DOE/EIS-0161

Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling

Executive Summary

United States Department of Energy
Office of Reconfiguration

October 1995

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Attention: Final Programmatic Environmental Impact Statement for
Tritium Supply and Recycling, Executive Summary.

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Department of Energy
Washington, DC 20585

October 19, 1995

Dear Interested Party:

The Final Programmatic Environmental Impact Statement (PEIS) for Tritium Supply and Recycling has now been completed. Tritium is an essential component of every warhead in the current and projected United States nuclear weapons stockpile. Tritium decays at a rate of 5.5 percent per year and must be replaced periodically as long as the Nation relies on a nuclear deterrent. In accordance with the Atomic Energy Act of 1954, as amended, the Department of Energy is responsible for developing and maintaining the capability to produce nuclear materials such as tritium. Currently, the Department does not have the capability to produce tritium in the required amounts.

The Tritium Supply and Recycling PEIS evaluates the siting, construction, and operation of tritium supply technology alternatives and recycling facilities at each of five candidate sites. The PEIS also evaluates the use of a commercial reactor for producing tritium.

On October 10, 1995, the Department announced its preferred alternative, a dual-track strategy under which the Department would begin work on two promising production options: use of an existing commercial light water reactor and construction of a linear accelerator. The Savannah River Site in South Carolina has been identified as the preferred site for an accelerator, should one be constructed. Details on this preferred alternative can be found in the Executive Summary and in section 3.7 of Volume I of the PEIS. A Record of Decision will follow in late November.

The Department of Energy appreciates your continued participation in this Program.

Sincerely,

Stephen M. Sohinki, Director
Office of Reconfiguration

DOE/EIS-0161

Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling

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United States Department of Energy
Office of Reconfiguration

October 1995

Changes to the Draft PEIS that are less than a paragraph, are shown in double underline in this Final PEIS. Larger text changes are shown by sidebar notation.

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy

COOPERATING AGENCY: U.S. Environmental Protection Agency

TITLE: Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling (DOE/EIS-0161).

CONTACT: For additional information on this statement, write or call:

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For general information on the DOE *National Environmental Policy Act* process, write or call:

Ms. Carol M. Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585
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ABSTRACT: Tritium, a radioactive gas used in all of the Nation's nuclear weapons, has a short half-life and must be replaced periodically in order for the weapon to operate as designed. Currently, there is no capability to produce the required amounts of tritium within the Nuclear Weapons Complex.

The PEIS for Tritium Supply and Recycling evaluates the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at each of five candidate sites: the Idaho National Engineering Laboratory, the Nevada Test Site, the Oak Ridge Reservation, the Pantex Plant, and the Savannah River Site. Alternatives for new tritium supply and recycling facilities consist of four different tritium supply technologies: Heavy Water Reactor, Modular High Temperature Gas-Cooled Reactor, Advanced Light Water Reactor, and Accelerator Production of Tritium. The PEIS also evaluates the impacts of the DOE purchase of an existing operating or partially completed commercial light water reactor or the DOE purchase of irradiation services contracted from commercial power reactors. Additionally, the PEIS includes an analysis of multipurpose reactors that would produce tritium, dispose of plutonium, and produce electricity.

Evaluation of impacts on land resources, site infrastructure, air quality and acoustics, water resources, geology and soils, biotic resources, cultural and paleontological resources, socioeconomics, radiological and hazardous chemical impacts during normal operation and accidents to workers and the public, waste management, and intersite transport are included in the assessment.

PUBLIC COMMENTS: In preparing the Final PEIS, DOE considered comments received by mail, fax, handed in at hearings, transcribed from messages recorded by telephone, and those transmitted via Internet. In addition, interactive public hearings were held in April 1995 at the following locations where comments and concerns identified during discussions were summarized by notetakers: Washington, DC; Las Vegas, Nevada; Oak Ridge, Tennessee; Pocatello, Idaho; North Augusta, South Carolina; and Amarillo, Texas.

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Acronyms

APT	Accelerator Production of Tritium
ALWR	Advanced Light Water Reactor
CEQ	Council on Environmental Quality
DOE	Department of Energy
DP	DOE Office of the Assistant Secretary for Defense Programs
ES&H	environment, safety, and health
HLW	high-level waste
HWR	Heavy Water Reactor
INEL	Idaho National Engineering Laboratory
IP	implementation plan
LLW	low-level waste
MHTGR	Modular High Temperature Gas-Cooled Reactor
NEPA	*National Environmental Policy Act* of 1969
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
ORR	Oak Ridge Reservation
PEIS	programmatic environmental impact statement
ROD	Record of Decision
SRS	Savannah River Site
TRU	transuranic

EXECUTIVE SUMMARY

INTRODUCTION

In January 1991, the Secretary of Energy announced that the Department of Energy (DOE) Office of the Assistant Secretary for Defense Programs (DP) would prepare a programmatic environmental impact statement (PEIS) examining alternatives for the reconfiguration of the Nation's Nuclear Weapons Complex (Complex) (figure ES–1). The framework for the Reconfiguration PEIS was described in the January 1991 *Nuclear Weapons Complex Reconfiguration Study,* a detailed examination of alternatives for the future Complex. Because of the significant changes in the world since January 1991, especially with regard to projected future requirements for the United States nuclear weapons stockpile, the framework described in the *Nuclear Weapons Reconfiguration Study* does not exist today. Therefore, the Department separated the Reconfiguration PEIS into two PEISs: a PEIS for Tritium Supply and Recycling; and a Stockpile Stewardship and Management PEIS. The Tritium Supply and Recycling Proposal is analyzed in this PEIS. The Stockpile Stewardship and Management Proposal is currently being analyzed in a separate PEIS being prepared by DP.

Another issue, which was once part of reconfiguration, was the storage of all weapons-usable fissile materials, primarily highly enriched uranium and plutonium. In early 1994 the Secretary established a Department-wide program for developing recommendations and for directing implementation of decisions concerning disposition of excess nuclear materials. This program was recognized in the FY 1995 *Defense Authorization Bill* which directed that an office be established for this purpose.

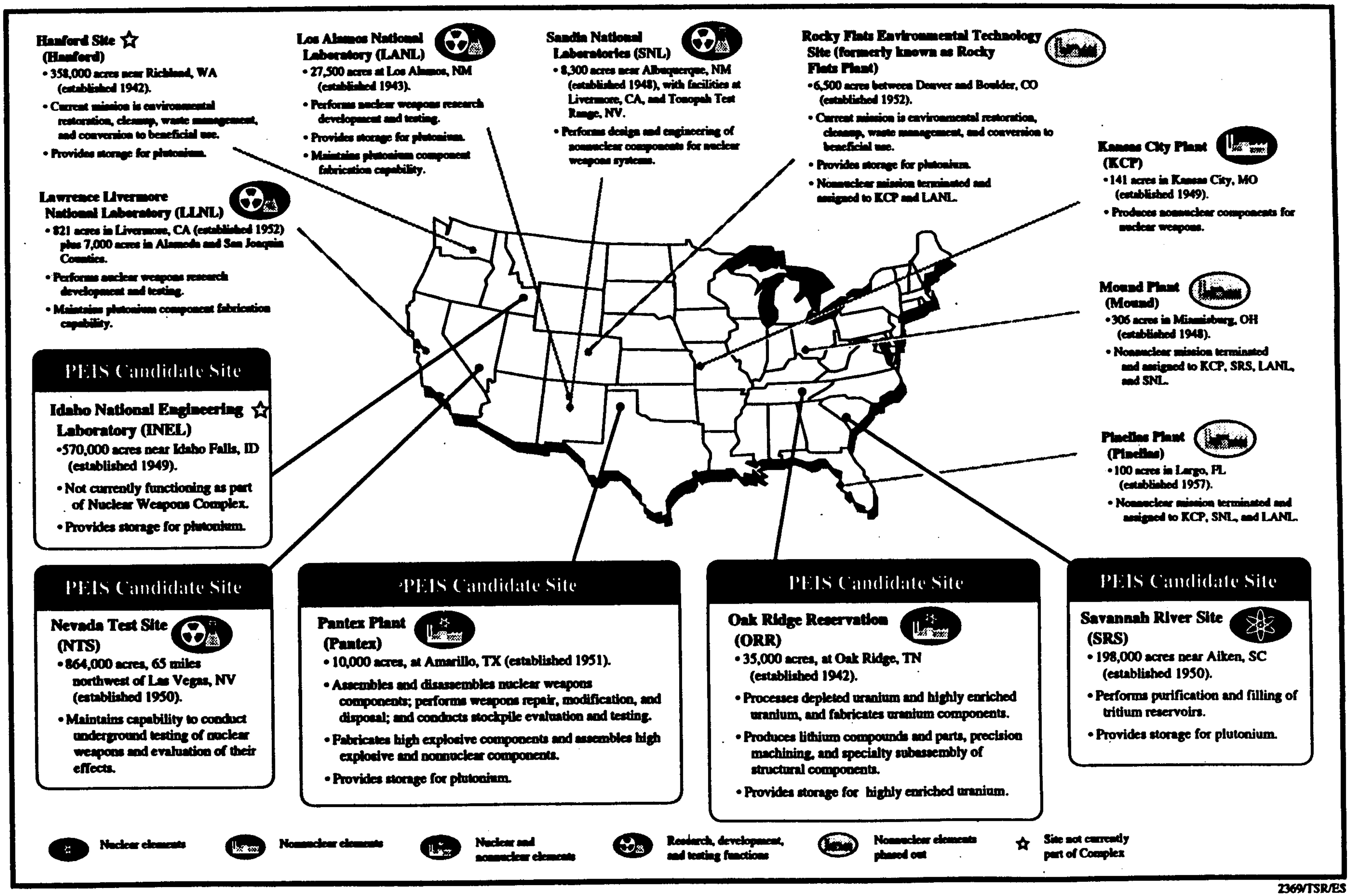
A determination was made that a PEIS was needed to support the decision-making for disposition of surplus weapons-usable fissile materials. Since long-term storage is so closely related (connected) to disposition, the long-term storage analysis that had been part of the Reconfiguration PEIS was moved into the program for Long-Term Storage and Disposition of Weapons-Usable Fissile Materials. As a result, a third PEIS, the *Long Term Storage and Disposition of Weapons-Usable Fissile Materials PEIS*, is being prepared to analyze alternatives for the long-term storage of all weapons-usable fissile materials, primarily highly-enriched uranium and plutonium. That PEIS will also address the disposition of plutonium declared surplus to national defense needs by the President. An EIS for the disposition of surplus highly enriched uranium is also being prepared.

TRITIUM SUPPLY AND RECYCLING PROPOSAL

DOE proposes to provide tritium supply and recycling facilities for the Complex. Tritium, a man-made radioactive isotope of hydrogen, is an essential component of every warhead in the current and projected U.S. nuclear weapons stockpile. These warheads depend on tritium to perform as designed. Tritium decays at a rate of 5.5 percent per year and must be replaced periodically as long as the Nation relies on a nuclear deterrent. Currently, the Complex does not have the capability to produce the required amounts of tritium, yet projections require that new tritium be available by approximately 2011. The *Tritium Supply and Recycling Programmatic Environmental Impact Statement* evaluates the siting, construction, and operation of tritium supply technology alternatives and recycling facilities at each of five candidate sites: the Idaho National Engineering Laboratory (INEL), the Nevada Test Site (NTS), the Oak Ridge Reservation (ORR), the Pantex Plant, and the Savannah River Site (SRS). The PEIS assesses the environmental impacts of all reasonable alternatives discussed in the following section, including No Action.

Tritium supply deals with the production of new tritium in either a reactor or an accelerator (by irradiating target materials with neutrons) and the subsequent extraction of the tritium in pure form for its use in nuclear weapons. Tritium recycling consists of recovering residual tritium from weapons components, purifying it, and refilling weapons components with both recovered and new tritium when it becomes available.

Under the No Action alternative, DOE would not establish a new tritium supply capability. The current



Hanford Site ☆ (Hanford)
- 358,000 acres near Richland, WA (established 1942).
- Current mission is environmental restoration, cleanup, waste management, and conversion to beneficial use.
- Provides storage for plutonium.

Los Alamos National Laboratory (LANL)
- 27,500 acres at Los Alamos, NM (established 1943).
- Performs nuclear weapons research development and testing.
- Provides storage for plutonium.
- Maintains plutonium component fabrication capability.

Sandia National Laboratories (SNL)
- 8,300 acres near Albuquerque, NM (established 1948), with facilities at Livermore, CA, and Tonopah Test Range, NV.
- Performs design and engineering of nonnuclear components for nuclear weapons systems.

Rocky Flats Environmental Technology Site (formerly known as Rocky Flats Plant)
- 6,500 acres between Denver and Boulder, CO (established 1952).
- Current mission is environmental restoration, cleanup, waste management, and conversion to beneficial use.
- Provides storage for plutonium.
- Nonnuclear mission terminated and assigned to KCP and LANL.

Lawrence Livermore National Laboratory (LLNL)
- 821 acres in Livermore, CA (established 1952) plus 7,000 acres in Alameda and San Joaquin Counties.
- Performs nuclear weapons research development and testing.
- Maintains plutonium component fabrication capability.

Kansas City Plant (KCP)
- 141 acres in Kansas City, MO (established 1949).
- Produces nonnuclear components for nuclear weapons.

Mound Plant (Mound)
- 306 acres in Miamisburg, OH (established 1948).
- Nonnuclear mission terminated and assigned to KCP, SRS, LANL, and SNL.

Pinellas Plant (Pinellas)
- 100 acres in Largo, FL (established 1957).
- Nonnuclear mission terminated and assigned to KCP, SNL, and LANL.

PEIS Candidate Site

Idaho National Engineering Laboratory (INEL) ☆
- 570,000 acres near Idaho Falls, ID (established 1949).
- Not currently functioning as part of Nuclear Weapons Complex.
- Provides storage for plutonium.

PEIS Candidate Site

Nevada Test Site (NTS)
- 864,000 acres, 65 miles northwest of Las Vegas, NV (established 1950).
- Maintains capability to conduct underground testing of nuclear weapons and evaluation of their effects.

PEIS Candidate Site

Pantex Plant (Pantex)
- 10,000 acres, at Amarillo, TX (established 1951).
- Assembles and disassembles nuclear weapons components; performs weapons repair, modification, and disposal; and conducts stockpile evaluation and testing.
- Fabricates high explosive components and assembles high explosive and nonnuclear components.
- Provides storage for plutonium.

PEIS Candidate Site

Oak Ridge Reservation (ORR)
- 35,000 acres, at Oak Ridge, TN (established 1942).
- Processes depleted uranium and highly enriched uranium, and fabricates uranium components.
- Produces lithium compounds and parts, precision machining, and specialty subassembly of structural components.
- Provides storage for highly enriched uranium.

PEIS Candidate Site

Savannah River Site (SRS)
- 198,000 acres near Aiken, SC (established 1950).
- Performs purification and filling of tritium reservoirs.
- Provides storage for plutonium.

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FIGURE ES–1.—*Current and Former Nuclear Weapons Complex Sites.*

inventory of tritium would decay and DOE would not meet stockpile requirements of tritium. This would be contrary to DOE's mission as specified by the *Atomic Energy Act* of 1954, as amended. Alternatives for new tritium supply and recycling facilities consist of four different tritium supply technologies and five locations as shown in figure ES–2. The four technologies proposed to provide a new supply of tritium are Heavy Water Reactor (HWR), Modular High Temperature Gas-Cooled Reactor (MHTGR), Advanced Light Water Reactor (ALWR), and Accelerator Production of Tritium (APT). Both Large (1,300 MWe) and Small (600 MWe) options for the ALWR are evaluated as well as a phased approach for the APT. The use of an existing commercial light water reactor that would be used for irradiation services or purchased and converted for tritium production is also included as an alternative for long-term tritium supply.

