimentation operations. Remove or demolish vacated structures.	Same as No Action Alternative	Same as No Action Alternative
DARHT EIS [d]	Install dynamic experimentation structure at TA-15.	Same as No Action Alternative	Same as No Action Alternative

R&D = research and development; DD&D = decontamination, decommissioning, and demolition; DARHT = Dual Axis Radiographic Hydrodynamic Test Facility; EIS = environmental impact statement; TA = technical area.

[a] DOE 1999a.
[b] LANL 2004c, 2006a.
[c] DOE 2003e.
[d] DOE 1995a.

Dynamic Experiments. A dynamic experiment is an experiment that provides information regarding basic physics of materials or characterizes physical changes or motion of materials under influence of high explosives detonations. Most dynamic experiments are conducted at TA-15 and TA-36; some are conducted at TA-39 and TA-40. DOE could perform dynamic experiments using plutonium in the future at DARHT and other facilities. Dynamic experiments involving plutonium would be conducted inside containment vessels.

Explosives Research and Testing. Explosives research and testing activities would be conducted primarily to study properties of the explosives themselves as opposed to explosive effects on other materials. Examples include tests to determine effects of aging on explosives, safety and reliability of explosives from a quality assurance point of view, and fire resistance of explosives. Explosives research and testing activities could be performed at any of the High Explosives Testing sites.

Munitions Experiments. Munitions experiments study the influence of external stimuli, for example, projectiles or other impacts on explosives. These studies include work on conventional munitions for the U.S. Department of Defense. Most of the munitions experiments are performed at TA-36 and TA-39, but any of the firing sites could be used as required.

High Explosives Pulsed-Power Experiments. High explosives pulsed-power experiments are conducted to develop and study new concepts based on explosively driven electromagnetic power systems. These experiments are conducted primarily at TA-39.

Calibration, Development, and Maintenance Testing. This testing involves experiments conducted primarily to prepare for more elaborate tests and includes tests to develop, evaluate, and calibrate diagnostic instrumentation or other systems. Calibration, development, and maintenance testing activities are concentrated at TA-15 and TA-36, but could involve any of the High Explosives Testing sites. Activities within this capability also include image processing capability maintenance.

Other Explosives Testing. This capability includes activities such as advanced high explosives development and work to improve weapons evaluation techniques.

Construction, Upgrades, and DD&D. Under all three alternatives, portions of this Key Facility would be relocated to one centralized area, as analyzed in the *Final Environmental Assessment for the Proposed Consolidation of Certain Dynamic Experimentation Activities at the Two-Mile Mesa Complex, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2003e). This project would consolidate operations of the LANL organization responsible for dynamic experimentation within the Two-Mile Mesa Complex (portions of TA-6, TA-22, and TA-40). The project includes constructing 15 to 25 new structures over a 10-year timeframe to replace about 59 structures in a number of TAs. These new structures would consist of two to five combination office and laboratory buildings, a Characterization of Highly Energetic Materials Laboratory, an Engineering Diagnostic Facility, five Contained Firing Capability buildings and associated support structures, a High-Bay Laboratory, a Detonator Qualification Laboratory, two to four Gas Gun Facility buildings, a machine shop, a Classified High Explosives Storage Building, and a lecture hall. This project would also involve upgrading or constructing new roads, parking, fencing, and utilities within the Two-Mile Mesa Complex, including construction

of a new road and security gate to provide access to the Dynamic Experimentation Facility. In addition, the project provides for removal or demolition of some of the vacated structures.

Another project for this Key Facility would be the possible assembly, installation, and operation of a containment structure for assembling components into test assemblies for dynamic experimentation. Currently, test components are assembled in TA-16. Completed test assemblies are then transported to TA-8 for radiographic examination, after which they are transported to the firing site in TA-15. The proposed structure, to be located at TA-15, is designed to contain any explosions that could occur during test component assembly. The *Final Environmental Impact Statement, Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility* (*DARHT EIS*) (DOE 1995a) evaluates containment options for dynamic experiments at the DARHT facility, including containment vessels and a building addition.

Assembly and radiography operations would be collocated in this containment structure at the DARHT firing site, which would reduce test assembly transportation. This would reduce security risks and the risk of vibration-induced explosions during transport. Risks to the environment and collocated workers would also be substantially reduced compared to those associated with facilities currently used for these activities. The containment structure would be brought to the LANL site in sections for assembly adjacent to the DARHT firing site in TA-15, and could be used to support other DARHT tests.

3.1.3.8 Tritium Facilities

The Weapons Engineering Tritium Facility in TA-16 is the principal building in this Key Facility. The Tritium Science and Fabrication Facility in TA-21 had been part of this Key Facility, but operations in this building have ceased and those operations have been moved to the Weapons Engineering Tritium Facility and another DOE site as discussed in Section 3.1.2.3. In the past, tritium operations were conducted in the Tritium Systems Test Assembly Facility in TA-21, but that building is no longer used and is also no longer part of the Tritium Facilities Key Facility. Some equipment is being removed from the building, and the building is in surveillance and maintenance mode. Residual tritium is present in the Tritium Systems Test Assembly and will remain until completion of decontamination activities.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–10** indicates activity types and levels proposed under all three alternatives for each capability. The activity levels shown in the table may not be possible during the entire period covered by this SWEIS. An updated probabilistic seismic hazard analysis (LANL 2007a) was completed in 2007 which indicated a greater seismic risk than previously recognized. To mitigate the accident risk associated with the increased seismic risk, a limitation on the amount of tritium used in the Weapons Engineering Test Facility was imposed pending completion of a facility-specific seismic analysis (LANL 2007b, NNSA 2007c).

Table 3–10 Tritium Facilities Capabilities and Activity Levels [a]

Capability	*No Action Alternative* [b]	*Reduced Operations Alternative*	*Expanded Operations Alternative*
High-Pressure Gas Fills and Processing	Handle and process tritium gas in quantities of about 3.5 ounces (100 grams) approximately 65 times per year at the Weapons Engineering Tritium Facility.	Same as No Action Alternative	Same as No Action Alternative
Gas-Boost System Testing and Development	Conduct gas-boost system R&D and testing and gas processing operations at the Weapons Engineering Tritium Facility approximately 35 times per year using quantities of about 3.5 ounces (100 grams) of tritium.	Same as No Action Alternative	Same as No Action Alternative
Diffusion and Membrane Purification	Conduct research on gaseous tritium movement and penetration through materials—perform up to 100 major experiments per year. Use this capability for effluent treatment.	Same as No Action Alternative	Same as No Action Alternative
Metallurgical and Material Research	Conduct metallurgical and materials research and application studies, and tritium effects and properties R&D. Small amounts of tritium would be used for these studies.	Same as No Action Alternative	Same as No Action Alternative
Gas Analysis	Measure the composition and quantities of gases (in support of tritium operations).	Same as No Action Alternative	Same as No Action Alternative
Calorimetry	Perform calorimetry measurements in support of tritium operations.	Same as No Action Alternative	Same as No Action Alternative
Solid Material and Container Storage	Store about 35 ounces (1,000 grams) of tritium inventory in process systems and samples, inventory for use, and waste.	Same as No Action Alternative	Same as No Action Alternative for TA-16 operations. Eliminate TA-21 activities.
Hydrogen Isotopic Separation	Perform R&D of tritium gas purification and processing in quantities of about 7 ounces (200 grams) of tritium per test.	Same as No Action Alternative	Same as No Action Alternative
Radioactive Liquid Waste Pretreatment	Pretreat liquid low-level radioactive waste at TA-21 prior to transport for treatment. Activity ends with decommissioning of TA-21 tritium buildings.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades /DD&D			
TA-21 Structure DD&D Project	No activity	No activity	Implement *TA-21 Structure DD&D Project (see Section 3.3.2.2)*: - DD&D of TA-21 buildings. - Eliminate TA-21 buildings from Tritium Key Facilities.

R&D = research and development; DD&D = decontamination, decommissioning, and demolition; TA = technical area.

[a] Activity levels shown may not be met while there are restrictions on operations instituted due to seismic concerns related to the updated probabilistic seismic hazard analysis (LANL 2007a). Pending evaluation of the need for and implementation of corrective actions, limitations have been imposed on the amount of tritium allowed in the Weapons Engineering Test Facility (LANL 2007b, NNSA 2007c).

[b] DOE 1999a, LANL 2006a.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

High-Pressure Gas Fills and Processing. High-pressure gas fills and processing operations for R&D and nuclear weapons systems are performed at the Weapons Engineering Tritium Facility. High-pressure gas containers (reservoirs) are filled with tritium or deuterium gas mixtures, or both, to specified pressures in excess of 10,000 pounds per square inch (6,900 newtons per square meter). This capability is also used for filling experimental devices (for example, filling small inertial confinement fusion targets that require high-pressure tritium gas).

Gas-Boost System Testing and Development. Modern nuclear weapons are equipped with gas-boost systems that use hydrogen isotopes, including tritium. These systems and their components need ongoing maintenance, testing, development, gas replacement, and modifications to maintain safety and reliability. The Weapons Engineering Tritium Facility provides highly specialized system function testing and experimental equipment for conducting gas-boost system R&D and testing for existing systems, new gas-boost systems development and testing, and gas processing operations.

Diffusion and Membrane Purification. The Weapons Engineering Tritium Facility has the operational capability to separate and purify tritium from gaseous mixtures using diffusion and membrane purification techniques. The facility conducts research on gaseous tritium penetration of, and movement through, materials. This capability could also be used on a continuing basis for effluent treatment.

Metallurgical and Material Research. Tritium-handling capabilities at the Weapons Engineering Tritium Facility accommodate a wide variety of metallurgical and material research activities, such as studying methods to remove hydrogen isotopes (including tritium) from a flowing stream of nitrogen and other inert gases. Metallurgical and materials research, including metal getter research and application studies, and tritium effects and properties R&D, is conducted at the Weapons Engineering Tritium Facility.

Gas Analysis. Spectrometry and other techniques, such as beta scintillation counting, are used to measure composition and quantities of gas samples on a real-time or batch basis.

Calorimetry. This nondestructive method is used for measuring the amount of tritium in containers. No tritium leaves the container during these measurements.

Solid Material and Container Storage. Tritium gas may be stored in either specially designed dual-wall containers or certified shipping containers, and tritium oxide (tritiated water) can be stored in solid form when it is adsorbed (gathered on a surface in a condensed layer) on molecular sieves. Tritium is also present in process systems and samples, inventory for use, and waste. Most tritium would be stored in the Weapons Engineering Tritium Facility, which has an administrative limit of 35 ounces (1,000 grams) of tritium inventory.

Hydrogen Isotopic Separation. Tritium gas purification R&D activities are an important capability of this Key Facility. Methods such as hydrogen isotopic separation are used at the Weapons Engineering Tritium Facility.

Radioactive Liquid Waste Pretreatment. Tritium-contaminated liquid low-level radioactive waste is collected in storage tanks. As needed, it is pretreated by adjusting the acidity prior to transfer to TA-50 for treatment in the Radioactive Liquid Waste Treatment Facility or to TA-53 for solar evaporation.

3.1.3.9 Pajarito Site

The Pajarito Site Key Facility is located entirely within TA-18 and contains the Los Alamos Critical Experiments Facility and other experimental facilities. This Key Facility consists of a main building, three outlying remote-controlled critical assembly and storage areas, and several smaller support buildings. In 2002, NNSA prepared the *TA-18 EIS* (DOE 2002i) to evaluate relocating the Pajarito Site Key Facility capabilities and materials. In the ROD, NNSA announced its decision to relocate Security Category I and II capabilities and related materials to the Device Assembly Facility at the Nevada Test Site, in effect initiating Pajarito Site Key Facility closure. No decisions were made, however, about relocation of Security Category III and IV materials and activities or the Solution High-Energy Burst Assembly (SHEBA). The ROD indicated that additional NEPA analysis would be required to support those decisions, and this SWEIS provides that NEPA analysis. Implementation of the ROD for Security Category I and II removal activities was initiated in 2004.

Under the No Action Alternative, only Security Category III and IV nuclear materials would be stored at TA-18. The only critical assembly remaining at TA-18 would be SHEBA, which would be operated in its Security Category III configuration. To ensure that specific programs continue uninterrupted, certain activities would occur intermittently at TA-18. These activities could involve temporary use of Security Category I or II materials that would be transported to TA-18 for the day and afterwards returned to storage elsewhere at LANL. Sealed sources retrieved from other locations under the Off-Site Source Recovery Project would continue to be received at TA-3 and repackaged as necessary for storage at LANL locations, including the Pajarito Site, pending shipment to the Waste Isolation Pilot Plant (WIPP) or other offsite locations for final disposition. Experiments and activities to support NNSA's Second Line of Defense Program, Nuclear Nonproliferation Research and Development Testing, and Emergency Response Program activities would continue. Training activities, including nuclear criticality training courses, would also continue.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–11** indicates activity types and levels proposed under all three alternatives for each capability. Although the ability to perform some of these activities would be reduced or eliminated as the Pajarito Site is being closed, these capabilities are included in the No Action Alternative for evaluation of potential impacts.

Dosimeter Assessment and Calibration. Nuclear accident dosimetry studies are conducted using critical assembly radiation to simulate criticality accident radiation.

Detector Development. The Pajarito Site offers the capability to configure nuclear materials to develop and validate instruments and methods used in nuclear nonproliferation programs, assess potential threats from terrorist organizations, and train nuclear emergency search team personnel to use these instruments.

Table 3–11 Pajarito Site Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Dosimeter Assessment and Calibration	Perform criticality experiments.	No activity	No activity
Detector Development	Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Materials Testing	Perform criticality experiments. Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Subcritical Measurements	Perform criticality experiments. Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Fast-Neutron Spectrum	Perform criticality experiments. Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Dynamic Measurements	Perform criticality experiments. Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Skyshine Measurements	Perform criticality experiments.	No activity	No activity
Vaporization	Perform criticality experiments.	No activity	No activity
Irradiation	Perform criticality experiments. Develop safeguards instrumentation and perform R&D for nuclear materials and materials processing.	No activity	No activity
Other Activities	Continue Security Category III and IV nuclear activities at TA-18. Operate SHEBA in its Security Category III configuration. Receive and store sealed radioactive sources retrieved under the Off-Site Source Recovery Project. These would be repackaged as necessary for storage at LANL pending shipment to WIPP or other offsite locations for final disposition. Support experiments and activities for: - NNSA Second Line of Defense Program - Nuclear Nonproliferation Research and Development Testing - Emergency Response Program activities Continue training activities, including nuclear criticality training courses.	No activity	Cease operations at Pajarito Site. Move Security Category III and IV materials to other LANL facilities (see Appendix H).
Construction/Upgrades/DD&D			
DD&D of TA-18 Structures	No activity	Cease operations at Pajarito Site. Place in surveillance and maintenance mode. Eliminate Pajarito Site as a Key Facility.	Implement *TA-18 Closure Project*: - Shut down Pajarito Site. - DD&D Pajarito Site buildings as appropriate. Eliminate Pajarito Site as a Key Facility.

R&D = research and development; TA = technical area; SHEBA = Solution High-Energy Burst Assembly; NNSA = National Nuclear Security Administration; DD&D = decontamination, decommissioning, and demolition.

[a] DOE 1999a, 2002i; LANL 2004c.

[b] DOE 2002i.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Materials Testing. The primary purpose of the Pajarito Key Facility is to characterize and evaluate materials, primarily by measuring their nuclear properties. Materials evaluated are typically structural materials or those used for shielding or neutron absorbers. Materials testing typically involves use of radiation sources or critical assemblies as radiation generators and measurement of radiation levels under a variety of conditions.

Subcritical Measurements. Subcritical measurements are those performed on arrays of fissile material that are below the critical mass for material in a given form. Subcritical experiments can vary any or all factors that influence criticality (mass, density, shape, volume, concentration, moderation, reflection, neutron absorption, enrichment, and interactions). Associated measurement techniques involve measuring some aspect of the neutron or gamma population in the material to assess its criticality state.

Fast-Neutron Spectrum. There are bare and reflected metal critical assemblies that operate on a fast-neutron spectrum. These assemblies typically have irradiation cavities in which flux foils, small replacement samples, or small experiments can be inserted. Typical experiments include evaluation of material reactivity, irradiation of novel neutron and gamma measuring instrumentation, and testing and calibrating radiation dosimeters.

Dynamic Measurements. Two fast-pulsed assemblies produce controlled, reproducible pulses of neutron and gamma radiation from tens of microseconds to several tens of milliseconds in duration. These pulses are useful for applications such as neutron physics measurements, instrumentation development, dosimetry, and materials testing.

Skyshine Measurements. The study of skyshine (radiation transported point-to-point without a direct line of sight) is a component of dosimetry that is primarily applicable to neutron-producing processes and facilities. Critical assemblies can be used to produce radiation fields to mimic those found around nuclear weapons production and dismantlement facilities and in storage and experimental areas.

Vaporization. Fast-pulsed assemblies have the capability of vaporizing fissile materials placed in a thermalizing material next to the assembly or in an internal cavity. These vessels are placed inside multiple containment vessels to prevent leakage of vaporized materials and fission products. This capability is useful for testing materials, measuring fissile materials properties, and testing reactor fuel materials in simulated accident conditions.

Irradiation. Several critical assemblies can have varying spectral characteristics in both steady-state and pulsed modes. These assemblies are typically used for irradiating fissile materials and other energetic-response materials to test and verify computer code calculations.

3.1.3.10 Target Fabrication Facility

The Target Fabrication Key Facility comprises three main buildings (35-213, 35-455, and 35-458). The main building is a two-story structure with approximately 61,000 square feet (5,700 square meters) of floor space located in TA-35. Laboratories and offices are located on both floors. Approximately 48,000 square feet (4,500 square meters) is laboratory space; the remainder is used for offices. The Target Fabrication Key Facility houses activities related to

weapons production and laser fusion research. These activities are accomplished through high-technology material science, effects testing, characterization, and technology development.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–12** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–12 Target Fabrication Facility Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Precision Machining and Target Fabrication	Provide targets and specialized components for approximately 12,400 laser and physics tests per year. Perform approximately 100 high-energy density physics tests per year. Analyze up to 36 tritium reservoirs annually.	Same as No Action Alternative	Same as No Action Alternative
Polymer Synthesis	Produce polymers for targets and specialized components for approximately 12,400 laser and physics tests per year. Perform approximately 100 high-energy density physics tests per year.	Same as No Action Alternative	Same as No Action Alternative
Chemical and Physical Vapor Deposition	Coat targets and specialized components for approximately 12,400 laser and physics tests per year. Support approximately 100 high-energy density physics tests per year. Support plutonium pit rebuild operations.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
	No activity	No activity	No activity

DD&D = decontamination, decommissioning, and demolition.
[a] DOE 1999a, LANL 2006a.
[b] LANL 2006a.

Precision Machining and Target Fabrication. Considered the primary measurement of activity for this Key Facility, precision machining operations produce sophisticated devices consisting of very accurate part shapes and often optical-quality surface finishes. A variety of processes are used to produce the final parts, which include conventional machining, ultraprecision machining, lapping, and electron discharge machining. Dimensional inspections are performed during part production using a variety of mechanically and optically based inspection techniques. Tritium reservoirs are analyzed at the Target Fabrication Facility.

Polymer Synthesis. Polymer synthesis science formulates new polymers, studies their structure and properties, and fabricates them into various devices and components. Capabilities exist at the Target Fabrication Facility for developing and producing polymer foams by organic synthesis, liquid crystalline polymers, polymer host dye laser rods, microfoams and composite foams, high-energy density polymers, electrically conducting polymers, chemical sensors, resins and membranes for actinide and metal separations, thermosetting polymers, and organic coatings. The materials and devices are typically prepared using solvents at temperatures ranging from 70 to 302 °F (20 to 150 °C) or by melt-processing at temperatures from room temperature up to

572 °F (300 °C). A wide variety of analytical techniques are used to determine the structure and behavior of polymers, including spectroscopy, microscopy, x-ray scattering, thermal analysis, chromatography, rheology, and mechanical testing.

Chemical and Physical Vapor Deposition. Chemical vapor deposition and infiltration are processes used to produce metallic and ceramic bulk coatings, various forms of carbon (including pyrolytic graphite, amorphous carbon, and diamond), nanocrystalline films, powder coatings, thin films, and a variety of shapes up to 3.5 inches (9 centimeters) in diameter and 0.5 inches (1.25 centimeters) in thickness. Chemical vapor deposition and infiltration coating processes are routine operations that use a variety of methods such as thermal hot wall, cold wall, and fluidized bed techniques; laser-assisted, laser ablation, radiofrequency and microwave plasma techniques; direct-current glow discharge and hollow cathode techniques; and organometallic chemical vapor deposition techniques. Polymer processing and extensive characterization is performed in conjunction with this work.

Physical vapor deposition capabilities can be used to apply layers of various materials on sophisticated devices with high precision. These layers, applied by various coating techniques, include a wide range of metals and metal oxides, as well as some organic materials.

3.1.3.11 Bioscience Facilities (formerly Health Research Laboratory)

Major Bioscience Facilities buildings include the main Health Research Laboratory; four buildings in TA-43; and additional offices and laboratories located in three buildings in TA-35, several buildings in TA-3, and six buildings in TA-46. There is also some activity in TA-16. This Key Facility focuses on the study of intact cells, cellular components (ribonucleic acid [RNA], deoxyribonucleic acid [DNA], and proteins), instrument analysis (laser and mass spectroscopy), and cellular systems (repair, growth, and response to stressors). Activities other than theoretical or paper studies are subject to review and approval by internal organizations such as the LANL Bioscience Oversight Review Board. External organizations such as the Centers for Disease Control and Prevention and the National Institutes of Health also review and approve projects for which they provide funding. Work with biohazardous agents is reviewed and approved by the LANL Institutional Biosafety Committee, which includes members that are both internal and external to LANL organizations.

Work with biological materials at LANL is governed by LANL Biosafety Program requirements, which are based on the document *Biosafety in Microbiological and Biomedical Laboratories* (HHS 2007) published by the Centers for Disease Control and Prevention. This document establishes requirements for workplace safety by biosafety level, of which there are four. These biosafety levels consist of progressively more stringent protocols for laboratory practices, techniques, safety equipment, and laboratory facilities. LANL has laboratories that operate at Biosafety Level 1 and Biosafety Level 2. (These levels are defined in Appendix C, Section C.3.3.) Work with select agents, specifically regulated pathogens and toxins defined in 42 CFR Part 73, is limited at LANL to Biosafety Level 2 activities. A new facility intended for work requiring Biosafety Level 3 conditions was constructed in 2004, but the building has not been occupied or used for this purpose. NNSA is currently preparing the *Environmental Impact Statement for the Operation of the Biosafety Level 3 Facility at the Los Alamos National Laboratory* to analyze potential impacts of operating this facility.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–13** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–13 Bioscience Facilities Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Biologically Inspired Materials and Chemistry (Biomaterials and Chemistry in the *1999 SWEIS*)	Determine formation and structure of biomaterials. Synthesize biomaterials. Characterize biomaterials.	Same as No Action Alternative	Same as No Action Alternative
Cell Biology	Study stress-induced effects and responses on cells. Study host-pathogen interactions. Determine effects of beryllium exposure.	Same as No Action Alternative	Same as No Action Alternative
Computational Biology	Collect, organize, and manage information on biological systems. Develop computational theory to analyze and model biological systems.	Same as No Action Alternative	Same as No Action Alternative
Environmental Microbiology	Study microbial diversity in the environment. Collect and analyze environmental samples. Study biochemical and genetic processes in microbial systems.	Same as No Action Alternative	Same as No Action Alternative
Genomic Studies	Analyze genes of living organisms such as humans, animals, microbes, viruses, plants, and fungi.	Same as No Action Alternative	Same as No Action Alternative
Genomic and Proteomic Science	Develop and implement high-throughput tools. Perform genomic and proteomic analysis. Study pathogenic and nonpathogenic systems.	Same as No Action Alternative	Same as No Action Alternative
Measurement Science and Diagnostics	Develop and use spectroscopic tools to study molecules and molecular systems. Perform genomic, proteomic and metabolomic studies.	Same as No Action Alternative	Same as No Action Alternative
Molecular Synthesis	Synthesize molecules and materials. Perform spectroscopic characterization of molecules and materials. Develop new molecules that incorporate stable isotopes. Develop chem-bio sensors and assay procedures. Synthesize polymers and develop applications for them. Utilize stable isotopes in quantum computing systems.	Same as No Action Alternative	Same as No Action Alternative
Structural Biology	Research three-dimensional structure and dynamics of macromolecules and complexes. Use various spectroscopy techniques. Perform neutron scattering. Perform x-ray scattering and diffraction.	Same as No Action Alternative	Same as No Action Alternative

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Pathogenesis	Perform genome-scale, focused and computationally enhanced experimental studies on pathogenic organisms.	Same as No Action Alternative	Same as No Action Alternative
Biothreat Reduction and Bioforensics	Analyze samples for biodefense and national security purposes. Identify pathogen strain signatures using DNA sequencing and other molecular approaches.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrades/DD&D			
New *Science Complex* in TA-62	No activity	No activity	Move most Bioscience operations to proposed *Science Complex* (see Appendix G). This new space would replace buildings vacated by Bioscience staff as the major component of the Bioscience Facilities.

DD&D = decontamination, decommissioning, and demolition; TA = technical area.
[a] LANL 2004c, 2006a.
Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Biologically Inspired Materials and Chemistry. This capability is used primarily to determine formation-structure-function relationships in biological and biologically relevant materials at macroscopic, microscopic, and molecular scales, with the goal of using this knowledge to create new biologically inspired materials with novel functionalities for a variety of applications. Synthesis and characterization of biological and biologically relevant materials at scales from the molecular to macroscopic are an integral part of this capability. Characterization tools include spectroscopy with laser sources, microscopy, spectral imaging, electrochemistry, mass spectrometry, and nuclear magnetic resonance spectroscopy. Stable isotopes are used to enable many of these characterization measurements.

Cell Biology. This research area focuses on understanding stress responses at the molecular level, within the whole cell, and in multicellular and cell environment systems. Historically, cellular response to ionizing radiation has been the primary focus. New focus areas include host-pathogen interactions, the human health effects of exposure to beryllium, and the regulation of plant growth for applications in carbon management and energy. Specific capabilities include culture and biochemical analysis of a variety of cell types, including nonpathogenic environmental microbes, infectious microbes (including viruses) under controlled conditions, and plant and mammalian cells.

Computational Biology. This capability is purely theoretical and does not involve any experimental, operational, or production activities. This capability includes collection, organization, and management of biological data and development of computational tools to analyze, interpret, and model biological information. Certain activities involve partnering with computational scientists to develop computation-based biological theory and to analyze and model biological systems.

Environmental Microbiology. This work focuses on gaining a better understanding of microbial systems and their environment. This capability underpins the ability of LANL scientists to achieve its goals in biothreat reduction and is key to work related to climate change, bioremediation, bioenergy, and environmental monitoring. Activities include collection of environmental samples containing microbes (including viruses), biochemical and genetic analysis of their distribution and functions in ecological systems, and growth and analysis of environmental isolates.

Genomic Studies. This capability involves conducting research using molecular and biochemical techniques to analyze the genetics of living organisms such as animals (particularly humans), microbes (including viruses), plants, fungi, and other species. Specifically, personnel develop strategies to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to identify these genes and map the genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each gene in all 46 chromosomes of the human genome.

Genomic and Proteomic Science. This capability emphasizes development and implementation of high-throughput tools and technologies for understanding biology at the systems level. Researchers perform production sequencing, finishing, clone selection, quality assurance, and bioinformatics and are involved in development of high-throughput technologies for high-affinity, high-specificity ligand generation, expression arrays, and proteomics. This capability focuses on pathogen and environmental microbial sequencing and comparative genomics and on affinity tag production for detection and sensing applications in support of biothreat reduction work.

Measurement Science and Diagnostics. These activities encompass a broad set of technologies including spectroscopy for understanding molecular dynamics and structure and for biomedical applications; imaging microscopy for exploring molecular events using ultrafast time resolution measurements, at times as short as 10 to 13 seconds; and flow-based analyses using flow cytometry methods for measuring everything from single molecules to multicellular spheroids, spanning a size range from 10 Angstroms to 100 microns. A developing area is mass spectrometry for proteomics and structural biology. These technologies provide the platforms and data that can lead to new strategies for detection and sensing technologies. Capabilities include a variety of spectroscopies for analysis of biomolecules and biomolecular complexes; flow-cytometry-based analysis of materials spanning the range from single molecules to intact chromosomes to single cells to multicellular spheroids; and mass spectrometry for proteomics, metabolomics, and structural biology.

Molecular Synthesis. Work in this area includes synthesis, materials preparation, and spectroscopic characterization of a variety of compounds. Current work is focused on creating new molecules using natural and enriched stable isotopes for biomolecular structure analysis, for observation of specific chemical groups, and for use as standards in detection of chemical agents and biological toxins. Additional work in this area includes linking antibodies to biomimetic surfaces, creating chemical and biological microsensors for detection and sensing, developing polymers to protect soldiers' eyes from laser light, and using stable isotopes to demonstrate the feasibility of quantum information processing.

Structural Biology. This research focuses on determination and analysis of three-dimensional structures and dynamics of macromolecules and the complexes that they form. Experimental techniques include x-ray scattering and neutron diffraction, nuclear magnetic resonance, and time-resolved vibrational spectroscopies. State-of-the-art neutron protein crystallography capabilities provided as part of the Manuel Lujan Neutron-Scattering Center are accessed on a national level.

Pathogenesis. This work involves performing genome-scale, focused, and computationally enhanced experimental studies to gain a quantitative understanding of various aspects of pathogen lifecycle. The focus is on infections in humans, animals, and plants, as well as understanding the epidemiology and life cycle of pathogens in the environment.

Biothreat Reduction and Bioforensics. This capability, a collection of forensic and molecular biological capabilities, is used to analyze samples for biodefense and national security purposes. Analyses include DNA sequencing and other molecular approaches to identify pathogen strain signatures. This capability also includes the ability to undertake classified laboratory and information processing and analysis projects.

3.1.3.12 Radiochemistry Facility

The Radiochemistry Key Facility includes all of TA-48 (116 acres [47 hectares]), although the main research buildings are located together in an area of only 8.6 acres (3.5 hectares). These buildings include the Radiochemistry Laboratory, Machine and Fabrication Shop, Diagnostic Instrumentation and Development Building, Clean Chemistry/Mass Spectrometry Building, and Weapons Analytical Chemistry Facility. The Radiochemistry Facility fills three roles: research, production of medical radioisotopes, and support services to other LANL organizations, primarily through radiological and chemical analyses of samples. Research supports environmental management projects such as the Yucca Mountain Project, plutonium stabilization, catalysis, basic energy, and other scientific efforts. Chemistry research is performed in the areas of inorganic, actinide, organometallic, environmental, geochemistry, and nuclear chemistry. Production activities use a hot cell located in the Radiochemistry Laboratory Building to separate and package radioisotopes for medical research and clinical uses.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–14** indicates activity types and levels proposed under all three alternatives for each capability.

Radionuclide Transport. Chemical and geochemical investigations address concerns about hydrologic flow and transport of radionuclides. Areas of study include the sorption (binding) of actinides, fission products, and activation products in minerals and rocks and the solubility and speciation of actinides in various chemical environments such as those associated with waste disposal. Paired with model development, these studies are used to evaluate various activities and phenomena such as parameters for performance assessment of mined geologic disposal systems.