Tritium Supply and Recycling Proposal:

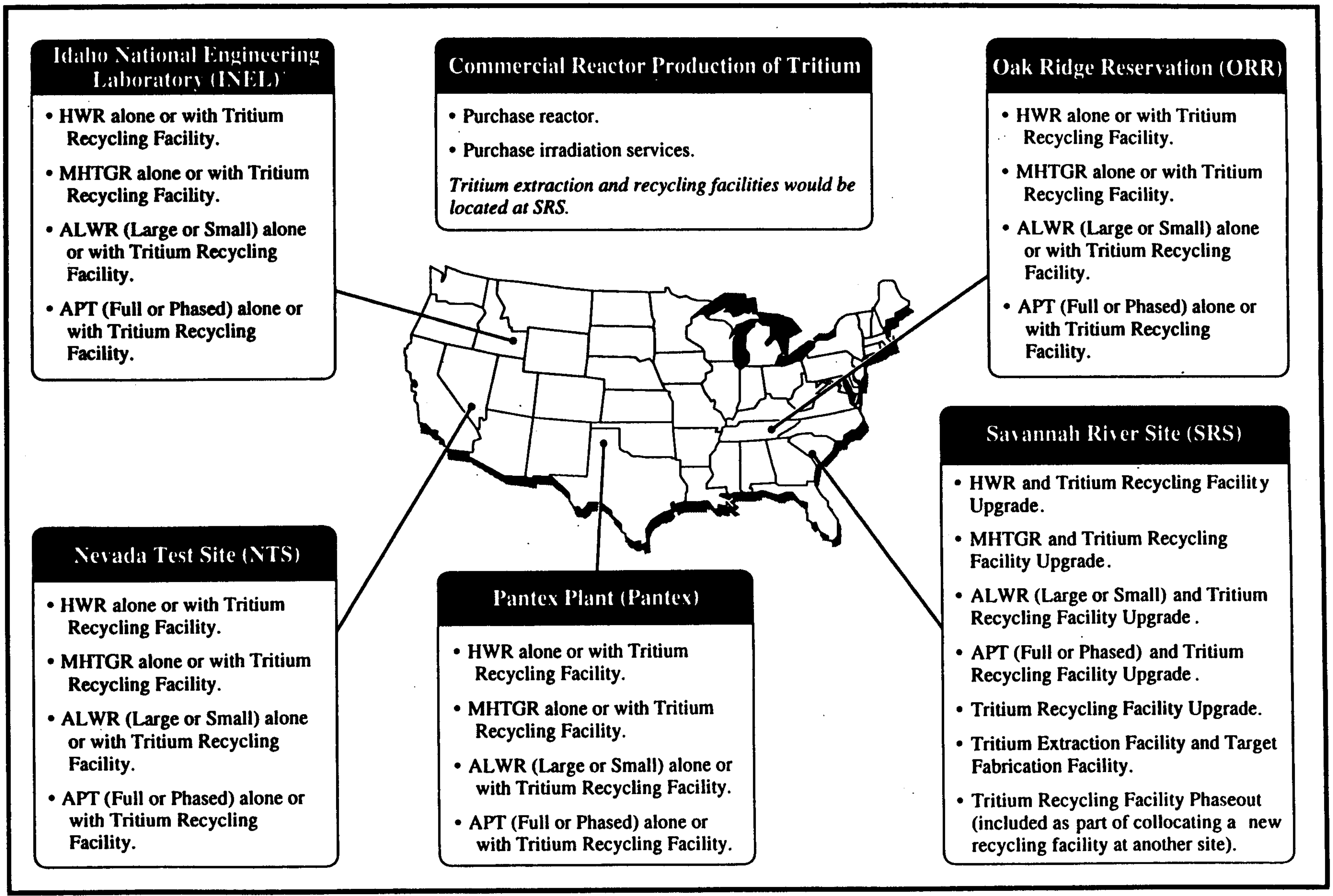
- **Provide the long-term, assured supply of tritium.**
- **Safely and reliably fulfill all future national defense requirements for tritium.**
- **Protect the health of workers, the general public, and the environment.**

Additionally, the *PEIS for Tritium Supply and Recycling* includes an assessment of the environmental impacts associated with using one or more commercial light water reactors for tritium production as a contingency in the event of a national emergency. Specific commercial reactors are not identified in the PEIS.

This PEIS also addresses the environmental impacts of an ALWR or modular gas-cooled reactor used as a multipurpose reactor. A commercial reactor could also be used as a multipurpose reactor. Throughout the PEIS, references to and discussion of impacts for the multipurpose ALWR are also applicable to a multipurpose commercial reactor. A multipurpose ("triple play") reactor is defined as one capable of producing tritium, "burning" plutonium, and generating revenues through the sale of electric power. The multipurpose ALWR would operate the same as the uranium-fueled tritium production ALWR. Therefore, the environmental impacts from operation of a multipurpose ALWR would be expected to be similar to those from the tritium production ALWR. However, a plutonium Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to provide the mixed-oxide fuel rods for the ALWR multipurpose reactor and would be the major contributor to potential environmental impacts greater than those for a uranium-fueled tritium production ALWR for this scenario. For a modular gas-cooled multipurpose reactor, twice as many reactor modules would be needed both to meet tritium requirements and to burn plutonium. A plutonium Pit Disassembly/Conversion/Fuel Fabrication Facility also would be needed. Thus, the potential environmental impacts for a multipurpose gas-cooled reactor are expected to be substantially greater than a uranium-fueled tritium production gas-cooled reactor.

The PEIS evaluates alternative tritium supply technologies against a baseline tritium requirement (i.e., a specific quantity of tritium, the exact amount of which is classified). Understanding the concept of the baseline tritium requirement is crucial to understanding the alternatives and the analysis in the PEIS. The baseline tritium requirement is the amount necessary to support the 1994 *Nuclear Weapons Stockpile Plan*, which is based on a START II stockpile level of approximately 3,500 accountable weapons. In the PEIS, the baseline tritium requirement is approximately 3/8ths the tritium requirement that was analyzed in the New Production Reactor Draft EIS published in April 1991. This is the tritium requirement "baseline" which the tritium supply technologies must support, and against which they are assessed.

This baseline tritium requirement is made up of two specific components: (1) a steady-state tritium requirement to make up for tritium lost through natural decay; and (2) a surge tritium requirement to replace any tritium which might be used in the event the Nation ever dipped into, or lost, its tritium reserve. The sizing of the surge capacity is based on the requirement set forth in the *Nuclear Weapons Stockpile Plan* to reconstitute the entire reserve in a



Idaho National Engineering Laboratory (INEL)

- HWR alone or with Tritium Recycling Facility.
- MHTGR alone or with Tritium Recycling Facility.
- ALWR (Large or Small) alone or with Tritium Recycling Facility.
- APT (Full or Phased) alone or with Tritium Recycling Facility.

Commercial Reactor Production of Tritium

- Purchase reactor.
- Purchase irradiation services.

Tritium extraction and recycling facilities would be located at SRS.

Oak Ridge Reservation (ORR)

- HWR alone or with Tritium Recycling Facility.
- MHTGR alone or with Tritium Recycling Facility.
- ALWR (Large or Small) alone or with Tritium Recycling Facility.
- APT (Full or Phased) alone or with Tritium Recycling Facility.

Savannah River Site (SRS)

- HWR and Tritium Recycling Facility Upgrade.
- MHTGR and Tritium Recycling Facility Upgrade.
- ALWR (Large or Small) and Tritium Recycling Facility Upgrade.
- APT (Full or Phased) and Tritium Recycling Facility Upgrade.
- Tritium Recycling Facility Upgrade.
- Tritium Extraction Facility and Target Fabrication Facility.
- Tritium Recycling Facility Phaseout (included as part of collocating a new recycling facility at another site).

Nevada Test Site (NTS)

- HWR alone or with Tritium Recycling Facility.
- MHTGR alone or with Tritium Recycling Facility.
- ALWR (Large or Small) alone or with Tritium Recycling Facility.
- APT (Full or Phased) alone or with Tritium Recycling Facility.

Pantex Plant (Pantex)

- HWR alone or with Tritium Recycling Facility.
- MHTGR alone or with Tritium Recycling Facility.
- ALWR (Large or Small) alone or with Tritium Recycling Facility.
- APT (Full or Phased) alone or with Tritium Recycling Facility.

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FIGURE ES–2.—*Tritium Supply and Recycling Alternatives.*

5-year period. The steady-state component accounts for approximately 50 percent of the baseline tritium requirement, while the surge accounts for the remaining 50 percent. Tritium supply technologies being evaluated must be able to support the steady-state tritium requirement (a specific quantity of tritium every year), and make up for any lost tritium reserves.

Time Frame of Proposed Action:

- **1999 to 2009—Construction**
- **2010—Initial Operation**
- **2010 to 2050—Full Operation**

The Tritium Supply and Recycling Proposal will proceed in three phases. The first phase involves preparing information to support programmatic decisions on siting and technology. This includes preparing this PEIS and the associated Record of Decision (ROD). The ROD may include the following programmatic decisions:

- Whether to build new tritium supply and new or upgraded tritium recycling facilities;
- Where to locate new tritium supply and recycling facilities; and
- Which technologies to employ for tritium supply.

During the second phase, DOE would develop detailed designs and meet project-specific *National Environmental Policy Act* of 1969 (NEPA) requirements which would focus on where the facility would be placed and construction and operation impacts. The third phase would involve constructing, testing, and certifying the selected tritium supply and recycling facilities, leading to full operation. Present planning requires the tritium facilities to be fully operational by the year 2010 with new tritium available for use approximately 1 year later. The PEIS also includes analyses of providing tritium at an earlier date (approximately 2005) to support a higher stockpile level.

Following the PEIS, DOE will develop a schedule for implementing the ROD decision. The schedule will be subject to change and include reassessments required by congressional authorizations and appropriations. Although the individual schedules of any activities or projects may overlap, the current uncertainty associated with any given activity or project requires that assumptions be made regarding the time periods used in the PEIS analyses.

Because of the uncertainties associated with the scheduling of the second and third phases, the PEIS assumes an environmental baseline period for construction between 1999 and 2009, and an operational period, beginning in approximately 2010, of 40 years. Although the design life of the tritium supply and recycling facilities has not yet been determined by engineering studies, the assumption of an operational period of approximately 40 years is consistent with the operating periods used in prior DOE NEPA documents for similar new facilities. Project-level tiered NEPA documents would identify in detail the specific construction and operational periods for each project implemented.

AGENCY PREFERRED ALTERNATIVE

The Council on Environmental Quality (CEQ) Regulations require an agency to identify its preferred alternative(s) in the Final Environmental Impact Statement (40 CFR 1502.14(e)). The preferred alternative is the alternative which the agency believes would fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. Consequently, to identify a preferred alternative, the Department has developed information on potential environmental impacts, costs, technical risks, and schedule risks for the alternatives under consideration.

This PEIS provides information on the environmental impacts. Cost, schedule, and technical analyses have also been prepared, and are summarized in the Tritium Supply and Recycling Technical Reference Report which is available in the appropriate DOE Reading Rooms for public review.

Based upon the analysis presented in the documents identified above, the Department's preferred alternative is a acquisition strategy that assures tritium production for the nuclear weapons stockpile rapidly, cost effectively, and safely. The preferred strategy is to begin work on the two most promising production alternatives: (1) purchase an existing commercial light water reactor or irradiation services with an option to purchase the reactor for conversion to a defense facility; (2) design, build, and test critical components of an accelerator system for tritium production. Within a three year period, the Department would select one of the alternatives to serve as the primary source of tritium. The other alternative, if feasible, would be developed as a back-up tritium source.

Savannah River Site has been designated as the preferred site for an accelerator, should one be built. The preferred alternative for tritium recycling and extraction activities is to remain at the Savannah River Site with appropriate consolidation and upgrading of current facilities, and construction of a new extraction facility.

PURPOSE OF AND NEED FOR THE DEPARTMENT OF ENERGY'S ACTION

Since nuclear weapons came into existence in 1945, a nuclear deterrent has been a cornerstone of the Nation's defense policy and national security. The President reiterated this principle in his July 3, 1993, radio address to the Nation. Tritium was used in the design process to enhance the yield of nuclear weapons and allow for the production of smaller or more powerful warheads to satisfy the needs of modern delivery systems. As a result, the United States' strategic nuclear systems are based on designs that use tritium. Therefore, the Nation requires a reliable tritium supply source. Tritium has a relatively short radioactive half-life of 12.3 years. Because of this relatively rapid radioactive decay, tritium must be replenished periodically in nuclear weapons to ensure that they will function as designed. Over the past 40 years, DOE has built and operated 14 reactors to produce tritium and other nuclear materials for weapons purposes. Today, none of these reactors is operational, and no tritium has been produced since 1988.

Pursuant to the *Atomic Energy Act* of 1954, as amended, DOE is responsible for developing and maintaining the capability to produce nuclear materials such as tritium, which are required for the defense of the United States. The primary use of tritium is for maintaining the Nation's stockpile of nuclear weapons as directed by the President in the *Nuclear Weapons Stockpile Plan*. Figure ES–3 depicts the *Nuclear Weapons Stockpile Plan* process.

Tritium, with a 12.3-year half-life, decays at the rate of approximately 5 percent per year and is necessary for all nuclear weapons that remain in the stockpile.

The *Nuclear Weapons Stockpile Plan* is normally forwarded annually from the Secretaries of the Departments of Energy and Defense via the National Security Council to the President for approval. The *Nuclear Weapons Stockpile Plan* reflects the size and composition of the stockpile needed to defend the United States and provides an assessment of DOE's ability to support the proposed stockpile. Many factors are considered in the development of the *Nuclear Weapons Stockpile Plan*, including the status of the currently approved stockpile, arms control negotiations and treaties, Congressional constraints, and the status of the nuclear material production and fabrication facilities. Revisions of the *Nuclear Weapons Stockpile Plan* could be issued when any of the factors indicate the need to change requirements established in the annual document. The most current *Nuclear Weapons Stockpile Plan*, which was approved by President Clinton on March 7, 1994, authorizes weapons production and retirement through fiscal year 1999. The analysis in this PEIS is based on the requirements of the 1994 *Nuclear Weapons Stockpile Plan* which is based on START II stockpile levels (approximately 3,500 accountable weapons). The 1994 *Nuclear Weapons Stockpile Plan* represents the latest official guidance for tritium requirements. A *Nuclear Weapons Stockpile Plan* for 1995 has not yet been issued. Appendix CA, which is classified, contains quantitative projections for tritium requirements based on the 1994 *Nuclear Weapons Stockpile Plan*, and details of the transportation analysis.

Even with a reduced nuclear weapons stockpile and no identified requirements for new nuclear weapons production in the foreseeable future, an assured long-term tritium supply and recycling capability will be required. Presently, no source of new tritium is available. The effectiveness of the U.S. nuclear deterrent capability depends not only on the Nation's current stockpile of nuclear weapons or those it can produce, but also on its ability to reliably and safely provide the tritium needed to support these weapons.

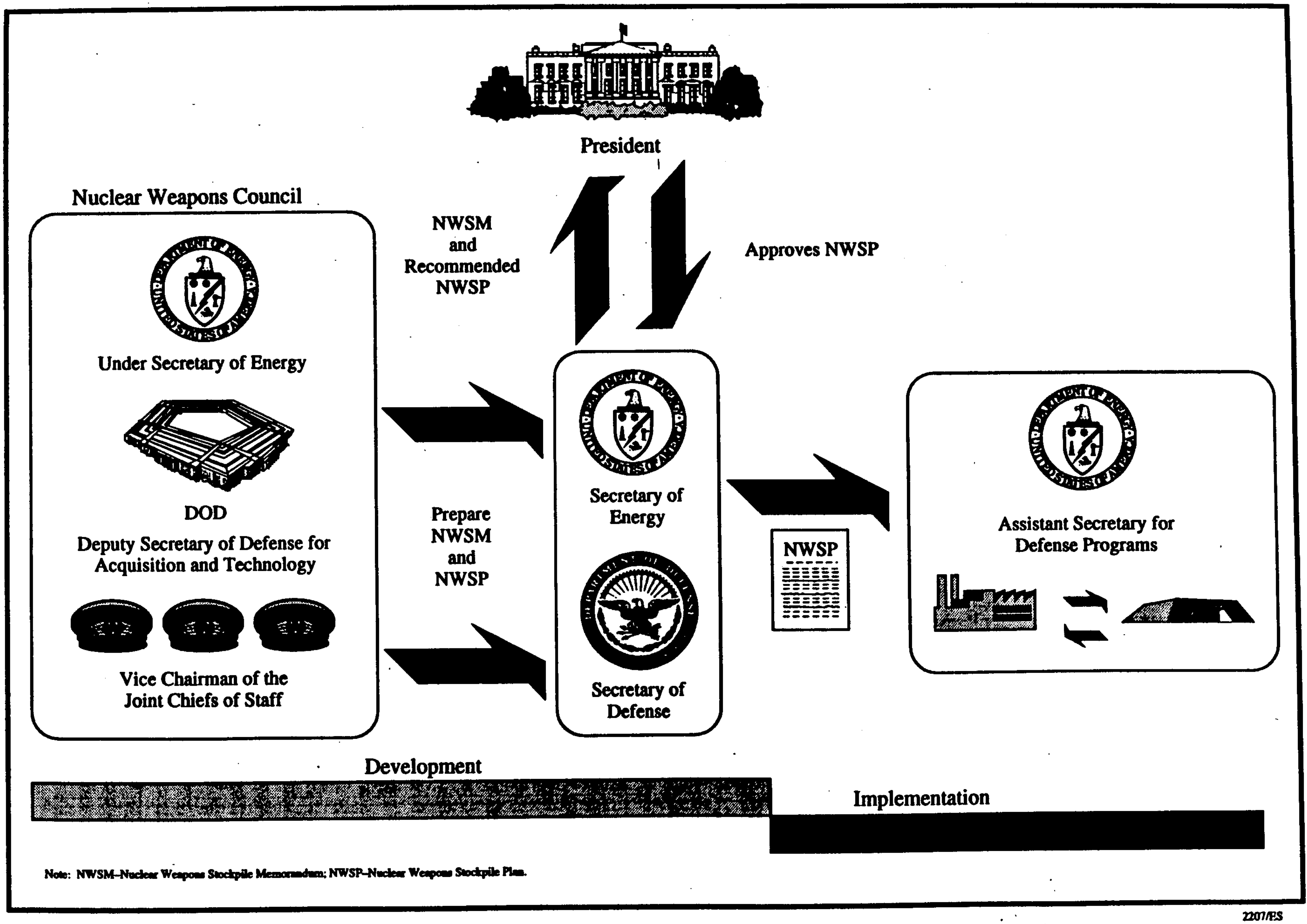
Until a new tritium supply source is operational, DOE will continue to support tritium requirements by recycling tritium from weapons retired from the Nation's nuclear weapons stockpile. However, because tritium decays relatively quickly, recycling can only meet the tritium demands for a limited time. Current projections, derived from classified projections of future stockpile scenarios, indicate that recycled tritium will adequately support the Nation's nuclear weapons stockpile until approximately 2011 (figure ES–4). After that time, without a new tritium supply source, it would be necessary to utilize the strategic reserve of tritium in order to maintain the readiness of the nuclear weapons stockpile. The strategic reserve of tritium contains a quantity of tritium maintained for emergencies and contingencies. In such a scenario, if the strategic tritium reserve is depleted, the nuclear deterrent capability would degrade because the weapons in the stockpile would not be capable of functioning as designed. Eventually, the nuclear deterrent would be lost. The proposed tritium supply and recycling facilities would provide the capability to produce tritium safely and reliably in order to meet the Nation's defense requirements well into the 21st century while also complying with environment, safety, and health (ES&H) standards.

DOE has analyzed the activities that must take place in order to bring a new tritium supply source into operation. The analysis indicates that it could take approximately 15 years to research, develop, design, construct, and test a new tritium supply source before new tritium production can begin. Thus, in order to have reasonable confidence that the Nation will be able to maintain an effective nuclear deterrent, prudent management dictates that DOE proceed with the proposed action now. In addition, DOE was required to meet a statutory deadline of March 1, 1995, to issue a PEIS addressing tritium supply alternatives (Public Law 103-160, section 3145). That deadline was met by the issuance of a Draft PEIS for Tritium Supply and Recycling in February 1995. Following public hearings, comments received have been considered in preparing this Final PEIS which will be submitted to Congress to close out DOE's obligation with respect to the intent of Public Law 103-160, Section 3145.

Changes from the Draft Programmatic Environmental Impact Statement

The 60-day public comment period for the Draft PEIS began on March 17, 1995, and ended on May 15, 1995. However, comments were accepted as late as June 23, 1995. During the comment period, public hearings were held in Las Vegas, NV; Washington, DC; Pocatello, ID; Oak Ridge, TN; North Augusta, SC; and Amarillo, TX. Two hearings were held at each location. In addition, the public was encouraged to provide comments via mail, fax, electronic bulletin board (Internet), and telephone (toll-free 800-number). During public review of the Draft PEIS a majority of the comments regarded concerns that alternatives and/or candidate sites were not given the correct amount of consideration on factors including cost and technical feasibility. Although these concerns made up the majority of the comments, many others involved the resources analyzed, NEPA and regulatory issues, and DOE and Federal policies as they related to the PEIS. The major issues identified by commentors included the following:

- The electrical requirements of the various alternatives, particularly the APT, and the potential for the MHTGR and ALWR to produce electricity;
- The impacts of the alternatives on groundwater, including the potential for aquifer depletion and contamination and the consideration of the use of treated wastewater for cooling;
- The socioeconomic impacts, both positive and negative, of locating or failing to locate a facility at one of the candidate sites;



Note: NWSM–Nuclear Weapons Stockpile Memorandum; NWSP–Nuclear Weapons Stockpile Plan.

Figure ES–3.—*Nuclear Weapons Stockpile Plan Process.*

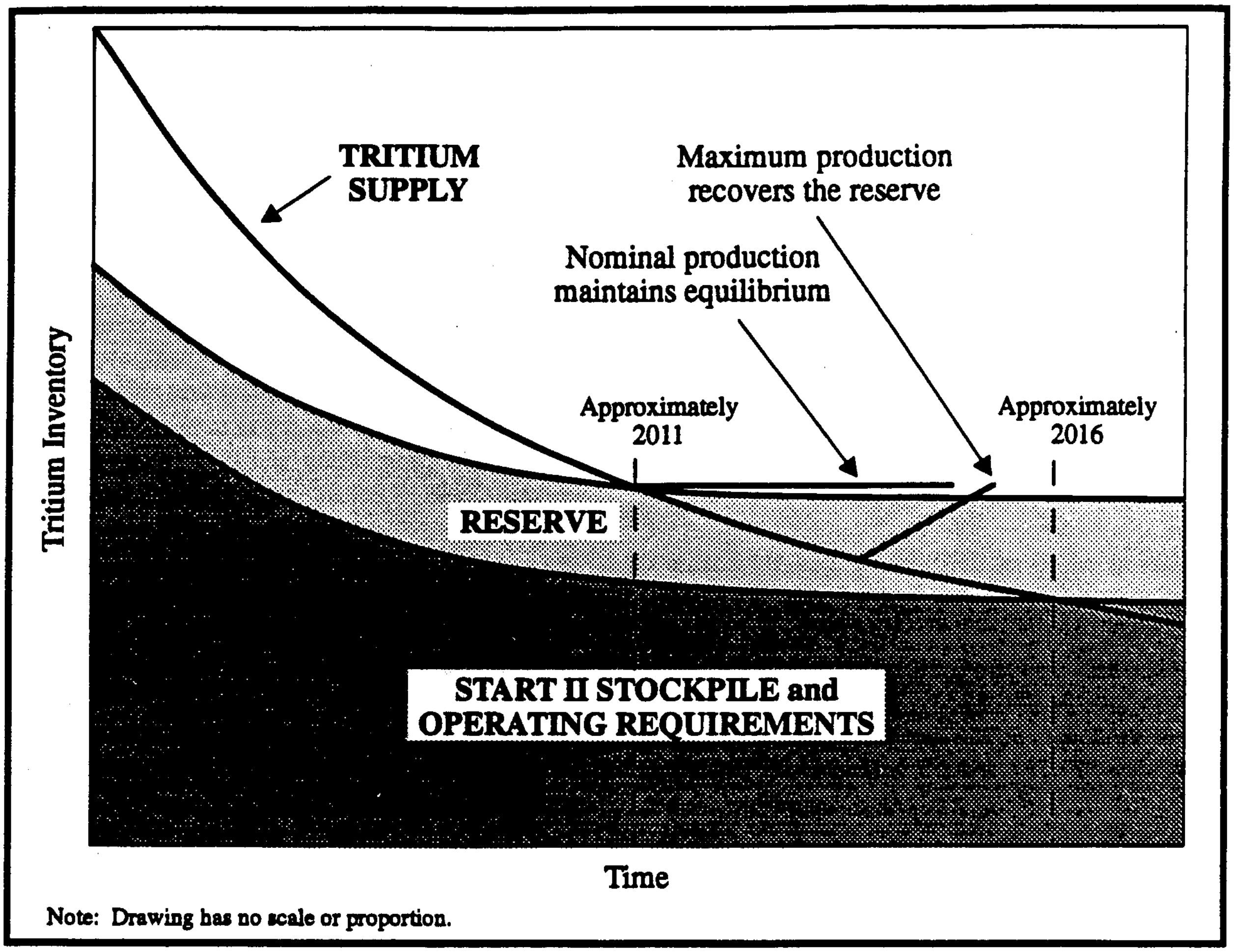


FIGURE ES–4.—*Estimated Tritium Inventory and Reserve Requirements.*

- The generation, storage, and disposal of radioactive and hazardous wastes (including spent nuclear fuel) and the associated risks;
- The impacts of the alternatives on human health (both from radiation and hazardous chemicals) and how these risks were determined and evaluated;
- The relationship of this PEIS to other DOE documents and programs, particularly the Waste Management PEIS and the Fissile Materials Disposition Program, and the need to make decisions based on all associated programs and activities concurrently;
- The need for decisions to be based on many different factors, including environmental, cost, and safety concerns;
- The failure of DOE to consider a no tritium or zero stockpile alternative, and the negative national and international implications of building a new tritium supply facility; and
- The need for DOE to consider a commercial reactor alternative in greater detail.

Additionally, as a result of public comments, DOE published on August 25, 1995 a Notice in the *Federal Register* (60 FR 44327) to include the purchase of irradiation services from a commercial reactor as a reasonable alternative. The Draft PEIS considered this an unreasonable alternative because of the longstanding policy of the United States that civilian nuclear facilities should not be utilized for military purpose and nonproliferation concerns. Nonetheless, the Draft PEIS included an evaluation of the environmental impacts of irradiation services using an existing commercial reactor to make tritium. Because of public comments on the Notice, public review of the Draft PEIS, and further consideration of nonproliferation issues, purchase of irradiation services is evaluated in the PEIS as a reasonable alternative. During the extended comment period, there were two major issues of concern raised:

- License and regulatory implication; and
- Non-proliferation concerns.

Revisions in the Final PEIS include additional discussion and analysis in the following areas: severe accidents and design-basis accidents for all tritium supply technologies; site-specific environmental impacts of a dedicated power plant for the Accelerator Production of Tritium (APT); revisions to water resources sections; site-specific analysis of the multipurpose reactor that could produce tritium, burn plutonium as fuel, and produce electricity; and the commercial reactor alternative, specifically the purchase of an existing reactor and the purchase of irradiation services for DOE target rods to produce tritium. Each of these areas will be discussed in more detail below.

Analyses of an ALWR design-basis accident were reevaluated as a result of public comments questioning the apparent severity and frequency of the accident consequences shown in the Draft PEIS. Additional analyses were performed to accurately estimate the impacts from a more reasonable design-basis accident and these results have been included in the Final PEIS.

The analyses of impacts of severe reactor accidents were also revised. The Draft PEIS presented the impacts of a single severe accident for each of the reactor technologies. Since accident consequences vary greatly depending on the selected accident frequency value, a spectrum of severe accidents with a range of frequencies was used to perform a more representative analysis for each technology. The new analyses presented reflect the probable effects of a set of accidents for each reactor rather than the single accident scenario.

Public comments also suggested that a disparity existed between the reactor and APT accident analyses, thereby creating a bias in favor of the APT. The Final PEIS now includes an APT severe accident with loss of confinement. The new accident analysis has a more severe initiating event, a lower frequency, and a higher consequence than the analysis presented in the Draft PEIS.

The Final PEIS has been modified to include a qualitative discussion of impacts to involved workers (workers assigned to the facility and located in close proximity to the facility as a result of the proposed action) and quantitative impacts to noninvolved workers (workers collocated at the site independent of the proposed action). For involved workers, impacts were addressed qualitatively, explaining the significant risk for exposure and fatality and that mitigative features would be provided in the design and operation to minimize worker impacts from accidents.

For the noninvolved worker, the impacts were represented by the exposure of a hypothetical worker at several prescribed distances from the accident (but within the site boundary). These impacts were described in terms of dose (rems), increases in the likelihood of cancer fatalities, and risk of cancer for the maximally exposed noninvolved worker.

Another significant change in the document is a more detailed description of potential impacts of a dedicated power plant for the APT. The section has been revised to include site-specific impacts for the gas-fired power plant.

Based on public comments received at the hearings, two revisions were incorporated in the water resources sections for NTS and Pantex. For NTS, the Final PEIS incorporates more accurate recharge rates and information regarding the potential project use of the NTS aquifer to present a more accurate impact on groundwater resources.

For Pantex, the Final PEIS includes the use of reclaimed sanitary wastewater sources, the Hollywood Road Wastewater Treatment Plant and the Pantex Plant Wastewater Treatment Plant for tritium supply cooling water.

A more detailed analysis of the multipurpose reactor has been included in the Final PEIS. Since the multipurpose reactor would use plutonium fuel, an analysis of the construction impacts of a Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility to support a multipurpose ALWR has been incorporated in the site-specific analysis for each of the five candidate sites. Impacts of just the pit disassembly/conversion part of the facility are included for the multipurpose MHTGR since this technology already includes a fuel fabrication component. For the operation of a multipurpose reactor, additional detail regarding the impacts on atmospheric emissions, liquid emissions, water requirements, socioeconomics, human health (for both normal operations and accidents), waste management, and intersite transportation has been included in the site-specific analysis.

Analysis and a discussion of potential impacts have been expanded and included in this PEIS on the alternative of DOE purchasing an existing operating commercial reactor or an incomplete reactor and converting it to production of tritium for defense purposes. Also included in the Final PEIS is an analysis of the alternative of DOE purchasing irradiation services from one or more commercial light water reactors for the production of tritium using DOE targets.

TRITIUM SUPPLY AND RECYCLING

The tritium supply technologies and site alternatives are described below. For each alternative except those being considered for SRS, a new tritium recycling facility could either be collocated with the new supply facilities or DOE could use the existing tritium recycling facilities at SRS after upgrade. For the alternatives at SRS, DOE would utilize existing recycling facilities at SRS, which would be upgraded to support the tritium mission.

TECHNOLOGIES

Of the tritium supply technologies considered by DOE for the production of tritium in this PEIS, only the HWR has tritium production operating experience. The MHTGR and light water reactor (upon which the ALWR is based) technologies have been used in electrical power production but lack tritium production experience and development of tritium target technology. The APT technology, which has an operating history in research and development programs, also has no tritium production experience and only recent development of tritium targets.

Since both the MHTGR and the ALWR were originally developed to produce electricity and as such have steam turbines as an integral part of their designs, the PEIS evaluates the environmental effects of both of these technologies with turbines included. The actual sale of steam or generation of electricity by DOE would be covered in the site-specific tiered NEPA documents if either of these technologies is chosen. The general impacts of the transmission lines necessary to carry this generated electricity are discussed. In addition, the general impacts of constructing and operating a dedicated power plant (either coal or natural gas burning) to provide the required power for the APT are also presented. As both the MHTGR and the ALWR technologies could also be used for the ultimate disposition of plutonium, the general impacts of operating these two technologies with plutonium-uranium fuel is presented in the PEIS.

Heavy Water Reactor. The HWR would be a low pressure, low temperature reactor whose sole purpose would be to produce tritium. The HWR would use heavy water as the reactor coolant and moderator. Because of the low temperature of the exit coolant, a power conversion system designed to produce electrical power as an option would not be feasible. In addition to the reactor, the HWR complex would consist of several support buildings and other facilities required for the supply and extraction of tritium.

The HWR complex would cover approximately 260 acres and the entire area would be surrounded by a security fence. The main reactor would be about 10 stories high and other associated buildings would range from one story to three stories in height. The cooling towers would vary in height, depending on the type of cooling towers utilized. The cooling tower basin, which serves as a holding pond for the cooling towers, would cover approximately 2 acres. In this PEIS, dry sites such as INEL, NTS, and Pantex which lack plentiful surface water sources would use mechanical draft dry cooling towers while wet sites such as ORR and SRS with abundant surface water resources would use natural draft wet cooling towers.