Table 3–14 Radiochemistry Facility Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Radionuclide Transport Studies	Conduct 80 to 160 actinide transport, sorption, and bacterial interaction studies annually. Develop models for evaluation of groundwater. Assess performance or risk of release for radionuclide sources at proposed waste disposal sites.	Same as No Action Alternative	Same as No Action Alternative
Environmental Remediation and Risk Mitigation	Conduct background contamination characterization pilot studies. Conduct performance assessments, soil remediation research and development, and field support. Support environmental remediation activities.	Same as No Action Alternative	Same as No Action Alternative, plus: - Perform beryllium dispersion and mitigation assessments.
Ultra-Low-Level Measurements	Perform chemical isotope separation and mass spectrometry at current levels.	Same as No Action Alternative	Same as No Action Alternative
Nuclear and Radiochemistry Separations	Conduct radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides at current levels for nonweapons and weapons work.	Same as No Action Alternative	Same as No Action Alternative
Isotope Production	Conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes to support approximately 150 offsite shipments annually.	Same as No Action Alternative	Same as No Action Alternative
Actinide and Transuranic Chemistry	Perform radiochemical separations involving alpha-emitting radionuclides.	Same as No Action Alternative	Same as No Action Alternative
Data Analysis	Reexamine archive data and measure nuclear process parameters of interest to weapons radiochemists.	Same as No Action Alternative	Same as No Action Alternative
Inorganic Chemistry	Conduct synthesis, catalysis, and actinide chemistry activities: - Conduct chemical synthesis of organo-metallic complexes. - Conduct structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies. - Conduct synthesis of new ligands for radiopharmaceuticals. - Conduct environmental technology development activities: – Ligand design and synthesis for selective extraction of metals, – Soil washing, – Membrane separator development, and – Ultrafiltration.	Same as No Action Alternative	Same as No Action Alternative
Structural Analysis	Perform synthesis and structural analysis of actinide complexes at current levels. Conduct x-ray diffraction analysis of powders and single crystals.	Same as No Action Alternative	Same as No Action Alternative

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Sample Counting	Measure the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems.	Same as No Action Alternative	Same as No Action Alternative
Hydrotest Sample Analysis	Measure beryllium contamination from simulated nuclear weapons hydrotesting.	Reduce activity levels consistent with High Explosive Processing and Testing	Same as No Action Alternative
Atom Trapping	No activity	No activity	Implement atom trapping capability for fundamental and applied research.
Construction/Upgrades/DD&D			
Radiological Sciences Institute	No activity	No activity	Construct and operate the new *Radiological Sciences Institute*. Construct and operate the Institute for Nuclear Nonproliferation Science and Technology (see Appendix G). Relocate Security Category III and IV capabilities and materials that would remain at LANL from TA-18 to the Institute for Nuclear Nonproliferation Science and Technology. Reconstruct CMR Building Wing 9 hot cell capabilities in the Radiological Sciences Institute.

DD&D = decontamination, decommissioning, and demolition; TA = technical area, CMR = Chemistry and Metallurgy Research.
[a] DOE 1999a.
[b] LANL 2006a.
Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Environmental Remediation and Risk Mitigation. Characterization and remediation of soils contaminated with radionuclides and toxic metals and data analysis and integrated site-wide assessment are the two functions provided by this capability. A major objective of characterizing and remediating soils is to minimize generation of large volumes of metal- and radionuclide-contaminated soils. The objective of data analysis and integrated site-wide assessment is to accelerate remediation through improved sampling schemes, clearer and more efficient evaluation of characterization data, and more effective tools for assigning priority to cleanup targets.

Ultra-Low-Level Measurements. Isotopic tracers and high-sensitivity measurement technologies have been developed to support the U.S. nuclear weapons program. Isotopic tracers can include both radioactive and nonradioactive isotopes, although this capability emphasizes nonradioactive tracers. Specialty applications include developing analytical techniques for a variety of problems in nuclear, environmental, and biological sciences. Typical analyses include

determining the origin of radioactive contamination in an environmental sample (for example, whether the contamination results from a nearby nuclear facility or from radioactive fallout from global weapons testing). This capability can also be used to trace the migration of radioactive contamination through the environment.

Nuclear and Radiochemistry Separations. Activities under this capability include developing radiation detectors, conducting radiochemical separations, and performing nuclear chemistry. Development, calibration, and use of radiation detectors include the use of off-the-shelf systems for routine measurement of radioactivity and development of new radiation detection systems for a number of special applications. LANL personnel conduct both routine and special separations of radioactive materials from other radioactive species and stable impurities. These experiments have provided support to Hanford waste tank treatment activities and production of medical isotopes. Separations are based on traditional approaches that use commercially available ion-exchange media and chemical reagents. LANL staff have also developed new separations techniques based on experimental chemical systems, using radioactive tracers to synthesize the chemicals and to characterize their performance. In addition, nuclear chemistry-related activities use exotic laser-based atom traps to probe the interactions of energy and atoms in energy regimes that are not easily accessed by other techniques. This work requires conducting extensive laser spectroscopy, handling of radioactive materials, and interpreting the resulting data. Other nuclear chemistry-related activities include irradiating targets at the Los Alamos Neutron Science Center (LANSCE) or at offsite reactors to produce specific radioactive isotopes. These isotopes are then separated from impurities, and their neutron-capture cross sections are measured at the Radiochemistry Laboratory.

Isotope Production. Activities under this capability include the production, chemical separation, and distribution of isotopes to medical and industrial users. Activities also include preparing the target packages to be irradiated using the LANSCE accelerator, processing in the Radiochemistry Laboratory hot cell to recover the desired isotopes, and packaging the isotopes for offsite shipment.

Actinide and Transuranic Chemistry. Activities in the Alpha wing of the Radiochemistry Laboratory are essentially the same as the radiochemical separations carried out in the rest of the building, but with different materials. The materials handled are actinides and transuranics that require the special safe handling environment provided in this wing.

Data Analysis. Data analysis is the evaluation of experimental data to interpret results of experiments, measurements, and other activities. This capability includes evaluation of archived data in support of weapons programs.

Inorganic Chemistry. Inorganic chemistry work includes two main categories of activities: (1) synthesis, catalysis, and actinide chemistry; and (2) development of environmental technology. The former category includes chemical synthesis of new organometallic complexes, structural and reactivity analysis, organic product analysis, reactivity and mechanistic studies, and synthesis of new ligands for radiopharmaceuticals. Development of environmental technology includes designing and synthesizing ligands for selective extraction of metals, soil washing, development of membrane separators, photochemical processing, and ultrafiltration.

Other work involves oxidation-reduction studies on uranium and other metals for both environmental restoration and advanced processing.

Structural Analysis. Structural analysis includes the synthesis, structural analysis, and x-ray diffraction analysis of actinide complexes in both single-crystal and powder form. This capability supports programs in basic energy sciences, materials characterization, stockpile stewardship, and environmental management.

Sample Counting. Sample counting, the measurement of the quantity of radioactivity present in a sample, is accomplished with a variety of radiation detectors, each customized to the type of radiation being counted and the expected levels of radioactivity. All samples counted in the counting facility are sealed items placed inside appropriate detectors for specified periods of time. Data are automatically processed through the computer system and results are presented to the users.

Hydrotest Sample Analysis. This capability involves the measurement of beryllium contamination from hydrotesting simulated nuclear weapons. This work includes analysis, ligand binding, materials characterization, field sampling, fundamental beryllium chemistry, and beryllium mitigation (LANL 2006g).

3.1.3.13 Waste Management Operations: Radioactive Liquid Waste Treatment Facility

The Radioactive Liquid Waste Treatment Key Facility is located in TA-50 and consists of four primary structures: the Radioactive Liquid Waste Treatment Facility Building, the Pump House and Influent Storage Building, the acid and caustic solution tank farm, and a 100,000-gallon (380,000-liter) influent holding tank. The Radioactive Liquid Waste Treatment Facility treats radioactive liquid waste generated by other LANL facilities and houses analytical laboratories to support waste treatment operations. The Radioactive Liquid Waste Treatment Facility Building is the largest structure in TA-50, with 40,000 square feet (3,720 square meters) under roof. Construction of a new 300,000-gallon (1,100,000-liter) influent storage facility is complete, but it is not yet operational.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–15** indicates activity levels proposed under all three alternatives for each capability.

Waste Transport, Receipt, and Acceptance. Most radioactive liquid waste is conveyed directly to the Radioactive Liquid Waste Treatment Facility through an underground pipeline system. Pipelines for liquid radioactive waste exist in TA-3, TA-35, TA-48, TA-50, TA-55, and TA-59.[2] Waste from generators not connected by the underground pipeline system is transferred by tanker truck to the Radioactive Liquid Waste Treatment Facility. Generators of small quantities of radioactive liquid waste collect their waste in drums, which are then trucked to TA-50.

[2] *The pipelines in TA-53 move waste only within that TA (as part of LANSCE), and do not connect to or pump radioactive liquid waste to the Radioactive Liquid Waste Treatment Facility.*

Table 3–15 Waste Management Operations: Radioactive Liquid Waste Treatment Facility Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Waste Transport, Receipt, and Acceptance	Collect radioactive liquid waste from generators and transport it to RLWTF in TA-50. Support, certify, and audit generator characterization programs. Maintain the waste acceptance criteria for RLWTF. Send approximately 66,000 gallons (250,000 liters) of evaporator bottoms to an offsite commercial facility for solidification annually. (Approximately 25 cubic yards [20 cubic meters] of solidified evaporator bottoms would be returned annually for disposal as low-level radioactive waste at TA-54 Area G.) Transport annually to TA-54 for storage or disposal: - 330 cubic yards (250 cubic meters) of low-level radioactive waste; - 3 cubic yards (2 cubic meters) of mixed low-level radioactive waste; - 13 cubic yards (10 cubic meters) of transuranic waste; and - 880 pounds (400 kilograms) of hazardous waste.	Same as No Action Alternative	Same as No Action Alternative, except: - Send approximately 80,000 gallons (300,000 liters) of evaporator bottoms to an offsite commercial facility for solidification annually. (Approximately 30 cubic yards [23 cubic meters] of solidified evaporator bottoms would be returned annually for disposal as low-level radioactive waste at TA-54 Area G.) - Transport annually to TA-54 for storage or disposal: – 390 cubic yards (300 cubic meters) of low-level radioactive waste; – 3 cubic yards (2 cubic meters) of mixed low-level radioactive waste; – 18 cubic yards (14 cubic meters) of transuranic waste; and – 1,100 pounds (500 kilograms) of hazardous waste.
Radioactive Liquid Waste Treatment	Pretreat 30,000 gallons (110,000 liters) of liquid transuranic waste annually. Solidify, characterize, and package 16 cubic yards (12 cubic meters) of transuranic waste sludge annually. Treat 4 million gallons (15 million liters) of liquid low-level radioactive waste annually. Dewater, characterize, and package 70 cubic yards (50 cubic meters) of low-level radioactive waste sludge annually. Process 260,000 gallons (1 million liters) of secondary liquid waste generated by RLWTF treatment processes through the RLWTF evaporator annually. Discharge treated liquids through an NPDES outfall.	Same as No Action Alternative	Same as No Action Alternative, except: - Pretreat 50,000 gallons (190,000 liters) of liquid transuranic waste annually. - Solidify, characterize, and package 22 cubic yards (17 cubic meters) of transuranic waste sludge annually. - Treat 5 million gallons (20 million liters) of liquid low-level radioactive waste annually. - Dewater, characterize, and package 80 cubic yards (60 cubic meters) of low-level radioactive waste sludge annually. - Process 320,000 gallons (1,200,000 liters) of secondary liquid waste generated by RLWTF treatment processes through the RLWTF evaporator annually.

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Construction/Upgrades/DD&D			
RLWTF Upgrade	Construction of a new 300,000-gallon (1.1 million-liter) influent storage facility is complete.	Same as No Action Alternative	Same as No Action Alternative, plus: - Implement *RLWTF Upgrade Project* (see Appendix G): – Construct and operate a replacement for the existing RLWTF at TA-50. Start-up estimated in 2012. – Construct and operate evaporation tanks in TA-52 for treated effluent from RLWTF – DD&D portions of existing RLWTF.

RLWTF = Radioactive Liquid Waste Treatment Facility; TA = technical area; NPDES = National Pollutant Discharge Elimination System; DD&D = decontamination, decommissioning, and demolition.
[a] DOE 1999a, LANL 2006a.
[b] LANL 2006a.
Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

In addition to receiving and accepting radioactive liquid waste trucked to the TA-50 facility from other LANL locations, some radioactive liquid waste is trucked to the TA-53 facility for evaporation, and other radioactive liquid waste is shipped to an offsite commercial facility for solidification. Returned solidified waste and other solid wastes are sent from the Radioactive Liquid Waste Treatment Facility to waste management facilities in TA-54 for storage or disposal.

Radioactive Liquid Waste Treatment. Liquid transuranic waste and low-level radioactive waste are treated in sequential steps to remove and reduce the radioactive components of the liquid waste stream. Neutralization, precipitation, filtration, ion exchange, and reverse osmosis are among the treatment steps that can be used, depending on individual waste stream characteristics. Liquid effluents are discharged through a permitted National Pollutant Discharge Elimination System outfall. To meet discharge limits, liquids with higher concentrations of tritium are transported to TA-53, where they are treated in solar evaporation basins. Resultant low-level radioactive waste sludges are drummed and transferred to TA-54 for disposal. Transuranic waste sludges are cemented and transferred to TA-54 for storage until they are certified and sent to WIPP for disposal.

3.1.3.14 Los Alamos Neutron Science Center

LANSCE is located on a 750-acre (303-hectare) mesa top at TA-53 and contains approximately 400 structures. LANSCE is LANL's major accelerator R&D complex, consisting of a high-power 800-million-electron-volt proton linear accelerator, a proton storage ring, production targets at the Manuel Lujan Neutron-Scattering Center and the Weapons Neutron Research Facility, and a variety of associated experimental areas and spectrometers. Particle beams are used to conduct basic and applied research in the areas of condensed-matter science, materials science, nuclear physics, particle physics, nuclear chemistry, atomic physics, and defense-related experiments. LANSCE also produces medical radioisotopes.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–16** indicates activity types and levels proposed under all three alternatives for each capability.

Table 3–16 Los Alamos Neutron Science Center Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Accelerator Beam Delivery, Maintenance, and Development	Operate 800-million-electron-volt linear accelerator and deliver accelerator beam to Areas A, B, and C; Weapons Neutron Research Facility; Lujan Center; Dynamic Test Facility; and Isotope Production Facility for 10 months each year (6,400 hours). The H^+ beam current would be 1,250 microamps; the H^- beam current would be 200 microamps. Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.	LANSCE would be shut down, and all capabilities would cease except radioactive liquid waste treatment. Systems would be maintained in a condition to support future restart. LANSCE would be eliminated as a Key Facility.	Same as No Action Alternative
Experimental Area Support	Provide support to ensure availability of the beam lines, beam line components, handling and transport systems, and shielding, as well as radiofrequency power sources. Perform remote handling and packaging of radioactive materials and waste, as needed.	No activity	Same as No Action Alternative
Neutron Research and Technology	Conduct 1,000 to 2,000 different experiments annually, using neutrons from the Lujan Center and Weapons Neutron Research Facility. Support contained weapons-related experiments using small to moderate quantities of high explosives, including: - Approximately 200 experiments per year using nonhazardous materials and small quantities of high explosives; - Approximately 60 experiments per year using up to 10 pounds (4.54 kilograms) of high explosives and depleted uranium; - Approximately 80 experiments per year using small quantities of actinides, high explosives, and sources; - Shockwave experiments involving small amounts, up to nominally 1.8 ounces (50 grams) of plutonium; and - Support for static stockpile surveillance technology research and development.	No activity	Same as No Action Alternative

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Materials Test Station	Irradiate materials and fuels in a fast-neutron spectrum and in a prototypic temperature and coolant environment.	No activity	Same as No Action Alternative
Subatomic Physics Research	Conduct 5 to 10 physics experiments annually at the Manuel Lujan Center and Weapons Neutron Research Facility. Conduct up to 100 proton radiography experiments, including using small to moderate quantities of high explosives, including: - Dynamic experiments in containment vessels with up to 10 pounds (4.5 kilograms) of high explosives and 100 pounds (45 kilograms) of depleted uranium; and - Dynamic experiments in powder launcher with up to 10 ounces (300 grams) of Class 1.3 explosives (gun powder). Conduct research using ultracold neutrons; operate up to 10 microamperes per year of negative beam current.	No activity	Same as No Action Alternative
Medical Isotope Production	Irradiate up to 120 targets per year for medical isotope production at the Isotope Production Facility.	No activity	Same as No Action Alternative
High-Power Microwaves and Advanced Accelerators	Conduct R&D in high-power microwave and advanced accelerators in areas including microwave research for industrial and environmental applications.	No activity	Same as No Action Alternative
Radioactive Liquid Waste Treatment (Solar Evaporation at TA-53)	Treat about 140,000 gallons (520,000 liters) per year of radioactive liquid waste.	Treat about 5,000 gallons (20,000 liters) per year of radioactive liquid waste brought to TA-53 from other locations (not generated by LANSCE activities).	Same as No Action Alternative
Construction/Upgrades/DD&D			
	Install Material Test Station equipment in Experimental Area A. Construct Neutron Spectroscopy Facility within existing buildings (under High-Powered Microwaves and Advanced Accelerators Capability).	Shut LANSCE down. Cease capabilities except radioactive liquid waste treatment. Maintain systems in a condition to support future restart.	Same as No Action Alternative, plus: - Implement *LANSCE Refurbishment Project* to extend reliable operation of facility for the future (see Appendix G).

Lujan Center = Manuel Lujan Neutron-Scattering Center; LANSCE = Los Alamos Neutron Science Center; R&D = research and development; TA = technical area; DD&D = decontamination, decommissioning, and demolition.

[a] DOE 1999a; LANL 2004c, 2004f.

[b] LANL 2006a.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Accelerator Beam Delivery, Maintenance, and Development. The heart of the LANSCE Key Facility is the linear accelerator itself. The building housing the accelerator is more than 0.5 miles (0.8 kilometers) long, and has 316,000 square feet (29,400 square meters) of floor space. The building contains equipment to form hydrogen ion beams (protons and negative hydrogen ions) and to accelerate them to 84 percent of the speed of light. The beam tunnel itself is located 35 feet (11 meters) below ground level to provide shielding from the radiation. Above-surface structures house radiofrequency power sources used to accelerate the beam. Ancillary equipment is used to transport the ion beams, maintain vacuum conditions in the beam transport system, and provide ventilation and cooling. Creating and directing the ion beam requires large amounts of power, much of which is ultimately removed as excess heat.

This capability is responsible for development, configuration, and maintenance of components and support systems needed to deliver proton ion beams and for delivery of those beams. Generation and delivery of the proton ion beams require considerable development and maintenance capabilities for all components of the linear accelerator, including the ion sources and injectors, the mechanical systems in the accelerator (including cooling water), all systems for the proton storage ring and its associated transfer lines, and beam diagnostics in the accelerator and transfer lines. Beam development activities include beam dynamics studies and design and implementation of new capabilities. This activity requires the coordination of many disciplines, including accelerator physics, high-voltage and pulsed-power engineering, mechanical engineering, materials science, radiation shielding design, digital and analog electronics, high-vacuum technology, mechanical and electronics design, mechanical alignment, hydrogen furnace brazing, machining, and mechanical fabrication.

Experimental Area Support. Beam users (LANL organizations and external users such as scientists from universities, other laboratories, and the international scientific community) require support from TA-53 personnel, whether they are preparing for, performing, or closing out their experiments. This support capability focuses on the maintenance, improvement, and operational readiness of beam lines and experimental areas at LANSCE.

Support also includes the design, operation, and maintenance of remote-handling systems for highly activated components; the handling and transportation (usually for disposal) of highly activated components; and the specification, engineering, design, and installation of radiation shielding.

The linear accelerator requires large power sources and is supplied at TA-53 by radiofrequency power sources. The capability to design, fabricate, operate, and maintain radiofrequency systems for accelerators and other applications is an important support function for LANSCE operations. Radiofrequency technology development also supports microwave materials processing and radiofrequency system design.

Neutron Research and Technology. Fundamental research is conducted on the interaction of neutrons with various materials, molecules, and nuclei to advance condensed matter science (including material science and engineering and aspects of bioscience), nuclear physics, and the study of dynamic phenomena in materials. Applied neutron research is conducted to provide scientific and engineering support to weapons stockpile stewardship and nonproliferation surveillance. Efforts include resonance neutron spectroscopy and neutron radiography. Research

is also performed to develop instrumentation and diagnostic devices by scientists from universities, other Federal laboratories, and industry.

Neutrons from the Manuel Lujan Neutron-Scattering Center and the Weapons Neutron Research Facility are used to conduct experiments at LANL. In addition, LANL continues to support contained weapons-related experiments using small-to-moderate quantities of high explosives and would provide support for static stockpile surveillance technology R&D.

Material Test Station. The Material Test Station capability would replace the Accelerator Transmutation of Waste capability analyzed in the *1999 SWEIS*. Similar to Accelerator Transmutation of Waste, the Material Test Station would provide the capability to safely irradiate materials and fuels in a fast-neutron spectrum and in a prototypic temperature and coolant environment. Two existing target locations would be replaced, and a spallation neutron source would be installed in an existing experimental area (Area A) at LANSCE. A fast-neutron irradiation environment would be produced by interaction of the proton beam with a tungsten target. The neutrons would be used to irradiate small samples of materials and fuels to conduct proof of performance experiments to prove the practicality of transmuting plutonium and high-level radioactive wastes into other elements or isotopes. This capability is anticipated to become operational in the 2009 to 2010 timeframe.

Subatomic Physics Research. This capability supports the conduct of physics experiments at the Manuel Lujan Center and the Weapons Neutron Research Facility, as well as the conduct of proton radiography experiments. Proton radiography experiments include contained experiments using small-to-moderate quantities of high explosives.

Medical Isotope Production. Radioisotopes used by the medical community for diagnostic procedures, therapeutic treatment, clinical trials, and biomedical research are produced at LANSCE. A new 100-million-electron-volt Medical Isotope Production Facility became fully operational in 2004. This new facility provides the ability to perform more selective and efficient isotope production while generating fewer byproduct isotopes than was previously possible.

In addition, an Isotope Production Facility would be established in an existing building. This facility would complement the 100-million-electron-volt Isotope Production Facility by using the 800-million-electron-volt proton beam available at the end of the linear accelerator to fabricate radioisotopes used by the medical community for diagnostic and other procedures.

Area A East would be stripped of existing contaminated and uncontaminated items for use as a staging area for shipments, receipts, equipment storage, and limited maintenance activities. Removal of existing items would generate an estimated 1,700 tons (1,540 metric tons) of waste for disposal, as detailed in Chapter 3, Section 3.2.11, of the *1999 SWEIS* (DOE 1999a).

High-Power Microwaves and Advanced Accelerators. R&D is conducted for advanced accelerator concepts, high-powered microwaves, room-temperature and superconducting linear accelerator structures, as well as in microwave chemistry for industrial and environmental applications. A neutron spectroscopy facility would be added under this capability for use in neutron research and technology. This facility would be constructed within existing buildings and would house photographic equipment and experiments contained within closed vessels.

Radioactive Liquid Waste Treatment. Wastes from LANSCE activities and certain wastes from TA-21 and TA-50 are treated in facilities at TA-53. Treatment includes wastewater storage to allow for short-lived radioisotope decay followed by solar evaporation. Radioactive liquid waste comes primarily from floor drains and accelerator magnet cooling water. Water flows by gravity into lift stations constructed adjacent to Experimental Area A and the Manuel Lujan Neutron-Scattering Center and is pumped from the lift stations through double-walled piping to one of three 30,000-gallon (113,562-liter) horizontal fiberglass tanks located in a building at the east end of TA-53. After allowing for decay, the radioactive liquid waste is pumped to one of two aboveground concrete evaporation basins. Each of the basins can hold 125,000 gallons (470,000 liters) of liquid and has impermeable liners and leak detection instrumentation.

3.1.3.15 Waste Management Operations: Solid Radioactive and Chemical Waste Facilities

The Solid Radioactive and Chemical Waste Facilities occupy over 200 structures in an area of 943 acres (382 hectares) in TA-54 and TA-50. This Key Facility processes, temporarily stores, and disposes of solid waste generated throughout LANL. A variety of wastes are managed, including toxic, hazardous, low-level radioactive, transuranic, and mixtures of these waste types. Most waste managed in TA-54 is in a solid physical state, although there are also small quantities of gaseous or liquid hazardous, toxic, and mixed wastes. Most low-level radioactive waste generated by LANL operations is disposed of onsite in TA-54. As evaluated in the *1999 SWEIS* and documented in the ROD, as disposal capacity in the currently active portion of Area G is used up, Zone 4 is being developed for continued low-level radioactive waste disposal. In addition to the operations at TA-54, transuranic waste is processed in the Waste Characterization, Reduction, and Repackaging Facility in TA-50 and is transported to TA-54 for assay and storage. Transuranic waste is stored onsite until it is transported to WIPP for disposal. Chemical and mixed radioactive wastes are transported to other offsite facilities for treatment and disposal.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–17** indicates activity types and levels proposed under all three alternatives for each capability.

Waste Characterization, Packaging, and Labeling. LANL supports, certifies, and audits generator characterization programs and maintains the waste acceptance criteria for LANL waste management facilities. LANL also manages compliance with the waste acceptance criteria for offsite treatment, storage, and disposal facilities. Deteriorating drums are overpacked, and small waste items are bulked (packaged together) to facilitate their management.

Capabilities include coring and visual inspection of a percentage of transuranic waste packages, ventilating packages of transuranic waste retrieved from below grade, maintaining compliance with the current version of the WIPP waste acceptance criteria, and coordinating with WIPP operations for disposal of LANL transuranic waste.

Table 3–17 Waste Management Operations: Solid Radioactive and Chemical Waste Facilities Capabilities and Activity Levels

Capability	*No Action Alternative* [a, b]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Waste Characterization, Packaging, and Labeling	Characterize 420 cubic yards (320 cubic meters) of newly generated transuranic waste annually. Characterize 11,000 cubic yards (8,400 cubic meters) of legacy transuranic waste. Characterize low-level radioactive, mixed low-level radioactive, and chemical waste, including waste from DD&D and remediation activities. Ventilate transuranic waste retrieved from belowground storage. Perform coring and visual inspection of a percentage of transuranic waste packages. Overpack and bulk small waste items as required. Support, certify, and audit generator characterization programs. Maintain waste acceptance criteria for LANL waste management facilities. Maintain waste acceptance criteria for offsite treatment, storage, and disposal facilities. Maintain WIPP waste acceptance criteria compliance and liaison with WIPP operations.	Same as No Action Alternative	Same as No Action Alternative, plus: - Characterize an additional 290 cubic yards (220 cubic meters) of newly generated transuranic waste annually. - Characterize approximately 3,100 cubic yards (2,400 cubic meters) of contact-handled and 130 cubic yards (100 cubic meters) of remote-handled legacy transuranic waste retrieved from belowground storage. - Characterize additional low-level radioactive, mixed low-level radioactive, and chemical waste, including waste from DD&D and remediation activities.
Waste Transport, Receipt, and Acceptance	Ship 420 cubic yards (320 cubic meters) of newly generated transuranic waste to WIPP annually. Ship 11,000 cubic yards (8,400 cubic meters) of legacy transuranic waste to WIPP. Ship low-level radioactive wastes to offsite disposal facilities. Ship 70 cubic yards (55 cubic meters) of mixed low-level radioactive waste for offsite treatment and disposal in accordance with EPA land disposal restrictions annually. Ship 7,100 tons (6,400 metric tons) of chemical wastes for offsite treatment and disposal in accordance with EPA land disposal restrictions annually. Ship low-level radioactive, mixed low-level radioactive, and chemical waste from DD&D and remediation activities. Collect chemical and mixed wastes from LANL generators and transport them to Consolidated Remote Storage Sites and TA-54. Receive, on average, 5 to 10 shipments annually of low-level radioactive waste and transuranic waste from offsite locations.	Same as No Action Alternative	Same as No Action Alternative, plus: - Ship 290 cubic yards (220 cubic meters) of additional transuranic waste to WIPP annually. - Ship approximately 3,000 cubic yards (2,340 cubic meters) of contact-handled and 130 cubic yards (100 cubic meters) of remote-handled legacy transuranic waste to WIPP. - Ship additional low-level radioactive, mixed low-level radioactive, and chemical waste from DD&D and remediation activities.

Capability	*No Action Alternative* [a, b]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Waste Retrieval	No activity	No activity	Retrieve remaining legacy transuranic waste (approximately 3,100 cubic yards [2,400 cubic meters] of contact-handled and 130 cubic yards [100 cubic meters] of remote-handled) from belowground storage in TA-54 Area G, including: Pit 9, above Pit 29, Trenches A–D, and Shafts 200-232, 235-243, 246-253, 262-266, and 302-306 (see Appendix H). [c]
Waste Treatment	Compact up to 3,000 cubic yards (2,540 cubic meters) of low-level radioactive waste annually. Process 3,000 cubic yards (2,400 cubic meters) of transuranic waste through size reduction at the Decontamination and Volume Reduction System. Demonstrate treatment (e.g., electrochemical) of liquid mixed low-level radioactive waste. Stabilize 1,100 cubic yards (870 cubic meters) of uranium chips.	Same as No Action Alternative	Same as No Action Alternative, plus: - Process newly generated transuranic waste through new TRU Waste Facility (formerly called the Transuranic Waste Consolidation Facility).
Waste Storage	Stage chemical and mixed wastes prior to shipment to offsite treatment, storage, and disposal facilities. Store transuranic waste until it is shipped to WIPP. Store mixed low-level radioactive waste pending shipment to a treatment facility. Store low-level radioactive waste uranium chips until sufficient quantities are accumulated for stabilization campaigns. Manage and store sealed sources for the Off-Site Source Recovery Project.	Same as No Action Alternative	Same as No Action Alternative, plus: - *Increase types and quantities of sealed sourced stored for the Off-Site Source Recovery Project* (see Appendix J). - Store transuranic waste generated by DD&D and remediation activities.
Waste Disposal	Dispose 110 cubic yards (84 cubic meters) of low-level radioactive waste in shafts, 30,000 cubic yards (23,000 cubic meters) of low-level radioactive waste in pits, and small quantities of radioactively contaminated polychlorinated biphenyls in shafts in Area G annually. Migrate operations in Area G to Zones 4 and 6 as necessary to allow continued onsite disposal of low-level radioactive waste.	Same as No Action Alternative	Same as No Action Alternative, plus: - Dispose additional low-level radioactive waste generated by DD&D and remediation activities.

Capability	*No Action Alternative* [a, b]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Decontamination Operations (Part of RLWTF operations in the *1999 SWEIS*)	Decontaminate approximately 700 personal respirators and 300 air-proportional probes per month for reuse. Decontaminate vehicles and portable instruments for reuse as required. Decontaminate precious metals for resale using an acid bath. Decontaminate scrap metals for resale by sand-blasting the metals. Decontaminate 260 cubic yards (200 cubic meters) of lead for reuse by grit-blasting.	Same as No Action Alternative	Same as No Action Alternative
Construction/Upgrade/DD&D			
Waste Management Facilities Transition Project	No activity	No activity	As described in Appendix H: - Construct and operate equipment and facilities for retrieval, characterization, and packaging of stored remote-handled transuranic waste. - Procure additional and upgraded equipment and facilities to increase throughput of stored transuranic waste drums being processed for shipment to WIPP. - Construct and operate a new *TRU Waste Facility*. - Construct and operate new access control station, low-level radioactive waste compactor building, and low-level radioactive waste certification building. - Relocate hazardous and mixed low-level radioactive waste storage facilities within TA-54, Area L, or move to other LANL locations.

WIPP = Waste Isolation Pilot Plant; TA = technical area; EPA = U.S. Environmental Protection Agency; RLWTF = Radioactive Liquid Waste Treatment Facility; TRU = transuranic; DD&D = decontamination, decommissioning, and demolition.

[a] DOE 1999a.

[b] LANL 2006a.

[c] LANL 2005e.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Waste Transport, Receipt, and Acceptance. Hazardous and mixed wastes are collected from LANL generators, transported to the consolidated remote storage sites and TA-54, and shipped offsite for treatment and disposal in accordance with U.S. Environmental Protection Agency (EPA) land disposal restrictions. Legacy and newly generated transuranic wastes are prepared for disposal and shipped to WIPP. Fewer than 10 shipments a year of low-level radioactive waste and transuranic waste are received from offsite locations. Receipt of offsite waste is not routine and must be approved by NNSA. Once received, the wastes are managed along with similar wastes generated at LANL. These wastes are generated by LANL activities at other locations and by other DOE facilities that do not have the capability to manage the wastes.

Waste Retrieval. This capability involves the retrieval and management of waste stored in pits, shafts, and trenches in TA-54 Area G so that the waste can be processed for eventual disposition.

Waste Treatment. This capability involves a variety of activities to prepare different waste types for storage and disposal: compaction, size reduction, and special treatment of wastes on an as-needed basis. Low-level radioactive waste generated onsite is compacted to reduce its volume prior to disposal.

Larger pieces of transuranic waste are reduced in size at the Decontamination and Volume Reduction System to make them suitable to be packaged for shipment to WIPP. This system is intended to handle large metal items. Processes include decontamination to low-level radioactive waste levels, as well as cutting and compacting so waste fits in containers accepted at WIPP.

On an as-needed basis, Waste Management Operations demonstrates treatment of liquid mixed low-level radioactive waste, stabilizes uranium chips, and accepts environmental restoration soils for disposal at Area G as low-level radioactive waste.

Waste Storage. LANL stores chemical and mixed wastes prior to shipment to offsite treatment, storage, and disposal facilities; legacy transuranic waste until it is shipped to WIPP; mixed low-level radioactive waste until it is transported to a treatment facility; sealed sources from the Off-Site Source Recovery Project until a disposition path is available; and low-level radioactive waste uranium chips until sufficient quantities are accumulated for stabilization campaigns.

Waste Disposal. Solid low-level radioactive waste is disposed of in cells, pits, and shafts in TA-54 Area G. The Consent Order requires investigation and remediation of environmental contamination at LANL, including certain subsurface units in MDA G in Area G. For this reason, and because the currently active portion of Area G is reaching the limit of its disposal capacity, the existing disposal units will be closed and disposal operations will be moved to Zone 4 in TA-54 to provide new disposal capacity and facilitate closure of MDA G. Zone 6 in TA-54 is also available for future expansion.

Decontamination Operations. This capability was relocated from the Radioactive Liquid Waste Treatment Facility in 2000. Decontamination is performed either to enable reuse or to reduce the contamination of materials before disposal. Items generally decontaminated include respirators, vehicles, portable equipment, scrap and precious metals, and lead shielding.

3.1.3.16 Plutonium Facility Complex

The Plutonium Facility Complex Key Facility is located on 40 acres (16 hectares) in TA-55 and consists of six primary buildings and a number of support, storage, security, and training structures located throughout the TA. The Plutonium Facility, a two-story laboratory of approximately 151,000 square feet (14,000 square meters), is the major R&D facility in the complex. 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.

The following paragraphs describe the capabilities of this Key Facility. **Table 3–18** indicates activity types and levels proposed under all three alternatives for each capability.

Plutonium Stabilization. This capability employs a variety of plutonium and other actinide recovery operations to improve the storage condition of legacy plutonium in the LANL inventory. Cleaning metallic plutonium, converting metal to oxide, reprocessing scrap material, and high-firing oxides are among the routine Plutonium Complex chemical processing capabilities.

Manufacturing Plutonium Components. This capability involves the manufacture of plutonium pits and parts, and fabrication of samples for R&D activities. This capability also includes fabrication of parts for dynamic and subcritical experiments.

Surveillance and Disassembly of Weapons Components. This capability provides for the disassembly of plutonium pits for examination. Destructive and nondestructive techniques are used for examination.

Actinide Materials Science and Processing Research and Development. Research would be conducted on plutonium (and other actinide) materials, including metallurgical and other characterization of samples and measurements of mechanical and physical properties. This includes continued operation of the 40-millimeter Impact Test Facility and other apparatus. Research is also conducted to develop new techniques that are useful for such research or for enhanced surveillance. In addition, research is performed to support development and assessment of technology for manufacturing and fabrication of components, including activities in areas such as welding; bonding; fire resistance; and casting, machining, and other forming technologies.

Special recovery processes are performed, including demonstration of the disassembly and conversion of plutonium pits using hydride-dehydride processes and development of expanded disassembly capacity. Neutron sources (plutonium and beryllium, and americium-241 and beryllium) can be processed at TA-55. Included in this capability is the technology to process neutron sources other than sealed sources, process items through the Special Recovery Line (tritium separation), and perform oralloy decontamination of uranium components.

Table 3–18 Plutonium Facility Complex Capabilities and Activity Levels

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Plutonium Stabilization	Recover, process, and store existing plutonium residue inventory.	Same as No Action Alternative	Same as No Action Alternative
Manufacturing Plutonium Components	Produce up to 20 plutonium pits per year. Fabricate parts and samples for research and development activities, including parts for dynamic and subcritical experiments.	Same as No Action Alternative, except: - Produce less than 20 plutonium pits per year.	Same as No Action Alternative except: - Produce up to 80 pits per year.
Surveillance and Disassembly of Weapons Components	Disassemble, surveil, and examine up to 65 plutonium pits per year.	Same as No Action Alternative	Same as No Action Alternative
Actinide Materials Science and Processing Research and Development	Perform plutonium (and other actinide) materials research, including metallurgical and other characterization of samples and measurements of mechanical and physical properties. Operate the 40-millimeter Impact Test Facility and other test apparatus. Develop expanded disassembly capacity and disassemble up to 200 pits per year. Process up to 5,000 curies of neutron sources (including plutonium and beryllium and americium-241 and beryllium). Process neutron sources other than sealed sources. Process up to 900 pounds (400 kilograms) of actinides per year between TA-55 and the CMR Building. Process pits through the Special Recovery Line (tritium separation). Perform oralloy decontamination of 28 to 48 uranium components per month. Conduct research in support of DOE actinide cleanup activities and on actinide processing and waste activities at DOE sites. Stabilize specialty items and residues from other DOE sites. Fabricate and study nuclear fuels used in terrestrial and space reactors. Fabricate and study prototype fuel for lead test assemblies. Develop safeguards instrumentation for plutonium assay. Analyze samples.	Same as No Action Alternative	Same as No Action Alternative, except (some of these are higher activity levels; some are additional activities): - Develop expanded disassembly capacity and disassemble up to 500 pits per year. - Process up to 1,800 pounds (800 kilograms) of actinides, including polishing up to 460 pounds (210 kilograms) of plutonium oxide, annually. - Provide support for dynamic experiments. - Conduct plutonium research, development, and support: prepare, measure, and characterize samples for fundamental research and development in areas such as aging, welding and bonding, coatings, and fire resistance.
Fabrication of Ceramic-Based Reactor Fuels	Make prototype mixed oxide fuel. Build test reactor fuel assemblies. Continue R&D on other fuels.	Same as No Action Alternative	Same as No Action Alternative

Capability	*No Action Alternative* [a]	*Reduced Operations Alternative*	*Expanded Operations Alternative* [b]
Plutonium-238 Research, Development, and Applications [c]	Process, evaluate, and test up to 55 pounds (25 kilograms) of plutonium-238 per year in production of materials and parts to support space and terrestrial uses. Recover, recycle, and blend up to 40 pounds (18 kilograms) per year of plutonium-238.	Same as No Action Alternative	Same as No Action Alternative
Storage, Shipping, and Receiving	Provide interim storage of up to 7.3 tons (6.6 metric tons) of the LANL special nuclear material inventory, mainly plutonium. Store working inventory in the vault in Building 55-4; ship and receive as needed to support LANL activities. Provide temporary storage of Security Category I and II materials removed in support of TA-18 closure, pending shipment to the Nevada Test Site and other DOE complex locations. Store sealed sources collected under DOE's Off-Site Source Recovery Project. Store mixed oxide fuel rods and fuel rods containing archive and scrap material from mixed oxide fuel lead assembly fabrication.	Same as No Action Alternative	Same as No Action Alternative, plus: - Conduct nondestructive assay on special nuclear material at TA-55-4 to identify and verify the content of stored containers. - Cut mixed oxide fuel rods and fuel rods containing archive and scrap materials from mixed oxide fuel lead assembly fabrication into smaller pieces, repackage, and continue to store.
Construction/Upgrades/DD&D			
Plutonium Facility Complex Refurbishment Project	No activity	No activity	Implement *Plutonium Facility Complex Refurbishment Project*, involving major systems repairs and replacements to extend reliable operation of facility for the future (see Appendix G).
TA-55 Radiography Facility Project	No activity	No activity	Construct and operate TA-55 Radiography Facility (see Appendix G).

R&D = research and development; TA = technical area; CMR = Chemistry and Metallurgy Research; DD&D = decontamination, decommissioning, and demolition.

[a] DOE 1999a.

[b] LANL 2006a.

[c] The *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE 2005c) evaluates consolidation of radioisotope power system nuclear operations, including those currently performed at the Plutonium Facility at LANL, at a single site. The Proposed Action would consolidate these activities at Idaho National Laboratory. Should DOE decide to implement consolidation, associated operations would cease at LANL and be transferred. However, other activities involving plutonium-238, such as the plutonium-238 fuel aging studies and plutonium-238 calibration standards activities would remain at LANL.

Note: Italicized entries indicate projects for which project-specific impact analyses are included in appendices to this SWEIS.

Research in support of DOE's actinide cleanup activities and on actinide processing and waste activities at DOE sites is conducted. In addition, LANL staff would stabilize specialty items and residues from other DOE sites; fabricate and study nuclear fuels used in terrestrial and space reactors; fabricate and study prototype fuel for lead test assemblies; develop safeguards instrumentation for plutonium assay; and analyze samples.

Fabrication of Ceramic-Based Reactor Fuels. Development and demonstration of ceramic fuel fabrication technologies is conducted. R&D continues on other fuels.

Plutonium-238 Research, Development, and Applications. Radioisotope thermoelectric generators and milliwatt generators using plutonium-238 as an energy source are developed and fabricated under this capability. As part of R&D and testing, plutonium-238 is processed, recovered, recycled, and blended. Materials and parts are fabricated and units are tested in support of space and terrestrial uses.

Storage, Shipping, and Receiving. The Plutonium Facility provides storage, shipping, and receiving activities for the majority of the LANL special nuclear material inventory, mainly plutonium. This includes temporary storage of Security Category I and II materials removed from TA-18 in support of TA-18 closure until these materials are shipped to the Nevada Test Site and other DOE sites. 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.

3.2 Reduced Operations Alternative

At the site-wide and TA levels, the Reduced Operations Alternative is the same as the No Action Alternative. Differences between the Reduced and No Action Alternatives occur only within Key Facilities as described in this section.

Under the Reduced Operations Alternative, the following Key Facilities would maintain the same capabilities and operate at the same activity levels as under the No Action Alternative (see Section 3.1 of this SWEIS):

- Sigma Complex
- Machine Shops
- Material Sciences Laboratory
- Nicholas C. Metropolis Center for Modeling and Simulation
- Tritium Facilities
- Target Fabrication Facility
- Bioscience Facilities
- Radiochemistry Facility

- Waste Management Operations: Radioactive Liquid Waste Treatment Facility
- Waste Management Operations: Solid Radioactive and Chemical Waste Facilities

The six Key Facilities discussed in the following paragraphs would operate at levels reduced from those described for the No Action Alternative.

3.2.1 Chemistry and Metallurgy Research Replacement Facility

Under the Reduced Operations Alternative, NNSA would not construct and operate the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility. Operations at the Chemistry and Metallurgy Research Building would continue to provide LANL's analytical chemistry and materials characterization research and mission support capabilities beyond 2010, while most administrative offices and support functions would move to TA-55 once construction of the new Chemistry and Metallurgy Research Replacement radiological laboratory, administrative office, and support building was completed. Operations remaining at the Chemistry and Metallurgy Research Building would likely be reduced and consolidated from Wings 3, 5 and 7 (operations have already been halted within Wings 2 and 4); ultimately Wing 7 might become the last remaining operable wing of the building before its total shutdown and closure. Operations overall within the Chemistry and Metallurgy Research Building would be reduced and nuclear materials stored within the building would also be reduced. Overall support to production activities would not be adequate to support a 20 pit-per-year rate.

3.2.2 High Explosives Processing Facilities

Under the Reduced Operations Alternative, capabilities described in the No Action Alternative for the High Explosives Processing Facilities Key Facility would remain the same, but their activity levels would be reduced by 20 percent (see Section 3.1.3.6). These activities would require an estimated 66,200 pounds (30,000 kilograms) of explosives and 2,300 pounds (1,100 kilograms) of mock explosives annually. Table 3–8 presents activity levels proposed under this alternative for each capability.

Construction of the TA-16 Engineering Complex would be completed as under the No Action Alternative, including removing or demolishing unneeded vacated structures.

3.2.3 High Explosives Testing Facilities

Under the Reduced Operations Alternative, capabilities for the High Explosives Testing Facilities would remain the same as those described in the No Action Alternative, but their activity levels would be reduced by 20 percent (see Section 3.1.3.7). Further, no special nuclear material would be used in dynamic experiments. Table 3–9 indicates activity levels proposed under all three alternatives for each capability. Under this alternative, up to 5,500 pounds (2,500 kilograms) of depleted uranium would be expended in experiments annually.

The same construction projects would be implemented as under the No Action Alternative: 15 to 25 new structures (new offices, laboratories, and shops) would be built within the Two-Mile Mesa Complex to consolidate activities currently conducted in various locations around LANL. Vacated structures would be removed or demolished as appropriate, and the dynamic experimentation assembly structure would be installed at TA-15.

3.2.4 Pajarito Site

Under the Reduced Operations Alternative, operations at the Pajarito Site would cease. The Pajarito Site would be placed in surveillance and maintenance mode and would be eliminated as a Key Facility. Table 3–11 identifies differences between the three alternatives for the Pajarito Site Key Facility.

3.2.5 Los Alamos Neutron Science Center

Under the Reduced Operations Alternative, LANSCE would be closed, placed into safe shutdown mode, and eliminated as a Key Facility. Systems would be maintained in a condition to support future restart. This shutdown would be a major change at LANL because LANSCE accounts for more than 90 percent of all radioactive air emissions from LANL and provides a source of neutron and proton beams that is not readily available elsewhere in the DOE complex. Radioactive liquid waste treatment would continue at TA-53, with approximately 5,000 gallons (20,000 liters) per year transported from TA-50 for solar evaporation. Table 3–16 identifies differences between the three proposed alternatives for LANSCE.

3.2.6 Plutonium Facility Complex

Under the Reduced Operations Alternative, the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility would not be constructed and analytical chemistry and materials characterization research would continue at the Chemistry and Metallurgy Research Building. As discussed in Chapter 1, Section 1.3.2, and in Section 3.2.1, overall support to pit production activities would not be adequate to support a 20 pit-per-year production rate.

3.3 Expanded Operations Alternative

This alternative considers LANL operations at a higher level than the No Action Alternative, as well as implementation of additional projects at the site-wide, TA, and Key Facility levels. Many capabilities would remain unchanged. Some projects that would be implemented, such as for the Pajarito Site Key Facility, would result in closure and demolition of facilities and loss of capabilities at LANL. Each proposed new construction project or major modification to existing facilities is described and the potential impacts are evaluated in an appendix to this SWEIS. Each of these appendices includes a proposed timeline for construction and operation.

3.3.1 Los Alamos National Laboratory Site-Wide Projects

Under the Expanded Operations Alternative, three major site-wide projects would be undertaken. The Security-Driven Transportation Modifications Project, remedial activities required to comply with the Consent Order, and an increase in the types and quantities of sealed sources managed at LANL by the Off-Site Source Recovery Project are described in this section.

3.3.1.1 Security Needs

As part of its ongoing security improvement effort, NNSA has determined there is a continuing need to upgrade physical protection in the area of the Pajarito Corridor West. Under the Expanded Operations Alternative, additional Security-Driven Transportation Modifications

involving extensive changes to general traffic flow patterns and site infrastructure identified in Table 3–1 would be implemented.

Under this approach, vehicular traffic in the Pajarito Corridor West between TA-48 and TA-63 could be limited, according to the security level, to only Government vehicles and physically inspected service vehicles. Access for staff and visitors to this controlled area would be provided by an internal shuttle system linked to large parking areas at TA-48 and TA-63. Surface parking lots for both private vehicles and commuter buses would be constructed at these two termini. A shuttle bus system would be deployed within the restricted area.

Modifications to certain existing roads and construction of new roads would be required. Retaining walls and security barriers would be constructed as needed to provide physical separation of the security-controlled portion of the Pajarito Corridor West from the parking areas and other roadways. A pedestrian and bicycle pathway system including shelters and related amenities would be provided at various locations within the project area. Pedestrian and vehicular crossings would be constructed between TA-63 and TA-35 over a branch of Mortandad Canyon (known locally as Ten Site Canyon).

Two auxiliary actions could also be implemented. Auxiliary Action A involves the construction of a two-lane bridge crossing Mortandad Canyon between TA-35 and Sigma Mesa (in TA-60) with a new road proceeding west through TA-60 to TA-3. Auxiliary Action B, which would be dependent on implementation of Auxiliary Action A, involves constructing a two-lane bridge over Sandia Canyon between TA-60 and TA-61, and a new road proceeding northward to East Jemez Road. The proposed project and an evaluation of the potential impacts are presented in Appendix J.

3.3.1.2 Remediation and Closure Activities

For several years, LANL personnel have conducted an environmental restoration program to identify locations where hazardous constituents may have been released into the environment and to carry out corrective measures in compliance with the Atomic Energy Act and the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). Under RCRA and related legislation, corrective action is enforced nationally by EPA and locally by the New Mexico Environment Department pursuant to the New Mexico Hazardous Waste Act. Since 1990, LANL personnel have conducted investigations and corrective actions at sites subject to HSWA in accordance with the LANL Hazardous Waste Facility Permit. The Consent Order signed on March 1, 2005, however, stipulates a more specific program of studies and corrective measures and requires cleanup to be completed by 2015.

The Consent Order establishes requirements for investigation and remediation of a large number of potential release sites, including several former MDAs, and specifies both the set of investigations and the schedule for their completion. Investigations by LANL staff would include installation of wells at the MDAs and in adjoining canyons, collection of soil and rock samples at the MDAs, collection of vapor samples from the MDAs, collection of alluvial sediment and groundwater samples in the adjoining canyons, and other related activities. These investigations would involve similar, if not identical, technologies that have been used for many

years at LANL with few, if any, environmental impacts. If, at the conclusion of the investigation process, the New Mexico Environment Department determines that corrective measures are needed to protect human health or the environment, LANL staff would evaluate a set of remedial options and recommend to the New Mexico Environment Department a preferred corrective measure. The New Mexico Environment Department would decide, however, which method should be implemented and is not obligated to select the preferred corrective measure.

Two scenarios for environmental restoration have been evaluated to bound the range of possible consequences of implementing corrective measures required by the Consent Order.[3] A Capping Option, a Removal Option, and a No Action Option are assumed and evaluated in Appendix I of this SWEIS. The No Action Option is the base case in which remedial investigations and cleanup activities would continue at a level comparable to that of recent years. Briefly, the Capping Option reflects the assumption that the waste and contamination within the MDAs would be left in-place and stabilized by installation of evapotranspiration caps as a mitigation measure. The Removal Option reflects the assumption that the waste and contamination within the MDAs covered by the Consent Order would be removed. For both the Capping and Removal Options, several additional potential release sites such as firing sites and outfalls would be remediated annually. These options are intended to bound the range of possible corrective measures and do not represent the preferred action NNSA would propose to the New Mexico Environment Department.

The Los Alamos County Solid Waste Landfill is an unlined facility that does not meet current regulatory standards. In lieu of bringing the landfill up to required standards, Los Alamos County will close the landfill, but has proposed to the New Mexico Environment Department that the landfill remain open through 2008 to achieve final waste grade (LAC 2007). Following closure, any remaining requirements would be addressed under the Consent Order as part of investigating and remediating the Upper Sandia Canyon Aggregate Area. The Investigation Work Plan for Upper Sandia Canyon Aggregate Area, including proposed groundwater monitoring, is due to the New Mexico Environment Department in 2008.

3.3.1.3 Increase in the Type and Quantity of Sealed Sources Managed at Los Alamos National Laboratory by the Off-Site Source Recovery Project

Under the Expanded Operations Alternative, the types and quantities of sealed sources accepted under the Off-Site Source Recovery Project would increase. In 2004, the scope of the Off-Site Source Recovery Project was expanded to include:

- all concentrations of the sources in the original scope commonly found in sealed sources;
- additional isotopes such as cobalt-60, cesium-137, iridium-192, radium-226, and californium-252, all of which are commonly found in sealed sources; and strontium-90, which is used in radioisotope thermoelectric generators (DOE 2004c).

[3] *NNSA is including impacts associated with Consent Order implementation in the SWEIS in order to more fully analyze the impacts resulting from Consent Order compliance. NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in the SWEIS.*

The Off-Site Source Recovery Project would use the same approach to manage these additional sealed sources as it does for those already managed under the No Action Alternative. The sealed sources would be brought to LANL for safe storage when other reasonable disposition options such as reuse or commercial disposal were not available. The potential impacts of the increased scope of the Off-Site Source Recovery Project at LANL are analyzed in Appendix J of this SWEIS.

3.3.2 Technical Area Projects

LANL activities discussed in this section would occur at TA-3, TA-21, TA-62, and TA-72. Proposed activities for TA-18, the Pajarito Site Key Facility, are discussed in Section 3.3.3.5.

3.3.2.1 Technical Area 3

Physical Science Research Complex Project

The Physical Science Research Complex Project (formerly the Center for Weapons Physics Research) would provide a new modern facility in which to consolidate staff currently located in TA-3 and other LANL locations in temporary structures or aging permanent buildings in poor condition. The new complex would collocate approximately 750 weapons scientists from various LANL organizations and disciplines to facilitate stockpile stewardship and certification activities. Security would be enhanced with construction of the Physical Science Research Complex, which would enable efficient conduct of classified work in a properly engineered security environment. Productivity is expected to be enhanced by collocating similar functions and organizations.

Under the Expanded Operations Alternative, the new Physical Science Research Complex would be constructed in a currently developed area of TA-3. The preliminary proposal is for a complex of four buildings, with a total floor space of approximately 350,000 square feet (32,500 square meters). Approximately 30 percent of the floor space would be laboratories (primarily laser). These laboratories would have an improved heating, ventilation, and air conditioning system; special flooring to limit vibration; extensive electrical grounding; and the use of pressurized air, helium, and nitrogen gas. The gases would be provided from a central location. No wet chemistry is expected to be performed. The complex would include both classified and unclassified workspace, a clean room, and vault space for classified weapons designers. A substantial amount of electrical power would be required to operate equipment.

Approximately 74,000 square feet (6,900 square meters) of existing structures at TA-3 would be removed to accommodate construction of the proposed new facility. Additionally, an undetermined number of other facilities could be demolished when the Physical Science Research Complex is complete. The potential impacts of this proposed project are evaluated in Appendix G.

Replacement Office Buildings Project

A complex of replacement office buildings and associated structures has been proposed for TA-3. The buildings would provide new modern structures to allow consolidation of staff currently located throughout TA-3 or other parts of LANL in temporary structures or aging

permanent buildings in failing and poor condition. The office complex would be located partially on undeveloped land south of West Jemez Road and partially in developed areas of the existing Wellness Center building. The project would consist of nine new buildings (one of which would be available to house DOE's Los Alamos Site Office) and two new parking structures, one located north of Mercury Road and one located south of West Jemez Road. The existing Wellness Center would be demolished to accommodate later phases of this project. Three new office buildings already under construction would become part of this complex through connecting parking and siting proximity.

The proposed Los Alamos Site Office Building would be a 45,500-square-foot (4,200-square-meter) building housing approximately 150 staff. The remaining office complex buildings would be two-story structures, each with a footprint of 8,000 to 9,000 square feet (740 to 840 square meters). These new buildings would provide approximately 15,000 to 17,500 gross square feet (1,400 to 1,600 square meters) of office space and house approximately 50 to 70 staff each. Staff would be transferred from other offices at LANL. Appendix G provides an analysis of the potential impacts of this project. Construction of the Los Alamos Site Office Building has begun.

3.3.2.2 Technical Area 21 Structure Decontamination, Decommissioning, and Demolition Project

Under the Expanded Operations Alternative, all or some of the structures located within the boundaries of TA-21 would undergo DD&D. Structures involved could range from only those that interfere with site investigations and remediation to all existing TA-21 structures: process buildings, administrative and logistics buildings, and support facilities. Infrastructure such as gas, water, and waste piping; electrical and communication lines; and fences that cross TA-21 en route to other LANL facilities would also be removed as necessary.

The Consent Order requires investigation and remediation of environmental contamination at LANL, including areas in TA-21. In many cases, these investigations and remedial actions would be hampered by buildings that are above or adjacent to proposed investigation areas. To facilitate investigation of these areas, decommissioning and decontamination of many of the structures is planned. Decommissioning and decontamination of the structures would be optimized by grouping structures with similar contaminant profiles, interrelated systems, and construction types. The composition of those groups is identified in Appendix H, which evaluates the potential impacts of DD&D of structures in TA-21.

Field activities include preparation work and establishment of waste staging areas, utility management, removal of internal equipment, abatement or decontamination, removal of roofing and exterior equipment, above- and below-grade structural demolition, limited removal of underlying soil and structures, verification sampling, and site restoration. Many buildings are extensively contaminated and have residual radiological material in systems and on surfaces. Drainage, ventilation, and other utility systems also could contain residual hazardous materials.

Heavy equipment, specialty equipment, safety systems, and waste processing systems could be used in the decommissioning and decontamination effort. This equipment would be operated inside and adjacent to the structures. Removal of the foundation, substructures, and underlying

soil would be limited to a depth of about 5 feet (1.5 meters) adjacent to and 2 feet (0.6 meters) below structure footprints. Remedial investigations and cleanup of the contaminated areas would be addressed by environmental restoration efforts as described in Section 3.3.1.2 and Appendix I of this SWEIS.

Actions would be taken on a schedule to support the investigation and corrective actions required under the Consent Order. DD&D of buildings and structures that might have an interim use, such as the steam plant and piping and administrative and logistics facilities, might be deferred. Appendix H lists buildings and structures identified for DD&D under this alternative and evaluates the potential impacts of these proposed activities.

3.3.2.3 Science Complex Project in Technical Area 62

The Science Complex is proposed to be built in TA-62; other siting options include the Research Park and south TA-3. The complex would consist of two buildings providing approximately 402,000 gross square feet (37,300 square meters) of office and light laboratory space along with the necessary supporting infrastructure and an auditorium, and would replace an equal amount of outdated and inefficient space that would be retired from service and eventually demolished. A parking structure of 504,000 square feet (46,800 square meters) would also be constructed. The complex would provide space for scientific staff involved in research in biosciences, computer and computational sciences, earth and environmental sciences, theoretical research, nonlinear studies, and geophysics and planetary physics.

Construction of the Science Complex would provide NNSA an opportunity to improve the quality of facilities that would be used to carry out current and future research programs in support of NNSA's Defense Program mission and to decrease and control operational and maintenance costs for LANL facilities. In addition, by providing consolidated space for staff performing work in related areas, peer groups would have frequent interactions that could contribute to collaborations and creative innovation and achieve efficiency.

NNSA's goal is to retain as much of the natural setting, vegetation, and overall environmental integrity of the site as practical. Potential environmental impacts of the construction and operation of the new Science Complex are analyzed in Appendix G.

3.3.2.4 Remote Warehouse and Truck Inspection Station Project in Technical Area 72

The proposed warehouse and truck inspection station in TA-72 would allow consolidation of truck inspections and warehousing operations at a location that is remote from core areas at LANL. The remote location would provide enhanced security because commercial vehicle shipments would be received and inspected before entering the more densely populated areas of LANL. The new Remote Warehouse and Truck Inspection Station would be sited on the southwest side of East Jemez Road, approximately 1 mile (1.6 kilometers) west of NM 4. Shipments would be offloaded and searched at the warehouse, then shipped to their onsite destinations.

The new facility would consolidate current distribution center activities into a modern facility that is safe, secure, cost-efficient, and environmentally compliant. The facility would replace

existing LANL warehouse facilities that are over 50 years old and in poor condition and would solve existing operational problems. The new Truck Inspection Station would replace the temporary station located on the north side of East Jemez Road.

This complex would include an 85,000-square-foot (7,900-square-meter) distribution warehouse building, a 12,000-square-foot (1,100-square-meter) office building, a 400-square-foot (37-square-meter) rest area, and a 600-square-foot (55-square-meter) guardhouse and dog kennel. The warehouse would contain a vault, loading docks, leveling ramps, conveyor belts, and a materials handling area. The office building would house support personnel for the warehouse and truck inspection station operations. In addition, there would be approximately 50,000 square feet (4,600 square meters) of paved area for the Truck Inspection Station.

After the proposed facility is in operation, the temporary truck inspection station would be demolished and the area would be returned to a natural condition. Potential impacts of the construction and operation of this new Remote Warehouse and Truck Inspection Station are evaluated in Appendix G.

3.3.3 Key Facilities

The following Key Facilities would maintain the same capabilities and operate at the same activity levels under the Expanded Operations Alternative as under the No Action Alternative (see Section 3.1 of this SWEIS):

- Sigma Complex
- Machine Shops
- Material Sciences Laboratory
- High Explosives Testing Facilities
- Target Fabrication Facility

Changes to the other Key Facilities are described in the following paragraphs.

3.3.3.1 Chemistry and Metallurgy Research Building

Under the Expanded Operations Alternative, activities and anticipated construction would proceed as under the No Action Alternative described in Section 3.1.3.1, with a few additions. The Actinide Research and Development capability and the Fabrication and Processing capability would include several new or expanded activities, as outlined in Table 3–3. Under the Expanded Operations Alternative, Chemistry and Metallurgy Research Building Wing 9 hot cell operations would be moved to the Radiological Sciences Institute proposed for TA-48 rather than being eliminated, and operations would be overseen by Radiochemistry Laboratory personnel. Potential impacts of construction and operation of the new Radiological Sciences Institute are evaluated in Appendix G.

3.3.3.2 Nicholas C. Metropolis Center for Modeling and Simulation

Operations levels for the Metropolis Center are described in Table 3–7. Under the Expanded Operations Alternative, the computing platform would operate at higher computational levels, initially estimated to be up to 100 teraflops, and could approach 1,000 teraflops (1 petaflops). The level to which operations could increase would be limited by the amount of electricity and water needed to support the increased capabilities. Increases in operational levels requiring more than 15 megawatts of electricity or 51 million gallons (193 million liters) of water per year would require additional NEPA analysis before implementation. Expansion of computational capabilities would be supported by installation of additional processors and mechanical and electrical equipment. Potential impacts of increasing the level of operation at the Metropolis Center are evaluated in Appendix J.

3.3.3.3 High Explosives Processing Facilities

Activity levels for the High Explosives Processing Facilities are shown in Table 3–8. Activities under the Expanded Operations Alternative would require an estimated 82,700 pounds (37,500 kilograms) of explosives and an increase to 5,000 pounds (2,300 kilograms) of mock explosives annually. In addition, the Safety and Mechanical Testing capability would operate at a higher level; the number of safety and mechanical tests conducted annually would increase from approximately 15 per year up to 500 tests per year. The remaining capabilities would operate at the same levels described for the No Action Alternative (see Section 3.1.3.6).

3.3.3.4 Tritium Facilities

Tritium Facilities capabilities and activity levels are described in Table 3–10. Under the Expanded Operations Alternative, activity levels would be the same as described for the No Action Alternative (see Section 3.1.3.8). Once all tritium operations are finished at the Tritium Systems Test Assembly and the Tritium Science and Fabrication Facility, however, the buildings would undergo DD&D as part of the TA-21 structure DD&D (see Section 3.3.2.2).

3.3.3.5 Pajarito Site

The Pajarito Site capabilities and activity levels are described in Table 3–11. Under the Expanded Operations Alternative, Security Category III and IV materials would be relocated to the proposed Institute for Nuclear Nonproliferation Science and Technology, which is part of the proposed Radiological Sciences Complex at TA-48, or to another location at LANL as evaluated in Appendices G and H. Sealed sources managed under the Off-Site Source Recovery Project would be moved to other LANL storage locations, and the remaining operations at the Pajarito Site would be discontinued. Buildings would be decontaminated and decommissioned, as appropriate. Except for a cabin structure and other historic properties from the Manhattan Project and Cold War eras that would be preserved, buildings at TA-18 would be demolished and the Pajarito Site would be eliminated as a Key Facility.

3.3.3.6 Bioscience Facilities

Under the Expanded Operations Alternative, most of the Bioscience Facilities operations would move to the proposed Science Complex described in Section 3.3.2.3 and evaluated in

Appendix G. Moving Bioscience Facilities operations to the Science Complex would facilitate eventual replacement of the Health Research Laboratory in TA-43.

3.3.3.7 Radiochemistry Facility

Under the Expanded Operations Alternative, most capabilities would operate at the same levels as under the No Action Alternative, as described in Table 3–14. In addition, there would be one new activity under an existing capability and one new capability. Beryllium dispersion and mitigation assessments would be performed as part of the Environmental Remediation and Risk Mitigation capability. The new capability, Atom Trapping, would use a high-efficiency magneto-optical trap coupled to an offline mass separator to efficiently trap radioactive atoms for fundamental and applied research efforts.

The Expanded Operations Alternative would also include construction of the first component of the new consolidated and integrated Radiological Sciences Institute. The new institute would be constructed over about 20 years in a phased approach. Construction would begin on the first phase, the Institute for Nuclear Nonproliferation Science and Technology, during the timeframe analyzed in this SWEIS. The Institute for Nuclear Nonproliferation Science and Technology would include a Security Category I and II training center with a Security Category I vault, several Security Category III and IV laboratories, a field security test laboratory, a secure radiochemistry facility, and associated office and support facilities. Security Category III and IV capabilities and materials from TA-18 remaining at LANL would be relocated to the Institute for Nuclear Nonproliferation Science and Technology.