Range of Selected Construction Requirements for Tritium Supply Technologies:

- **Electrical Energy Demand:**
  40,000 to 120,000 MWh per year
- **Land Use:**
  173 to 360 acres
- **Total Number of Construction Workers:**
  2,200 to 3,500
- **Water Consumption:**
  41,700,000 to 200,000,000 gallons
  (over 5 to 9 year period)
- **Steel Consumption**
  45,000 to 68,000 tons

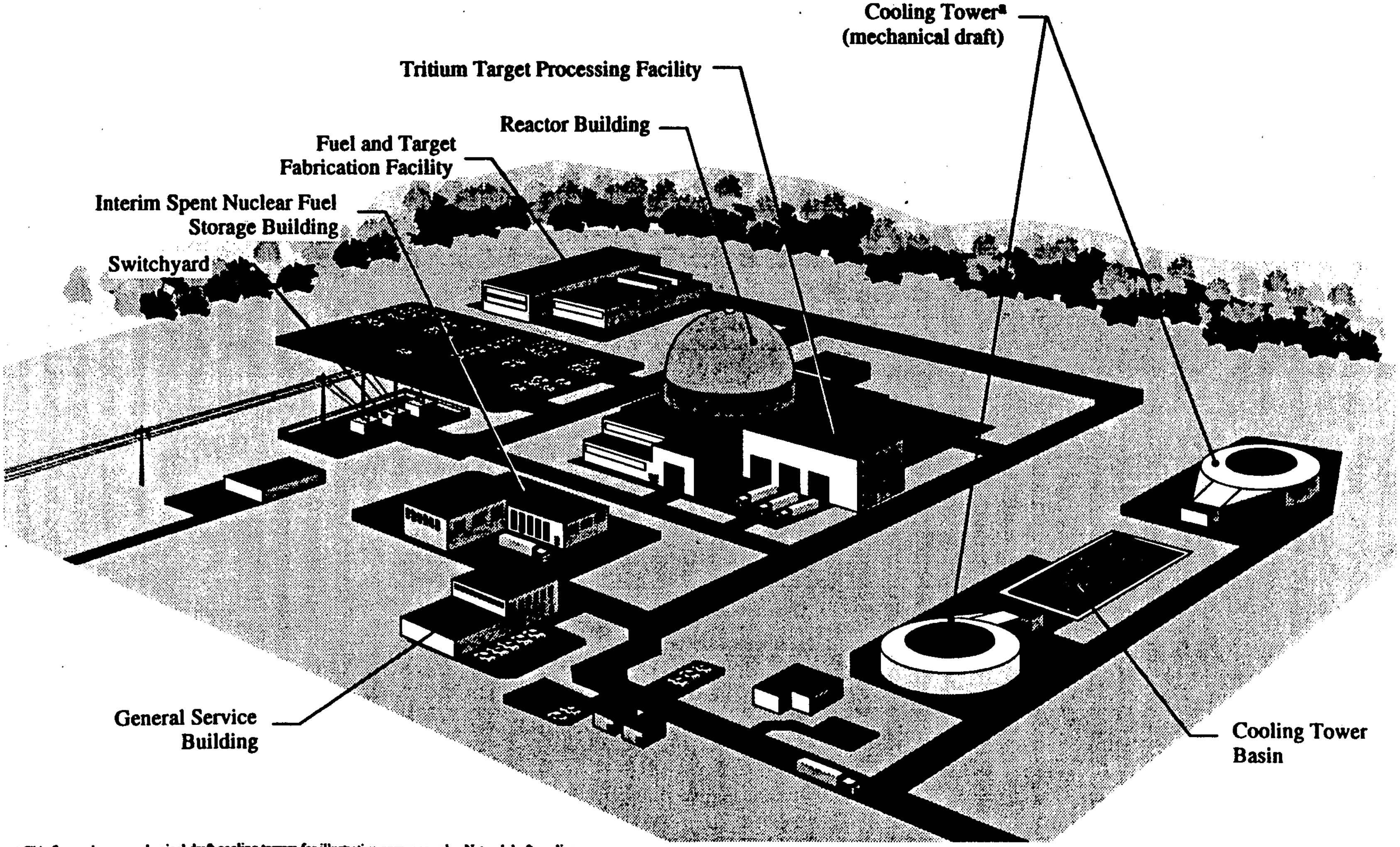
The conceptual design of the HWR complex includes a fuel and target fabrication facility to assemble fuel and target rods that are used in the reactor core; a tritium target processing facility to extract and collect tritium from irradiated targets; an interim spent fuel storage building to store used target and fuel rods; a general services building for administrative purposes; and a security infrastructure to control access to the complex. Figure ES–5 shows a representative drawing of an HWR complex with mechanical draft cooling towers for illustrative purposes only. The number and arrangement of buildings and support areas are descriptive only and can change significantly as design progresses. The fuel and target fabrication facility would be a steel or concrete structure designed to control the spread of contamination within the building and prevent the uncontrolled release of radioactive material. The target processing facility would consist of two attached structures: a process building and a support building. The process building would include the laboratory and other activities associated with handling tritium. The support building contains offices, maintenance areas, and nonradioactive ventilation systems.

The design of the HWR would incorporate numerous safety features including: an emergency power facility to house diesel generators or gas turbines for short-term emergency power to support safety related loads in the event of temporary failure of the offsite power supply; a reactor containment building to limit any operational or accidental release of radioactivity; an emergency core cooling system to makeup coolant for heat removal in the event of a loss of coolant or a loss of pumping; an emergency shutdown system with safety rods independent of the reactor control rods; a neutron poison system to inject neutron-absorbing material into the moderator tank; and a backup system to remove heat from the reactor if the primary coolant fails to circulate.

Construction of the HWR would take somewhat less than 8 years and require approximately 2,320 workers during the peak construction period. Once constructed, approximately 1 to 2 years would be needed for system checkout of the reactor prior to actual tritium production. Operation of the HWR would require approximately 930 workers.

Modular High Temperature Gas-Cooled Reactor. The MHTGR would be a high temperature, moderate pressure reactor whose primary purpose would be to produce tritium. The MHTGR would use helium gas as a core coolant and graphite as a moderator. Because of the high temperature of the exit coolant, a power conversion facility designed to produce electricity is an integral part of the design and is included in the analysis. In addition to the reactor building and the power conversion building, the MHTGR complex would consist of several buildings and other facilities required for the supply and extraction of tritium.

The MHTGR complex would cover approximately 360 acres and the entire area would be surrounded by a security fence. The MHTGR would consist of three 350 MWt reactor vessels housed in adjacent, below-ground, reinforced-concrete silos. The silos would extend approximately 160 feet below-grade and each reactor vessel would be about 22 feet in diameter and 75 feet high. Each reactor vessel would contain a reactor core, reflectors, and associated supports. A shutdown cooling heat exchanger and a shutdown cooling circulator would be located at the bottom of the vessels. Support buildings and other associated facilities within the MHTGR complex would range in height from one to three stories. Two cooling



[a] This figure shows mechanical draft cooling towers for illustrative purposes only. Natural draft cooling towers also could be used. The exact cooling tower configuration would be site dependent.

Source: DOE 1995d.

2297/ES

FIGURE ES–5.—*Heavy Water Reactor Facility (Typical).*

towers would be needed and their height would vary, depending on the type of cooling towers that are utilized. In this PEIS dry sites (INEL, NTS, and Pantex) would use mechanical draft dry cooling towers and wet sites (ORR and SRS) would use natural draft wet cooling towers.

The design of the MHTGR complex would include a fuel and target fabrication facility, a tritium target processing building, helium storage buildings, waste treatment facilities, spent fuel storage facility, a general services building, a security infrastructure, and a power conversion facility consisting of three turbine-generators and associated electrical control equipment. Figure ES-6 shows a representative drawing of a MHTGR complex with mechanical draft cooling towers shown for illustrative purposes only. The number and arrangement of buildings and support areas are descriptive only and can change significantly as design progresses. The design of the MHTGR would incorporate numerous safety features that include: an emergency power facility to house diesel generators or gas turbines for short-term emergency power to support safety related loads in the event of temporary failure of the offsite power supply; a below-grade design, which serves as a barrier to external hazards (aircraft, turbine blades, and tornado-generated debris), reduces seismic-induced stress on the reactors, and provides radiological shielding; a below-grade containment structure made of reinforced concrete; an emergency core cooling system; and an emergency shutdown system with safety rods independent of the reactor control rods.

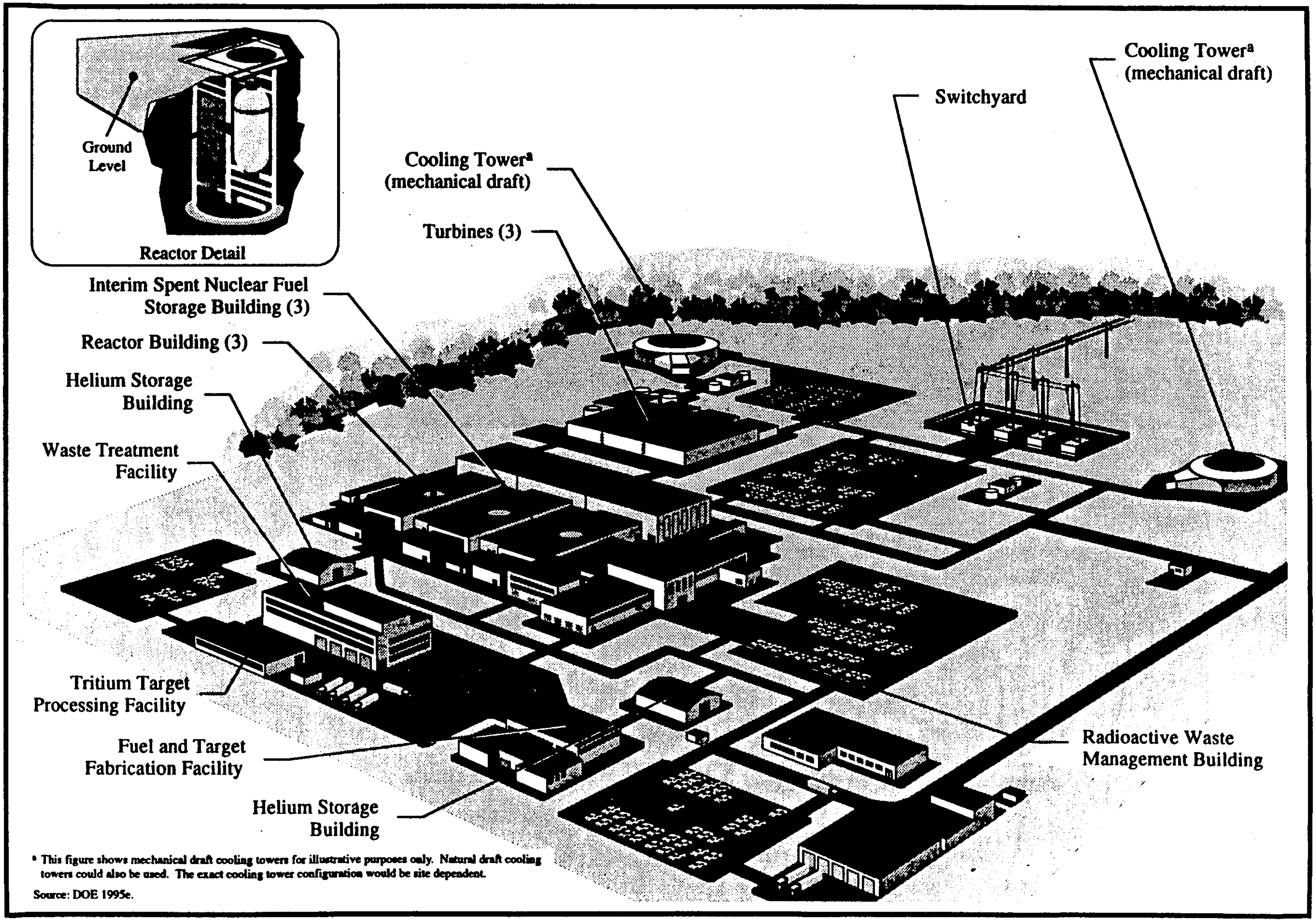
Construction of the MHTGR would take about 9 years and require approximately 2,210 workers during the peak construction period. One to 2 years would be needed after construction for system checkout of the reactor prior to actual tritium production. Operation of the MHTGR would require approximately 910 workers.

A modular gas-cooled reactor like the MHTGR would also be capable of performing the "triple play" missions of producing tritium, burning plutonium, and generating electricity. To burn plutonium in a gas-cooled reactor, a plutonium Pit Disassembly/Conversion/Plutonium-Oxide Fuel Fabrication Facility would be needed. Additionally, because tritium production decreases significantly in a plutonium-fueled gas-cooled reactor, twice as many reactor modules would be necessary in order to produce the steady-state tritium requirements. This doubling of reactor modules would be the major contributor to potential environmental impacts for this scenario. The PEIS contains an assessment of these potential environmental impacts.

Advanced Light Water Reactor. The ALWR would be a high temperature, high pressure reactor whose primary purpose would be to produce tritium. There are two options for the proposed ALWR technology: a Large ALWR (1,300 MWe) and a Small ALWR (600 MWe). The large and small options would be chosen from the following four candidates: a large or small pressurized water reactor; or a large or small boiling water reactor. All ALWR options would use light (regular) water as the reactor coolant and moderator. Like the MHTGR, a power conversion facility (steam turbine) is an integral part of the design for the ALWR because of the high temperature of the exit coolant and is included in the analysis. In addition to the reactor building, the ALWR complex would consist of several support buildings and other facilities for the supply and extraction of tritium.

The ALWR complex would cover approximately 350 acres and the entire area would be surrounded by a security fence. The main reactor building would be approximately 10 stories high. The other associated buildings would range from one to three stories in height. The differences between the large and small options are primarily in the power output of the reactors. Both of the small reactors are rated at 600 MWe, while the large options are rated at 1,300 MWe. The physical sizes of the large and small options for each of the technologies are generally the same.

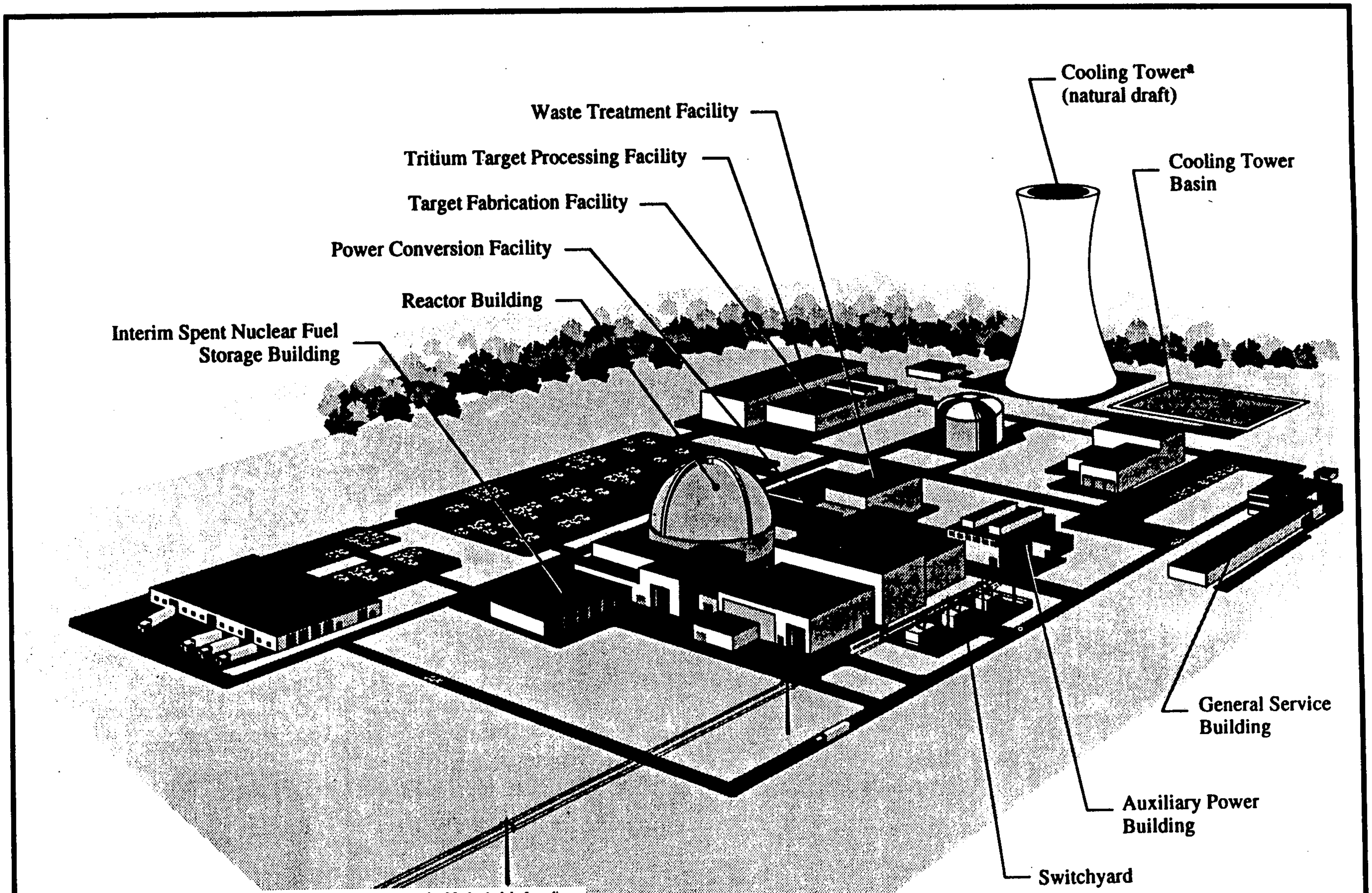
In addition to the reactor, the ALWR complex would include an interim spent fuel storage building, a waste treatment facility, a tritium target processing facility, warehouses, and a power conversion facility. Unlike the other technologies, the ALWR would not have a fuel fabrication facility since fuel rods would be obtained from offsite sources. Figure ES-7 shows a representative drawing of an ALWR complex with a natural draft cooling tower shown for illustrative purposes only. The number and arrangements of buildings and support areas are descriptive only and can change significantly as design progresses. The



[a] This figure shows mechanical draft cooling towers for illustrative purposes only. Natural draft cooling towers could also be used. The exact cooling tower configuration would be site dependent.

Source: DOE 1995e.

FIGURE ES-6.—*Modular High Temperature Gas-Cooled Reactor Facility (Typical).*



[a] This figure shows natural draft cooling towers for illustrative purposes only. Mechanical draft cooling towers could also be used. The exact cooling tower configuration would be site dependent.

Source: DOE 1995f.

2294/ES

FIGURE ES–7.—*Advanced Light Water Reactor Facility (Typical).*

tritium target processing facility would consist of the following two attached structures: a processing building and a support building. The process building would include the tritium extraction processes, laboratory, and other activities associated with handling tritium. The support building would contain offices, maintenance areas, and nonradioactive ventilation systems. The type of cooling tower used depends upon where the ALWR were located. In this PEIS, dry sites (INEL, NTS, and Pantex) would use mechanical draft dry cooling towers and wet sites (ORR and SRS) would use natural draft wet cooling towers.

The design of the ALWR would incorporate numerous safety features such as: an emergency power facility to house diesel generators or gas turbines for short-term emergency power to support safety-related loads in the event of temporary failure of the offsite power supply; a reactor containment building to limit any release of radioactivity; an emergency core cooling system to makeup coolant in the event of a loss of coolant or a loss of pumping; an emergency shutdown system; and a neutron poison system to inject neutron-absorbing material into the reactor vessel.

Construction of the ALWR would take about 6 years and require approximately 3,500 workers for the Large ALWR and 2,200 workers for the Small ALWR during the peak construction period. Once constructed, 1 to 2 years would be needed for system checkout of the reactor prior to actual tritium production. Operation of the Large and Small ALWR would require approximately 830 and 500 workers, respectively.

An ALWR would also be capable of performing the "triple play" missions of producing tritium, burning plutonium, and generating electricity. The multipurpose ALWR would operate essentially the same as a uranium-fueled tritium production ALWR. Therefore, the environmental impacts from operation of a multipurpose ALWR would be expected to be unchanged from the tritium production ALWR. To burn plutonium in an ALWR, a plutonium Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to provide the mixed-oxide fuel rods for the ALWR, and would be the major contributor to potential environmental impacts for this scenario. The PEIS contains an assessment of these potential environmental impacts.

Range of Selected Operation Requirements for Tritium Supply Technologies:

- **Electrical Energy Demand:**
  260,000 to 3,740,000 MWh per year
- **Land Use:**
  173 to 360 acres
- **Total Number of Operation Workers:**
  500 to 930
- **Water Consumption:**
  0.03 to 16 billion gallons per year
- **Spent Nuclear Fuel Generation:**
  0 to 80 cubic yards per year

Accelerator Production of Tritium. The APT would be a linear accelerator whose primary purpose would be to produce tritium. The APT accelerates a proton beam in a long tunnel to one of two target/blanket assemblies located in separate target stations. There are two target/blanket concepts being considered in the conceptual design of the Full APT: the helium-3 target and the spallation-induced lithium conversion target.

The APT complex would cover approximately 173 acres and the entire area would be surrounded by a security fence. The accelerator, 3,940 feet in length, would be housed in a concrete tunnel buried 40 to 50 feet underground for radiation shielding. The design of the APT radio frequency power system and its distribution network is similar to that of existing accelerators. The tunnel would be sealed and evacuated during operation but would vent to the atmosphere during shutdown period. The full size facility would consist of 10 cooling towers and 13 substations located above ground along the full length of the underground accelerator. The APT facility would require a peak electrical load of approximately 550 MWe to produce the 3/8 goal tritium quantity and 355 MWe to produce the steady-state tritium requirement. Additionally, there would be two cooling towers for the target/blanket beam stop located next to the target building. The cooling towers and the substations would be approximately one to two stories in height.

The preconceptual design of the APT complex includes: a target building that would house either the helium-3 or the spallation-induced lithium conversion target chambers located in a subterranean structure at the same level as the accelerator; a tritium processing facility to extract tritium from the targets; a klystron remanufacturing and maintenance facility; waste treatment buildings to treat all generated wastes; and various administration, operation, and maintenance facilities. Figure ES–8 shows a representative drawing of an APT complex. The number and arrangement of buildings and support areas are illustrative and can change significantly as design progresses.

The design of the APT would incorporate numerous safety features to include: an emergency power facility to house diesel generators or gas turbines for short-term emergency power to support safety-related loads in the event of temporary failure of the offsite power supply; multiple sensors and diagnostics which would determine if the accelerator beam is out of acceptable limits in terms of position, energy, size; etc.; redundant cooling systems for all heat-removal systems; and an automatic beam shutoff in the event of a loss of cooling, a misaligned beam, or abnormal radiation levels.

Construction of the APT would take about 5 years and require approximately 2,760 workers during the peak construction period. Additional construction area for equipment and materials would not be required since there would be sufficient unencumbered space within the APT boundaries. Once constructed, 1 to 2 years would be needed for system checkout of the accelerator prior to actual tritium production. Operation of the APT would require approximately 624 workers.

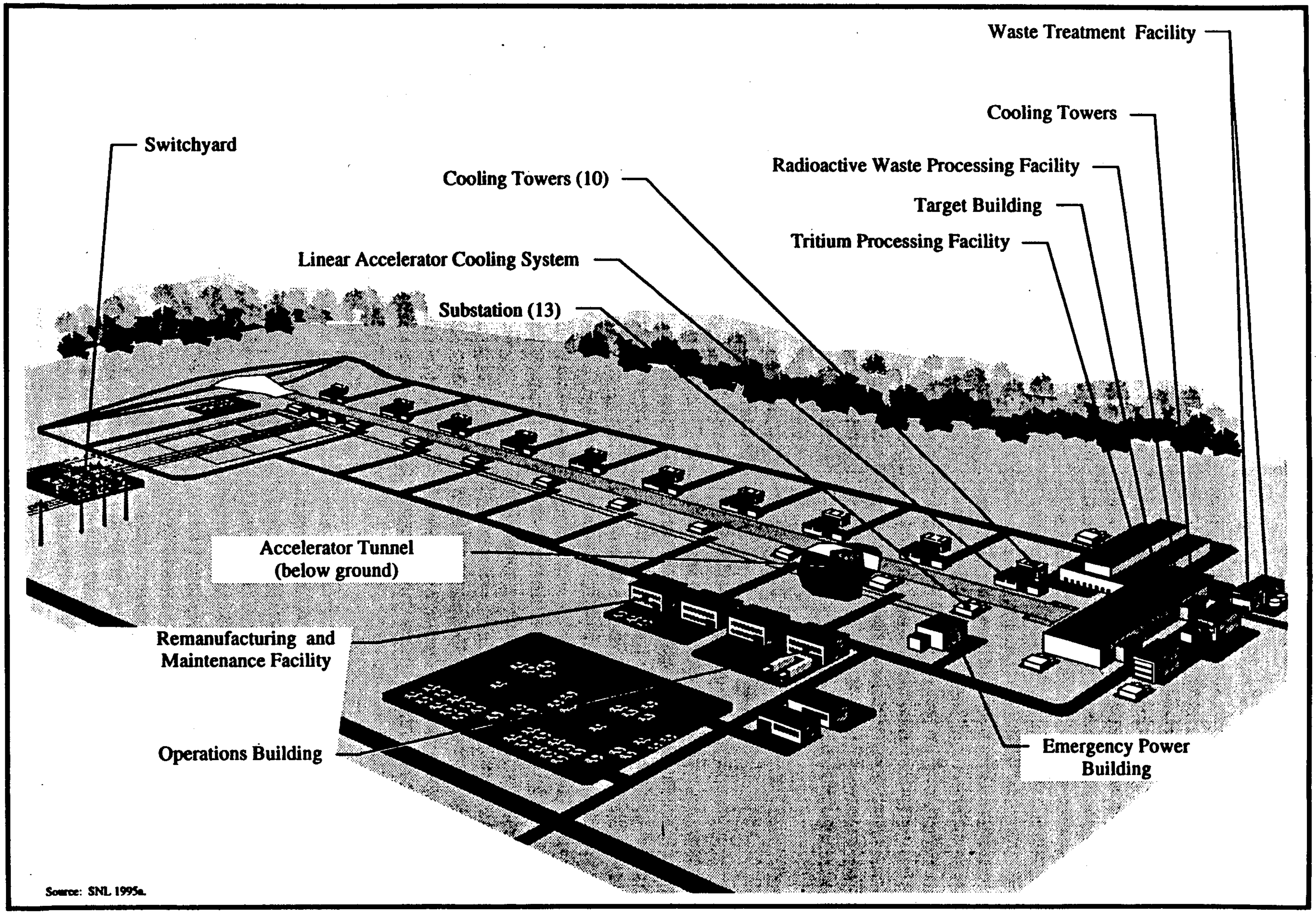
If desired, a phased construction of the APT could also occur. Under this scenario, initial construction of the APT would result in a facility that could produce the steady-state requirement of tritium (approximately 50 percent of baseline case). Expansion of the facility could be possible at a later date in order to increase tritium production to the baseline requirements if necessary. The helium-3 target is the primary target in the Phased APT option.

Commercial Light Water Reactor. The purchase by DOE of an existing operating or partially completed commercial power reactor is an alternative to meet the stockpile tritium requirement. Production of tritium using irradiation services contracted from commercial power reactor(s) (with the option to purchase the reactor) is also an alternative. Commercial light water reactors use both pressurized water and boiling water technologies. Of the two types, pressurized water reactors are more readily adaptable to the requirements of tritium production by DOE tritium target rod irradiation because they utilize burnable poison rods which could be replaced by tritium target rods.

Commercial pressurized water reactors are high-temperature, high-pressure reactors that use ordinary light water as the coolant and moderator and are capable of generating large amounts of electricity through a steam turbine generator. The range of electrical production for these plants is approximately 390 million kWh per year to 6,900 million kWh per year using an assumed annual capacity factor of 62 percent. A typical commercial light water reactor facility includes the reactor building, spent fuel storage facilities, cooling towers, a switchyard for the transmission of generated electricity, maintenance buildings, administrative buildings, and security facilities. Acreage for existing operating commercial light water reactor facilities varies in size from a low of 84 acres to a high of 30,000 acres.

The designs of typical commercial reactors incorporate numerous safety features including: a reactor containment building to limit any release of radioactivity; an emergency core cooling system for heat removal in the event of a loss of coolant or a loss of pumping; an emergency shutdown system with safety rods independent of the reactor control rods; and a backup system to remove heat from the reactor if the primary coolant fails to circulate.

The representative drawing for the ALWR complex (figure ES-7) would be similar to a commercial light water reactor complex except that tritium target fabrication and processing facilities would not be typical facilities. If a partially completed reactor were purchased, these facilities could potentially be con-



Source: SNL 1995a.

2296/ES

FIGURE ES–8.—*Accelerator Production of Tritium Facility Site Layout (Typical).*

structed along with the final construction of the reactor.

A commercial reactor would also be capable of performing the triple play" missions of producing tritium, burning plutonium, and generating electricity. The multipurpose commercial reactor would operate essentially the same as a uranium-fueled tritium production commercial reactor. Therefore, the environmental impacts from operation of a multipurpose commercial reactor would be expected to be unchanged from the tritium production commercial reactor. To burn plutonium in a commercial reactor, a plutonium Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to provide the mixed-oxide fuel rods for the commercial reactor, and would be the major contributor to potential environmental impacts for this scenario. The PEIS contains a generic assessment of these potential environmental impacts.

TRITIUM RECYCLING

The primary mission of the tritium recycling facility is to process and recycle tritium for use in nuclear weapons. This mission includes the steps necessary to empty reservoirs (small pressure vessels containing tritium installed in nuclear weapons), recover the tritium, provide new gas mixtures according to specifications, and reclaim usable reservoirs. Additionally, the tritium recycling facility would perform a full range of analytical, physical, and environmental tests to ensure that the quality and integrity of all reservoirs are maintained throughout their operational life. It would also provide for appropriate waste management, including storage, treatment, and disposal of tritiated wastes.

The tritium recycling facility would receive tritium in reservoirs returned from DOD and other activities, or as new tritium from the extraction facility that is associated with the tritium supply facility. The reservoirs would be unpacked from their shipping containers in the auxiliary building and taken to the tritium processing building for temporary storage. They would then be emptied and the contained gases would be processed to separate the hydrogen isotopes from other gases, primarily helium-3 (a stable isotope resulting from the radioactive decay of tritium). Prior to being placed into reservoirs, the tritium would undergo a purification process. The empty reservoir bottles would be sent to the tritium auxiliary building to be reclaimed. If reclamation is not possible, the bottles would be disposed of as LLW. Otherwise, they would be refurbished and sent to the tritium processing building to be filled.

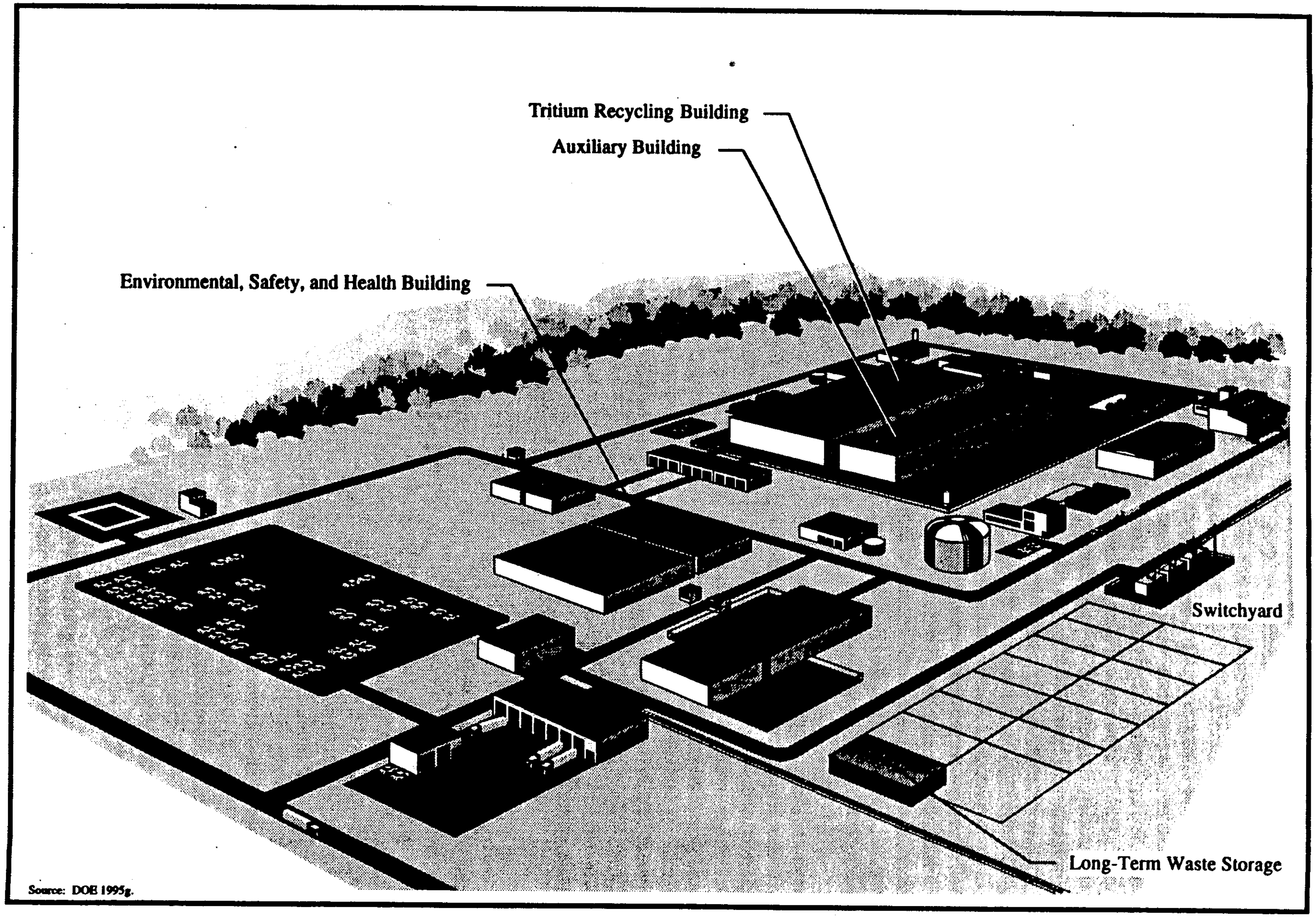
Reservoirs that have been filled with tritium and sealed would be transferred to the auxiliary building for finishing, where they would be decontaminated, leak tested, inspected, marked, measured for tritium content, and, if required, combined with various parts necessary for final assembly. The reservoirs would then be placed in storage until needed for limited life component exchange, or sent to the assembly and disassembly facility for use in new weapons.