Once the new complex is completed, existing Radiochemistry Facility capabilities, as well as those from several other buildings, would be relocated to the new Radiological Sciences Institute and the old buildings currently housing those operations would undergo DD&D. In addition, capabilities from the Chemistry and Metallurgy Research Building Wing 9 hot cell would be reconstructed in the new Radiological Sciences Institute, and responsibility for those operations would transfer to the Radiochemistry Key Facility. Potential impacts of construction and operation of the new Radiological Sciences Institute are evaluated in Appendix G.

3.3.3.8 Waste Management Operations: Radioactive Liquid Waste Treatment Facility

Radioactive Liquid Waste Treatment Facility capabilities and activity levels are described in Table 3–15. Under the Expanded Operations Alternative, the Waste Transport, Receipt, and Acceptance capability and the Radioactive Liquid Waste Treatment capability would operate at increased levels. In addition to operating the new influent storage facility, a replacement for the existing Radioactive Liquid Waste Treatment Facility Building would be constructed in TA-50, with an estimated start of operations in 2012. New low-level radioactive waste and transuranic waste treatment facilities would be constructed, and low-level radioactive waste and transuranic waste processes would be modified to achieve greater reliability, redundancy, and flexibility. Portions of the existing facility would be demolished. New equipment would be purchased; some existing equipment might be used to supplement the new equipment. Evaporation tanks would be installed in TA-52 to minimize the discharge of treated liquid effluent from the Radioactive Liquid Treatment Waste Facility to the environment. Treated effluent would be

conveyed to the evaporation tanks through a pipeline installed between TA-50 and TA-52. Potential impacts of this project are evaluated in Appendix G.

3.3.3.9 Los Alamos Neutron Science Center

Under the Expanded Operations Alternative, there would be no change in activity levels from the No Action Alternative, described in Table 3–16. The LANSCE Refurbishment Project, however, would be implemented. This project, which would include renovations and improvements to the existing facility to increase its reliability and extend its operation into the future, is described in Appendix G.

3.3.3.10 Waste Management Operations: Solid Radioactive and Chemical Waste Facilities

Under the Expanded Operations Alternative, most capabilities would continue to operate at the same activity levels described for the No Action Alternative in Table 3–17. Activity levels for the Waste Characterization, Packaging, and Labeling; and the Waste Transport, Receipt, and Acceptance capabilities would increase to accommodate additional transuranic waste resulting from increased pit production at the Plutonium Facility Complex. Storage and shipment of transuranic waste and disposal of low-level radioactive waste from DD&D and remediation activities would increase. In addition, the Waste Retrieval capability would be restarted to retrieve the transuranic waste stored in pits, shafts, and trenches in TA-54, Area G, as described in Table 3–17.

Within the Waste Storage capability, efforts to support the Off-Site Source Recovery Project would be expanded to accommodate expansion of the project to include additional types and concentrations of sealed sources. This project, which involves recovery of radioactive sources and devices (primarily sealed sources) that pose a potential risk to health, safety or national security, is evaluated in Appendix J.

Several new construction and upgrade projects would be implemented at the Solid Chemical and Radioactive Waste Facilities under the Expanded Operations Alternative. These projects would include construction and operation of a facility and equipment to retrieve and process remote-handled transuranic waste; procurement of additional and upgraded equipment for transuranic waste processing; construction and operation of a new TRU (Transuranic) Waste Facility (formerly the Transuranic Waste Consolidation Facility) in a TA along the Pajarito Road corridor; and construction and operation of a new access control station, low-level radioactive waste compactor building, and low-level radioactive waste certification building in TA-54. Potential impacts of construction and operation of these projects are analyzed in Appendix H.

3.3.3.11 Plutonium Facility Complex

Under the Expanded Operations Alternative, the Plutonium Facility Complex at TA-55 would increase pit production to up to 80 pits per year to meet the near-term needs of the Stockpile Stewardship Program. Increased pit production would impact all capabilities at the Plutonium Facility Complex, as shown in Table 3–18, and would also cause changes in activity levels at other Key Facilities. For example, a portion of the increased levels of transuranic waste

processing that would occur at the Solid Radioactive and Chemical Waste Facilities under this alternative would result from increased pit production.

In addition, under the Expanded Operations Alternative, activities in support of mixed oxide fuel fabrication would increase. Up to 500 pits would be disassembled and up to 460 pounds (210 kilograms) of plutonium oxide would be polished annually and stored pending shipment to the Savannah River Site for use at the Mixed Oxide Fuel Fabrication Facility. Also, mixed oxide fuel stored in TA-55 would be reconfigured for more compact storage and eventual transportation offsite. Two containers with approximately 1,455 pounds (660 kilograms) of mixed oxide fuel in the form of ceramic pellets enclosed in fuel rods are stored at the Plutonium Facility Complex in their Type B shipping containers. Under this alternative, the pellets would be removed from the fuel rods and repackaged into smaller containers for storage in the special nuclear material vault pending transport to other DOE sites in Type B containers.

The Plutonium Facility Complex Refurbishment Project has been proposed to modernize and upgrade existing facilities and infrastructure at the TA-55 complex. This project is part of a comprehensive, long-term strategy to extend the life of TA-55 so that it can continue to operate safely, securely, and effectively for at least another 25 years. The project would be executed through a series of subprojects at TA-55; 21 high-priority subprojects and other less-critical subprojects have been proposed. The subprojects focus on high-priority facility systems and components that would improve overall Plutonium Facility reliability and are critical to facility and program operations. Proposed upgrades and renovations are described and potential impacts evaluated in Appendix G.

Another proposed project is construction and operation of a high-energy x-ray radiography facility in TA-55 to relocate this capability from TA-8. Examination of nuclear items and components through radiography is a key process in verifying the safety and reliability of the U.S. nuclear weapons stockpile. Movement of these nuclear items and components between TA-55 and TA-8, a distance of 4.5 miles (7.2 kilometers), was difficult prior to September 11, 2001, but was stopped after that date because increased demands on security personnel impacted the availability of security resources. The capability for high-energy x-ray radiography that eliminates the need for transporting nuclear items and components outside the security perimeter of TA-55 is needed to meet mission milestones and deadlines.

The proposed new facility in TA-55 would have between 5,000 to 8,500 square feet (460 to 790 square meters) of floor space and would be no more than two stories high, with the second floor below ground level. Constructing and operating this facility in TA-55 would eliminate the need to move nuclear components and items from TA-55 and would allow this type of nondestructive examination to resume at LANL. The proposed facility is described and potential impacts evaluated in Appendix G.

3.4 Preferred Alternative

NNSA's Preferred Alternative for continued operation of LANL is the Expanded Operations Alternative. This alternative includes fabrication of up to 80 pits per year at the Plutonium Facility Complex in TA-55, as well as increased activity levels at certain other Key Facilities (such as the Chemistry and Metallurgy Research Replacement Facility) to support this level of pit

production. Proposed increases in activity levels would be implemented and new capabilities would be added to existing Key Facilities. Capabilities, activity levels, and projects identified under the No Action Alternative that remain unchanged under the Expanded Operations Alternative would continue as described. NNSA would undertake activities to facilitate compliance with the Consent Order and remediation of the MDAs, as well as other closure and DD&D projects. The proposed projects discussed in the appendices to this SWEIS would proceed, commensurate with funding.

However, full implementation of the Preferred Alternative may be affected by future programmatic decisions. NNSA is reconsidering its 2004 decision (69 FR 6967) to construct and operate the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility, pending evaluations and decisions related to Complex Transformation. NNSA may decide to proceed with construction and operation of the nuclear facility portion at LANL, as announced in the 2004 ROD, or to establish these capabilities as part of a consolidated plutonium center or an integrated part of a consolidated nuclear production center. Both the consolidated plutonium center and the consolidated nuclear production center are analyzed in the *Complex Transformation SPEIS*. A ROD for the *Complex Transformation SPEIS* is expected in late 2008.

3.5 Alternatives Considered but Not Analyzed in Detail in the Site-Wide Environmental Impact Statement

Among the comments received during the scoping process were suggestions for additional alternatives that should be considered in the SWEIS, including a "Greener Alternative" and a "true No Action Alternative" (or shutdown alternative).

A Greener Alternative was evaluated in the *1999 SWEIS*. The name and general description of the alternative were provided by interested citizens as a result of the scoping process for that SWEIS. This alternative included LANL capabilities existing at that time with an emphasis on work performed in support of basic science, waste minimization and treatment, nuclear weapons dismantlement, nonproliferation, and other areas of national and international importance. While the Greener Alternative contained components of both the No Action and the Expanded Operations Alternatives evaluated in the *1999 SWEIS*, the operational focus was on science, waste management, and nuclear weapons dismantlement. NNSA is not evaluating a similar alternative in this SWEIS because, as stated in the *1999 SWEIS* ROD (see Appendix A), a Greener Alternative would not support the nuclear weapons mission assigned to LANL. It should be noted, however, that important aspects of the Greener Alternative evaluated in the *1999 SWEIS*, specifically optimization of work in the field of nonproliferation of weapons of mass destruction, as well as enhanced weapons dismantlement work, have been incorporated into the No Action Alternative analyzed in this new SWEIS. Other aspects of the Greener Alternative in the *1999 SWEIS* also incorporated into the No Action Alternative of this SWEIS include enhanced research related to national health issues, waste minimization and environmental restoration technologies, and international nuclear safety.

The alternative characterized as a "true No Action Alternative," in which all operations at LANL, including production and testing in support of stockpile stewardship would cease, is not a reasonable alternative. Thus, NNSA is not analyzing it in this SWEIS. Ceasing operations would result in a loss of support to nonproliferation efforts and research aiding the fight against

terrorism. Because these activities are vital to national security and are among the major components of the mission assigned to LANL by NNSA, this alternative is not considered a reasonable alternative. This SWEIS updates previous EISs that have provided information supporting a number of decisions about operations at LANL. In such situations, an alternative that assumes LANL would cease all mission-related work is not reasonable.

3.6 Summary of Environmental Consequences

This section summarizes the impacts analyses performed for this SWEIS to provide an understanding of the overall consequences of each of the proposed alternatives and how the alternatives compare to each other. Chapter 5 of this SWEIS contains the detailed environmental analyses. Section 3.6.1 presents an overview for each of the resource areas, highlighting issues, concerns, or positive impacts. **Table 3–19** (located at the end of Section 3.6.1) summarizes the potential consequences of each alternative by resource area. Section 3.6.2 is a summary of the cumulative impacts analyses that considers operating LANL in the context of other past, present, and reasonably foreseeable actions.

The Expanded Operations Alternative includes implementation of specific projects evaluated in the appendices to this SWEIS. As discussed in Chapter 1, however, NNSA may make decisions on individual projects or proposed activities rather than making a single decision to implement an entire alternative. While Section 3.6.1 summarizes the impacts from these projects as part of the Expanded Operations Alternative, Section 3.6.3 summarizes the environmental consequences of each of the individual proposed projects evaluated in Appendices G, H, I, and J. This individual treatment is intended to facilitate the decision process by providing an understanding of how each of the proposed projects could affect the overall impacts of continued operations at LANL. Implementing the proposed projects may result in impacts to potential release sites covered under the Consent Order. As needed, these impacts would be addressed through the accelerated cleanup process described in Section VII.F of the Consent Order. NNSA intends to implement the actions necessary to comply with the Consent Order regardless of whether it implements decisions it makes on other actions analyzed in this SWEIS.

3.6.1 Comparison of Potential Consequences of Alternatives for Continued Operation at Los Alamos National Laboratory

This section focuses on the overall LANL site, providing an overview of impacts for each SWEIS alternative and resource area to provide an understanding of the total potential impacts of each alternative. Table 3–19, located at the end of this section, compares the environmental consequences of the three SWEIS alternatives.

Land Use

Under the No Action Alternative, the conveyance of land from LANL to Los Alamos County and the New Mexico Department of Transportation, and transfer of land to the Department of the Interior (to be held in trust for the Pueblo of San Ildefonso) would continue. Of the 4,078 acres (1,650 hectares) identified under Public Law 105-119 (Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, 1998), about 1,820 acres (737 hectares) remain to be transferred. This land conveyance and transfer, and the Power Grid

Upgrades Project, could impact site and regional land use. Effects of these actions include reduction in the size of LANL, possible changes in offsite land use from development following transfer, loss of recreational opportunities, and changes in site land use. Impacts would be similar under the Reduced Operations Alternative. Under the Expanded Operations Alternative, in addition to the impacts of the No Action Alternative, changes to land use could occur as the result of projects such as the Replacement Office Buildings Project, Radiological Sciences Institute Project, TA-18 Closure Project, MDA Remediation Project,[4] Radioactive Liquid Waste Treatment Facility Upgrade Project, Waste Management Transition Project, Science Complex Project, Remote Warehouse and Truck Inspection Station Project, and Security-Driven Transportation Modifications Project. While actions associated with these projects would in many cases be compatible with existing land use plans, there is no provision in the current plans for the new bridge that could be constructed over Sandia Canyon under Auxiliary Action B of the Security-Driven Transportation Modifications Project. Although no major changes in land use would occur in most cases, environmental remediation occurring for all alternatives could lead to fewer restrictions on land use. The fewest restrictions on land use would occur under the Removal Option for the MDA Remediation Project upon completion of remedial actions.

Visual Environment

Under the No Action Alternative, possible development following conveyance and transfer of land could degrade the views of presently undeveloped areas. For many projects, impacts to the visual environment would be limited to the construction phase. Once complete, most projects would be minimally visible from offsite locations, but more noticeable from closer vantage points; however, near views are often restricted to LANL employees. Under all alternatives, environmental remediation activities at some potential release sites could be publicly visible while remediation occurs. Power grid upgrades could adversely impact the views in previously undisturbed areas. Impacts under the Reduced Operations Alternative would be similar to those identified for the No Action Alternative.

Although in many cases impacts to the visual environment from implementation of the Expanded Operations Alternative would be similar those associated with the No Action Alternative, a number of proposed projects would cause noticeable changes to the visual environment. Capping or removing MDAs under the MDA Remediation Project would temporarily disturb areas or involve the use of temporary enclosures that could be visible in some cases. MDA Remediation Project activities would increase the visibility of the borrow pit in TA-61; and the Security-Driven Transportation Modifications Project would cause the construction of roads, parking lots, and new bridges over a site canyon. Additional visible bridges could be constructed over site canyons if the auxiliary actions were selected. In addition, new buildings associated with the Replacement Office Buildings and Science Complex Projects would be readily visible from West Jemez or Pajarito Roads. The new building associated with the Remote Warehouse and Truck Inspection Station would be visible from East Jemez Road. Establishment of evaporation tanks for final treatment of effluent from the Radioactive Liquid Waste Treatment Facility would cause a permanent change to the visual environment in the area near the border of TA-52 and TA-5. There would be a break in forest cover that could be seen from areas west of

[4] *The phrase MDA Remediation Project is used in this SWEIS as a general term for environmental remediation activities under the Consent Order, addressing MDAs and other potential release sites.*

LANL. The removal of old buildings would enhance the visual environment at both TA-18 and TA-21, and the visual environment at TA-21 could further change in the longer term if development takes place. Also, removal of the domes in TA-54 as part of the Waste Management Facilities Transition Project would have a beneficial impact on views of the site from both near (including the Pueblo of San Ildefonso) and far. Construction of the TRU Waste Facility, however, has the potential to impact the visual environment, including views from San Ildefonso Pueblo lands, depending on its location.

Geology and Soils

There is little difference in the impacts on geologic resources for the No Action and Reduced Operations Alternatives; however, the impacts from the Expanded Operations Alternative would be distinctly different. Under the Expanded Operations Alternative, facility construction and DD&D for the following projects would impact geologic materials: Physical Science Research Complex, Replacement Office Buildings, Radiological Sciences Institute, Radioactive Liquid Waste Treatment Facility Upgrade, TA-55 Radiography Facility, Science Complex, Remote Warehouse and Truck Inspection Station, TA-21 DD&D, Waste Management Facilities Transition, and the Security-Driven Transportation Modifications. A total of approximately 3.2 million cubic yards (2.5 million cubic meters) of soil and rock would be disturbed if all of these projects were implemented.

In addition, MDA remediation in compliance with the Consent Order would have a major impact on geologic resources. MDA remediation would require 1.2 million to 2.5 million cubic yards (0.9 million to 1.9 million cubic meters) of crushed tuff and other materials for evapotranspiration covers under the Capping Option, or up to 2.2 million cubic yards (1.7 million cubic meters) of backfill and surface materials under the Removal Option. These geologic resources would be available either at LANL or from nearby offsite sources.

Under all three alternatives, remediation of potential release sites would continue to remove existing contaminants from soils and shallow bedrock at LANL. This impact would be greatest under the Expanded Operations Alternative because the largest area and volume of contaminated soil would be remediated. The use of standard construction methods and best management practices would minimize the potential for erosion and release of soils during construction and decrease the potential for erosion, slope failure, and contaminant releases after remediation is complete.

Water Resources

There would be only minor adverse impacts on surface water quality and quantity from the No Action Alternative. There could be significant beneficial impacts on Sandia Canyon if the effluent from the Sanitary Wastewater Systems Plant is used as cooling water at the Metropolis Center for Modeling and Simulation. Under the Reduced Operations Alternative, the elimination of cooling tower effluent from LANSCE would result in a significant reduction of effluent discharge to Los Alamos Canyon. The Expanded Operations Alternative could have beneficial impacts on surface water quality due to the installation of new treatment technologies associated with the Radioactive Liquid Waste Treatment Facility Upgrade Project, and the possible elimination of the Radioactive Liquid Waste Treatment Facility discharge to Mortandad Canyon

if the auxiliary action to evaporate treated effluents were implemented. Complete DD&D of TA-21 under the Expanded Operations Alternative would eliminate two industrial effluent outfalls, which would have a minor beneficial impact on Los Alamos Canyon. Environmental remediation under all alternatives would have positive impacts on surface water quality; implementation of the MDA Remediation Project under the Expanded Operations Alternative would have additional beneficial impacts on surface water quality due to the potential removal or stabilization of contaminants at the MDAs. Removal of the flood retention structure in Pajarito Canyon under all the alternatives could impact floodplains downstream immediately following removal. None of the alternatives would likely have any other impacts on floodplains.

There would be no changes in the flow of contaminants to the alluvial or regional groundwater as a result of the No Action Alternative, except for that achieved from continuing the environmental remediation program that existed before the Consent Order. Most impacts to groundwater resources identified as occurring under the No Action Alternative would also occur under the Reduced Operations Alternative. Long-term impacts might be reduced by elimination of some of the canyon-outfalls and reduction of water use. Direct and indirect impacts to groundwater as a result of proposed construction and operations under the Expanded Operations Alternative would also be similar to those described for the No Action Alternative. Under the Expanded Operations Alternative, water usage would be greater than the range of LANL's water use over the last 7 years, but within the range of use over the last 14 years. Therefore, impacts to the water levels in the regional aquifer from withdrawals to supply LANL would be within historical levels. The effects of either an MDA Capping or Removal Option under the Expanded Operations Alternative would not appreciably affect the rate of transport of contaminants presently in the vadose zone in the near term, but would likely reduce very long-term migration of contaminants and corresponding impacts on the environment from wastes present in the MDAs.

Air Quality

Nonradiological air pollutant emissions from operations at LANL would continue within the limits of the operating air permit under all the alternatives. Reductions in emissions would occur under the Reduced Operations Alternative from reduced high explosives processing and testing, shutdown of LANSCE and the Pajarito Site (TA-18), and a smaller construction scope. A minor increase in operations emissions could occur under the Expanded Operations Alternative, but emissions would remain within the limits of the operating permit. Increased employment under the Expanded Operations Alternative could result in an increase in air pollutant emissions from additional vehicles of employees commuting from Santa Fe and Rio Arriba County and other locations and waste and materials shipments. Temporary localized increases in air pollutant emissions from construction, DD&D, and remediation activities would occur under all alternatives, but under the Expanded Operations Alternative the emissions would be larger. These activities could result in exceedances of short-term ambient standards for nitrogen oxides and carbon monoxide for some projects where activities are near the site boundary or public roads unless these activities are properly controlled. Appropriate management controls and scheduling would be used to minimize impacts on the public and to meet regulatory requirements. Development by others of lands conveyed and transferred could result in air quality impacts.

Radiological air emissions from normal operations under the No Action Alternative would be dominated by short-lived gaseous mixed activation products emitted from LANSCE (TA-53). Under the Reduced Operations Alternative, a reduction in the activity levels of some Key Facilities (including the continued use of the Chemistry and Metallurgy Research Building), and the shutdown of LANSCE and the Pajarito Site (TA-18) would greatly reduce the amount of radiological air emissions. Under the Expanded Operations Alternative, some small increases in radiological air emissions compared to the No Action Alternative would result from increased LANL activities and the operation of new facilities. These emissions would be dominated by operations at LANSCE. There could be temporary additions to radiological air emissions if the New Mexico Environment Department selects exhumation as the corrective measure for any of the MDAs.

Noise

Under the No Action Alternative, noise impacts from operations at LANL would be similar to the impacts from recent operations, including noise from explosives testing and traffic. Construction, DD&D, and remediation activities would result in a minor increase in offsite noise impacts to the public from equipment use and traffic under the No Action and Reduced Operations Alternatives. Under the Reduced Operations Alternative, however, a minor reduction in explosives testing noise would occur, as well as a minor decrease in construction and DD&D noise impacts compared to the No Action Alternative. Under the Expanded Operations Alternative, minor to moderate increases in traffic noise could occur from changes in traffic patterns due to increased construction, MDA remediation, DD&D activities, and increased employment at LANL. In addition, increased equipment-related noise impacts would occur from additional construction, DD&D, and MDA remediation activities. Activities near the site boundary or increases in truck traffic noise under various MDA remediation options could result in some public annoyance. Development by others of lands conveyed and transferred could also result in noise impacts.

Ecological Resources

Under the No Action Alternative, a number of actions would result in impacts on ecological resources. For example, conveyance of land to the county could result in the loss of 770 acres (312 hectares) of habitat through possible future development. Therefore, impacts such as loss and displacement of wildlife would take place. The Wildfire Hazard Reduction Program would have short-term adverse impacts on wildlife due to activities such as tree trimming, but would produce long-term benefits from returning the forest to a condition similar to that which existed in the past. Increased forest health could also benefit the Mexican spotted owl at LANL and across the region. Impacts from the Reduced Operations Alternative generally would be similar to the No Action Alternative.

Under the Expanded Operations Alternative, however, impacts on ecological resources would be larger than those of the No Action Alternative. A number of projects could impact habitat and wildlife. Those impacts mostly would be temporary disturbances during construction and demolition; however, if all of the proposed projects were implemented, up to about 170 acres (69 hectares) of habitat would be lost; borrow pit expansion, if required, would disturb some additional acreage. Most habitat loss would be associated with the Security-Driven

Transportation Modifications Project (30 acres [12 hectares] and its two auxiliary actions (91 acres [37 hectares]). Temporary disturbances to habitat and displacement of wildlife could occur from environmental remediation under all alternatives; however, because material disposal areas are mostly grassy, open areas, temporary habitat disturbances associated with the MDA Remediation Project under the Expanded Operations Alternative would be mostly associated with remediation support activities such as operation of temporary storage areas for capping materials. Withdrawal of crushed tuff from the TA-61 borrow pit to support MDA remediation may cause loss of habitat at the borrow pit for the Mexican spotted owl; Section 7 consultation with the U.S. Fish and Wildlife Service would be required.

Impacts to the Mexican spotted owl, bald eagle, and southwestern willow flycatcher were evaluated in a biological assessment prepared by DOE (LANL 2006b). This biological assessment determined that activities associated with many projects may affect, but were not likely to adversely affect, these species. Regarding the Security-Driven Transportation Modifications Project, the U.S. Fish and Wildlife Service determined that provided that reasonable and prudent measures are taken, construction of a span bridge over Ten Site Canyon would not result in adverse affects to the Mexican spotted owl. Further consultation would be needed, however, if a land bridge was to be used. A determination of potential impacts from construction of the auxiliary action bridges associated with the Security-Driven Transportation Modifications Project could not be made because bridge locations and final designs were not known. Thus, further consultation with the U.S. Fish and Wildlife Service would be required prior to bridge construction. Depending on where the TRU Waste Facility would be located, consultation could be required prior to building this facility since construction could affect both core and buffer habitat of the Mexican spotted owl.

Human Health

None of the alternatives would result in an increase in latent cancer fatalities (LCFs) in the population; and all doses estimated for the maximally exposed individual (MEI), a hypothetical individual located at the site boundary, would meet the regulatory limit of 10 millirem per year (40 CFR 61.92). Under the No Action Alternative, radiological air emissions from LANSCE (TA-53) would be responsible for over 70 percent of the estimated population dose of 30 person-rem per year; emissions from the firing sites (TA-15 and TA-36) would contribute approximately 20 percent. Under the No Action Alternative, the dose to the MEI would be about 7.8 millirem per year, with 7.5 millirem attributable to emissions from LANSCE.[5] Under the Reduced Operations Alternative, estimated annual doses to the population and the MEI would be reduced by approximately 80 percent and 90 percent, respectively, compared to the No Action Alternative. This reduction would largely be due to the shutdown of LANSCE, along with minor reductions from termination of operations at the Pajarito Site, lower levels of high explosives processing and testing, and continued use of the Chemistry and Metallurgy Research Building. Under the Expanded Operations Alternative, there would be small increases in emissions from the Plutonium Facility Complex from increased pit manufacturing activity and reduced emissions from the Pajarito Site and TA-21, which would result in slight increases in the estimated doses to

[5] *Administrative controls established at LANSCE to regulate beam operations as emissions levels increase require operational changes to prevent the generation of excessive radioactive air emissions, so that the maximum dose to the LANL site-wide MEI from air emissions at LANSCE is 7.5 millirem per year or less.*

the public and the MEI from routine operations compared to the No Action Alternative. In addition, there could be temporary increases in offsite doses if the Removal Option were implemented for MDA cleanup. The annual population dose could increase by about 20 percent to approximately 36 person-rem per year, and the MEI dose could increase by about 5 percent to approximately 8.2 millirem per year.

On an individual worker basis, impacts to worker health would be the same across all alternatives. Application of procedures designed to ensure safe worker environments would control exposure to radiation, chemicals, and biohazardous material. Individual radiation doses would be maintained below the DOE limit of 5 rem per year, with a goal of limiting the dose to 2 rem per year from external exposure. Under normal operating conditions, no adverse effects from chemical or biological exposures would be expected.

The collective dose for workers would be about 280 person-rem per year under the No Action Alternative. Under the Reduced Operations Alternative, the dose would drop to 257 person-rem annually due to the cessation of TA-18 activities and the shutdown of LANSCE. Under the Expanded Operations Alternative, collective doses would differ depending on the actions taken to remediate the MDAs. If the MDA Capping Option were implemented, the collective dose would be about 407 person-rem per year. This increase in dose over the No Action Alternative is primarily associated with manufacturing up to 80 pits per year at the Plutonium Facility Complex. If the MDA Removal Option were implemented, waste in the MDAs would be removed rather than capped in place. In this case, the collective dose would be about 543 person-rem annually. The average annual dose to the worker population contributed by the MDA Remediation Project alone would range from about 1 (MDA capping) to 137 (MDA removal) person-rem.

Cultural Resources

Under the No Action Alternative, potential impacts to cultural resources include conveyance or transfer of lands containing cultural resources from DOE. Further, there is potential for damage to these resources from development and for adverse effects on historic buildings from demolition and remodeling. From a positive standpoint, the Trails Management Program could enhance cultural resource protection by limiting public access to certain trails or trail segments. Documentation could be required to resolve possible adverse effects from demolishing and remodeling historic buildings involved in high explosives processing and testing. Impacts from the Reduced Operations Alternative generally would be similar to those described for the No Action Alternative.

Under the Expanded Operations Alternative, many impacts would also be similar to those that would occur under the No Action Alternative. In general, individual projects would have a minimal potential for impacting archaeological resources because most projects would not be located in the immediate area of archaeological sites; however, the proposed TRU Waste Facility has the potential to directly impact archaeological resources depending on its location, which has yet to be determined. Potentially affected resources would be protected by LANL requirements for protecting sensitive areas. Additionally, the implementation of LANL requirements would ensure that any proposed demolition or modification of existing historic buildings and structures would be in keeping with *A Plan for the Management of Cultural Heritage at Los Alamos*

National Laboratory, New Mexico (LANL 2006f). If the auxiliary actions to build bridges across canyons as part of the Security-Driven Transportation Modifications Project were implemented, certain traditional cultural properties could be adversely affected. Also, the proposed TRU Waste Facility has the potential to impact the view from traditional cultural properties if constructed within certain locations of the Pajarito Road corridor. Removal of the domes from Area G of TA-54 as part of the Waste Management Facilities Transition Project, however, would have a positive effect on views from Pueblo of San Ildefonso lands.

Possible impacts to cultural resources from environmental restoration would be reviewed for all potential release sites and protective measures taken as needed. There would be no direct impacts to cultural resources from either capping or removing material disposal areas under the Expanded Operations Alternative. Any temporary support areas needed for MDA remediation would be located and operated to be protective of cultural resources.

Socioeconomics

Under the No Action Alternative, no change in the socioeconomic impacts on the region from those currently being observed would be expected. As a major employer, LANL provides large socioeconomic contributions to the region. Impacts from the Reduced Operations Alternative would be similar to those associated with the No Action Alternative. Under the Reduced Operations Alternative, however, direct employment at LANL would be expected to decrease by about 3.7 percent (500 jobs) due to the closure of LANSCE, the reduction in high explosives processing and testing, and the cessation of TA-18 activities. This decrease in LANL employment would also be expected to indirectly result in additional job losses in the region. The combined loss of employment due to both direct and indirect job losses would be approximately 1,030 positions, but these losses are not expected to have a major adverse impact on the regional economy because the losses would be small in comparison to the total employment base for the region (less than 1 percent).

Under the Expanded Operations Alternative, jobs would be added at LANL to support the increased workload. It is projected that, compared to the 2005 level, up to 600 jobs by 2007 and 1,890 jobs by 2011 would be added at LANL, in addition to 640 indirect jobs by 2007 and 2,000 indirect jobs by 2011. Although the addition of these positions would be beneficial from an economic standpoint, the influx of workers would place demands on the regional infrastructure in terms of additional housing needs, schools, and community services. There is currently a housing shortage in Los Alamos County, although the county is planning for additional housing that could allow more employees to live within its borders. Rio Arriba and Santa Fe counties also would be expected to grow as a result of LANL employment increases. Considering that LANL positions are some of the highest paying positions in the region, the benefits associated with these positions in terms of increased revenues and taxes should more than offset any drawbacks. This is especially true in light of regional growth projections that show the region growing at a rate in line with LANL's projected growth rate under the Expanded Operations Alternative.

Infrastructure

Utility infrastructure demands for electricity, natural gas, and water are projected to increase in the LANL region of influence through 2011 regardless of the alternative selected in this SWEIS, mainly due to increasing demands among other Los Alamos County users who rely upon the same utility systems as LANL. Total projected utility infrastructure requirements are summarized for LANL operations and for other Los Alamos County users in Table 3–19. Under the No Action Alternative, the total energy and peak load requirements would be about 49 percent and 74 percent, respectively, of the capacity of the power pool serving the Los Alamos area. Natural gas requirements and water requirements respectively would be about 27 percent and 90 percent of system capacity. For the Reduced and Expanded Operations Alternatives, respectively, projected electricity requirements would be about 39 and 63 percent of capacity, peak load demand would be about 54 percent and 96 percent of capacity, natural gas requirements would be about 27 percent and 29 percent of capacity, and water requirements would be about 85 percent and 98 percent of capacity. Projections for natural gas demand show less variation across the alternatives because the demand is controlled mainly by space heating requirements, which are affected less than other utilities by operational levels. LANSCE operations have a major effect on LANL's demand for water and electricity. LANSCE has historically accounted for as much as 25 percent of total water demand and 50 percent of electrical demand at LANL.