Some reservoirs would be placed in the weapon surveillance program. The tritium recycling facility would include testing capability for production, surveillance, and research and development reservoirs. In general, tests on reservoirs filled with tritium would be performed in the tritium processing building, while tests on other bottles or parts of bottles would be performed in the auxiliary building.

Tritium recycling could be collocated with tritium supply, or be done in existing facilities at SRS. At SRS, an upgrade of the existing recycling facilities would be implemented rather than construction of a new facility. Discussed below are the options for new or upgraded recycling facilities.

New Recycling Facilities. If the tritium supply and recycling facilities are located at any site other than SRS, new recycling facilities would have to be constructed (figure ES–9). The tritium recycling facility would be housed in two major buildings and in several support facilities. The first building, the tritium processing building, would be a hardened facility designed with systems to contain tritium releases should they occur. The second building, the auxiliary building, would house nontritium and extremely small amounts of working tritium. These buildings would be located within a 202-acre plant area.

Upgrade of Recycling Facilities at Savannah River Site. If the tritium supply facilities are located at SRS or at one of the other sites without a collocated recycling facility, the existing tritium recycling facilities would be upgraded. The upgrade, presented here, called the unconsolidated upgrade, would result



Source: DOE 1995g.

2299/ES

FIGURE ES–9.—*New Tritium Recycling Facility (Typical).*

in no buildings being closed and no consolidation of tritium handling activities. Buildings 232-H, 232-1H, 234-H, 238-H, and 249-H (figure ES–10), would be upgraded to meet DOE Order 5480.28, *Natural Phenomena Hazards Mitigation*. These upgrades would involve adding wall and cross bracings to existing beams, strengthening some exterior walls, and reinforcing existing building frames. Additionally, Building 232-H would require an anchor for the service area roof slab as well as an upgrade to the Radiation Control and Monitoring System. Building 234-H would require upgrades to its reservoir storage encased safes which are used to protect filled reservoirs during high winds and earthquakes. No additional acreage would be required for these upgrades, and no upgrade modifications would be required for buildings 233-H (Replacement Tritium Facility), 235-H, 236-H, or 720-H.

As a potential mitigation measure, a consolidation of tritium activities into fewer buildings to minimize tritium emissions and waste is also possible. In this upgrade, called the consolidated upgrade, Building 232-H would be closed and its functions transferred to buildings 233-H and 234-H. As discussed above, upgrades would then be made to buildings 232-1H, 234-H, 238-H, and 249-H. Additionally, Building 233-H would require modifications in order to accept activities transferred from Building 232-H.

SITES

Commercial Light Water Reactor

The commercial light water reactor alternative does not include a specific site for analysis in the PEIS. Therefore, any one of the existing operating commercial nuclear reactors or partially completed reactors is a potential candidate site for the tritium supply mission. Currently, 109 commercial nuclear power plants are located at 71 sites in 32 of the contiguous states. Of these, 53 sites are located east of the Mississippi River. No commercial nuclear power plants are located in Alaska or Hawaii. Approximately one-half of these 71 sites contain two or three nuclear units per site.

Typically, commercial nuclear power plant sites and the surrounding area are flat-to-rolling countryside in wooded or agricultural areas. More than 50 percent of the sites have 50-mile population densities of less than 200 persons per square mile and over 80 percent have 50-mile densities of less than 500 persons per square mile.

Site areas range from 84 acres to 30,000 acres. Twenty-eight site areas range from 500 to 1,000 acres and an additional 12 sites are in the 1,000 to 2,000 acre range. Thus, almost 60 percent of the plant sites encompass 500 to 2,000 acres. The larger land-use areas are associated with plant cooling systems that include reservoirs, artificial lakes, and buffer areas.

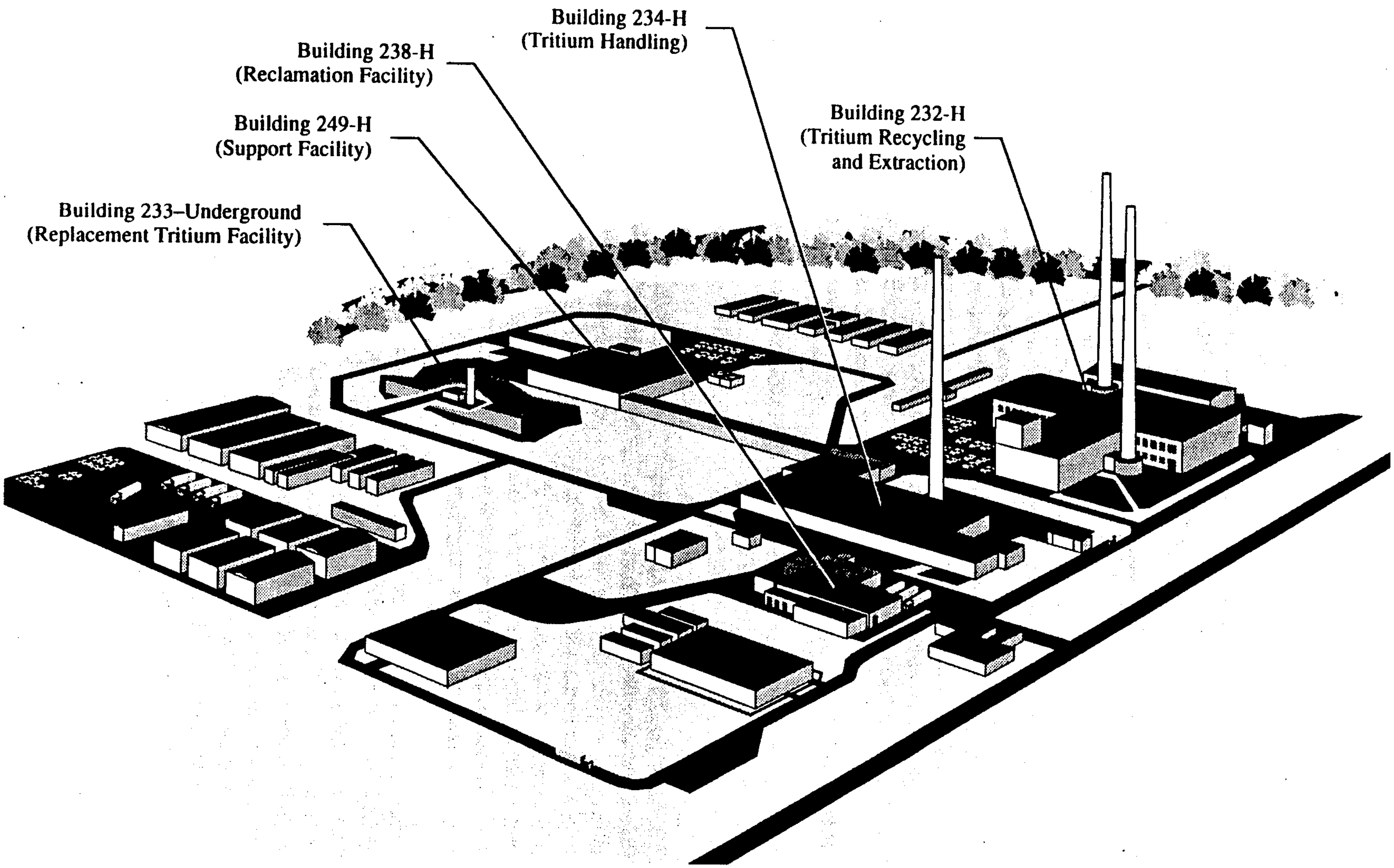
IDAHO NATIONAL ENGINEERING LABORATORY

In 1949, INEL was established in the southeastern Idaho desert 50 miles west of Idaho Falls. Situated on approximately 570,000 acres in four counties, the site is used to test, build, and operate nuclear facilities. INEL is one of DOE's primary centers for research and development activities on reactor performance, materials testing, environmental monitoring, waste processing, and breeder reactor development and serves as a naval reactor training site. The collection of reactors at INEL is the world's largest, varying from research and testing to power and ship propulsion reactors. Over the years, 52 research and test reactors at INEL have been used to test fuel and target design, reactor systems, and overall safety. Currently, there are four reactors in use, three of which are in continuous operation.

In addition to nuclear reactor research, other INEL facilities support reactor operations; processing and storage of high-level waste (HLW) and low-level waste (LLW); and storage of LLW and transuranic (TRU) waste generated by defense program activities. Until 1992, spent reactor fuels were reprocessed at the Idaho Chemical Processing Plant but this was terminated by DOE. Therefore, INEL has no current defense program missions.

NEVADA TEST SITE

In 1950, NTS was established in southern Nevada 65 miles northwest of Las Vegas, on approximately 864,000 acres of land. NTS is operated by several management and operating contractors under the direction of the Nevada Operations Office. The site is a remote, secure facility for conducting underground testing of nuclear weapons and evaluating the



Source: SR DOE 1995a.

2298/ES

FIGURE ES–10.—*Tritium Recycling Facilities Upgrades at Savannah River Site (Generalized).*

effects of nuclear weapons on military communications, electronics, satellites, sensors, and other materials. Approximately one-third of the land is used for nuclear weapons testing, one-third is reserved for future missions, and one-third is used for research and development and other facility requirements. In October 1992, the underground nuclear testing was halted, yet the site maintains the capability and infrastructure necessary to resume testing if authorized by the President. The infrastructure to continue research, development, and testing is being maintained (albeit at lower levels).

Facilities at NTS include nuclear device assembly, diagnostic canister assembly, hazardous liquid spill, and the Radioactive Waste Management Site. In addition, DOE is evaluating Yucca Mountain, an area on the border of the site, as a potential repository for spent nuclear fuel and high-level radioactive waste.

OAK RIDGE RESERVATION

ORR was established in 1942 as part of the World War II Manhattan Project. The site, located 20 miles west of Knoxville on approximately 35,000 acres, includes three major facilities: Oak Ridge National Laboratory; Y-12 Plant (Y-12); and the K-25 site (the former Oak Ridge Gaseous Diffusion Plant). Oak Ridge National Laboratory missions include basic and applied scientific research and technology development. Y-12 engages in national security activities and manufacturing outreach to U.S. industry. The K-25 site serves as an operations center for environmental restoration and waste management programs.

Y-12 is the primary location for defense program missions. Activities at Y-12 include the dismantling of nuclear weapons components returned from the Nation's stockpile, maintaining nuclear production capability (primarily uranium and lithium) and stockpile support, storing special nuclear materials, and providing special manufacturing support to DOE programs. Operational space at Y-12 is being downsized in response to the reduced workloads.

PANTEX PLANT

Pantex is located 17 miles northeast of Amarillo, TX, on approximately 10,000 acres. The site served as a conventional bomb plant during World War II. After the war, the site was sold to Texas Technological College (Texas Tech) but was repurchased by the Army in 1951 at the request of the Atomic Energy Commission. Pantex served as a nuclear weapons production facility and over the years absorbed the weapons modification functions of the Clarksville, TN (1965) and Medina, TX (1966) plants. In 1975, Pantex absorbed the functions of the decommissioned Burlington Plant in Iowa.

Today, Pantex functions include the fabrication of chemical explosives; nuclear weapons assembly, disassembly, testing, quality assurance, repair, and disposal of nonnuclear components; and development work in support of design laboratories. Due to recent reductions in the Nation's stockpile, Pantex has developed the interim capability for sealed pit storage of nuclear materials. Pantex is the only DOE facility that can execute the final assembly of a nuclear weapon for the DOD stockpile. At present, weapons disassembly and component storage dominate activity at the plant.

SAVANNAH RIVER SITE

In 1950, SRS was established 12 miles south of Aiken, SC, on approximately 198,000 acres. The major nuclear facilities at SRS have included fuel and target fabrication facilities; nuclear material production reactors; chemical separation plants used for recovery of plutonium and plutonium isotopes; a uranium fuel reprocessing area; and the Savannah River Technology Center, which provides process support.

SRS is the Nation's primary facility for tritium recycling operations, which provide tritium for weapons in the nuclear stockpile. Recycled tritium is delivered to Pantex for weapons assembly and directly to DOD to replace expired tritium reserves. In the past, SRS produced tritium but only tritium recycling operations continue at the Replacement Tritium Facility. Other activities at SRS include interim storage of plutonium, waste management, and environmental monitoring and restoration.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

By law, DOE is required to support the *Nuclear Weapons Stockpile Plan*. To do this, DOE must maintain a nuclear weapons production, maintenance, and surveillance capacity consistent with the President's Stockpile Plan. For the proposed action, the following alternatives were considered but eliminated from detailed study for the reasons stated.

PURCHASE OF TRITIUM FROM FOREIGN SOURCES

DOE has considered the purchase of tritium from other sources, including foreign nations. Conceptually, the purchase of tritium from foreign governments could provide a fraction of the tritium requirement. However, while there is no national policy against purchase of defense materials from foreign sources, DOE has determined that the uncertainties associated with obtaining tritium from foreign sources render this alternative unreasonable for an assured long-term supply.

REDESIGN OF WEAPONS TO REQUIRE LESS OR NO TRITIUM

The nuclear warheads in the enduring stockpile were designed and built in an era when the tritium supply was assured, when underground nuclear testing was being conducted, and when military needs required that the warheads be optimized in terms of weight and volume. Replacing these warheads with new ones that would use little or no tritium for the sole reason of reducing overall tritium demand would be infeasible and unreasonable. Without underground nuclear testing to verify their safety and reliability, new warhead designs cannot deviate very far from current designs that require the use of tritium. Even with underground testing to facilitate new designs and a fully operational production complex, it would still take many years to build enough warheads to replace the enduring stockpile. Therefore, replacing the enduring stockpile of warheads with new designs would most likely take longer and could cost more than constructing and operating a new tritium supply facility. Because neither the President nor the Congress has approved that the government embark on a costly and expansive design, testing, and construction program solely to eliminate tritium requirements, weapons redesign to use less or no tritium is not a reasonable short- or long-term alternative.

USE OF EXISTING DEPARTMENT OF ENERGY REACTORS OR ACCELERATORS

DOE (and its predecessor agencies) has designed, constructed, and operated many nuclear reactors over the past 50 years. The majority of these reactors were designed to assist in the development of nuclear research and safety standards development. DOE has also constructed nuclear reactors to produce the materials required to support the production and maintenance of nuclear weapons and has constructed nuclear reactors in support of the Naval Propulsion Program.

Among the first experimental reactors were the Water Boiler at Los Alamos National Laboratory and CP-3 at Argonne National Laboratory, which were completed in 1944. Since then, numerous experimental and research reactors were constructed for a variety of purposes, including material tests, new reactor concepts, and safety experiments. Only four DOE research reactors are currently operational: the High Flux Isotope Reactor at ORR; the High Flux Beam Reactor at Brookhaven National Laboratory; and the Experimental Breeder Reactor-II and the Advanced Test Reactor at INEL. In addition, there are some low power/critical facilities supporting medical research (at Brookhaven) and supporting reactor core configuration research (at Argonne National Laboratory-West at INEL). None of these facilities is large enough to produce the amount of tritium required to support the projected stockpile requirements. All are fully or partially committed to existing programs, and were constructed in the early 1960s, rendering their design life reliability unsuitable for the timeframe required for a new, assured, long-term tritium supply facility.

Of the existing DOE reactors that are currently not being operated, only one has the potential for producing any significant quantities of tritium: the Fast Flux Test Facility at the Hanford Site. This facility was designed and constructed to perform materials research for the national liquid-metal breeder reactor program. This small (440-megawatt thermal (MWt)) experimental reactor, based on liquid-metal reactor technology, could, after substantial core and cooling system modifications, as well as target technology development, have the potential to supply a significant percentage of the steady state tritium requirement. The Fast Flux Test Facility, however, was designed in the late 1970s and began operation in 1980. The Fast Flux Test Facility is currently defueled. A technical study to extend the life of the Fast Flux Test Facility to 10 years past its design 20-year lifetime has been completed. While technically possible to expand the lifetime, in the year 2010 the facility would be at the end of even the extended life. Relying on the ability to further modify and operate the Fast Flux Test Facility well into the middle of the next century is not a reasonable alternative.

DOE also constructed and operated more than a dozen nuclear reactors for production of nuclear materials at SRS and the Hanford Site, starting with the early part of the Manhattan Project during World War II. None of these reactors is currently operational. Of those reactors specifically designed to produce nuclear materials for the nuclear weapons program, the K-Reactor at SRS is the only remaining reactor which could be capable of returning to operation. It is currently in a "cold stand-by state" and has not been operated since 1988. The reactor was shut down for major environmental, safety, and health upgrades, to comply with today's stringent standards. DOE discontinued the K-Reactor Restart Program when the reduced need for tritium to support a smaller stockpile delayed the need for tritium. In this context—reliance upon the ability to upgrade and operate well into the middle of the next century—a first generation reactor designed in the 1940s is not a reasonable alternative for new, long-term, assured tritium supply.

DOE has been a world leader in the design and construction of particle accelerators and currently operates six national facilities. Of the existing research accelerators, none is capable of producing significant quantities of tritium. The existing DOE research accelerators are all of the pulsed design and are only capable of producing low power accelerator beams in the 800 kilowatt (kW) range. A production accelerator facility, utilizing continuous wave operation, would be required to deliver a high power proton beam of 100 megawatts (MW) for tritium production. None of the existing research accelerators could be reasonably upgraded to meet the long-term, assured tritium requirements.

ALTERNATIVE SITES

The process of determining these reasonable tritium supply alternative sites has been evolutionary, starting with the engineering studies and criteria developed by the New Production Reactor program, then utilizing additional criteria and considerations from the Reconfiguration Program, information related to changing missions at DOE sites, and input from public scoping.

During the preparation of the PEIS, the Department has continued to assess other alternative sites. In fact, once the APT was added as a potential tritium supply technology, an assessment was conducted to determine if the Los Alamos National Laboratory, which operates a linear accelerator and is the home of significant accelerator expertise, would be a reasonable site for a tritium producing accelerator.

The APT conceptual designs for tritium supply have established that evaporative cooling towers would be used to dissipate the heat generated in the tritium target assemblies and in the accelerator facility. These APT cooling water requirements are significantly greater than the current regulated allotment of water for Los Alamos National Laboratory and increasing the allotment to support the APT water requirement would be impractical and infeasible, and in any event beyond DOE's control.

It may be possible that an APT could use non-evaporative cooling towers, which would greatly reduce the water requirements. However, there is sufficient technical uncertainty regarding the feasibility and practicality of using non-evaporative cooling towers for a continuous wave APT to render this option unacceptable as a source for the Nation's only supply of tritium. The other five sites being analyzed in this PEIS could reasonably support the water requirements of the APT using evaporative cooling towers and, thus, would not incur the technical uncertainty and risk of Los Alamos National Laboratory. Thus, DOE has concluded that Los Alamos National Laboratory is not a reasonable site for an accelerator to produce tritium.

REDUCED TRITIUM REQUIREMENTS

The need for new tritium supply is based on the 1994 *Nuclear Weapons Stockpile Plan*, which projects a need for new tritium by approximately 2011 based on a START II level stockile size of approximately 3,500 accountable weapons. A smaller than START II stockpile size would extend the need date for new tritium beyond approximately 2011. If the need for new tritium were significantly later than 2011, the Department would not have a proposal for new tritium supply, and would not be preparing a PEIS for Tritium Supply and Recycling.

ENVIRONMENTAL RESOURCE IMPACT METHODS

The following is a brief description of the impact assessment approach used in the PEIS for addressing potential impacts of the tritium supply and recycling action.

LAND RESOURCES

Land Use. Land use impacts are assessed based on the extent and type of land that would be affected, and potential direct impacts resulting from the conversion or the incompatibility of land use changes with special status and protected lands.

Visual Resources. Visual impacts are assessed based on whether changes in existing facilities or construction of new facilities would appear uncharacteristic in each site's visual setting and, if so, how noticeable the changes would be.

SITE INFRASTRUCTURE

Changes to site infrastructure are assessed by overlying the support requirements of the respective tritium supply technologies and recycling facilities upon the projected site infrastructure capacities. These assessments focus upon power requirements, road networks, rail interfaces, and fuel requirements. The basis for the PEIS assessment is the supply and demand projections of the U.S. electric utilities published annually by the North American Electric Reliability Council.

AIR QUALITY AND ACOUSTICS

The assessment of potential impacts to air quality is based upon comparison of proposed project effects with applicable state, local, or national ambient air quality standards, or the potential exceedance of Prevention of Significant Deterioration increments. The more stringent of the standards serve as the comparison criteria. The comparison of project toxic pollutants includes guidelines or standards adopted or proposed by each state.

Acoustic impacts are assessed qualitatively on the basis of the potential degree of change in noise levels at sensitive receptors with respect to ambient conditions.

WATER RESOURCES

Surface Water. The surface water impacts are assessed based on water consumption and wastewater discharge for both construction and operation phases. Changes in the annual low flows of surface water resulting from proposed withdrawals and discharges are determined. The existing water supply is evaluated to determine if sufficient quantities are available to support an increased demand by comparing projected increases with the capacity of the supplier and existing water rights, agreements, or allocations. The assessment of water quality impacts from wastewater (sanitary and process) and stormwater runoff qualitatively addresses potential impacts to the receiving waters.

Floodplains impacts are assessed based on whether any of the proposed tritium supply technologies and recycling facilities are located within a floodplain. Where possible, the proposed location is compared with the 500-year floodplain.

Groundwater. Groundwater resource impacts are assessed based on the effects on aquifers, groundwater usage, and groundwater quality within the regions. Total groundwater use at the facility and projections of future usage are added to project water requirements to determine the short- and long-term impacts associated with construction and operation and dewatering withdrawals. Impacts of groundwater withdrawals on existing contaminant plumes because of construction and facility operation are assessed.

GEOLOGY AND SOILS

Impacts to the geological environment are assessed based on the destruction of or damage to unique geological features and subsidence caused by groundwater withdrawal, landslide, or shifting. Potential seismic impacts are assessed based on the locations of capable faults and the history of the seismicity of the site areas. Soil types at the proposed project sites are described and the capability of supporting construction of the proposed structures assessed.

BIOTIC RESOURCES

Potential impacts are assessed based on the degree to which various habitats or species could be affected by the project. Where possible, impacts are evaluated with respect to Federal and state protection regulations and standards.

Terrestrial Resources. Impacts to wildlife are based on plant community loss, which is associated with animal habitat. Also evaluated is the disturbance, displacement, or loss of wildlife. Based on expected releases and the results of past studies, impacts of radionuclides on site biota were not evaluated.

Wetlands. Impacts are assessed based on the nearness of wetlands to project areas and with the knowledge that standard construction erosion and sedimentation control measures would be implemented. Impacts from increased flows are assessed based on a comparison of expected discharge rates with present stream flow rates.

Aquatic Resources. Impacts as a result of sedimentation, increased flows, and effluent discharges are assessed in the same manner as wetlands. Impacts as a result of impingement and entrainment are assessed based on comparison of stream flow and intake volumes.

Threatened and Endangered Species. A list of species potentially present at each site using information obtained from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and appropriate state agencies, along with site environmental and engineering data, is used to assess whether the various technologies would impact any plant or animal.

CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric and Historic Resources. Impacts are assessed by considering whether the proposed action could substantially add to existing disturbance of resources in the areas, adversely affect National Register of Historic Places (NRHP) eligible resources, or cause loss of or destruction to important prehistoric resources.

Native American Resources. Impacts are assessed by considering whether the proposed action has the potential to affect sites important for their position in the Native American physical universe or belief system, or the possibility of reducing access to traditional use areas or sacred sites.

Paleontological Resources. Impact assessments for paleontological resources are based on the numbers and kinds of resources that could be affected as well as the quality of fossil preservation in a given deposit.

SOCIOECONOMICS

The assessment of impacts on local and regional socioeconomic conditions and factors include population, employment, economy, housing, public finance, and transportation. The impact assessment is based on the degree to which changes in employment and population affect the local economy, housing market, public finance, and transportation. The changes to these factors are projected to the year 2030 because it is assumed that after 2030 the impacts associated with the alternatives are negligibly different from the 2030 conditions.

RADIATION AND HAZARDOUS CHEMICAL ENVIRONMENT

The health effects are determined for each technology by identifying the types and quantities of material to which one is exposed, estimating doses, and then calculating the resultant health effects. The impacts on human health for workers and the public during normal operation and postulated accidents from various alternatives are assessed. Models such as GENII and MACCS for airborne and liquid radioactive releases; CHEM-PLUS for fire and explosions; and SLAB for hazardous chemical releases were used to project impacts. Atmospheric dispersion modeling performed for the air quality section is also utilized in the evaluation of impacts to workers from radiological and hazardous chemicals.

Experience from past and current operations that are similar to future operation is used to estimate the radiological health impacts to workers. Models are used to estimate the worker chemical exposure dose since no individual exposure data are available. Public health impacts could result from exposure to radioactive or hazardous chemical materials released during operation. Modeling is used to estimate the type and amount of material released and the associated radiological and chemical doses. These doses are converted to health effects using appropriate health risk estimators.

The relative consequences of postulated accidents in the evaluation of each alternative are assessed. The accident analysis involves less detail than a formal Probabilistic Risk Assessment and only addresses bounding accidents (high consequence, low probability) and a representative spectrum of possible operational accidents (low consequence but high probability of occurrence). The technical approach for the selection of accidents is consistent with the DOE Office of NEPA Oversight *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements Guidance* (May 1993), which recommends consideration of two major categories of accidents: within design basis accidents and beyond design basis accidents.

Risk is defined as the mathematical product of the probability and consequence of an accident. Both probabilities and consequences are presented in the PEIS. The risk-contributing scenarios consider both design-basis and severe accidents. The specific accidents consider the types of facilities.

WASTE MANAGEMENT

The analysis addresses the waste types and waste volumes projected to be generated from the various supply technologies and recycling facilities at each site. Impacts are assessed in the context of site practices for treatment, storage, and disposal plus the applicable regulatory settings.

Pantex is the only site under consideration that does not have existing onsite low-level waste disposal; the number of additional shipments required to transport low-level waste from Pantex to a DOE low-level waste disposal facility is estimated. The risk associated with additional shipments is also addressed.

INTERSITE TRANSPORTATION

The intersite transportation assessment was based on the transport mode, weight of material, curies, proximity dose rates (transport index), type of package, number of shipments, and/or distance. Health impacts from the transportation of tritium, highly-enriched uranium, plutonium, heavy water, and LLW are presented. Radiological health risks attributed to transport of tritium target rods from commercial reactors, the transport of highly-enriched uranium to potential HWR and MHTGR tritium supply sites, the transport of plutonium pits to support the multipurpose MHTGR and ALWR, and the transport of low-level waste from Pantex to NTS are also addressed.

Environmental Justice

The environmental justice analysis addressed selected demographic characteristics of the region-of-influence (50-miles) for each of the five candidate sites. The analysis identified census tracts where people of color comprise 50 percent (simple majority) of the total population in the census tract, or where people of color comprise less than 50 percent but greater than 25 percent of the total population in the census tract. The analysis also identified low-income communities where 25 percent or more of the population is characterized as living in poverty (yearly income of less than $8,076 for a family of two). Impacts are assessed based on the analysis presented for each resource and issue area for each tritium supply technology at each site. No disproportionately high and adverse human health or environmental effects on minority and low-income populations were identified.

ENVIRONMENTAL IMPACTS

In accordance with Council on Environmental Quality (CEQ) regulations, the environmental consequences discussions provide the analytical detail for comparisons of environmental impacts associated with the various tritium supply technologies and recycling facilities.

Tables ES–1 and ES–2, at the end of this summary, present a summary comparison of environmental impacts of the tritium supply and recycling alternatives. Impacts associated with collocation of a tritium supply and recycling alternative in table ES–1 are evaluated for every site except SRS. At SRS, impacts are evaluated for a tritium supply with upgraded recycling and a tritium upgrade. In addition, impacts associated with tritium supply alone alternatives are evaluated for all the candidate sites except SRS. A supply alone alternative does not exist for SRS because of existing recycling facilities. The tritium upgrade is part of the supply alone alternatives at the other four candidate sites (INEL, NTS, ORR, and Pantex) and the commercial reactor alternative. For the supply alone alternatives and the commercial reactor alternative, there would be minor impacts associated with upgrading the facilities at SRS.

For comparison purposes, environmental concentrations of emissions and other potential environmental effects are presented with appropriate regulatory standards or guidelines. However, the compliance with regulatory standards is not an assessment of the significance or severity of the environmental impact for NEPA purposes. The purpose of the analysis of environmental consequences is to identify the potential for environmental impacts. The PEIS for Tritium Supply and Recycling (Volume I) discusses in detail the environmental assessment methods used and the factors considered in assessing environmental impacts.

To satisfy the requirements of the NEPA, No Action is presented for comparison with the action alternatives. Under No Action (2010), DOE would not establish a new tritium supply capability, the current inventory of tritium would decay, and DOE would not meet current projections of stockpile requirements of tritium. Sites would continue waste management programs to meet the legal requirements and commitments in formal agreements and would proceed with cleanup activities. Production facilities and support roles at specific sites, however, would be downsized or eliminated in accordance with the reduced workload projected for the year 2010 and beyond.

To minimize repetition and be as concise as possible, the comparison of alternatives in tables ES–1 and ES–2 concentrate on the areas in which the public has expressed considerable interest and on programmatic factors important to DOE decisionmaking. Accordingly, the following resources are compared in table ES–1:

- Land resources;
- Site infrastructure;
- Water resources (surface water and Groundwater);
- Biotic resources (wetlands, aquatic resources, and threatened and endangered species and/or species of concern);
- Socioeconomics (employment during construction and operation and unemployment during operation);
- Radiological and hazardous chemical impacts during normal operations;
- Radiological impacts–accidents;
- Waste management; and
- Intersite transportation.

For the other resource areas summarized below, the environmental impacts do not vary significantly from site to site or technology to technology.

Visual Resources. Visual impacts may occur at NTS, ORR, or SRS. There would be no impacts to visual resources at INEL or Pantex. The use of a wet cooling system at ORR or SRS would produce some visible cooling tower plumes during certain weather conditions.

Air Quality and Acoustics. Construction activities would result in exceedance of 24-hour PM_{10} and TSP standards. At all sites, air pollutant concentrations would increase during operation but would be within standards, and noise levels would increase during both construction and operation.

Floodplains. No construction would take place in areas designated as 100-year flood plains at any site, or in areas designated as 500-year flood plains at INEL. NTS, ORR, Pantex, and SRS would require 500-year floodplain assessments.

Geology and Soils. There would be no impacts associated with geological conditions and no impacts to soils except for the disturbed areas.

Terrestrial Resources. The impacts to terrestrial resources would vary by the acreage disturbed during construction, and some salt drift impacts are possible with wet cooling systems.

Cultural and Paleontological Resources. Some NRHP-eligible resources may occur within the proposed site; Native American resources may be affected by land disturbance and audio or visual intrusions; and some paleontological resources may be affected by construction excavations deeper than 50 feet.

Other Socioeconomic Issues. Unemployment would decrease slightly in the economic study area at all sites during construction. Population and housing demand would increase slightly in the economic study area during construction and operation, as would per capita income. Revenues and expenditures for most region-of-influence counties, cities, and school districts would increase during construction and operation. Traffic conditions would worsen slightly during construction and operation on main access routes to the sites.

MULTIPURPOSE ("TRIPLE PLAY") REACTOR

The Department's Office of Fissile Materials Disposition is preparing a PEIS addressing the issue of how to dispose of plutonium that is excess to nuclear weapons requirements. Among the alternatives to be analyzed in the *Long-Term Storage and Disposition of Weapons-Usable Fissile Materials PEIS* is the use of plutonium as a fuel in existing, modified, or new nuclear reactors.

The nuclear reactors evaluated for tritium production in the Tritium Supply and Recycling PEIS utilize uranium as the fuel source, and the analysis in this PEIS is based on that design. Nonetheless, it is technically feasible to also use plutonium or plutonium-uranium oxide (mixed-oxide) fuel for a tritium production reactor. Congress and commercial entities have expressed interest in developing a multipurpose ("triple play") reactor that could produce tritium, "burn" plutonium, and generate revenues through the sale of electric power. Only the commercial reactor, ALWR, and MHTGR would be capable of performing the triple play missions; the potential environmental impacts from these triple play reactors are summarized below. The discussion for the multipurpose ALWR also applies to the multipurpose commercial reactor.