Under the Expanded Operations Alternative, peak load demand would approach the capacity of the Los Alamos Power Pool. Similarly, the water demand under the Expanded Operations Alternative could approach the Los Alamos Water Supply System's available water rights. This potential exists because of the projected infrastructure requirements for increased operations at LANL and the forecasted demands of other non-LANL users in Los Alamos County. Completion of a new transmission line and other upgrades, however, would reduce any concerns about peak load capacity. Also there are plans to install a second new combustion turbine generator at the TA-3 Co-Generation Complex, if needed. The second generator would add an additional 20 megawatts (175,200 megawatt-hours) of generating capacity. As for future water needs, Los Alamos County, as owner and operator of the Los Alamos Water Supply System, is currently pursuing use of the San Juan-Chama Transmountain Diversion Project to secure additional water for its customers, including LANL. This would supply the Los Alamos area with up to an additional 391 million gallons (1,500 million liters) of water per year, an increase in capacity of approximately 20 percent.

Waste Management

Under the No Action Alternative, waste management impacts from LANL operations would remain within the capacity of LANL's infrastructure. Most wastes, with the exception of low-level radioactive waste, would be disposed of offsite at facilities designed for specific categories of wastes. The expansion into TA-54, Area G, Zones 4 and 6, as necessary, would provide onsite disposal capacity for low-level radioactive waste from operations through 2016 and beyond. Due to the uncertainties of predicting environmental remediation wastes, variances from projections are likely in future years. The waste management infrastructure at LANL would be adequate, in terms of staffing and facilities, to manage the quantities of waste expected to be generated under the No Action Alternative.

Under the Reduced Operations Alternative, waste management impacts from LANL operations would be similar to those under the No Action Alternative, with some reductions in waste quantities from operations due to the closure of LANSCE and the Pajarito Site, reduced operational levels at the high explosives facilities, and a smaller construction scope. Although some reductions in operational waste volumes are expected, continued generation of low-level radioactive waste would be expected to result in the expansion of future disposal operations into Zone 4. Wastes generated by environmental restoration and DD&D activities would be expected to be the same as those generated under the No Action Alternative. The LANL waste management infrastructure would be capable of managing the projected quantities.

The Expanded Operations Alternative includes implementing a large number of projects involving major construction and DD&D, as well as increases in operation levels at a number of Key Facilities, so larger volumes of all waste types would be generated than under the other alternatives. Retrieval and processing of transuranic waste stored below grade in Area G of TA-54 would also generate additional volumes of transuranic and low-level radioactive waste. To accommodate the processing and storage of legacy and newly generated transuranic waste from LANL operations, NNSA is proposing to install and operate additional waste management equipment and facilities, and upgrade existing processes, as identified in Appendix H, Section H.3.

Full implementation of the MDA Removal Option is conservatively estimated to generate about 1.1 million cubic yards (840,000 cubic meters) of low-level radioactive waste and 22,000 cubic yards (17,000 cubic meters) of transuranic waste, most of which DOE buried before 1970. Final waste volumes may be smaller than the maximum volumes analyzed in this SWEIS because waste generation is dependent on future regulatory decisions by the New Mexico Environment Department. In addition, the estimates are based on the volume of waste as excavated (including soil) and the removal of all major MDAs; no credit has been taken for waste volume reduction techniques such as sorting.

Onsite disposal capacity for low-level radioactive wastes may be sufficient, depending upon the actual volumes generated by remediation; disposal capacity would be supplemented by offsite facilities if needed. The transportation analysis includes the impacts of shipping all low-level radioactive waste offsite. In this SWEIS, it is assumed that the transuranic waste would be disposed of at WIPP. WIPP disposal capacity is expected to be sufficient for disposal of all retrievably stored waste and all newly generated transuranic waste from the DOE complex over the next few decades, but not sufficient for this waste plus all transuranic waste buried before 1970 across the DOE complex (63 FR 3624). Decisions about disposal of transuranic waste from full removal of LANL MDAs, if generated, would be based on the needs of the entire DOE complex. Any transuranic waste that may be generated at LANL without a disposal pathway would be safely stored until disposal capacity becomes available.

Transportation

Under all alternatives, radioactive, hazardous, and commercial materials would be transported onsite and to and from various offsite locations. The evaluation of impacts in this SWEIS focuses on repeated shipments of materials to and from offsite locations. The specific locations analyzed were the Pantex Plant in Texas, the Y-12 Complex and Oak Ridge National Laboratory in Tennessee, the Lawrence Livermore National Laboratory in California, the Nevada Test Site in Nevada, and the Savannah River Site in South Carolina for transport of special nuclear material (such as plutonium, highly enriched uranium [mainly uranium-235], and uranium-233); WIPP in New Mexico for the transport of transuranic wastes; the Nevada Test Site and a commercial disposal site for low-level radioactive wastes; and multiple locations for disposal of hazardous and nonhazardous waste materials.

It is unlikely that transportation of radioactive materials under any of the alternatives would cause a fatality as a result of radiation either from incident-free operations or postulated accidents. The highest risks to the public would result from the Expanded Operations Alternative if all of the large MDAs were exhumed under the MDA Remediation Project and the Nevada Test Site was the main option for disposal of low-level radioactive waste. This alternative could result in about 122,440 shipments of radioactive materials (both special nuclear material and radioactive waste). It is estimated that there could be about three fatalities from nonradiological traffic accidents associated with the transportation activities required to implement this alternative.

All trucks carrying radioactive materials to or from LANL would travel the section of road from LANL to Pojoaque; many of these trucks would also travel the section of road from Pojoaque to Santa Fe. The radiological risks to the population along these two sections of road are very small under all alternatives. The nonradiological accident risks (the potential for fatalities as a direct result of traffic accidents) are greater than the radiological risks; however, even under the scenario involving the largest amount of transportation, the Expanded Operations Alternative with the MDA Removal Option, no fatalities would be expected along these routes.

Local traffic flows would be expected to remain at current levels under the No Action Alternative because employment would stay at current levels. Under the Reduced Operations Alternative, traffic through LANL would decline by about 4 percent, mainly as a result of the projected decrease in employment. Under the Expanded Operations Alternative, traffic would be expected to increase by up to 18 percent (averaged across all LANL entrances) due to the projected increases in employment and construction, DD&D, and remediation activities. Transportation of waste and fill material by truck for DD&D and MDA remediation could accelerate wear on local roads and exacerbate traffic problems.

Environmental Justice

Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) requires every Federal agency to analyze whether its Proposed Actions and alternatives would have disproportionately high and adverse impacts on minority or low-income populations. Based on the analysis of impacts for other resource areas, NNSA expects no high and adverse impacts from the continued operation of LANL under any of the alternatives. For all alternatives the radiological dose from emissions associated with normal operations are slightly lower for members of Hispanic, Native American, total minority, and low-income populations than for the members of the population that are not in these groups. The maximum annual dose for the average member of any of the minority or low-income populations was 0.092 millirem compared to a dose of 0.10 millirem for a member of the general population and a dose of 0.11 millirem for a member of the population that does not belong to a minority or low-income group.

NNSA also analyzed human health impacts from exposure through special pathways, including subsistence consumption of native vegetation (pinyon nuts and Indian Tea [Cota]), locally grown produce and farm products, groundwater, surface waters, fish (game and nongame), game animals, other foodstuffs, and incidental consumption of soils and sediments (on produce, in surface water, and ingestion of inhaled dust). The special pathways could be important to the environmental justice analysis because some of these pathways may be more important or viable for the traditional or cultural practices of members of minority populations in the area. Analyses, however, show that the human health impacts associated with these special pathways would not present disproportionately high and adverse impacts on minority or low-income populations.

Facility Accidents

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. Facility accident impacts are presented in terms of consequences and risks. Reported consequences assume that the accident occurs and do not account for how probable the accident is. The risk associated with an accident reflects the probability of the accident occurring; it is calculated by multiplying the consequences times the probability of occurrence.

In 2000, the Cerro Grande Fire burned a heavily forested canyon area to within about 0.75 miles (1.2 kilometers) of the waste storage domes in TA-54, but none were burned and there were no radiological releases from domes. Additional fuel reduction has been conducted since the Cerro Grande Fire, both to the vegetation surrounding the TA-54 area and within the domes themselves (for example, wooden pallets have been replaced with metal pallets), to further decrease the potential for a waste storage dome fire occurring as a result of a site wildfire. In the event of a wildfire that impacted LANL, burned the waste storage domes at TA-54, and caused their contents to be released to the environment, the radiological releases from those waste storage domes would dominate the potential impacts to LANL workers and to the public from the fire. Should such an accident scenario occur in which the contents of the waste storage domes actually caught on fire and burned, the MEI would likely develop a fatal cancer during his or her lifetime and an additional 55 LCFs could be expected in the general area population. Any onsite worker

located within 110 yards (100 meters) of the facility during such an accident would likely develop a fatal cancer during his or her lifetime. Taking into account the probability of occurrence, the annual risks are estimated to be about 1 chance in 20 of an LCF for the MEI or for an onsite worker and an additional 3 (calculated value of 2.7) LCFs in the offsite population. These risks assume that workers and members of the public do not take evasive action in the event of a wildfire. It is likely that workers and members of the public would be evacuated, as happened during the Cerro Grande Fire. These risks would decrease as transuranic waste is removed from the domes and transported to WIPP for disposal. In terms of chemical risks from a wildfire, the accidental release of formaldehyde from the Bioscience Facilities in TA-43 would expose the public and noninvolved workers to the greatest risks, similar to those associated with a seismic event, as discussed below.

The seismic event that presents the largest risk to the public would be a postulated Performance Category 3 earthquake (Seismic 2 scenario). If this 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. The consequences of such a seismic accident would be an increased lifetime risk of an LCF of 0.55 (1 chance in 1.8) for the MEI and an additional 22 LCFs could be expected in the population; a noninvolved worker 110 feet (100 meters) from certain failed buildings would likely develop an LCF.

The seismic accident scenarios (Seismic 1 and 2) analyzed in the SWEIS are based on the *Seismic Hazards Evaluation of the Los Alamos National Laboratory (February 24, 1995)*. The 1995 study concluded that a seismic event characterized by a peak horizontal ground acceleration of 0.22g (0.22 times the acceleration due to gravity) had an estimated annual probability of exceedance (probability of occurrence when calculating risk) of 0.001 (1 in 1,000). The study also showed that the more severe seismic event characterized by a peak ground acceleration of 0.31g had an estimated annual probability of exceedance of 0.0005 (1 in 2,000). An updated probabilistic seismic hazard analysis that provides an improved understanding of the seismic characteristics of LANL was completed in 2007 (LANL 2007a). The new study indicates that the seismic hazard is higher than previously understood; that is, the likelihood of earthquakes capable of producing strong ground shaking at the LANL site is greater than previously estimated. For example, the annual probabilities of exceedance for the previously analyzed peak ground accelerations are now estimated to be about 1 in 700 rather than 1 in 1,000 and 1 in 1,250 rather than 1 in 2,000. Using the assumptions inherent in the accident source terms developed for the SWEIS Seismic 1 (Performance Category 2 earthquake) and Seismic 2 (Performance Category 3 earthquake) accident scenarios, the most conservative effect on accident risks would be an increase of 50 percent and 60 percent, respectively. Although the greater probability of exceedance results in a higher risk from seismic events, these risks remain lower than those associated with other postulated accidents.

Taking into account the probability of occurrence, the annual risks from a Seismic 2 accident are estimated to be an increase of 1 chance in 2,200 of the MEI developing an LCF and no additional LCFs (a calculated risk much less than 1) in the offsite population. The largest chemical risk from such an event would result from a formaldehyde release from the Biosciences Facilities in TA-43, leading to life-threatening concentrations at the locations of the noninvolved worker and the MEI. The seismic event that presents the largest risk to a noninvolved worker is the Seismic 1 accident (a Performance Category 2 earthquake) with a frequency of once every 700 years. The annual increased risk of a LCF to the noninvolved worker would be about 0.0015 or 1 in 700.

Just as the updated probabilistic seismic hazards analysis used new data and advanced methods to calculate LANL seismic hazards, revised structural analysis tied to damage states credited in the safety assessments will be used to update the seismic structural integrity evaluation of LANL facilities. The effect of the higher values of peak horizontal ground acceleration on calculated seismic accident consequences and risks will be analyzed in future LANL facility safety analyses and incorporated as appropriate into future LANL NEPA documents. NNSA and the LANL contractor will undertake an evaluation of LANL facility performance in terms of the updated seismic hazard information. Until a revised analysis is completed, facility operations are authorized based on NNSA approval of a contractor-prepared justification for continued operation.

Under all alternatives, 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. If this accident were to occur, there could be six additional LCFs in the offsite population. Under the Expanded Operations Alternative, if the Chemistry and Metallurgy Research Building fire involving sealed sources were to occur, the consequence to the offsite population would be greater (seven LCFs) than that of the Radioassay and Nondestructive Testing Facility lightning strike fire; however, the estimated frequency is much less. Also, the consequences of that accident are based on a conservative assumption that the entire inventory of radiological material allowed in the Chemistry and Metallurgy Research Building is dedicated to a single isotope contained in sealed sources.

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 as modeled, the noninvolved worker and the MEI would receive large radiation doses. Depending on the specific radionuclides released and the route of human exposure, radiation doses of this magnitude would result in near-term health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose to the exposed individual, mitigating health impacts, or both. In addition to the conservative assumptions used to develop the source term (amount of radioactive material released) for this accident, the calculated doses are based on the assumptions that no protective action is taken during the entire time of exposure and that no subsequent medical intervention occurs.

Taking into account the frequency of the postulated accidents, the estimated highest risk accident would be a lightning strike fire at the Radioassay and Nondestructive Testing Facility. The relatively large risk of the accident is due to the conservative assumption that any lightning strike at the Radioassay and Nondestructive Testing Facility has sufficient energy and occurs at a location that results in a building fire and concomitant source term. The increased risk of an LCF for this accident would be 0.06 (about 1 chance in 16) for the MEI, 0.12 (about 1 chance in 8) for the noninvolved worker,[6] and 0.8 for the offsite population (a risk of 1 LCF occurring in the population over approximately 1.3 years of operation).

For chemical accident risks, the individual facility accident with the largest risk to the public is a selenium hexafluoride release from TA-54. There is an annual risk of about 1 chance in 240 that members of the public could receive life-threatening exposures from this accident. For a chlorine gas release outside of TA-55, there is an annual risk of about 1 chance in 15 that noninvolved workers could receive a life-threatening exposure to this chemical from this accident. There is a great deal of uncertainty regarding how much and which chemicals were disposed of in the MDAs. The MDA closest to the public (and thus with the potentially greatest impacts on the public), MDA B, was chosen to bound the chemical accident impacts for MDA cleanup. Two chemicals, sulfur dioxide (a gas) and beryllium (assumed to be in powder form), were chosen based on their respective hazards to bound the impacts of chemicals possibly disposed of in the MDAs. Both of these chemicals, if present in the quantities assumed, would dissipate to below life-threatening concentrations very close to the release point, but would continue to present a risk to the public due to the short distance to the nearest public access point for MDA B.

Substantive details of terrorist 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 intentionally destructive acts, impacts may be similar to or would exceed bounding accident impact analyses prepared for the SWEIS. A separate classified appendix to this Final SWEIS has been prepared that evaluates the underlying facility threat assumptions with regard to malevolent, terrorist, or intentionally destructive acts. These data provide NNSA with information upon which to base, in part, decisions supported by this SWEIS.

[6] *The lightning strike fire at the Waste Characterization, Reduction, and Repackaging Facility has a slightly higher risk for the noninvolved worker; an increased risk of an LCF of 0.14 (1 chance in 7) per year.*

Table 3–19 Summary of Environmental Consequences by Resource Area

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Land Use			
	Land Conveyance and Transfer - The remaining 1,820 acres (737 hectares) of the 4,078 acres (1,650 hectares) of land identified per Public Law 105-119 would be conveyed or transferred. - Development may occur on up to 826 acres (334 hectares). - Potential introduction of incompatible land uses. - Loss of recreational opportunities. *Electrical Power System Upgrades* - 473 acres (191 hectares) affected by upgrades. - Project generally compatible with existing land use.	Same as No Action Alternative.	Same as No Action Alternative, plus: *MDA Remediation Project* - Fewer restrictions on land use for Removal Option than for the Capping Option. - No major changes in land use designations in most cases because surrounding land uses would retain their current classification. *Security-Driven Transportation Modifications Project* - Most development would not conflict with current land use designations. - Auxiliary Action A - Within scope of current land use plans. - Auxiliary Action B - Partially within scope of current land use plans. Current plans, however, contain no provision for a bridge over Sandia Canyon. *Replacement Office Buildings Project* - 13 acres (5.3 hectares) of undeveloped land in TA-3 would be developed consistent with a change in future land use from Reserve to Physical/Technical Support. *TA-18 Closure Project* - Possible change in land use designation of TA-18 to Reserve after DD&D of the Pajarito Site. *TA-21 Structure DD&D Project* - Future LANL development could negate the proposed change in land use from the current designation to Reserve. *Radiological Sciences Institute Project* - 12.6 acres (5.1 hectares) of undeveloped land at or near TA-48 would be developed consistent with land use plans. *RLWTF Upgrade Project* - Up to 4 acres (1.6 hectares) of undeveloped land near the border of TA-5 and TA-52 could be developed for evaporation tanks. *Science Complex Project* - 5 acres (2 hectares) of undeveloped land at or near TA-62 would be developed; 15.6 acres (6.3 hectares) could undergo a change in land use plans to Experimental Science.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
			Remote Warehouse and Truck Inspection Station Project - 4 acres (1.6 hectares) of undeveloped land in TA-72 would be developed with a change in land use plans to Physical/Technical Support. *Waste Management Facilities Transition Project* - Up to 7 acres (2.8 hectares) of undeveloped land could be disturbed that could result in a change in land use designation.
Visual Environment			
	Land Conveyance and Transfer - Development could degrade views of presently undeveloped tracts. *Electrical Power System Upgrades* - Short-term visual impacts during construction. - Adverse visual impact in undisturbed areas. - No overall change in view from Bandelier National Monument. *Wildfire Hazard Reduction Program* - Forest would appear more park-like. - Some LANL facilities would be more visible. *Disposition of Flood Retention Structures* - Temporary impacts during removal if staging areas are located near Pajarito Road. Temporary impacts during construction of the CMRR Facility at TA-55. Temporary impacts during construction of replacement or new buildings and long-term enhancement of visual environment from removal of old buildings for the following projects: - High Explosives Processing Facilities, and - High Explosives Testing Facilities.	Same as No Action Alternative.	Same as No Action Alternative, plus: *MDA Remediation Project* - Temporary visual impacts during MDA capping or removal. - Borrow pit in TA-61 would become more visible due to the large quantities of material needed under both options. *Security-Driven Transportation Modifications Project* - Temporary impacts during construction. - Pronounced impacts due to parking lots, as well as vehicle and pedestrian bridges, especially for auxiliary actions involving bridges across canyons. *Physical Science Research Complex* - Temporary impacts during construction. - New structures would blend with other TA-3 construction. - Appearance of TA-3, TA-35, and TA-53 would improve with demolition of vacated structures. *Replacement Office Buildings Project* - Temporary impacts during construction. - New buildings and parking lot would be visible from West Jemez Road and Pajarito Road. *TA-18 Closure Project* - Temporary impact from demolition of Pajarito Site facilities at TA-18. - Long-term enhancement of visual environment as area is restored to more natural appearance. *TA-21 Structure DD&D Project* - Enhancement of visual environment from the removal of old structures from TA. Both conveyed and nonconveyed lands could undergo development which could change visual environment.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
			Radiological Sciences Institute Project - Temporary impacts during demolition and construction. *RLWTF Upgrade Project* - Short-term impact from construction of new treatment building in TA-50. - Permanent change to the visual environment if evaporation tanks are built near the border of TA-5 and TA-52. *Waste Management Facilities Transition Project* - Beneficial impact on near and distant views from removal of domes in TA-54. - Minimal visual impact of the TRU Waste Facility to the public; possible impact on views from San Ildefonso Pueblo lands, depending on its location. - Temporary impacts during construction of structures at TA-54 and another location in the Pajarito Road corridor. *Science Complex Project* - Under Options 1 and 2, the new facility would be readily visible from West Jemez Road and forested buffer between LANL and Los Alamos Canyon would be lost; potential impacts to Los Alamos Canyon from night lighting. - Negligible impacts for Option 3. *Remote Warehouse and Truck Inspection Station Project* - 4 acres (1.6 hectares) would be cleared making the site readily visible from East Jemez Road; lighting could be visible from Tsankawi Unit of Bandelier National Monument.
Geology and Soils			
	Overall level of legacy contamination in soil should continue to decrease as a result of ongoing remediation projects including cleanup of suspected contamination at TA-21.	Same as No Action Alternative, except that the potential impact of LANL operations on soil could decrease because of the 20 percent reduction in high explosives testing activities.	Same as No Action Alternative, except: *MDA Remediation Project* - Use of large amounts of soil and rock for backfill or closure caps (up to 2.5 million cubic yards) (1.9 million cubic meters). - Positive impact from removal or containment of legacy waste. - TA-61 borrow pit would be expanded to provide additional soil and rock; other sources may be required. Temporary adverse impacts from excavation of large amounts of rock and soil during construction and DD&D, and positive impacts from removal of legacy contamination for the following projects: *- Physical Science Research Complex,* *- Replacement Office Buildings,* *- TA-18 Closure,*

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
			- TA-21 Structure DD&D, *- Radiological Sciences Institute* *- RLWTF Upgrade,* *- Waste Management Facilities Transition,* *- TA-55 Radiography Facility,* *- Science Complex,* *- Remote Warehouse and Truck Inspection Station, and* *- Security-Driven Transportation Modifications.*
Water Resources – Surface Water			
	Only minor impact on surface water quality or quantity, or floodplains from activities other than the project to remove flood retention structures. Removal of flood retention structures could result in potential impacts on Pajarito floodplains. Restoration of normal flow would cause sediments to alter channel and readjust floodplains.	Same as No Action Alternative, except shutdown of LANSCE operations would result in significant reductions of NPDES-permitted cooling tower discharges, particularly to Los Alamos Canyon.	Same as No Action Alternative, and: Potentially long-term positive impact from MDA remediation because water quality would be protected by removal or stabilization of waste or contaminants in soil. DD&D of TA-18 structures would eliminate potential contaminant sources, thereby enhancing protection of surface water quality. Complete Removal Option for DD&D of TA-21 would eliminate two NPDES-permitted outfalls reducing discharges to Los Alamos Canyon. Although increased pit production would increase RLWTF outfall volumes by 25 percent, this would have a negligible effect on surface water volumes in Mortandad Canyon because other facilities contribute 90 percent of the outfall flow in that canyon. Implementing the zero discharge option at the RLWTF (evaporation tanks) would have a minor effect on surface water volume, but would improve surface water quality by reducing the uptake of historical contaminations in the sediments downstream of that outfall.
Water Resources – Groundwater			
	Construction and DD&D activities are unlikely to affect groundwater resources. Operations-related impacts to groundwater are not likely to be significant in nature.	Same as No Action Alternative, except long-term impacts as a result of operations might be reduced by elimination of additional outfalls and reduction of water use.	Same as No Action Alternative, except impacts from water supply well withdrawals could increase and positive long-term impacts could occur from MDA remediation and the reduced potential for contaminant migration.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Nonradiological Air Quality			
	Minor temporary localized increases in air emissions from construction and demolition activities. Minor increases in air emissions from operations and remediation activities, including operation of new combustion turbine generators.	Same as No Action Alternative, except for reductions in emissions from reduced high explosives processing and testing activities and shutdown of LANSCE and the Pajarito Site (TA-18).	- Higher level of emissions from increased operations and proposed construction, demolition, and remediation including increases in emissions from commuter vehicles, and waste and materials shipments. - Hazardous air pollutants could increase by up to 2.5 percent from the High Explosives Processing Facilities resulting from the increased use of mock explosives. - Temporary construction-type releases of criteria pollutants would occur from MDA remediation, DD&D, and construction of new facilities. - Minor to moderate air quality impacts would result from remediating MDAs, and other PRSs, particularly for MDA removal.
Radiological Air Quality			
Curies per year:			
Tritium [a]	2,400	2,400	2,400 [b]
Americium-241	4.2×10^{-6}	4.2×10^{-6}	4.2×10^{-6} [c]
Plutonium [d]	0.00082	0.000092	0.00084 [c]
Uranium [e]	0.15	0.12	0.15
Particulate and vapor activation products	30	0.014	30
Gaseous mixed activation products	30,600	100 [f]	30,600 [f]
Mixed Fission Products [g]	1,650	1,650	1,650
Emissions from remediation	Not applicable	Not applicable	Variable [h]

[a] Includes both gaseous and oxide forms of tritium.

[b] Tritium emissions would decrease to 1,850 curies per year after about 2009 following decontamination, decommissioning, and demolition of TA-21.

[c] Americium-241 emissions could increase to 1.1×10^{-5} curies per year and plutonium emissions to 0.00089 curies per year if the Decontamination and Volume Reduction System, the new TRU Waste Facility, and remote-handled transuranic waste retrieval activities operated simultaneously (estimated to occur from 2012 through 2015).

[d] Includes plutonium-238, plutonium-239, and plutonium-240.

[e] Includes uranium-234, uranium-235, and uranium-238.

[f] Gaseous mixed activation products emissions would decrease by 100 curies per year after about 2009 due to the permanent shutdown of TA-18, resulting in zero emissions of gaseous mixed activation products in the Reduced Operations Alternative and 30,500 curies per year in the Expanded Operations Alternative.

[g] Mixed fission products include krypton-85, xenon-131m, xenon-133, and strontium-90.

[h] There would be additional emissions from the remediation of the larger MDAs. These emissions would depend on radionuclides present, whether an MDA is being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under an enclosure (see Appendix I).

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Noise			
	Operations noise levels would have little impact on the public with the exception of sporadic noise from explosives detonations and traffic noise. Temporary localized increases in noise levels would occur from construction, demolition, and remediation activities that would be expected to have little impact on the public.	Same as No Action Alternative, except minor reductions in noise levels from reduced high explosives testing activities and shutdown of LANSCE and Pajarito Site (TA-18).	Higher noise levels than the No Action Alternative from increased operations, construction, DD&D, and remediation activities. Increase in truck and personal vehicle traffic noise, some of which could occur during nighttime, could result in public annoyance: - Up to a 32 percent increase in traffic along DP Road affecting nearby businesses and residents. - Up to a 13 percent increase in traffic along East Jemez Road affecting residents.
Ecological Resources			
	Land Conveyance and Transfer - 770 acres (312 hectares) of habitat could be lost through development. - Transfer of resource protection responsibility could result in a less rigorous environmental protection review process. *Electrical Power System Upgrades* - Temporary displacement of wildlife due to construction-related activities. - Potentially positive impact by providing perching sites for larger birds. *Wildfire Hazard Reduction Program* - Short-term disturbance of wildlife due to forest thinning activities. - Increased forest health could benefit the Mexican spotted owl and other species. *Disposition of Flood Retention Structures* - Temporary displacement of wildlife due to construction-related activities. - Potentially minor impacts on downstream wetlands *Trails Management Program* - Temporary disturbance of wildlife during implementation activities. Clearing of some ponderosa pine forest in TA-48 and TA-55 for construction of CMRR Facility would cause loss or displacement of associated wildlife.	Same as No Action Alternative, plus: - Reduction in high explosives testing activities would reduce the number of times animals would be subjected to stress resulting from high explosives testing.	Same as No Action Alternative, plus: *MDA Remediation Project* - Short-term disturbance and displacement of wildlife during capping or waste removal. - Loss of habitat at borrow pit in TA-61, including buffer and core habitat for the Mexican spotted owl. Section 7 consultation with the U.S. Fish and Wildlife Service would be required. - Remediation activities may affect, but are not likely to adversely affect the Mexican Spotted Owl, bald eagle, and southwestern willow flycatcher. *Security-Driven Transportation Modifications Project* - Parking lot construction and placement of pedestrian and vehicle bridges would destroy up to 30 acres (12 hectares) of natural habitat. Construction of a span bridge over Ten Site Canyon would be unlikely to adversely affect the Mexican spotted owl. - Auxiliary Action A would disturb up to 25.4 acres (10.6 hectares) of undeveloped core and buffer Mexican spotted owl habitat. Auxiliary Action B would disturb up to 67.1 acres (27.2 hectares) of undeveloped core and buffer habitat. - Under both auxiliary actions, bridge traffic over the core zone of the Sandia-Mortandad Canyon Mexican spotted owl Area of Environmental Interest could cause long-term impacts. Section 7 consultation with the U.S. Fish and Wildlife Service would be needed. *Replacement Office Buildings Project* - Temporary displacement of wildlife due to construction-related activities.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
	Short-term impacts in TA-6, TA-22, and TA-40 from construction of new High Explosives Test Facility buildings and demolition of old structures would cause loss or displacement of wildlife.		- Clearing 13 acres (5.3 hectares) of mixed conifer forest in TA-3 would result in loss or permanent displacement of wildlife. - Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. *TA-18 Closure Project* - Minor impact on wildlife during demolition of Pajarito Site structures in TA-18. DD&D activities may affect, but is not likely to adversely affect, the Mexican spotted owl and southwestern willow flycatcher. - Restoration of TA-18 (Pajarito Site) would create a more natural habitat and benefit wildlife, potentially including the Mexican spotted owl. *TA-21 Structure DD&D Project* - Minor disturbance of wildlife on adjacent land during demolition of structures. DD&D activities may affect, but is not likely to adversely affect, the Mexican spotted owl. *Radiological Sciences Institute Project* - Temporary disturbance of wildlife during demolition of structures and construction in TA-48. - Clearing of 12.6 acres (5 hectares) of ponderosa pine forest would cause loss or displacement of associated wildlife. - Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. - DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl. *RLWTF Upgrade Project* - Loss of up to 5.4 acres (2.2 hectares) of habitat if the evaporation tanks and pipeline are constructed. - Implementation of the evaporation tank option would reduce wetlands and riparian habitat in Mortandad Canyon and the abundance and diversity of Mexican spotted owl prey species, requiring Section 7 consultation with the U.S. Fish and Wildlife Service. - Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. *Waste Management Facilities Transition Project* - Short-term impacts on wildlife in the vicinity of TA-54 and the TRU Waste Facility site from new construction and demolition activities. - TRU Waste Facility construction could result in the loss of 2.5 to 7 acres (1.0 to 2.8 hectares) of ponderosa pine forest or open field.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
			- Construction at TA-54 may affect, but is not likely to adversely affect, the southwestern willow flycatcher. - A TRU Waste Facility could be built in portions of the Mexican spotted owl Area of Environmental Interest which would require Section 7 consultation with the U.S. Fish and Wildlife Service.
			Science Complex Project - Temporary displacement of wildlife due to construction-related activities. - Options 1 and 2 would remove 5 acres (2 hectares) of ponderosa pine forest. - Under Option 3, less than 5 acres (2 hectares) of grassland and forest would be cleared. - Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. *Remote Warehouse and Truck Inspection Station Project* - Temporary displacement of wildlife due to construction-related activities. - 4 acres (1.6 hectares) of ponderosa pine forest and pinyon-juniper woodland would be cleared. - Construction may affect, but is not likely to adversely affect, the bald eagle.
Human Health			
Offsite Population Dose (person-rem per year) Risk (LCFs per year)	 30 0.018	 6.1 [i] 0.0037	 Less than 36 [j, k] 0.022
MEI [l] Dose (millirem per year) Risk (LCFs per year)	 7.8 4.7×10^{-6}	 0.78 [i] 4.7×10^{-7}	 Less than 8.2 [j, k] 4.9×10^{-6}
Workers Dose (person-rem per year) Risk (LCFs per year)	 280 0.17	 257 0.15	 407 to 543 [m] 0.24 to 0.33 [m]

[i] After about 2009, TA-18 (Pajarito Site) would no longer be able to contribute to radiological air emissions, thereby reducing the MEI and population doses.

[j] Population dose and MEI dose include 6.2 person-rem and 0.42 millirem respectively, attributable to the assumed removal of all MDAs (LCF risk of 3.7×10^{-3} and 2.5×10^{-7}, respectively). This dose could be smaller depending on the MDAs being remediated, whether an MDA is capped rather than removed, the number of MDAs being remediated at one time, and other factors.

[k] After about 2009, TA-18 (Pajarito Site) and TA-21 would not contribute to radiological air emissions, thereby reducing the MEI and population doses.

[l] Under the No Action Alternative and the Expanded Operations Alternative, the LANL site-wide MEI would be located near LANSCE. Under the Reduced Operations Alternative, the LANL site-wide MEI would be located near the firing sites at TA-36.

[m] The range for the Expanded Operations Alternative reflects the contribution from the two MDA Remediation Project options. The lower value is for the Capping Option, the higher value is for the Removal Option. The annual average worker doses contributed by the MDA Remediation Project alone would range from about 1 (MDA capping) to 137 (MDA removal) person-rem per year (0.0006 to 0.082 LCF per year).

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Cultural Resources			
	Land Conveyance and Transfer - Potential damage to cultural resources and impacts on protection of and accessibility to Native American sacred sites from conveyance or transfer of cultural resources out of the responsibility and protection of DOE. Potential damage on conveyed or transferred parcels due to future development. *Trails Management Program* - Enhanced protection of cultural resources. Potentially adverse effects from demolition and remodeling of historic buildings in High Explosive Processing and Testing Facilities. Documentation would be required to resolve adverse effect.	Same as No Action Alternative.	Same as No Action Alternative plus: *Waste Management Facilities Transition Project* Removal of domes would have a positive impact on views from traditional cultural properties. Potential impact to cultural resources from construction of the TRU Waste Facility. Also, this facility could be visible from lands of the Pueblo of San Ildefonso, depending on its location. *MDA Remediation Project* No direct impacts are expected for either option of the MDA Remediation Project, although the potential for indirect impacts from temporary remediation support activities in the vicinities of the MDAs and PRSs would require review and protective measures taken as needed. To varying degrees, impacts on archaeological sites or historic structures eligible or potentially eligible for listing on the National Register of Historic Places could result from the following projects. These resources would be protected as appropriate and documentation would be developed as required to resolve adverse effects. *- Security-Driven Transportation Modifications,* *- Physical Science Research Complex,* *- Replacement Office Buildings,* *- Radiological Sciences Institute (including the Institute for Nuclear Nonproliferation Science and Technology),* *- RLWTF Upgrade,* *- LANSCE Refurbishment,* *- Waste Management Facilities Transition,* *- TA-55 Radiography Facility,* *- Science Complex* *- Remote Warehouse and Truck Inspection Station.* *- TA-18 Closure Project* *- TA-21 Structure DD&D*

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Socioeconomics			
	LANL Employment		
	2005 levels of employment assumed to remain steady at 13,504 employees.	A decrease of 500 employees from 2005 levels would be expected to result in the loss of 530 indirect jobs in the region (total 1,030 jobs lost).	An employment increase of 2.2 percent per year from 2007 to 2011 would result in an additional 600 to 1,890 employees working at LANL and creation of another 640 to 2,000 indirect jobs. This growth rate is consistent with the projected regional growth rate.
	Housing		
	No new housing units needed specific to changes in LANL employment level.	Additional housing units could become available in the tri-county area as a result of the projected decrease in LANL's employment level. These could be expected to offset the need for additional housing units in the region because the population would still be expected to grow, although at a slower rate (about 1.5 percent versus 2.3 percent).	Additional housing units would be required in the tri-county area due to the projected increase in LANL's employment level along with the projected increase in the region's population. More LANL employees could be expected over time to reside in Rio Arriba, Santa Fe, or other surrounding counties, compared to Los Alamos County, where a shortage of available housing would likely continue. The number of housing units needed would depend on the number of workers relocating from outside the area. Overall, the number of units needed would likely be small compared to overall needs in the tri-county area.
	Construction		
	Completion of previously approved construction projects is expected to draw workers already in the region who historically work from job-to-job.	Same as the No Action Alternative for construction projects.	An increase in the number of construction projects would be expected to draw workers already in the region who historically work from job-to-job.
	Local Government Finance		
	Annual gross receipts tax yields would be expected to remain at current levels in real terms.	Annual gross receipts tax yields directly and indirectly associated with LANL employment could decrease by about 1.1 percent.	Annual gross receipts tax yields directly and indirectly associated with LANL employment are projected to increase by between 1.3 and 3.9 percent from 2007 through 2011 over 2005 levels in real terms.
	Services		
	The demand for services such as police, fire, and hospital beds would be expected to remain at current levels in proportion to LANL employment. Regional population is projected to increase even if LANL employment remains flat, so there would be an increase in the demand for regional services but the increased demand would not be driven by LANL employment growth.	Demand for services would be expected to decrease in proportion to the number of out-of-work LANL-related employees leaving the region. However, regional population would still be projected to increase even if LANL employment was to decrease by the small levels envisioned in this alternative compared to the No Action Alternative. Demand for services would likely increase as well.	Demand for services would be expected to increase in proportion to the number of additional LANL-related jobs added to the region. The associated number of additional school age children would be between 440 and 1,400 in the tri-county area, resulting in an estimated increase in needed public school funding from the State of $3.2 million in 2007 to $11 million in 2011. Most of the additional services would be required in Rio Arriba, Santa Fe, and other surrounding counties.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Site Infrastructure			
LANL Site and Other Los Alamos County Users Total Per Alternative (annual)	Electricity requirements: 645,000 megawatt-hours total (495,000 megawatt-hours for LANL); 49 percent of system capacity.	Electricity Requirements: 516,000 megawatt-hours total (366,000 megawatt-hours for LANL); 39 percent of system capacity.	Electricity Requirements: 827,000 megawatt-hours total (677,000 megawatt-hours for LANL); 63 percent of system capacity.
	Electric Peak Load: 111 megawatts total (91.2 megawatts for LANL); 74 percent of system capacity.	Electric Peak Load: 80.6 megawatts total (60.4 megawatts for LANL); 54 percent of system capacity.	Electric Peak Load: 144 megawatts total (124 megawatts for LANL); 96 percent of system capacity.
	Natural Gas Demand: 2,215,000 decatherms total (1,197,000 decatherms for LANL); 27 percent of system contract capacity supply.	Natural Gas Demand: 2,181,000 decatherms total (1,163,000 decatherms for LANL); 27 percent of system contract supply capacity.	Natural Gas Demand: 2,331,000 decatherms total (1,313,000 decatherms for LANL); 29 percent of system contract supply capacity.
	Water Demand: 1,621 million gallons total (380 million gallons for LANL); 90 percent of system available water rights.	Water Demand: 1,544 million gallons total (303 million gallons for LANL); 85 percent of system available water rights.	Water Demand: 1,763 million gallons total (522 million gallons for LANL); 98 percent of system available water rights.
	Project Effects: - Ongoing electrical power system upgrades would have a positive incremental impact onsite electrical energy and peak load capacity. - Potential for increased natural gas consumption from increased capacity at the TA-3 Co-Generation Complex. Note: Values are rounded.	*Project Effects:* Same as the No Action Alternative.	*Project Effects:* - Increases in electrical energy, peak load, and water demands over the No Action Alternative due to increased operational levels at the Metropolis Center and LANSCE (see above).
MDA Remediation (total over 10 years)	No change in utility demands.	Same as No Action Alternative.	Annual average of up to 70 million gallons of liquid fuels and 58 million gallons of water for remediation activities.

Waste Type	No Action Alternative	Reduced Operations Alternative	Expanded Operations Alternative (Preferred Alternative)		
			Total Including MDA Remediation Project	Total Excluding MDA Remediation Project	MDA Remediation [n] Project Only
Waste Management (10-Year Total)					
Transuranic Waste					
Contact-handled [o] (cubic yards)	3,500 to 5,900	3,500 to 5,900	5,300 to 33,000	5,200 to 11,000	68 to 22,000
Remote-handled [p] (cubic yards)	–	–	11 to 61	11	0 to 50
Low-Level Radioactive Waste [p, q]					
Bulk low-level radioactive waste (cubic yards)	39,000	39,000	196,000 to 884,000	186,000	11,000 to 698,000
Packaged low-level radioactive waste (cubic yards)	33,000 to 128,000	33,000 to 110,000	80,000 to 183,000	80,000 to 183,000	–
High activity low-level [p] radioactive waste (cubic yards)	–	–	0 to 347,000	–	0 to 347,000
Remote-handled low-level [p] radioactive waste (cubic yards)	–	–	480 to 1,700	480	0 to 1,200
Mixed low-level radioactive waste (cubic yards)	1,800 to 2,800	1,800 to 2,800	3,900 to 183,000	3,200 to 4,400	710 to 178,000
Construction/Demolition Debris [r] (cubic yards)	198,000	197,000	642,000 to 722,000	595,000	47,000 to 126,000
Chemical waste [s] (pounds)	19,000,000 to 37,000,000	19,000,000 to 36,000,000	64,000,000 to 129,000,000	22,000,000 to 39,000,000	42,000,000 to 90,000,000
Liquid Radioactive Wastes					
Liquid transuranic waste (gallons)	300,000	300,000	500,000	500,000	(t)
Liquid low-level radioactive waste (at TA-50) (gallons)	40,000,000	40,000,000	50,000,000	50,000,000	(t)
Liquid low-level radioactive waste (at TA-53) (gallons)	1,400,000	50,000 [u]	1,400,000	1,400,000	(t)

[n] Waste volumes are the incremental increase over remediation waste projections from the No Action Alternative.

[o] Operations waste volumes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste; small volumes of remote-handled or high-activity waste may be generated.

[p] These waste types are generated during retrieval of waste from MDAs under the Expanded Operations Alternative. Nominal volumes generated under other alternatives are accounted for in other waste categories.

[q] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of transportation and disposal options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[r] Demolition waste includes uncontaminated wastes such as steel, brick, concrete, pipes and vegetative matter from land clearing.

[s] Chemical waste includes wastes regulated under the Resource Conservation and Recovery Act, Toxic Substances Control Act, or state hazardous waste regulations. The large increase under the Expanded Operations Alternative is primarily due to high volumes of waste associated with MDA remediation.

[t] MDA remediation is projected to generate roughly 10,000 to 24,000 gallons (38,000 to 91,000 liters) of industrial, hazardous, low-level, and mixed low-level liquid wastes.

[u] Under the Reduced Operations Alternative, operations at the LANSCE facility would cease. Approximately 5,000 gallons (20,000 liters) of radioactive liquid waste per year from TA-50 would continue to be treated at TA-53.

Note: Because values have been rounded to the nearest hundred, thousand, or million, totals may not equal the sum of individual contributions.
To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359; gallons to liters, multiply by 3.78533.

	No Action Alternative	*Reduced Operation Alternative*	*Expanded Operations Alternative (Preferred Alternative)*				
			Total Including MDA Remediation Project		*Excluding MDA Remediation Project*	*MDA Remediation Project Only*	
			Capping	*Removal*		*Capping*	*Removal*
Transportation (for 10-Year Period 2007-2016)							
Incident Free							
Public Radiation Exposure *Dose (person-rem) / Risk (LCFs):*							
Total	58.4/0.035	53.1/0.032	89.1/0.053	286.8/0.17	88.6/0.053	0.49/0.0003	198.2/0.12
LANL to Pojoaque	1.8/0.0011	1.7/0.0010	2.8/0.0017	8.1/0.0049	2.8/0.0017	0.01/0.000006	5.3/0.0032
Pojoaque to Santa Fe	3.3/0.0020	3.1/0.0019	4.6/0.0028	13.3/0.0080	4.6/0.0028	0.02/0.00001	8.7/0.0052
Worker Radiation Exposure: (transport drivers) *Dose (person-rem) / Risk (LCFs):*	163.8/0.098	147.2/0.088	255.9/0.15	910.3/0.55	254.0/0.15	1.9/0.0012	656.4/0.40
Transportation Accidents							
Population: *- Radiological Risk (LCFs)*	0.00017	0.00015	0.00025	0.0016	0.00024	0.00001	0.0013
- Nonradiological Traffic Fatalities [v]	0 (0.37)	0 (0.34)	1 (0.95)	3 (3.23)	1 (0.90)	0 (0.02)	2 (2.3)

[v] Nonradiological traffic fatalities include all traffic accidents involving both radioactive and nonradioactive materials and waste shipments. Values presented are the nearest whole number.

	No Action Alternative	*Reduced Operation Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Local Traffic			
Average Daily Traffic at Entry Points	42,300	40,600	up to 49,800
Environmental Justice			
	No disproportionately high and adverse impacts on minority or low-income populations. Radiological doses to minority and low-income populations would be lower than those to sectors of the population that are not members of these groups. Human health impacts from exposure through special pathways (including subsistence consumption of fish and wildlife) would not present disproportionately high and adverse impacts to minority or low-income populations.	Same as No Action Alternative.	While there would be small, but not significant, increases in radiological and chemical risks to the public (0.004 LCFs), increased levels of operations and implementation of proposed projects are not expected to have any disproportionately high and adverse impacts on minority or low-income populations. Radiological doses to minority and low-income populations would be lower than those to sectors of the population that are not members of these groups.

	No Action Alternative	*Reduced Operation Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Facility Accidents (highest risk and MDA removal accidents presented)			
Wildfire – Radiological (Waste Storage Domes at TA-54 – assumed frequency 1 in 20 years)			
Offsite Population			
Dose (person-rem)	91,000	Same as No Action Alternative.	Same as No Action Alternative.
Risk (LCFs per year)	2.7		
MEI			
Dose (rem)	1,900 [w]		
Risk (LCFs per year)	0.05 [x]		
Noninvolved Worker			
Dose (rem)	8,700 [w]		
Risk (LCF per year)	0.05 [x]		
Wildfire – Chemical (Releases formaldehyde at TA-43 – assumed frequency 1 in 20 years)			
- Concentrations above which life-threatening health effects could result (ERPG-3 [y] limit)	25 parts per million	Same as No Action Alternative	Same as No Action Alternative.
- ERPG-3 distance	97 yards		
- Distance to the site boundary	13 yards		
Site-Wide Seismic Event – Radiological (PC-3 seismic event – assumed frequency 1 in 1,250 years) [z]			
Offsite Population			
Total Dose (person-rem)	36,000	Same as No Action Alternative	Same as No Action Alternative
Risk (LCF per year)	0.014		
MEI			
Maximum Dose (rem)	460 [w]		
Risk (LCF per year)	0.00045		
Noninvolved Worker [aa]			
Maximum Dose (rem)	2,000 [w]		
Risk (LCF per year)	0.0008		
Site-Wide Seismic Event – Chemical (PC-3 seismic event releases formaldehyde at TA-43 – assumed frequency 1 in 1,250 years) [z]			
- Concentrations above which life-threatening health effects could result (ERPG-3 [y] limit)	25 parts per million	Same as No Action Alternative	Same as No Action Alternative.
- ERPG-3 distance	120 yards		
- Distance to the site boundary	13 yards		
Facility Accident (RANT lightning strike fire – assumed frequency 1 in 8 years)			
Offsite Population			
Dose (person-rem)	11,000	Same as No Action Alternative	Same as No Action Alternative
Risk (LCF per year)	0.8		
MEI			
Dose (rem)	410 [w]		
Risk (LCF per year)	0.06		
Noninvolved Worker [bb]			
Dose (rem)	1,900 [w]		
Risk (LCF per year)	0.12 [x]		

	No Action Alternative	*Reduced Operation Alternative*	*Expanded Operations Alternative (Preferred Alternative)*
Facility Chemical Release (Selenium hexafluoride at TA-54 – assumed frequency 1 in 240 years)			
- Concentrations above which life-threatening health effects could result (ERPG-3 [y] limit)	5 parts per million	Same as No Action Alternative	Same as No Action Alternative.
- ERPG-3 distance	962 yards		
- Distance to the site boundary	537 yards		
MDA G Removal Accident – Radiological (explosion – assumed frequency 1 in 100 years)			
Offsite Population	Not applicable	Not applicable	
Dose (person-rem)			770
Risk (LCF per year)			0.005
MEI			
Dose (rem)			55
Risk (LCF per year)			0.0007
Noninvolved Worker			
Dose (rem)			410
Risk (LCF per year)			0.005
MDA B Removal Accident (sulfur dioxide – frequency not assumed)			
- Concentrations above which life-threatening health effects could result (ERPG-3 [y] limit)	Not applicable	Not applicable	15 parts per million
- ERPG-3 distance			37 yards
- Distance to the site boundary			49 yards

[w] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[x] The risk to any individual would not exceed the risk of the accident scenario.

[y] 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 (DOE 2005b).

[z] Based on the 2007 update of the probabilistic seismic hazard analysis (LANL 2007a).

[aa] The maximum risk (considering consequence and probability) to the noninvolved worker comes from the PC-2 seismic event which has a frequency of 1 in 700 (LANL 2007).

[bb] The maximum risk (considering consequence and probability) to the noninvolved worker comes from the Waste Characterization, Reduction, and Repackaging Facility lightning strike fire which has a frequency of 1 in 7.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; MDA = material disposal area; LANSCE = Los Alamos Neutron Science Center; NPDES = National Pollutant Discharge Elimination System; RLWTF = Radioactive Liquid Waste Treatment Facility; CMRR = Chemistry and Metallurgy Research Replacement Facility; LCF = latent cancer fatality; MEI = maximally exposed individual; ERPG = Emergency Response Planning Guideline; PC = performance category; RANT = Radioassay and Nondestructive Testing; ROI = region of influence.

Note: To convert gallons to liters, multiply by 3.7854; cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359.

3.6.2 Summary of Cumulative Impacts

In accordance with Council on Environmental Quality regulations, a cumulative impact analysis includes "the incremental impacts of 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 1508.7). The cumulative impact analysis for this SWEIS includes (1) an examination of cumulative impacts presented in the *1999 SWEIS*; (2) impacts since the *1999 SWEIS* was issued (presented in this SWEIS in Chapter 5); and (3) a review of the environmental impacts of past, present, and reasonably foreseeable actions for other Federal and non-Federal agencies in the region.

Reasonably foreseeable actions that are likely to occur at LANL are described in Section 3.3 under the Expanded Operations Alternative. Additional DOE or NNSA actions that could impact LANL include the possible consolidation of nuclear operations related to production of radioisotope power systems (DOE/EIS-0373D) (DOE 2005c); proposed operation of a Biosafety Level 3 facility; a proposed advanced fuel cycle facility for research and development associated with the Global Nuclear Energy Partnership (GNEP) initiative; the potential implementation of Complex Transformation; and a potential disposal facility for Greater-Than-Class C waste.

Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems – As proposed in the *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE/EIS-0373D) (*Consolidation EIS*) (DOE 2005c), consolidation of DOE plutonium-238 activities at the Idaho National Laboratory would reduce plutonium-238 operations at LANL. But regardless of the decision on the *Consolidation EIS*, some plutonium-238 operations would continue at LANL. Therefore, very small changes in the impacts from plutonium-238 activities at LANL would occur.

If current plutonium-238 operations were to continue at the LANL Plutonium Facility Complex, as described under the *Consolidation EIS* No Action Alternative, manufacturing of up to 80 pits per year could still be accomplished within the LANL Plutonium Facility Complex. This would be accommodated by consolidating a number of plutonium processing and support activities (such as analytical chemistry and materials characterization at the Chemistry and Metallurgy Research Replacement Facility). The impacts of the 80-pit-per-year production rate and plutonium-238 processing (at levels far above the level of plutonium-238 processing identified in the *Consolidation EIS*) have been evaluated in both the LANL *1999 SWEIS* and this new SWEIS. Therefore, there would be no additional cumulative effects from these activities.

Biosafety Level 3 Facility – NNSA is preparing an *Environmental Impact Statement for the Operation of a Biosafety Level 3 Facility at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EIS-0388D) to analyze the potential environmental impacts of operating a Biosafety Level 3 Facility. Operation of the facility would be consistent with the land use designation of Research & Development for Experimental Science. The facility is visually compatible with surrounding structures; therefore, there would be no impacts to visual resources. There would be no impacts to geology and soils and water resources from operations. Air emissions from the facility's laboratories are HEPA-filtered, resulting in very minor air quality effects. Noise impacts would be restricted to noise from heating, ventilation, and air

conditioning system operations, consistent with other buildings in the area. Facility operations would have no effect upon ecological resources in the area. There would be no effect on prehistoric, historic, traditional, or paleontological resources. Facility personnel would come primarily from the existing LANL workforce, leading to no socioeconomic impacts. Operations would be well within LANL infrastructure capability to provide utilities such as electricity, water, and natural gas. There would be no discernable effects on local traffic conditions. There have been no reported cases of illnesses in the United States due to the release of diagnostic specimens during transport (Cummings 2007).

There would be a low potential risk of illness to site workers or visitors and no public human health effect from routine operations involving biohazardous material. Accident conditions would result in minimal or no impact to the public primarily because there would be severely limited opportunity for transport of an infectious dose of a biohazardous material to the public. Biohazardous material in open cultures would be handled only in biosafety cabinets where a spill would be contained. In addition, biohazardous material would be handled in a liquid or solid culture container that would release very few organisms to the air if dropped or spilled. This means that one of the most critical risk factors, public exposure to an infectious dose from a biohazardous material, is greatly minimized, and therefore, the potential risk of disease would be very low. The EIS will address slope stability at the Biosafety Level 3 Facility based on the recent update to the LANL probabilistic seismic hazard analysis (Cummings 2007, LANL 2007a).

Advanced Fuel Cycle Facility – On January 4, 2007, DOE issued an NOI (72 FR 331) to prepare a Programmatic EIS for the GNEP initiative. GNEP would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and radiotoxicity of spent nuclear fuel before disposal in a geologic repository. LANL is one of the DOE sites being considered for an advanced fuel cycle facility. The advanced fuel cycle facility would be a large shielded facility (approximately 1 million square feet [92,900 square meters] (DOE 2008). Potential cumulative impacts at LANL associated with the proposed advanced fuel cycle facility are based on preliminary data and could change prior to the public release of the Draft *GNEP PEIS*.

Complex Transformation – On January 11, 2008, NNSA announced the availability of the Draft *Complex Transformation SPEIS* (73 FR 2023), which evaluates NNSA's proposal for a smaller, more efficient nuclear weapons complex that would be better able and more suited to respond to future national security challenges. The Preferred Alternative in the Draft *Complex Transformation SPEIS* is to pursue distributed centers of excellence. LANL would be the center of excellence for plutonium manufacturing and research and development, with a production capacity of up to 80 pits per year. This alternative would be based on the use of the existing and planned infrastructure already described in the SWEIS Expanded Operations Alternative (DOE 2007b). Among other alternatives for LANL that are evaluated in the *Complex Transformation SPEIS*, the one that would have the largest potential cumulative impacts is the consolidated nuclear production center. The SWEIS cumulative impacts analysis addresses the impacts of construction and operation of a consolidated nuclear production center at LANL.

Disposal of Greater-Than-Class-C Low-Level Radioactive Waste (GTCC EIS). On July 23, 2007, DOE issued an NOI to prepare an *Environmental Impact Statement for the Disposal of*

Greater-Than-Class-C Low-Level Radioactive Waste (GTCC EIS) (72 FR 40135). The *GTCC EIS* will address the disposal of low-level radioactive waste generated by activities licensed by the Nuclear Regulatory Commission or an Agreement State that contain radionuclides in concentrations exceeding 10 CFR 61 Class C limits, as well as DOE waste having similar characteristics. LANL is being considered as one of eight candidate DOE disposal sites for Greater-Than-Class C waste, along with a generic commercial disposal facility option in arid and humid environments. In addition, DOE is evaluating several disposal technologies in the *GTCC EIS* including geologic repositories, intermediate depth boreholes, and enhanced near-surface disposal facilities. The alternatives in the *GTCC EIS* could result in changes to facilities or operations at LANL, but because the changes have yet to be developed, quantitative data are not available for the cumulative impacts analysis.

Reasonably foreseeable actions for the region surrounding LANL were also reviewed for the cumulative impacts analysis. Interviews were conducted with personnel in planning departments in the surrounding counties, as well as from the regional Bureau of Land Management and Santa Fe National Forest offices, to collect information on activities that might affect cumulative impacts. Available documentation was reviewed for activities that could contribute to cumulative impacts.

Each resource area in this SWEIS was reviewed for potential cumulative impacts; the analyses are summarized in the following paragraphs. The level of detail provided for each resource area is commensurate with the extent of the potential cumulative impacts. Some resources were not provided with a detailed analysis based on minimal or very localized impacts from LANL operations and a judgment that, cumulatively, there would be no appreciable impacts on these resources.

The following paragraphs summarize cumulative impacts for LANL and the surrounding region of influence. The maximum cumulative impacts for all resource areas would occur if a decision was made to implement the SWEIS Expanded Operations Alternative in its totality.

Land Use, Visual Environment, Ecological Resources, and Cultural Resources

Impacts on land use, visual environment, ecological resources, and cultural resources from LANL operations have been discussed previously. Additional impacts could arise from the conveyance and transfer of land as required under Public Law 105-119. Up to 826 acres (334 hectares) of land could be developed after transfer or conveyance. For example, Los Alamos County has indicated there are proposals to develop approximately 1,000 new residences on land adjacent to LANL and to develop land for light industry, retail, and residential development along the Los Alamos Canyon rim across from the airport. This could change the current land use and increase cumulative impacts on visual, ecological, and cultural resources. In addition, the *Complex Transformation SPEIS* consolidated nuclear production center facilities, if constructed at LANL, could result in disturbance of up to 545 acres (221 hectares) of land. The total land area required for the GNEP advanced fuel cycle facility would be approximately 373 acres (151 hectares) with 144 acres (58 hectares) inside a property protection fence, including approximately 62 acres (25 hectares) within a perimeter intrusion, detection, and assessment system (DOE 2008).

Impacts associated with construction of the consolidated nuclear production center or the GNEP advanced fuel cycle facility at LANL would include the loss of habitat and of less mobile wildlife, such as reptiles and small mammals. Best management practices and implementation measures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* would be used to minimize the potential for any adverse effects to plant and animal communities and on threatened and endanger or special interest species. After construction, temporary structures would be removed and the sites reclaimed.

Proposed sites for the *Complex Transformation SPEIS* consolidated nuclear production center in TA-16 or TA-55 and the GNEP advanced fuel cycle facility in TA-36 that involve undisturbed lands are likely to contain archaeological resources due to the high density of these resources in the region. Identification, evaluation, determination of impact, and implementation of mitigative measures would be conducted in consultation with the New Mexico State Historical Preservation Office (SHPO), interested Native American tribes, and in accordance with *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico*.

Geology and Soils

For geology and soils, the primary impacts are due to proposed closure of the MDAs under the Expanded Operations Alternative in compliance with the Consent Order. If the waste at the MDAs is contained in place (MDA Capping Option), the final covers would require up to 2.5 million cubic yards (1.9 million cubic meters) of bulk materials including crushed tuff, rock, gravel, topsoil, and other materials for surface grading and erosion control. Construction of the consolidated nuclear production center or the GNEP advanced fuel cycle facility would also require the use of bulk geologic materials. These materials would be obtained from LANL resources and from quarries and mines in the surrounding counties. While the quantity of materials would be large, there would be sufficient resources in the region to meet the demand.

Water Resources

Reasonably foreseeable activities in the region could affect surface water and groundwater in combination with past and present activities, as well as those proposed at LANL in this SWEIS. Mitigation measures implemented by Federal agencies during fire and vegetation management projects and modification of water control structures installed after the Cerro Grande Fire would minimize impacts on surface water quality and quantity. Use of facilities to evaporate treated effluent from the Radioactive Liquid Waste Treatment Facility would improve surface water resources in Mortandad Canyon. Additional groundwater depletion projected as a result of potential new residential development within Los Alamos County could be somewhat offset by reduced depletion of the regional aquifer following implementation of the city of Santa Fe's water diversion project and reduced pumping of the Buckman Well Field. Monitoring of the quality and quantity of the regional aquifer would be needed to evaluate the rate and direction of contaminant movements and to track the amount of water available for use. The North Railroad Avenue groundwater contamination plume located over 12 miles (19 kilometers) from the LANL boundary is undergoing remediation, and is not expected to migrate into groundwater and surface water impacted by past or present LANL operations.

Air Quality

Under the Expanded Operations Alternative, construction, excavation, and remediation activities could result in temporary increases in air pollutant concentrations at the site boundary and along publicly accessible roads. These impacts would be similar to those that would occur during construction of a housing project or a commercial complex. Emissions of fugitive dust from these activities would be controlled with water sprays and other engineering and management practices as appropriate. The maximum ground level concentrations offsite and along publicly accessible roads would be below ambient air quality standards, except for possible short-term concentrations of nitrogen oxides and carbon monoxide for certain projects that could occur near the site boundary. Appropriate management controls and scheduling would be used to minimize impacts on the public and to meet regulatory requirements. The impacts on the public would be minor.

The projected increase in LANL employees and vicinity populations would cause an increase in vehicles and an associated increase in vehicle emissions along the routes used to access the site. However, cumulative concentrations of all criteria pollutants are expected to remain compliant with Federal and State ambient air quality standards.

The 24-hour standard for nitrogen dioxide and total suspended particulates could be exceeded if the Complex Transformation consolidated nuclear production center operated at LANL along with implementation of the Expanded Operations Alternative. Based on these potential exceedances, more detailed site-specific analyses would need to be performed if LANL were selected as the site for the consolidated nuclear production center. Preliminary data available for the GNEP advanced fuel cycle facility do not include emissions.

The contribution to cumulative air quality impacts from offsite construction and operation activities was also evaluated. The maximum impacts from construction activities (including fugitive dust) for oil and gas development in the region are evaluated in the *Farmington Proposed Resource Management Plan and Final EIS* and were shown to occur very close to the source, with concentrations decreasing rapidly with distance (BLM 2003b). Therefore, it is expected that offsite air emissions from disturbance and construction would not contribute substantially to cumulative impacts at LANL.

Impacts of inert pollutants (pollutants other than ozone and its precursors) generally were found to be limited to a few miles downwind from the source. For emissions from the oil and natural gas well fields, the distance where the nitrogen dioxide concentrations dropped below their significance levels was 15.6 to 24.9 miles (25 to 40 kilometers). Therefore, it is expected that emissions from the operation of offsite facilities would not contribute substantially to cumulative impacts at LANL.

In contrast, the maximum effects of volatile organic compounds and nitrogen oxide emissions on ozone levels usually occurs several hours after these compounds are emitted and many miles from their sources (BLM 2003b). A number of mitigation measures for activities occurring in the region are designed to reduce the cumulative air quality impacts from gas and oil wells and pipelines. One of the more successful mitigation measures requires that new and replacement wellhead compressors limit their nitrogen oxide emissions to less than 10 grams per horsepower-

hour, and each pipeline compressor station limit its total nitrogen oxide emissions to less than 1.5 grams per horsepower-hour. This measure is intended to substantially reduce the level and extent of emissions that form ozone throughout the region and to reduce visibility impacts on Class I Areas such as Bandelier National Monument.

Human Health

For human health, the dose to the general public from all anticipated airborne emissions at LANL (Expanded Operations Alternative) could be as much as 36 person-rem per year. The dose to the offsite MEI from all anticipated airborne emissions at LANL could be as much as 8.2 millirem per year. The Clean Air Act regulations limit airborne radiation doses to 10 millirem per year for any individual member of the public. No additional LCFs would be expected at these dose levels. If the consolidated nuclear production center facilities were sited at LANL, the offsite radiological impacts would be essentially unchanged due to closure of facilities whose functions would be included in the new center. Preliminary data available for the GNEP advanced fuel cycle facility do not include estimates of offsite dose impacts.

Collective worker doses would increase if the MDA Removal Option was implemented. Collective worker dose would increase from about 280 person-rem per year under the No Action Alternative to an average of up to about 540 person-rem per year due to the number of workers involved. At the maximum dose, the annual risk of a LCF in the worker population would be about 0.3 (or for each 3 years of operation, 1 chance of an LCF in the worker population). Worker dose would decrease by about 140 person-rem annually after the MDA remediation work was complete. Worker doses would be expected to increase from operation of the consolidated nuclear production center facilities at LANL. The net increase in collective worker doses would be approximately 105 person-rem per year. The increased annual risk of an LCF in the worker population would be 0.06 (or for each 17 years of operation, an additional LCF might be expected in the worker population). Preliminary data for the GNEP advanced fuel cycle facility do not include a worker population dose estimate. Individual worker doses would be maintained as low as reasonably achievable (ALARA) and within applicable regulatory limits.

Environmental surveillance results for radioisotopes and chemicals, monitoring of LANL radiological emissions and radiation dose data, and cancer mortality and incidence rates in New Mexico and all counties surrounding LANL are presented in this SWEIS. These data, along with the final LANL Public Health Assessment, issued on August 31, 2006, by the U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, show that "there is no evidence of contamination from LANL that might be expected to result in ill health to the community" and "[o]verall, cancer rates in the Los Alamos area are similar to cancer rates found in other communities" (CDC 2006). Additionally, there is currently a Center for Disease Control and Prevention dose reconstruction project at LANL in the initial information gathering phase (CDC 2006). Therefore, this information is not available to include in the cumulative impacts analysis.

Socioeconomics

By 2011, LANL operations under the No Action Alternative could account for approximately 20 percent of employment in the tri-county area (Los Alamos, Rio Arriba, and Santa Fe

Counties) and an even higher percentage of wages due to the large difference in average wages for LANL employees versus the county averages. Under the Expanded Operations Alternative, direct employment at LANL could increase by another 14 percent by 2011. Of the 1,890 direct and 2,000 indirect jobs thus created, about 1,600 and 1,700 jobs, respectively, would be held by those in the tri-county area. This would increase the estimated percentage of the population employed in the tri-county area as a result of LANL operations activities to 22 percent.

If the maximum number of jobs estimated for operation of the Los Alamos Research Park and the conveyance and transfer of land were also created by 2011, there could be additional socioeconomic impacts in the region of influence. Cumulatively, the Expanded Operations Alternative and these activities could result in nearly 21,000 direct and 22,000 indirect jobs in the region. This scenario would increase the estimated percentage of the population employed by LANL-related activities or actions to 31 percent of the region of influence.

Increases in employment related to the proposed *Complex Transformation SPEIS* consolidated nuclear production center facilities would add approximately 1,500 direct and 1,600 indirect jobs for a total of 3,100 additional employees living in the tri-county region of influence. The addition of the GNEP advanced fuel cycle facility could add about 1,100 direct jobs in the tri-county region of influence, generating approximately 1,200 indirect jobs for a total 2,300 additional employees living in the tri-county region of influence. Combined with the other initiatives discussed above and LANL's continuing operations under the Expanded Operations Alternative, this scenario could increase the estimated percentage of the population employed by LANL-related activities to 33 percent of the region of influence.

The rate of population growth in the region would likely exceed current rates, placing additional strain on regional infrastructure and social services. For example, additional demand would be placed on regional water and electrical systems, roads would be more heavily traveled, additional housing would need to be constructed, and there may be demands for additional schools and hospitals. There would also be beneficial gains in terms of average wages and benefits flowing into the local economy because many of these jobs should be relatively higher paying jobs (for example, research jobs), and the unemployment rate would likely fall.

Infrastructure

Under the SWEIS Expanded Operations Alternative, the cumulative peak electrical load would approach, but not exceed, the system capacity; and the water use would approach, but not exceed, the system available water rights. Planned upgrades to the electrical system should enhance peak load capacity and ensure that electric energy is available for future operations. For water use, Los Alamos County is currently pursuing additional water rights to supply its water customers, including LANL. LANL water requirements have been decreasing compared to the demand in 1999, and are far below projections included in the *1999 SWEIS*. In the near term, no infrastructure capacity constraints are expected, and LANL demands on infrastructure resources are below projected levels and within site capacities. Potential shortfalls in available capacity would need to be addressed if increased site requirements are larger than those analyzed in this SWEIS.

If the proposed Complex Transformation consolidated nuclear production center, the GNEP advanced fuel cycle facility, or both were located at LANL, the system capacities for electricity and water could be exceeded and additional resources might need to be identified to satisfy the projected demand. It is likely that significant modifications would be required and LANL would need to obtain greater water resources, or significantly reduce its potable water use through mitigative measures. Overall LANL work assignments might have to be revamped, reduced, or eliminated so that existing potable water supplies would be adequate to support the assigned LANL work load.

Waste Management

Cumulative generation of all waste types is expected to be substantial, largely due to future remediation of MDAs and DD&D of facilities. Although this would be the case under all alternatives, the quantities of wastes projected under the Expanded Operations Alternative would be significantly larger than those projected under the other alternatives. Sufficient disposal capacity, both on- and offsite, for all waste types would be available except possibly under the Expanded Operations Alternative. Up to 1.4 million cubic yards (1.1 million cubic meters) of low-level radioactive waste and 33,000 cubic yards (25,000 cubic meters) of transuranic waste are projected. About two-thirds of the transuranic waste volume is associated with postulated complete removal of all waste from the MDAs – including transuranic waste buried before 1970. Final waste volumes from MDA remediation may be smaller because waste generation is dependent on future regulatory decisions by the New Mexico Environment Department and on waste volume reduction techniques such as sorting. Additional resources, including new storage and handling facilities, could be required to augment existing and proposed waste management capabilities.

Onsite disposal capacity for low-level radioactive wastes may be sufficient, depending on the actual volumes generated by remediation; disposal capacity can be supplemented by offsite facilities if needed. It is assumed that the transuranic waste would be disposed of at WIPP. WIPP disposal capacity is expected to be sufficient for disposal of all retrievably stored waste and all newly generated transuranic waste from the DOE complex over the next few decades, but not sufficient for this waste and all of the transuranic waste buried before 1970 across the complex (63 FR 3624). Decisions about disposal of transuranic waste from full removal of LANL MDAs would be based on the needs of the entire DOE complex. Any transuranic waste that may be generated at LANL without a disposal pathway would be safely stored until disposal capacity becomes available.

Operation of the proposed Complex Transformation consolidated nuclear production center would result in additional radioactive waste being generated. Up to 1,160 cubic yards (890 cubic meters) of transuranic waste, 12,000 cubic yards (9,000 cubic meters) of low-level radioactive waste, and 72 cubic yards (55 cubic meters) of mixed low-level radioactive waste would be generated annually. Operations would also generate up to 8,900 gallons (33,800 liters) of liquid low-level waste and up to 3,600 gallons (13,700 liters) of mixed low-level liquid waste annually. These wastes would be treated and packaged for disposal in accordance with their characteristics and applicable requirements in existing facilities or new facilities. Low-level waste would be disposed of onsite, mixed low-level waste would be disposed of at a permitted offsite facility, and transuranic waste would be disposed of at WIPP.

The volumes of low-level radioactive waste (up to 3,450 cubic yards [2,640 cubic meters]) and mixed low-level radioactive waste (up to 4.4 cubic yards [3.4 cubic meters]) projected to be generated annually by the GNEP advanced fuel cycle facility (DOE 2008) would be managed within the current waste management program. In addition, the project could generate up to 928 cubic yards (710 cubic meters) of nondefense transuranic waste annually (DOE 2008), which is not eligible for disposal at WIPP. Transuranic waste without a disposal pathway would be safely stored until a disposal facility became available. The project could also generate 34 cubic yards (26 cubic meters) of high-level radioactive waste annually (DOE 2008). Facilities to safely manage high-level radioactive waste until it could be sent to a geologic repository would have to be provided by the project since no high-level radioactive waste is currently managed at LANL.

Transportation

The total cumulative worker dose from 130 years of radioactive materials shipments (general transportation, historical DOE shipments, and reasonably foreseeable actions as estimated in the *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-S1D) (DOE 2007a), as well as shipments associated with the LANL SWEIS alternatives, would be a maximum of 382,400 person-rem, which could result in 229 LCFs. The total cumulative dose to the general public would be a maximum of 343,900 person-rem, which could result in 206 excess LCFs. The total estimated traffic fatalities associated with accidents involving radioactive material and waste transports would be a maximum of 119.

Implementing the Expanded Operation Alternative would result in no more than three additional traffic fatalities and zero worker or public cancer deaths (LCFs); therefore, they would not contribute substantially to cumulative impacts. For perspective, in 2004, there were 522 traffic fatalities in New Mexico, 58 of which occurred in the three counties neighboring LANL (Los Alamos, Rio Arriba, and Santa Fe Counties) (see Chapter 4, Table 4–56).

Daily traffic could increase on county roads by up to 18 percent (averaged across all LANL entrances) due to (1) increased development of both housing and light industry, as a result of the conveyance and transfer of lands; (2) increased truck shipments under the Expanded Operations Alternative; (3) projected increases in the LANL workforce under the Expanded Operations Alternative; and (4) increased employment at the Los Alamos Research Park. Development of land transferred under the *Land Conveyance and Transfer EIS* (DOE/EIS-0293) (DOE 1999d) could increase traffic in the vicinity of the airport and TA-21 based on current Los Alamos County plans to develop light industry, retail, and residential units on these tracts. This action, combined with the increased traffic associated with DD&D activities at TA-21, could cause excessive traffic loads on NM 502.

The major radiological transportation actions involving Category I/II special nuclear material related to the proposal to consolidate activities at LANL would be transportation of pits currently stored at Pantex and highly enriched uranium currently stored at Y-12 to LANL. After these one-time shipments were completed, there would be no annual shipment of pits and highly enriched uranium from these sites. The estimated radiological health impacts of the one-time transportation of pits and highly enriched uranium to LANL would not result in any additional

LCFs in the general public. Non-radiological impacts would be expected to result in zero fatalities as a result of accidents. Workers handling the movement of pits and highly enriched uranium would receive a collective dose of approximately 5,500 person-rem, resulting in an estimated 3.3 LCFs. It should be noted that in accordance with DOE regulations, the maximum annual dose to a radiation worker would be administratively controlled to 2 rem per year; therefore, an individual worker would not be expected to develop a lifetime latent fatal cancer from exposures during these activities.

The major transportation actions involving radioactive materials related to the *GNEP PEIS* advanced fuel cycle facility at LANL would involve the receipt of shipments of spent reactor fuel, shipments of transmutation fuel, shipments of spent fast reactor fuel, and radioactive waste shipments associated with operation of the advanced fuel cycle facility (DOE 2008).

The addition of proposed facilities and an increased number of workers for the consolidated nuclear production center in TA-16 would likely result in increased traffic along NM 4 from White Rock to West Jemez Road and on West Jemez Rd to the center of the site. The consolidation of facilities in TA-16 would somewhat alleviate current concerns related to increased traffic along Pajarito Road under the Expanded Operations Alternative, because there could be a corresponding decrease in traffic along Pajarito Road from NM 4 to TA-55 if the activities at the Plutonium Facilities Complex were relocated to TA-16. Conversely, the GNEP advanced fuel cycle facility is proposed to be built in TA-36 which would lead to increased traffic along Pajarito Road from NM 4 to the center of LANL, if approved.

Environmental Justice

No disproportionately high adverse human and environmental effects to minority or low-income populations would be expected as a result of implementing any of the three alternatives considered in this SWEIS, constructing and operating the *Complex Transformation SPEIS* consolidated nuclear production center or the GNEP advanced fuel cycle facility. Employment at LANL and in the surrounding region would be expected to increase, thus creating additional employment opportunities for local individuals. As additional funding flows into the regional economy, increased opportunities for low-income and minority populations should be realized. Also, the conveyance and transfer of land to the Department of the Interior that has occurred benefits people inhabiting the Pueblo of San Ildefonso. A consultation process is in place to address possible impacts to traditional cultural properties from LANL activities.

3.6.3 Summaries of Potential Consequences from Project-Specific Analyses

Appendices G, H, I, and J of this SWEIS contain evaluations of the environmental impacts of projects proposed for implementation under the Expanded Operations Alternative. They include projects to replace or refurbish existing structures and their related capabilities, DD&D of old structures and remediation of environmental contamination, modifications to site infrastructure, and expansion of site capabilities. This section summarizes the potential consequences of implementing each of the proposed projects.

The sliding-scale approach is used in this SWEIS to evaluate environmental consequences. This approach implements the Council on Environmental Quality instruction to "focus on significant

environmental issues" (40 CFR 1502.1) and to discuss impacts "in proportion to their significance" (40 CFR 1502.2[b]). For some of the project-specific analyses it was determined that there would be no or only minor impacts for some resource areas. Consequently, these resource areas are not analyzed in detail. In the following tables, these resource areas are identified as having "no or negligible impacts."

General temporary construction-related impacts would be expected to occur for most of the projects summarized in this section during construction and DD&D activities. After project completion, these impacts would cease and the area would return to normal. These impacts are not discussed in detail in the project summaries:

- Physical disturbances to areas under or in the vicinity of construction and DD&D projects would disrupt land use, affect the visual environment, and disturb the soils and geology, the latter primarily from excavation activities.
- Water resources, primarily surface water quality, could be temporarily affected by runoff and increased sediment loads from construction and DD&D sites. Stormwater Pollution Prevention Plans describing best management practices would be required and would mitigate most of these impacts. A Construction General Permit, a U.S. Army Corps of Engineers Section 404 Dredge and Fill Permit, and a Section 401 New Mexico Water Quality Certification would be obtained, if needed, for projects that may affect surface water.
- Air quality impacts would be increased by emissions of criteria air pollutants, primarily carbon monoxide and nitrogen oxides from vehicles and heavy equipment, as well as particulate matter from soil disturbance.
- Noise levels could rise from the increased number of personal vehicles, trucks hauling materials and waste to and from construction sites, and heavy equipment involved in the activities. Most noise would be localized, but if a project were near a LANL site boundary, offsite populations could be disturbed.
- Loss of habitat from land disturbance and increased noise and light are potentially adverse ecological impacts from construction and DD&D activities. Impacts could be minimized by avoiding working during nesting seasons for sensitive species, using special lighting, protecting areas of concern, and working only during certain times of the day or year.
- Construction workers would be subject to accidents typical of any construction site. Adverse effects could range from relatively minor (such as lung irritation, cuts, or sprains) to major (such as lung damage, broken bones, or fatalities). To prevent serious exposures and injuries, all site construction contractors would be required to submit and adhere to a Construction Safety and Health Plan and undergo site-specific hazard training. Appropriate personal protection measures would be a routine part of construction activities, including use of personal protection equipment such as coveralls, respirators, gloves, hard hats, steel-toed boots, eye shields, and earplugs or covers. Workers also would be protected by other engineered and administrative controls.
- Increased consumption of fuels, water, and electricity would occur during construction and DD&D.

- Implementing the projects addressed in this section may result in impacts to potential release sites covered under the Consent Order. As needed, these potential impacts would be addressed through the accelerated cleanup process described in Section VII.F of the Consent Order.

Summary of Impacts for the Physical Science Research Complex Project

The Physical Science Research Complex would be a complex of four buildings in TA-3 with approximately 350,000 square feet (32,500 square meters) of floor space, approximately 30 percent of which would be laboratory space (primarily laser). This complex would be available to consolidate staff currently located in TA-3 and other LANL locations in newer, more efficient and modern space. A number of structures would be demolished to make room for the Physical Science Research Complex, and a number of buildings vacated by staff moving to the new facility would also undergo DD&D. A building potentially eligible for listing on the National Register of Historic Places could be impacted, as well as the Administration Building which has been determined to be eligible. Proposed activities would require documentation to resolve adverse effects. Only minor impacts would be expected from construction and operation of this facility. There would be some improvement in the overall appearance of areas in which aging buildings and temporary structures would be demolished. **Table 3–20** summarizes the potential impacts of implementing this project.

Table 3–20 Summary of Impacts for the Physical Science Research Complex Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – No or negligible impact. *Visual Environment* – Demolition of vacated structures would improve the overall appearance of TA-3, TA-35, and TA-53.
Geology and Soils	Temporary construction- and DD&D-related impacts. Approximately 499,000 cubic yards of rock and soil would be disturbed during construction.
Water Resources	No or negligible impact.
Air Quality and Noise	*Air Quality* – Temporary construction- and DD&D-related impacts. Little or no change in emissions from operations. *Noise* – Temporary construction- and DD&D-related impacts.
Ecological Resources	No or negligible impact.
Human Health	Temporary construction-related impacts and accident potential for workers. Potential worker exposure to radiological contamination and asbestos during DD&D. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment. Positive impact on relocated staff from improved working conditions.
Cultural Resources	Possible impact on a building potentially eligible for listing on the National Register of Historic Places and the Administration Building, which has been determined to be eligible. Proposed activities would require documentation to resolve adverse effects.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No more than negligible impact on LANL utility capacity; requirements would be similar to or less than the facilities being replaced.
Waste Management	*Construction* – 1,600 cubic yards of construction debris. *DD&D* – 17,000 cubic yards of low-level radioactive waste; 177,000 cubic yards of solid waste including demolition debris; and 314,000 pounds of chemical waste.
Transportation	Transportation of construction materials and wastes and demolition wastes (some radioactive) would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; LCF = latent cancer fatality.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359.

There would be no major environmental impacts from construction, operation, and DD&D of existing buildings for the Replacement Office Buildings Project. Most construction would be in a developed portion of TA-3; however, a portion of the project area would require use of about 13 acres (5.3 hectares) of currently undeveloped land. Protection of cultural resources and potential accommodation for the Mexican spotted owl during construction could be required. **Table 3–21** summarizes the potential impacts of implementing this project.

Table 3–21 Summary of Impacts for the Replacement Office Buildings Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – Consistent with future land use plans; about 13 acres of undeveloped land would be disturbed. *Visual Environment* – New buildings and parking lot could be visible from West Jemez Road and Pajarito Road.
Geology and Soils	Temporary construction- and DD&D-related impacts. Approximately 369,000 cubic yards of rock and soil would be disturbed during construction.
Water Resources	Temporary construction- and DD&D-related impacts.
Air Quality and Noise	*Air Quality* – Temporary construction-and DD&D-related impacts. No change in emissions from operations. *Noise* – Temporary construction- and DD&D-related impacts.
Ecological Resources	Temporary construction-related impacts. Loss of 13 acres of habitat. Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle.
Human Health	Temporary construction- and DD&D-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment.
Cultural Resources	Possible impact on a historic trail potentially eligible for listing on the National Register of Historic Places. Proposed activities could require documentation to resolve adverse effects.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No more than negligible impact on LANL utility capacity; requirements would be similar to or less than the facilities being replaced.
Waste Management	*Construction* – 1,700 cubic yards of construction waste. *DD&D* – 31 cubic yards of low-level radioactive waste and 6,900 cubic yards of demolition debris.
Transportation	No or negligible impact.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

TA = technical area; DD&D = decontamination, decommissioning, and demolition.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; acres to hectares, multiply by 0.40469.

Summary of Impacts for the Radiological Sciences Institute Project, Including Phase I – the Institute for Nuclear Nonproliferation Science and Technology

The proposed project would involve the DD&D of 52 obsolete structures scattered over 6 TAs, and the construction of the Radiological Sciences Institute in TA-48, which would include as many as 13 new facilities. Phase I would include construction of five buildings associated with the Institute for Nuclear Nonproliferation Science and Technology. This facility would include Security Category I and II laboratories and vaults, other laboratory space, a secure radiochemistry laboratory, and associated offices and support facilities.

DD&D activities and transportation would result in the largest potential impacts. DD&D activities are expected to generate large quantities of debris, including some radioactively-contaminated debris. With the exception of low-level radioactive waste, most DD&D waste

would be transported to appropriate offsite facilities. Transportation impacts would include temporary disruption of traffic on Pajarito Road during construction; increased local traffic during operations; and movement of large amounts of DD&D waste. **Table 3–22** summarizes the potential impacts of implementing this project.

Table 3–22 Summary of Impacts for the Radiological Sciences Institute Project, Including Phase I – the Institute for Nuclear Nonproliferation Science and Technology

Resource Area	*Impact Summary*
Land Resources	*Land Use* – Some currently designated Reserve and Experimental Science areas would be redesignated in the future as Nuclear Materials Research and Development; 12.6 acres of undeveloped land would be disturbed. *Visual Environment* – Minor impact from new development in TA-48 west of existing buildings.
Geology and Soils	Temporary construction-related impacts. Approximately 802,000 cubic yards of rock and soil would be disturbed during construction. Excavation of welded tuff could necessitate blasting. Negligible impacts anticipated from DD&D activities.
Water Resources	Temporary construction-related impacts. DD&D of older contaminated structures could reduce the potential for future surface water and groundwater contamination.
Air Quality and Noise	*Air Quality* – Temporary construction- and DD&D-related nonradiological impacts and potential for release of radionuclides in contaminated soils in the vicinity of the proposed building location. Little or no change in emissions from operations. *Noise* – Temporary construction- and DD&D-related impacts could include blasting.
Ecological Resources	Temporary construction-related impacts. Loss of 12.6 acres of habitat. Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl.
Human Health	Temporary construction-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment. No additional LCFs in general population or to the MEI from radiological doses from facility construction or operation and associated DD&D.
Cultural Resources	Possible impact on two archaeological sites determined to be eligible for the National Register of Historic Places and on potentially eligible historic buildings, including the Radiochemistry Building. Documentation to resolve adverse effects on the archaeological sites would be required before beginning construction of the Radiological Sciences Institute and could be required before demolition of any of the potentially important historic structures.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No more than negligible impact on LANL utility capacity, requirements would be similar to or less than the facilities being replaced.
Waste Management	*Construction* – 2,800 cubic yards of construction debris and associated solid waste. *DD&D* – 1,100 cubic yards of transuranic waste; 96,000 cubic yards of low-level radioactive waste; 1,000 cubic yards of mixed low-level radioactive waste; 77,000 cubic yards of demolition debris; and 988,000 pounds of chemical waste.
Transportation	Transportation of construction materials and wastes, and demolition wastes (some of which would be radioactive) would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	Postulated facility accident with the highest impacts would result in an LCF risk of 1 in 12,000 for a noninvolved worker and 1 in 77,000 for the MEI; there would be no excess LCFs expected in the exposed population.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; LCF = latent cancer fatality; MEI = maximally exposed individual.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359; acres to hectares, multiply by 0.40469.

Summary of Impacts for Radioactive Liquid Waste Treatment Facility Upgrade Project

This project has been proposed to improve the operation and reliability of the Radioactive Liquid Waste Treatment Facility in TA-50. Three options have been proposed to upgrade the facility, each involving DD&D of part of the existing facility. Under Option 1, a new building for treating liquid low-level radioactive and transuranic wastes would be constructed west of the existing facility in a parking area, along with a central utilities building. The East Annex would be demolished. Under Option 2, the Radioactive Liquid Waste Treatment Facility treatment capabilities would be housed in two or more separate structures to the west and north of the existing facility (for example, one or more structures for low-level radioactive liquid waste and one or more structures for transuranic liquid waste). The East Annex, the North Annex, and a transformer located on the north side of the existing facility would be demolished to accommodate the new construction. Option 3 is identical to Option 2, except that the existing facility would be renovated for reuse; the most DD&D would be required under this option. An auxiliary action of installing a pipeline and constructing evaporation tanks to treat effluent could occur with any of the options, including the No Action Option (not upgrading the facility).

Potential impacts from each of the action options would be similar. Demolition of the East Annex and the transuranic influent storage tanks would likely produce considerable low-level radioactive waste and some transuranic waste. There is also the potential for releasing radioactive or other hazardous constituents from contaminated soils and contaminated structural materials, but proper procedures would be followed to minimize their release. **Table 3–23** summarizes the potential impacts of implementing this project.

Implementing the auxiliary action to construct evaporation tanks and a pipeline would result in a change in the land use category and the loss of habitat of up to 5.4 acres (2.2 hectares) of currently undeveloped land. Tank construction would cause a break in the forest cover that would be noticeable from areas west of LANL. Use of the evaporation tanks would improve surface water quality by eliminating a discharge that could contribute to movement of existing environmental contamination.

Table 3–23 Summary of Impacts for the Radioactive Liquid Waste Treatment Facility Upgrade Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – If the option to construct evaporation tanks and pipeline were implemented, the land use designation of up to 5.4 acres of land for the area of the tanks would change from Reserve to Waste Management. *Visual Environment* – The new treatment buildings would not result in a change to the overall visual character of the area within TA-50, but the area proposed for construction of the evaporation tanks is currently undeveloped and wooded, and a break in the forest cover would be noticeable from areas west of LANL.
Geology and Soils	Temporary construction- and DD&D-related impacts. Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. Permanent removal of contaminated soil to accommodate new facilities. Up to 164,000 cubic yards of rock and soil could be disturbed, assuming construction of the evaporation tanks and pipeline.
Water Resources	Potential positive impact on effluent water quality and quantity due to more stringent discharge requirements and improved processing.
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. Potential for increased radioactive emissions during DD&D. Minimal impact expected from operation. *Noise* – Minor construction equipment and traffic noise impact to workers.
Ecological Resources	Temporary construction- and DD&D-related impact. Loss of up to 5.4 acres of habitat if the evaporation tanks and a pipeline are built. May affect, but is not likely to adversely affect, the Mexican Spotted Owl and bald eagle.
Human Health	Temporary construction-related impacts and accident potential for workers. Potential worker exposure to radiological contamination during DD&D. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment. During operations, worker health and safety would be improved because of improved reliability and design and less maintenance on new systems. RLWTF emissions do not have a distinguishable effect on the projected dose to the public.
Cultural Resources	Possible impact on several historic properties, including the RLWTF, potentially eligible for listing on the National Register of Historic Places. Proposed activities could require documentation or excavation to resolve adverse effects.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – Utility requirements are expected to increase but to stay within LANL utility capacity.
Waste Management	*Construction* – Up to 1,150 cubic yards of construction debris. *DD&D* – Up to 230 cubic yards of transuranic waste; 10,300 cubic yards of low-level radioactive waste; 150 cubic yards of mixed low-level radioactive waste; 1,800 cubic yards of demolition debris; and 212,000 pounds of chemical waste.
Transportation	Temporary disruption of local traffic during construction and DD&D. Transportation of construction materials and wastes and demolition wastes (some of which would be radioactive) would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; LCF = latent cancer fatality; RLWTF = Radioactive Liquid Waste Treatment Facility.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; gallons to liters, multiply by 3.7854; pounds to kilograms, multiply by 0.45359; acres to hectares, multiply by 0.40469.

Summary of Impacts for Los Alamos Neutron Science Center Refurbishment Project

The LANSCE Refurbishment Project would include renovations and improvements to the existing facility in TA-53 to increase its reliability and extend its operating life. Impacts from implementation would be minimal. There could be minimal indirect effects on utility usage and air emissions from increased usage of the facilities after the project was complete. **Table 3–24** summarizes the potential impacts of LANSCE Refurbishment Project activities.

Table 3–24 Summary of Impacts for the Los Alamos Neutron Science Center Refurbishment Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – No or negligible impact. *Visual Environment* – No or negligible impact.
Geology and Soils	No or negligible impact.
Water Resources	Project implementation may result in a small increase in nonradiological cooling water discharge from increased facility usage.
Air Quality and Noise	*Air Quality* – Negligible to minor impacts during refurbishment. Operations may result in increased nonradiological air emissions from increased facility usage. *Noise* – Potential temporary increase in onsite noise levels during refurbishment.
Ecological Resources	No or negligible impact.
Human Health	Temporary construction-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and use of personal protective equipment. Operations impacts may increase as a result of increased accelerator usage. The maximum dose to the MEI as a result of emissions, however, would be limited to 7.5 millirem per year.
Cultural Resources	Possible impact on several historic buildings potentially eligible for listing on the National Register of Historic Places and the LANSCE accelerator building, which has been determined to be eligible. Documentation to resolve adverse effects would be required before making modifications to the accelerator building and could be required before modifications or demolition of any of the other potentially important historic structures.
Socioeconomics and Infrastructure	*Socioeconomics* – No impacts identified. *Infrastructure* – Negligible utility requirements during refurbishment. Project implementation could result in increased utility demands from increased facility usage. Peak load demand could approach current capacity but ongoing improvements to LANL's electric power infrastructure should alleviate this concern.
Waste Management	Small quantities of low-level radioactive waste, mixed low-level radioactive waste, chemical waste, and nonhazardous solid waste would be generated during refurbishment.
Transportation	No or negligible impact.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

MEI = maximally exposed individual; LANSCE = Los Alamos Neutron Science Center.

Summary of Impacts for the Radiography Facility Project

The proposed Radiography Facility would be constructed at TA-55 to eliminate the need for transporting nuclear items to different locations at LANL during the examination process. Minor impacts from construction would be expected. Radiography operations would use engineering and administrative controls to ensure workers would not be exposed to high radiation fields. Implementation of the project would reduce the number of onsite trips for nuclear components, resulting in fewer road closures and improved traffic flow. **Table 3–25** summarizes the potential impacts of the proposed TA-55 Radiography Facility Project.

Table 3–25 Summary of Impacts for the Technical Area 55 Radiography Facility Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – No or negligible impact. *Visual Environment* – No or negligible impact.
Geology and Soils	Temporary construction-related impacts. Up to 8,000 cubic yards of soil and rock would be disturbed.
Water Resources	No or negligible impact.
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. *Noise* – Temporary construction-related impacts.
Ecological Resources	No or negligible impact.
Human Health	*Construction* – Temporary construction-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment. *Operations* – Operations would involve high radiation fields. Worker health would be protected by facility design, radiation control procedures, and personal protective equipment.
Cultural Resources	No or negligible impact.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No more than negligible impact on LANL utility capacity.
Waste Management	*Construction* – Up to 24 cubic yards of solid waste would be generated during construction of the new building.
Transportation	Implementation of project would reduce onsite nuclear material transport.
Environmental Justice	No or negligible impact.
Facility Accidents	Accident impacts are bounded by those analyzed for the TA-55 Plutonium Facility Complex.

TA = technical area.
Note: To convert cubic yards to cubic meters, multiply by 0.76456.

Summary of Impacts for Plutonium Facility Complex Refurbishment Project

The TA-55 Plutonium Facility Complex Refurbishment Project would upgrade the electrical, mechanical, safety, and other selected facility systems to improve overall reliability to ensure continued operations. The project would be implemented in phases as a series of subprojects. All work would be performed inside the existing TA-55 complex. Several subprojects could have positive impacts on the environment, including replacement of the chiller, which would result in fewer emissions of ozone-depleting substances; implementation of the Steam System Subproject, which would reduce emissions of criteria pollutants; several subprojects that would improve the safety basis of the complex; and improvement in stack mixing and emissions monitoring resulting from implementation of the Stack Upgrade and Replacement Subproject. Implementation of the project would result in small amounts of radioactive and chemical waste that would be accommodated by the LANL waste management infrastructure. **Table 3–26** summarizes the potential impacts for the Plutonium Facility Complex Refurbishment Project.

Table 3–26 Summary of Impacts for the Plutonium Facility Complex Refurbishment Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – Temporary construction-related impacts of previously disturbed areas. *Visual Environment* – No impacts identified.
Geology and Soils	Temporary construction-related impacts.
Water Resources	No impacts identified.
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. Potential reduction in air emissions from upgrades and installation of new equipment. *Noise* – Temporary construction-related impacts confined to LANL site in and near TA-55, except for a very small potential increase in traffic noise.
Ecological Resources	No or negligible impact.
Human Health	Temporary construction-related impacts and accident potential for workers. Potential worker exposure to radiological contamination during refurbishment activities. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment. No radiological risks to members of the public identified from construction or normal operations.
Cultural Resources	No or negligible impact.
Socioeconomics and Infrastructure	*Socioeconomics* – No impacts identified. *Infrastructure* – No more than negligible impact on LANL utility capacity.
Waste Management	*Construction and DD&D* – 340 cubic yards of transuranic waste; 1,300 cubic yards of low-level radioactive waste; 220 cubic yards of mixed low-level radioactive waste; 2,700 cubic yards of demolition debris; and 2,000 pounds of chemical waste.
Transportation	Transportation of construction materials and wastes and demolition wastes (some of which would be radioactive) would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	A number of the higher-priority subprojects involve upgrades that would substantially improve the safety basis of the Plutonium Facility Complex.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; LCF = latent cancer fatality.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.4536.

Summary of Impacts for the Science Complex Project

The proposed Science Complex, a state-of-the-art multidisciplinary facility used for light laboratory and offices, would consist of two buildings and one supporting parking structure. The Science Complex would be constructed at one of three proposed sites: in TA-62, west of the Research Park area; in the Research Park in the northwest portion TA-3; or in the southeast portion of TA-3.

Construction of the Science Complex at the TA-62 site or the Research Park site would disturb about 5 acres (2 hectares) of undeveloped land. Each of the locations would require some modification of site infrastructure such as extending natural gas pipelines. The Research Park option would likely require rerouting of additional utilities currently located in or near the project area. **Table 3–27** summarizes the potential impacts of Science Complex Project activities.

Table 3–27 Summary of Impacts for the Science Complex Project

Resource Area	Impact Summary		
	Northwest TA-62 Option	***Research Park Option***	***South TA-3 Option***
Land Resources	*Land Use* – 5 acres of undeveloped land would be permanently disturbed; the land use plans for 15.6 acres would be changed. *Visual Environment* – Views from neighboring properties and roadways would be altered by construction of the proposed structures and from night lighting. Forested buffer between LANL and Los Alamos Canyon would be lost.	*Land Use* – Impacts similar to Northwest TA-62 Site. *Visual Environment* – Impacts similar to Northwest TA-62 Site.	*Land Use* – Negligible impacts identified. *Visual Environment* – No impacts identified.
Geology and Soils	Temporary construction-related impacts. Approximately 840,000 cubic yards of soil and rock would be disturbed.		
Water Resources	Temporary construction-related impacts.		
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. *Noise* – Temporary construction-related impacts. Minor increased noise levels from operation.		
Ecological Resources	Temporary construction-related impacts; loss of up to 5 acres of habitat. Under the TA-62 option, construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle.		
Human Health	Temporary construction-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment.		
Cultural Resources	Possible impact on two archaeological sites determined to be eligible for the National Register of Historic Places. Proposed activities would require documentation to resolve adverse effects.	No impacts identified.	No impacts identified.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – Addition of a natural gas line and tie-in to sanitary sewage system would be required. No more than negligible impact on LANL utility capacity.	*Socioeconomics* – No or negligible impact. *Infrastructure* – Would likely require rerouting of many utilities currently located on the site and extension of a sewer trunk line.	*Socioeconomics* – No or negligible impact. *Infrastructure* – Addition of a natural gas line and tie-in to sanitary sewage system would be required.
Waste Management	*Construction* – Approximately 3,300 cubic yards of construction debris would be generated.		
Transportation	Once complete, impacts would include an estimated 5,790 vehicle trips on the average weekday (2,895 vehicles entering and exiting in a 24-hour period).	Impacts similar to Northwest TA-62 Site.	Impacts would be greater than those for the Northwest TA-62 site due to the site location within the planned Security Perimeter Road and higher traffic flows on Diamond Drive relative to those on West Jemez Road. Construction traffic impacts would also be greater due to travel on Diamond Drive.
Environmental Justice	No or negligible impact.		
Facility Accidents	Risk of an LCF for a Science Complex occupant from a CMR Building accident: 1 chance in 560,000 per year.	Risk of an LCF for a Science Complex occupant from a CMR Building accident: 1 chance in 240,000 per year.	Risk of an LCF for a Science Complex occupant from a CMR Building accident: 1 chance in 60,000 per year.

TA = technical area; LCF = latent cancer fatality; CMR = Chemistry and Metallurgy Research.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; acres to hectares, multiply by 0.40469.

Summary of Impacts for Remote Warehouse and Truck Inspection Station Project

The Remote Warehouse and Truck Inspection Station Project would relocate shipment receiving, warehousing, and distribution functions from TA-3 to a site in TA-72. In addition, the Truck Inspection Station would be relocated from its current location on the northwest corner of NM 4 and East Jemez Road to the new location. Impacts resulting from this project would be minor, although the proposed facilities would be constructed in a relatively undeveloped area with desirable aesthetic qualities. Some screening of the proposed facilities would be possible using selective tree cutting and strategic placement of the facilities, but the view would be permanently altered to one that is typical of a more developed area. Nearby sensitive archaeological sites and National Historic Landmarks would be protected from construction and operation activities and increased visitation by installing fencing around the perimeter of the Remote Warehouse and Truck Inspection Station. **Table 3–28** summarizes the potential impacts for this project.

Table 3–28 Summary of Impacts for the Remote Warehouse and Truck Inspection Station Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* –Land use designation would change from Reserve to Physical/Technical Support; 4 acres of undeveloped land would be disturbed**.** *Visual Environmental* – Views would change from primarily natural landscape to include developed area. Lighting could be visible from Tsankawi Unit of Bandelier National Monument.
Geology and Soils	Temporary construction-related impacts. Approximately 90,000 cubic yards of soil and rock would be disturbed during construction.
Water Resources	Temporary construction-related impacts.
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. *Noise* – Temporary construction-related impacts. Possible noticeable noise along East Jemez Road during operations.
Ecological Resources	Temporary construction-related impacts; loss of 4 acres of habitat. Construction may affect, but is not likely to adversely affect, the bald eagle.
Human Health	Temporary construction-related impacts and accident potential for workers. Impacts would be mitigated through safe work practices, procedures, and personal protective equipment.
Cultural Resources	Possible impact on three nearby archaeological sites potentially eligible for listing on the National Register of Historic Places and two National Historic Landmarks. Proposed activities could require documentation to resolve adverse effects. Fencing around perimeter of project site would aid in protecting these sensitive sites.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – Addition of a natural gas line and means of sanitary sewage treatment, conveyance, or disposal would be required. No more than negligible impact on LANL utility capacity.
Waste Management	Approximately 610 cubic yards of construction debris would be generated.
Transportation	Changes to geometry of East Jemez Road. Potential reduction of traffic in and around TA-3.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

TA = technical area.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; acres to hectares, multiply by 0.40469.

Summary of Impacts for TA-18 Closure Project, Including Remaining Operations Relocation, and Structure Decontamination, Decommissioning, and Demolition

This proposed project would relocate the Security Category III and IV capabilities and materials remaining in TA-18, and would conduct DD&D of the buildings and structures at TA-18. The removal of buildings and structures at TA-18 (Pajarito Site) would provide positive local visual impacts, as would the eventual return of the area to its natural state, which would blend with other undisturbed portions of LANL. Buildings of historic importance and other cultural sites are located in TA-18. These cultural resources would be protected during DD&D activities as required. **Table 3–29** summarizes the potential impacts of these activities.

Table 3–29 Summary of Impacts for the Technical Area 18 Closure Project, Including Remaining Operations Relocation and Structure Decontamination, Decommissioning, and Demolition

Resource Area	*Impact Summary*
Land Resources	*Land Use* – DD&D could result in an overall change in the land use designation from Nuclear Materials Research and Development to Reserve. *Visual Environmental* – Potentially positive impact from removal of old buildings.
Geology and Soils	Temporary DD&D-related impacts.
Water Resources	DD&D would remove facilities from a floodplain, thereby enhancing protection of surface water quality.
Air Quality and Noise	*Air Quality* – Temporary DD&D-related impacts. *Noise* – Temporary DD&D-related impacts.
Ecological Resources	Temporary DD&D-related impacts. DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl and southwestern willow flycatcher. Restoration of the site could create a more natural habitat and benefit wildlife.
Human Health	The primary source of potential impacts on workers and members of the public would be associated with the release of radiological contaminants during DD&D. Potential impacts would be much less than during past operations and would be mitigated using confinement and filtration methods.
Cultural Resources	Three archaeological resources sites found at TA-18 (a rock shelter, a cavate complex, and the Ashley Pond cabin) have been determined to be eligible for listing on the National Register of Historic Places, and there are other eligible and potentially eligible buildings within the TA. Proposed activities would require documentation to resolve adverse effects, and these buildings would be protected during DD&D activities as required. Several historic properties at TA-18 have been identified for permanent retention, including the Pond Cabin, the Slotin Accident Building (TA-18-1), and other properties that represent the history of the TA and LANL.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No or negligible impact.
Waste Management	Waste generated from the disposition of the buildings and structures is estimated to be 4,700 cubic yards of low-level radioactive waste; 5 cubic yards of mixed low-level radioactive waste; 17,000 cubic yards of demolition debris; and 75,000 pounds of chemical waste.
Transportation	Transportation of wastes would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; LCF = latent cancer fatality.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359.

Summary of Impacts for the TA-21 Structure Decontamination, Decommissioning, and Demolition Project

All or a portion of the buildings and structures at TA-21 would undergo DD&D under this project. Two options are proposed: the Complete DD&D Option would remove essentially all

structures within TA-21; the Compliance Support Option would remove only those structures necessary to support remediation activities.

Onsite and offsite visual impacts would be improved by removal of some or all of the buildings and structures at TA-21. DD&D activities would affect buildings and structures potentially eligible for listing on the National Register of Historic Places, so documentation to resolve adverse effects could be required. Implementation of this project at the same time that TA-21 MDA remediation is underway would result in local traffic impacts along DP Road and in the Los Alamos townsite. **Table 3–30** summarizes the potential impacts of these activities.

Table 3–30 Summary of Impacts for Technical Area 21 Structure Decontamination, Decommissioning, and Demolition Project

Resource Area	*Impact Summary*	
	Complete DD&D Option	***Compliance Support Option***
Land Resources	*Land Use* – The remainder of the western portion of the area would be available for conveyance to Los Alamos County. The eastern part of the TA would remain a part of LANL for the foreseeable future. *Visual Resources* – Temporary DD&D-related impacts. Long-term impacts would be positive with the removal of old industrial buildings.	*Land Use* – Currently unconveyed portions of TA-21 would remain under DOE control. Land use designations would remain unchanged. *Visual Environment* – Temporary construction- and DD&D-related impacts. Over the long-term, the view of the TA from NM 502 and from higher elevations to the west would still include portions of the current mix of 50-year-old structures.
Geology and Soils	Temporary DD&D-related impacts.	Temporary DD&D-related impacts.
Water Resources	Improvement in overall water resources from discontinuing processes and associated water use and eliminating two outfalls.	Little or no impact on water resources.
Air Quality and Noise	*Air Quality* – Temporary DD&D impacts. Operational emissions would be relocated or cease. *Noise* – Temporary DD&D-related impacts.	*Air Quality* – Nonradioactive air pollutant emissions from the three natural gas-fired boilers in Building 21-0357 and the vehicle exhaust and emissions from activities in the maintenance facilities would remain. *Noise* – Temporary DD&D-related impacts.
Ecological Resources	Temporary DD&D-related impacts. Activities may affect, but are not likely to adversely affect, the Mexican spotted owl.	
Human Health	East Gate MEI would receive 2×10^{-4} millirem over the life of the project.	
Cultural Resources	DD&D of buildings and structures at TA-21 would have direct effects on 15 NRHP-eligible historic buildings and structures (and 1 potentially eligible building) associated with the Manhattan Project and Cold War years at LANL.	
Socioeconomics and Infrastructure	*Socioeconomics* – Temporary modest increase in employment due to DD&D activities. *Infrastructure* – No or negligible impact.	
Waste Management	DD&D would generate 1 cubic yard of transuranic waste; 34,000 cubic yards of low-level radioactive waste, 65 cubic yards of mixed low-level radioactive waste; 47,000 cubic yards of solid waste; and 420,000 pounds of chemical waste.	The volume of solid waste and debris generated under this Option would be about 29,000 cubic yards less than that under the Complete DD&D Option.
Transportation	Transportation of construction materials and wastes and demolition wastes (some radioactive) would not be expected to result in any fatalities or excess LCFs. Local traffic impacts associated with DD&D activities would be exacerbated by MDA remediation occurring at the same time.	
Environmental Justice	No or negligible impact.	
Facility Accidents	No or negligible impact.	

TA = technical area; DD&D = decontamination, decommissioning, and demolition; MEI = maximally exposed individual; NRHP = National Register for Historic Places; LCF = latent cancer fatality; MDA = material disposal area.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359.

Summary of Impacts for Waste Management Facilities Transition Project

This project involves DD&D of certain aboveground facilities in TA-54, Areas G and L, to facilitate closure of those areas; construction of additional waste management facilities; removal of waste stored underground in pits and shafts in Area G; and preparation and shipment of this waste for disposal. New waste management facilities would include a retrieval facility to assist in removal of high-activity remote-handled transuranic waste from certain shafts, new low-level radioactive waste facilities in TA-54, and a new TRU Waste Facility in the Pajarito Road Corridor to store and process transuranic waste.

The waste storage domes in Area G would be removed as part of this project, which would have a beneficial impact on both near and distant views. Because these domes are visible from the lands of the Pueblo of San Ildefonso, their removal would improve the views from that vantage point. Construction at TA-54 may affect, but is not likely to adversely affect, the southwestern willow flycatcher. Construction of the TRU Waste Facility, which could require up to 7 acres (2.8 hectares), could occur within Mexican spotted owl Areas of Environment Interest which would require consultation with the U.S. Fish and Wildlife Service. (The location of the TRU Waste Facility has not been finalized, so land resource, ecological, and cultural resource impacts could vary.) Eventual removal of stored wastes in Area G would reduce the dose to the facility-specific MEI. Worker doses could also decrease after 2015, once waste management activities in Area G are completed. **Table 3–31** summarizes the potential impacts of these activities.

Summary of Impacts for Major Material Disposal Area Remediation, Canyon Cleanups, and Other Consent Order Actions[7]

The environmental impacts that could result from implementation of the Consent Order depend on decisions yet to be made by the New Mexico Environment Department. To bound the range of possible consequences of implementing different corrective measures, two action options have been evaluated: (1) a Capping Option, in which specific MDAs are stabilized in-place, and (2) a Removal Option, in which the waste and contamination within the MDAs are removed. These options are for analytical purposes only and do not necessarily represent the corrective measures that NNSA would propose to the New Mexico Environment Department. Remediation of other potential release sites would also occur at LANL. The impacts of remediating other potential release sites would be small relative to those for MDA remediation.

The Removal Option would result in larger near-term impacts than the Capping Option. Both options would involve major ground-disturbing activities that would require use of heavy equipment and hauling of materials and wastes. Temporary construction impacts such as increases in noise levels and emissions of criteria pollutants and particulate matter would be expected. Because these activities would be widespread and would continue over a number of years, MDA remediation activities would have a larger impact than other proposed projects. Under the Removal Option, large quantities of wastes would be generated including low-level radioactive waste and transuranic waste buried at LANL before 1970. Onsite disposal capacity

Table 3–31 Summary of Impacts for the Waste Management Facilities Transition Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – Temporary construction-related impacts. The TRU Waste Facility could require up to 7 acres (2.8 hectares) of undeveloped land and could result in a change in land use designation, depending on its location. *Visual Environment* – Positive impact due to removal of the domes in TA-54. The TRU Waste Facility could be visible from San Ildefonso Pueblo lands, depending on its location.
Geology and Soils	Temporary construction- and DD&D-related impacts would occur in previously disturbed areas; impacts would be minor. Up to 169,000 cubic yards of soil and rock would be disturbed.
Water Resources	Minor impacts to surface water and groundwater. New facilities would use mitigative techniques to minimize impacts of spills.
Air Quality and Noise	*Air Quality* – Temporary construction impacts. Operational emissions would be mitigated using engineering controls, such as filtration systems, and monitored. Emissions from new facilities would not exceed those currently measured at the Decontamination and Volume Reduction System. Point source and area emissions in Area G would decrease by the end of 2015. *Noise* – Temporary construction-related impacts.
Ecological Resources	Temporary construction-related impacts at TA-54 may affect, but is not likely to adversely affect, the southwestern willow flycatcher. Construction of the TRU Waste Facility could disturb up to 7 acres (2.8 hectares) of ponderosa pine forest and open field. Consultation with the U.S. Fish and Wildlife Service could be required since construction could take place within Mexican spotted owl Areas of Environmental Interest.
Human Health	Minimal radiological impacts to offsite population. Reduced impacts to the MEI. Removal of transuranic waste would reduce area sources of occupational radiological exposure in Area G, potentially decreasing worker exposures after 2015.
Cultural Resources	Removal of the domes at TA-54 would reduce visual impacts on nearby traditional cultural properties. Potential impact to cultural resources could occur from construction of the TRU Waste Facility, depending on its location.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – Infrastructure demands would not exceed current LANL site capabilities.
Waste Management	Construction waste would include 500 cubic yards of construction debris. DD&D waste would include 30,000 cubic yards of low-level radioactive waste; 8 cubic yards of mixed low-level radioactive waste; 54,000 cubic yards of solid waste including demolition debris; and 566,000 pounds of chemical waste.
Transportation	Transportation of construction materials and wastes and demolition wastes (some radioactive) would not be expected to result in any fatalities or excess LCFs.
Environmental Justice	No or negligible impact.
Facility Accidents	The postulated facility accident having the highest impacts would result in an LCF risk of 1 in 900 for a noninvolved worker, 1 in 12,000 for the MEI, and 1 in 500 to the exposed population.

TA = technical area; DD&D = decontamination, decommissioning, and demolition; MEI = maximally exposed individual; LCF = latent cancer fatality.
Note: To convert cubic yards to cubic meters, multiply by 0.76456, pounds to kilograms, multiply by 0.45359.

for low-level radioactive wastes may be sufficient, depending on the actual volumes generated by remediation; disposal capacity can be supplemented by offsite facilities if needed. WIPP's disposal capacity is expected to be sufficient for disposal of all retrievably stored waste and all newly generated transuranic waste from the DOE complex over the next few decades, but not sufficient for this waste plus all transuranic waste buried before 1970 across the DOE complex (63 FR 3624). Decisions about disposal of transuranic waste from full removal of LANL MDAs, if generated, would be based on the needs of the entire DOE complex. Any transuranic waste

[7] *NNSA is including impacts associated with Consent Order implementation in the SWEIS in order to more fully analyze the impacts resulting from Consent Order compliance. NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in the SWEIS.*

generated at LANL without a disposal pathway would be safely stored until disposal capacity becomes available.

The Removal Option would result in over 100,000 shipments of radioactive and nonradioactive wastes that could require transport to offsite disposal facilities. These shipments could lead to two to three traffic fatalities over a 10-year period from nonradiological (truck collision) accidents. In addition, both the Capping or Removal Option would require the use of large quantities of soil, rock, and other bulk materials that would be obtained from LANL or local sources including the borrow pit in TA-61. Transporting this material to the MDAs could increase traffic congestion on LANL and local roads. Acquisition of large quantities of material from the TA-61 borrow pit could result in local visual impacts and some elimination of wildlife habitat.

Operational accidents postulated for the Removal Option could result in radiological or chemical exposures and risks to noninvolved workers, the MEI, and the population within a 50-mile (80-kilometer) radius. Although sulfur dioxide is not known to be present in MDA B, an accident was postulated in which a quantity of the gas would be released. This postulated accident could result in concentrations of sulfur dioxide in excess of the Emergency Response Planning Guideline (ERPG)-3 out to 111 feet (34 meters) (DOE 2005e). The MDA B MEI distance is 148 feet (45 meters). The ERPG-2 distance would be approximately 270 feet (80 meters). **Table 3–32** summarizes the potential impacts of the options for remediation, cleanup, and Consent Order actions.

Table 3–32 Summary of Impacts for Major Material Disposal Area Remediation, Canyon Cleanups, and Other Consent Order Actions

Resource Area	*Capping Option*	*Removal Option*
Land Resources	*Land Use* – Temporary commitment of land may be required to support remediation. Future use of the MDAs would remain restricted because capping would stabilize rather than remove existing contamination. *Visual Environment* – Temporary adverse impacts would result from capping activities. Borrow pit in TA-61 would become more visible.	*Land Use* – Temporary commitment of land may be required to support remediation. Decontamination would provide expanded opportunities for future use of some lands. *Visual Environment* – Temporary adverse impacts would result from removal activities. Borrow pit in TA-61 would become more visible.
Geology and Soils	Up to 2.5 million cubic yards of soil and rock would be required for capping; most material would be available from LANL sources. Covers for the MDAs would be contoured and provided with run-on and run-off control measures. Contamination within the subsurface of the MDAs and in the immediate vicinities would be fixed in-place except for contaminated gases or vapors.	Up to 2.2 million cubic yards of soil and rock would be required for fill and cover material; most would be available from LANL sources. Complete removal of the MDAs would eliminate the susceptibility of buried materials to erosional or other geological processes. Existing soil contamination in the vicinity of the MDAs would be greatly reduced, and contaminated soil or gas would be largely eliminated.
Water Resources	Few, if any impacts to surface water or groundwater from site investigations. Final MDA covers would minimize surface water run-on, runoff, erosion, and could protect surface and groundwater resources.	Few, if any, impacts to surface or groundwater from site investigations. There would be much less contamination in soils and sediments that could present a risk to water quality.

Resource Area	Capping Option	Removal Option
Air Quality and Noise	*Air Quality* – Minor to moderate impacts from releases of airborne pollutants caused by heavy equipment used in remediation and trucks hauling materials. Increased potential for particulate matter release from TA-61 borrow pit. *Noise* – Minor to moderate increase in traffic noise associated with remediation.	*Air Quality* – Larger releases of airborne pollutants than Capping Option from additional vehicles and heavy equipment. Comparable particulate matter release. The potential for long-term release of volatile organic compounds from the MDAs would be greatly reduced, if not eliminated. *Noise* – Temporary increase in noise in vicinity of remediation. Minor to moderate increase in traffic noise associated with remediation.
Ecological Resources	Temporary localized, construction-type impacts during site investigations and remediation. In a few cases, remediation activities may affect, but are not likely to adversely affect, the Mexican spotted owl, bald eagle, and southwestern willow flycatcher. Possible loss of habitat at the TA-61 borrow pit, including undeveloped buffer and core habitat for the Mexican spotted owl. Expansion of the borrow pit would require consultation with the U.S. Fish and Wildlife Service.	
Human Health	Radiological and nonradiological risks to workers would be minor. There would be no risk to the public during MDA capping, while future risks would be reduced.	Radiological and nonradiological risks to workers would be increased. There would be small risk to the public during MDA removal, while future risks would be greatly reduced.
Cultural Resources	No archaeological resources are located within any of the MDAs. Few or no risks to cultural resources at potential release sites. All work would be coordinated with LANL personnel responsible for preservation of cultural resources.	
Socioeconomics and Infrastructure	*Socioeconomics* – Marginal increases in employment, personal income, and other economic measures. *Infrastructure* – Marginal increases in utility usage.	*Socioeconomics* –Increases anticipated in employment, personal income, and other economic measures. *Infrastructure* – Increases in utility infrastructure demands.
Waste Management	280 cubic yards of transuranic waste; 20,000 cubic yards of low-level radioactive waste; 1,800 cubic yards of mixed low-level radioactive waste; 47,000 cubic yards of solid waste; and 50 million pounds of chemical waste. Sufficient capacity would exist at LANL to dispose of the low-level radioactive waste.	22,000 cubic yards of transuranic waste; 1,000,000 cubic yards of low-level radioactive waste; 180,000 cubic yards of mixed low-level radioactive waste; 130,000 cubic yards of solid waste; and 97 million pounds of chemical waste. This volume of low-level radioactive waste may require use of some offsite disposal capacity.
Transportation	Increase in shipments of waste and bulk materials on onsite and offsite roads would not be expected to result in any LCFs among workers or the public from radiation exposure during waste transport, nor traffic fatalities from accidents.	Large increase in shipments of waste and bulk materials on onsite and offsite roads would not be expected to result in any LCFs among workers or the public from radiation exposure during waste transport, but could result in traffic fatalities.
Environmental Justice	No disproportionately high and adverse impacts on minority or low-income populations.	
Facility Accidents	Low risks of accidents involving radioactive or hazardous materials.	Postulated facility accident with the highest radiological impacts would result in an LCF risk of 1 in 210 for a noninvolved worker; 1 in 1,500 for the MEI; and 1 in 220 for the population within a 50-mile radius. Postulated facility accident with the highest chemical impacts would result in concentrations of sulfur dioxide exceeding ERPG-3 out to 111 feet; ERPG-2 out to 270 feet.

MDA = material disposal area; TA = technical area; LCF = latent cancer fatality; MEI = maximally exposed individual.
ERPG = Emergency Response Planning Guideline.
Note: To convert cubic yards to cubic meters, multiply by 0.76456; feet to meters, multiply by 0.3048; miles to kilometers, multiply by 1.6093; pounds to kilograms, multiply by 0.45359.

Summary of Impacts for Security-Driven Transportation Modifications Project

This proposed project would restrict privately owned vehicles (according to their security level) along portions of Pajarito Corridor West between TA-48 and TA-63. The project would involve constructing new roadways, parking lots, pedestrian and vehicle bridges across Ten Site Canyon, and security check points. Auxiliary actions are also being considered that would construct bridges across Mortandad and Sandia Canyons. **Table 3–33** summarizes the potential impacts of these activities.

Table 3–33 Summary of Impacts for the Security-Driven Transportation Modifications Project

Resource Area	*Impact Summary*	
	Proposed Action	***Auxiliary Actions***
Land Resources	*Land Use* – Development of portions of the Pajarito Corridor West would be within current land use plans. *Visual Environment* – Temporary construction impacts. Permanent, pronounced changes to views from parking lots and pedestrian and vehicle bridges across Ten Site Canyon.	*Land Use* – The route for Auxiliary Action A would represent a change in land use but would be within the scope of the LANL Comprehensive Site Plan. The route for Auxiliary Action B would be partially within current land use plans. *Visual Environment* – Permanent, pronounced changes to views from proposed bridges over Mortandad and Sandia Canyons.
Geology and Soils	Temporary construction-related impacts. Approximately 238,000 cubic yards of soil and rock would be disturbed during construction. Up to 26,000 cubic yards of soil and rock would be disturbed if both auxiliary actions are implemented.	
Water Resources	Temporary construction-related impacts.	
Air Quality and Noise	*Air Quality* – Temporary construction-related impacts. Minor increase in vehicle emissions during operation. *Noise* – Temporary construction-related impacts. Minor increase in traffic noise in vicinity of new roads and bus routes during operation.	*Air Quality* – Temporary construction-related impacts. Minor increase in vehicle emissions during operation. *Noise* – Temporary construction-related impacts. Minor increase in traffic noise in vicinity of new roads and bus routes during operation.
Ecological Resources	Temporary construction-related impacts. Up to 30 acres of habitat loss from parking lot and bridge construction. Construction of a span bridge across Ten Site Canyon would be unlikely to cause adverse affects to the Mexican spotted owl.	Temporary construction-related impacts. Proposed Auxiliary Action A construction falls within Areas of Environmental Interest core and buffer zones for the Mexican spotted owl, and would disturb up to 25.4 acres of habitat. Proposed Auxiliary Action B construction falls within Areas of Environmental Interest buffer zone for the Mexican spotted owl, and would disturb 67.1 acres of habitat. Potentially adverse impacts on owls from traffic noise and light. Implementation of either Auxiliary Action would necessitate consultation with the U.S. Fish and Wildlife Service.
Human Health	No or negligible impact.	
Cultural Resources	Proposed bridges could adversely affect views of Ten Site Canyon from nearby Traditional Cultural Properties.	Further detailed analysis would be required once the exact bridge locations are determined to ensure protection of prehistoric and historic sites located to the east and west of the proposed bridge corridor. Proposed bridges could adversely affect views of Mortandad and Sandia Canyons from nearby Traditional Cultural Properties.
Socioeconomics and Infrastructure	*Socioeconomics* – No impacts identified. *Infrastructure* – Temporary construction-related impacts. Some existing utilities might require relocation or rerouting.	
Waste Management	Approximately 1,260 cubic yards of construction debris.	Approximately 160 cubic yards under Auxiliary Action A, and 110 cubic yards under Auxiliary Action B, of construction debris.
Transportation	Some temporary and intermittent disruption of traffic during construction of new roads and bridges. Traffic patterns would be permanently altered, but impacts would be minor.	
Environmental Justice	No or negligible impact.	

Note: To convert cubic yards to cubic meters, multiply by 0.76456; acres to hectares, multiply by 0.40469.

The most consequential impacts from implementing this project would be on the visual environment and the Mexican spotted owl. The removal of open and forested land under the Proposed Action would add to the overall developed appearance of the Pajarito Corridor West as viewed from nearby and higher elevations to the west. The construction of both vehicle and pedestrian bridges across Ten Site Canyon under the Proposed Action, and Mortandad and Sandia Canyons under the auxiliary actions, would be major changes to the landscape. While careful site selection and bridge design would help mitigate visual impacts, the bridges would nevertheless alter the natural appearance of the canyons as viewed from both nearby and distant locations. The proposed bridges could adversely affect views of the three canyons from nearby traditional cultural properties. Bridges constructed across Mortandad and Sandia Canyons would pass through Areas of Environmental Interest for the Mexican spotted owl. Habitat would be lost as a result of the proposed and auxiliary actions, and the light and noise from traffic could create adverse effects. The U.S. Fish and Wildlife Service has determined that, provided reasonable and prudent measures are taken, construction of a span bridge over Ten Site Canyon would be unlikely to cause adverse affects to the Mexican spotted owl. Additional consultation with the U.S. Fish and Wildlife Service would be needed for the proposed action if a land rather than span bridge was to be used, and for the auxiliary actions once the exact locations and designs of the optional bridges over Mortandad and Sandia Canyons are better known.

Summary of Impacts for Nicholas C. Metropolis Center for Modeling and Simulation Increase in Level of Operations

This project would expand the computing capabilities of the Metropolis Center to support a 100-teraflops capability at a minimum, and could approach 1,000 teraflops (1 petaflops). This action would add mechanical and electrical equipment, including chillers, cooling towers, and air-conditioning units. **Table 3–34** summarizes the potential impacts of these activities.

The level to which operations could increase would be limited by the amount of electricity (15 megawatts) and water (51 million gallons [193 million liters] per year) needed to support the increased capabilities. Because each new generation of computing capability machinery continues to be designed with increased computational speed and enhanced efficiency in cooling water and electrical requirements, it is anticipated that higher computing capabilities could be achieved within these limitations. Planned improvements to the Sanitary Effluent Recycling Facility should increase its effectiveness in supplying the Metropolis Center with cooling water. Accordingly, the Metropolis Center's reliance on groundwater is expected to diminish substantially.

Table 3–34 Summary of Impacts for Nicholas C. Metropolis Center for Modeling and Simulation Increase in Level of Operations

Resource Area	*Impact Summary*
Land Resources	*Land Use* – No or negligible impact. *Visual Environment* – No or negligible impact.
Geology and Soils	No or negligible impact.
Water Resources	Discussed in infrastructure.
Air Quality and Noise	No or negligible impact.
Ecological Resources	No or negligible impact.
Human Health	No or negligible impact.
Cultural Resources	No or negligible impact.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – Water usage would expand to 51 million gallons per year, which would not exceed available water supply capacities. Electrical demand would increase to 15 megawatts, which would not exceed available electrical supply capacities.
Waste Management	No or negligible impact.
Transportation	No or negligible impact
Environmental Justice	No or negligible impact.
Facility Accidents	No or negligible impact.

Note: To convert gallons to liters, multiply by 3.7854.

Summary of Impacts for Increase in Type and Quantity of Sealed Sources Managed at LANL by the Off-Site Source Recovery Project

This proposed project would expand the types and quantities of sealed sources that could be managed at LANL by the Off-Site Source Recovery Project. The proposed project would continue the current approach of providing safe storage of sealed sources at LANL when other reasonable options for disposition, such as reuse or commercial disposal, are not available. The only impacts resulting from these activities would result from exposure to the radioactive sources during normal operations and postulated accidents. Under normal conditions, the sealed sources would be completely contained and would contribute only to external radiation exposure. Proper shielding and radiation control procedures would minimize worker exposure. Noninvolved workers and the public would not be expected to receive any measurable dose during normal operations.

For purposes of analysis, potential bounding accident scenarios were assessed for an aircraft crash with fire at Area G at TA-54, as well as a seismic event with fire at Wing 9 of the Chemistry and Metallurgy Research Building. Consequences of the Wing 9 event also were calculated for a release emanating from TA-48 because the Radiological Sciences Institute that would be built in TA-48 would provide a replacement for the Chemistry and Metallurgy Research Building Wing 9 hot cell. None of these accidents would result in a fatal dose to the noninvolved worker, the MEI, or the population within a 50-mile (80-kilometer) radius. The highest LCF risk to the population would result from an accident at Wing 9 of the Chemistry and Metallurgy Research Building with consequences calculated at TA-3. This postulated accident could result in an increase in LCF risk of approximately 1 chance in 6 million for the noninvolved worker, 1 chance in 70 million for the MEI, and 1 chance in 600 for the population within a 50-mile (80-kilometer) radius.

Potential mitigation measures could include placing sealed sources at locations where they would not be susceptible to damage from an aircraft crash, fire, or seismic event (kept underground); or instituting lower limits for maximum allowable source radioisotope activity in shipping containers, the TA-54 dome, and Wing 9 of the Chemistry and Metallurgy Research Building. **Table 3–35** summarizes the potential impacts from increasing the scope of the Off-Site Source Recovery Project at LANL.

Table 3–35 Summary of Impacts for Increase in Type and Quantity of Sealed Sources Managed at Los Alamos National Laboratory by the Off-Site Source Recovery Project

Resource Area	*Impact Summary*
Land Resources	*Land Use* – No or negligible impact. *Visual Environment* – No or negligible impact.
Geology and Soils	No or negligible impact.
Water Resources	No or negligible impact.
Air Quality and Noise	*Air Quality* – No or negligible impact. *Noise* – Temporary construction-related impacts from construction and burial activities.
Ecological Resources	No or negligible impact.
Human Health	Involved worker doses would be maintained below their regulatory and administrative limits through use of shielding, safe work practices, procedures, and personal protective equipment. Noninvolved workers and the public would not be expected to receive any measurable doses during normal operations.
Cultural Resources	No or negligible impact.
Socioeconomics and Infrastructure	*Socioeconomics* – No or negligible impact. *Infrastructure* – No impacts identified.
Waste Management	No impacts identified.
Transportation	No or negligible impact.
Environmental Justice	No or negligible impact.
Facility Accidents	Postulated accidents could result in an increase in LCF risk to the noninvolved worker, the MEI, and population within 50-mile radius. Highest LCF risk to population would be from a CMR Building Wing 9 accident.

LCF = latent cancer fatality; MEI = maximally exposed individual; CMR = Chemistry and Metallurgy Research.
Note: To convert miles to kilometers, multiply by 1.6093.