Advanced Light Water Reactor. If an ALWR were used to burn plutonium, the major contributions to potential environmental impacts would be from a new plutonium Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility. Such a facility could disturb up to 129 acres of land, and require a peak construction force of 550 during the peak year of the 6-year construction period.

During operation, this facility would require approximately 10 percent as much water as a large ALWR at a dry site, and would employ as many workers as the ALWR. Radiological exposures to workers during normal operation would be kept as low as reasonably achievable, and would not be expected to exceed 50 mrem per worker per year. If all 650 workers were exposed to such a dose, a highly conservative assumption, 0.52 latent cancer fatalities (less than one) would be expected over the 40 year operation life of the facility. The goal for the facility for public radiation exposure would be not to exceed 1.0 mrem effective dose equivalent per year.

Safety analysis reports have not been prepared for this facility. However, bounding accident scenarios have been identified from safety analysis reports for similar plants. Criticality accidents, explosions, and fires could occur in such a facility, and release radiation to the environment. The use of plutonium in an ALWR would not significantly affect the consequences of radioactivity releases from severe accidents, though there would be some small changes in the source term release spectrum and frequency.

Using a mixed-oxide fuel in an ALWR would have no major effect on reactor operations, and therefore, impacts would not be expected to change significantly from those associated with utilizing a uranium fueled reactor. This is based on a study conducted by the NRC, the *Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed-Oxide Fuel in Light Water Reactors (August, 1976).*

Modular High Temperature Gas-Cooled Reactor. To burn plutonium in a modular gas-cooled reactor, a plutonium Pit Disassembly/Conversion Facility would also be needed, and the environmental impacts from such a facility are expected to be approximately the same as those described for the similar facility to support a multipurpose ALWR. In a plutonium-fueled gas-cooled reactor, however, tritium production decreases significantly. Thus, twice as many reactor modules would be necessary in order to produce the steady-state tritium requirements. This doubling of reactor modules would be the major contributor to potential environmental impacts for this scenario.

Overall, building twice as many reactor modules could double most environmental impacts. Some construction impacts (land distributed, construction duration, and peak construction workforce) might be less than double because of economies of scale and shared support infrastructure. Depending upon the particular site, some impacts could be significant.

During operation of twice as many reactor modules, water requirements could increase by 80 percent. Impacts to groundwater would not change significantly from those expected with the three module MHTGR at those sites that would use groundwater resources. The expected workforce increase would approximately double any socioeconomic impacts and radiation doses to workers. Radiation exposure to the public from normal operation might also double. The use of plutonium in a MHTGR would not significantly affect severe accident consequences because fuel failures are not expected in any severe accident. Spent fuel generation would also double with the addition of twice as many reactor modules.

COMMERCIAL LIGHT WATER REACTOR

The purchase by DOE of an existing operating or partially completed commercial power reactor is a reasonable alternative being evaluated to meet the stockpile tritium requirement mission. Production of tritium using irradiation services contracted from commercial power reactors is also being evaluated as a reasonable alternative and as a potential contingency measure to meet the projected tritium requirements for the Nation's nuclear weapons stockpile in the event of a national emergency. The reactors employed for domestic electric power generation in the United States are conventional light water reactors that use ordinary water as moderator and coolant. The potential environmental impacts of the commercial light water reactor alternative are summarized below.

The option to purchase an operating commercial power reactor or finish construction of a partially complete commercial reactor to support the stockpile tritium requirement would have similar impacts. The reactor technologies and characteristics would be the same. However, some additional land use impacts may occur to incorporate security infrastructure and other requirements which would be needed for a DOE-owned and -operated tritium production facility. The potential land use impacts would result from new buffer zone requirements, new fencing, security buildings, and road access restrictions or construction of new roads.

The environmental impacts of completing construction of an unfinished commercial nuclear power plant would be relative to the extent that the potential power plant has been completed by the utility. For construction impact analysis, a range of reactor completion (45 percent to 85 percent) was used. Environmental impacts from the upgrade of existing site infrastructure to support renewed construction activities would be minor. Completing construction of a nuclear reactor would result in impacts from air emissions, increased worker numbers, and waste generation and management. Air emissions would be temporary and would not be expected to significantly affect air quality in the projected area. The increase in construction workers would have potential impact on the local economy and area population, housing, and local services. Because a majority of the nuclear power plant infrastructure and the power plant itself have already been completed using a much larger overall workforce and peak workforce, socioeconomic impacts are expected to be minor.

Construction activities are expected to generate construction debris and other hazardous and nonhazardous wastes. Typical hazardous wastes generated during the completion of the construction phase would include paints, solvents, acids, oils, and degreasers. Adverse environmental impacts from management and disposal of these wastes would not be expected.

The commercial reactor alternatives for producing tritium would result in additional environmental impacts from the changes in the reactor operational characteristics due to the introduction of DOE target rods. Impacts would likely result from core changes, personnel requirements, effluents, waste, spent fuel, radiation exposure, and transportation/handling.

Core Changes. Production of tritium in a commercial light water reactor would require physical changes to the reactor core, which could range from replacement of burnable poison elements with DOE target elements to the replacement of fuel rods with DOE target assemblies. Core changes could alter the accident basis and would modify the source term. The estimated additional core tritium content in curies per reactor at the end of the irradiation period would be 3.2×10^7 for a single reactor. Because of the reduced burn up in the reactor core, the total fission products in each fuel rod would decrease.

Personnel Requirements. An estimated 72 additional personnel would be needed for a typical commercial nuclear power facility. The additional personnel would represent an increase of approximately 9 percent for a single reactor. The number of personnel would be smaller for each commercial reactor site if multiple reactors were used.

Effluent. Because of the addition of DOE target rods, airborne and water-borne effluent would be expected to change (particularly for tritium). Estimates for expected increases of gaseous tritium effluent range from 5,740 Ci per year for a single reactor to 3,680 Ci per year in the multiple reactor scenario. Estimated increases of liquid tritium effluent ranges from 1,460 Ci per year for a single reactor to 935 Ci per year per reactor in the multiple reactor scenario.

Waste. Additional activities associated with the handling, processing, and shipping of DOE target assemblies would be expected to increase waste generation rates at the commercial reactor site. An estimated 164 yd^3 per year of LLW per reactor would be expected. This would be approximately a 50-percent increase for a typical plant. No increase in mixed waste generation would be anticipated. Depending on the selected site, expansion of existing or construction of new facilities may be required.

Spent Nuclear Fuel. More frequent refueling operations and the segmenting of fuel assemblies could result in an increase in spent nuclear fuel volumes With the single reactor case, 137 additional spent fuel assemblies (40 yd^3, assuming 8 ft^3/assembly) would be generated each year. This amounts to approximately 58 metric tons of heavy metal. The additional fuel assemblies represent more than a 3-fold increase over the average of 56 assemblies (24 metric tons of heavy metal) for a typical pressurized commercial light water reactor. The change to 12-month refueling cycles with full core discharge would accelerate the consumption of available spent nuclear fuel pool storage and would require earlier use of additional storage alternatives such as dry storage at some commercial reactor sites.

Worker Radiation Exposure. New DOE target assembly process activities and, in some cases, more frequent refueling-type operations would be expected to increase radiation exposure for some categories of workers. Estimates for expected increases of exposure for refueling personnel range from 19 person-rem per reactor for maintenance workers to less than 1 person-rem for supervisory personnel. In the multiple reactor scenario, no additional refueling personnel would be required; therefore, no additional worker exposure would be expected. The increase in person-rem per reactor for all personnel ranges from 24 for maintenance workers to 1 for supervisory personnel.

Radiological Impacts

Normal Operations. The impact from adding tritium targets to a commercial reactor would vary depending on the reactor type, reactor site location, and the number of sites involved in the tritium production mission. The maximum impacts at a given site would occur if all of the tritium were produced at that site. The impacts would lessen at a given site if multiple sites are used.

Considering that the arithmetic mean annual radiation dose to people who lived within a 50-mile radius of a commercial nuclear power plant in 1991 was about 1.2 person-rem (0.25 and 0.95 person-rem from airborne and liquid releases, respectively) and the median was less than 0.2 person-rem (NUREG/CR-2850), impacts of normal operation from tritium production are expected to be less than the NESHAPS 10 mrem limit for atmospheric releases and less than the drinking water limit of 4 mrem. It is estimated that the changes in radioactive releases associated with the production of tritium in a single reactor would result in an annual dose increase of 0.51 person-rem to the 50-mile population. This would result in a calculated increase of 0.10 fatal cancer in this population as the result of 40 years of reactor operation. There would be a slightly larger increase in the total number of fatal cancers in the several population groups for the multiple reactor scenario compared with the single reactor, but the calculated risk to an individual member of the public would be less because of the larger number of people exposed.

Detailed impact analysis would be performed after the reactor/site combination(s) have selected. If the results of the impacts analysis indicates exceedances of either NESHAPS and/or drinking water limits, the reactor's radioactive waste management system would be revised to reduce the effluent to acceptable limits.

Transportation/Handling. Assuming that an inventory of 500 target rods would be accumulated for shipment at one time in NRC-approved fuel assembly shipping casks, and one cask per transport truck, approximately 12 shipments per year would occur. The curie content per truck would be approximately $2.7x10^6$. The upper bound radiological consequences of an accident during transportation from a single site to SRS might incur an additional 240 person-rem per year.

QUALITATIVE COMPARISON

To aid the reader in understanding the differences in environmental impacts among the PEIS alternatives (particularly the tritium supply technology alternatives i.e., HWR, MHTGR, ALWR, and commercial light water reactor), this section presents a brief, qualitative summary comparison of the alternatives. Tables ES–1 and ES–2 which follow this section, present quantitative comparisons of greater detail.

For some of the resource areas evaluated in the PEIS, the analyses indicate that there are no major differences in the environmental impacts among the tritium supply technology and site alternatives. Resource areas where no major differences exist, or where potential environmental impacts are small, are: land resources, air quality, water resources, geology and soils, biotic resources, and socioeconomics. For these resource areas, this general conclusion is particularly true when comparing the operational impacts of the tritium supply facilities. For construction, this general conclusion is also particularly true when comparing among the various types of new tritium supply facilities (e.g., HWR, MHTGR, ALWR, and APT).

However, when comparing the potential impacts of constructing a new tritium supply facility against the alternative of using an existing commercial reactor (purchase of irradiation services or purchase and conversion of an existing commercial reactor), the environmental impacts of the latter are clearly less because the facility already exists, and, thus, there are minimal construction-related environmental impacts. For tritium recycling, this also applies when comparing the existing tritium recycling facilities at SRS against constructing a new tritium recycling facility at another site.

For other resource areas evaluated in the PEIS, the analyses indicate that there are notable environmental impact differences. Resource areas where notable differences exist are: site infrastructure (electrical requirements), human health (from radiological impacts due to accidents), and wastes generated. Each of these resource areas is discussed in greater detail below.

Site Infrastructure. Infrastructure and electrical capacity exist at each of the alternative sites to adequately support any of the tritium supply technology alternatives. Nonetheless, because the ALWR and MHTGR technologies could generate electricity while also producing tritium, these technologies could have a positive environmental impact by delaying the need to build some electrical generating facility in the future. The PEIS acknowledges, and qualitatively discusses, these potential "avoided" environmental impacts. The APT, and to a significantly lesser degree the HWR, would be energy consumers. The PEIS assesses the environmental impacts of providing power to the energy consumers. Thus, in terms of environmental impacts, there could be approximately 1,800 MWe of difference (i.e., ALWR generating 1,300 MWe versus an APT consuming 500 MWe) between the tritium supply technologies. For commercial reactors that already exist and produce electrical power, there would be no change to the existing electrical infrastructure.

Human Health. There are differences among the tritium supply technology and site alternatives regarding the potential human health impacts from accidents. The potential consequences are directly related to the amount of radioactivity released and the population density near the facility. For each of the tritium supply technology alternatives, the probability of severe accidents occurring is extremely small, on the order of once every millions of years at most. Based upon the PEIS analyses of the reactor technologies, the ALWR could cause the largest potential impacts to human health from severe accidents, while the MHTGR would have the smallest potential impacts. Because the APT does not utilize fissile materials, and there is no significant decay heat, there are virtually no radiological consequences from any APT accidents.

Consequently, the APT would have the fewest potential impacts to human health from accidents. The commercial reactor alternatives do not acquire any substantial risks by assuming a tritium-production mission.

Regarding the site alternatives, in the event of an accident at sites with small populations (INEL, NTS, and to a lesser extent Pantex), there would be fewer impacts to human health. Because ORR and SRS have larger populations within 50 miles of the proposed facilities, these two sites have greater potential human health impacts than the other sites. Because there are virtually no radiological consequences from any APT accidents, there are no grounds for discrimination among sites in the case of the APT. It is, in essence, site neutral with respect to potential impacts to human health.

Generated Wastes

Spent Fuel Generation. All of the tritium supply reactor technologies would generate spent fuel. While the MHTGR would generate the greatest volume of spent fuel (because of the graphite moderator), the residual heavy metal content of spent fuel from the ALWR would be the greatest. Reactors providing irradiation services would not generate additional spent fuel over and above what they would otherwise generate during their planned lifetime, assuming that multiple reactors are used and the operating scenarios do not change fuel cycles. However, if only a single reactor were used (irradiation services or purchased and converted), additional spent fuel would likely be generated because the reactor's refueling cycle would be shortened. The APT is not a reactor and would not generate spent fuel.

Low-level Waste. None of the alternatives would generate unacceptably large amounts of low-level waste. However, of the alternatives, the HWR would create the most low-level waste in 1 year (almost 5 times as much as any other reactor alternative). The APT would generate the least amount of low-level waste annually. In producing tritium, the commercial reactor alternatives would generate additional low-level waste, but this amount would be less than the new reactor alternatives. With regard to sites, except for Pantex, all sites have the ability to handle and dispose of low-level nuclear waste at the site. Low-level nuclear waste generated at Pantex would need to be shipped to another site for disposal.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 1 of 32]

INEL	NTS	ORR	PANTEX	SRS
Land Resources—No Action				
• Under No Action there would be no impacts to land use or visual resources.	• Under No Action there would be no impacts to land use or visual resources.	• Under No Action there would be no impacts to land use or visual resources.	• Under No Action there would be no impacts to land use or visual resources.	• Under No Action there would be no impacts to land use or visual resources.
Land Resources—Collocated Tritium Supply and Recycling				
• The land disturbance by technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling: 202 acres	• The land disturbance by technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling: 202 acres	• The land disturbance by technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling: 202 acres	• The land disturbance by technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling: 202 acres	• The land disturbance by technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling upgrade: 0 acres
Site Infrastructure—No Action				
• Under No Action the peak electrical load requirement would reduce by 51 MWe. Annual energy consumption would remain the same.	• Under No Action the peak electrical load requirement would reduce by 7MWe. Annual energy consumption would remain the same.	• Under No Action the peak electrical load requirement would reduce by 1,304 MWe. Annual energy consumption would reduce by 11,641,800 MWh per year.	• Under No Action the peak electrical load requirement would reduce by 1 MWe. Annual energy consumption would reduce by 7,000 MWh per year.	• Under No Action the peak electrical load requirement would reduce by 214 MWe. Annual energy consumption would reduce by 878,000 MWh per year.
Site Infrastructure—Collocated Tritium Supply and Recycling				
• The increase in the current site electrical requirement (MWe) for each technology: HWR: 34 MHGTR: 11 Large ALWR: 105 Small ALWR: 40 Full APT: 515 Phased APT: 320	• The increase in the current site electrical requirement (MWe) for each technology: HWR: 78 MHGTR: 55 Large ALWR: 149 Small ALWR: 84 Full APT: 559 Phased APT: 364	• The change in current capacity (MWe) for each technology: HWR: 1,237 less MHGTR: 1,252 less Large ALWR: 1,192 less Small ALWR: 1,236 less Full APT: 738 less Phased APT: 933 less	• The increase in the current site electrical requirement (MWe) for each technology: HWR: 84 MHGTR: 61 Large ALWR: 155 Small ALWR: 90 Full APT: 565 Phased APT: 370	• The change in current capacity (MWe) for each technology: HWR: 163 less MHGTR: 178 less Large ALWR: 118 less Small ALWR: 162 less Full APT: 336 (increase) Phased APT: 141 (increase)

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 2 of 32]

INEL	NTS	ORR	PANTEX	SRS
Site Infrastructure—Collocated Tritium Supply and Recycling				
• The percent of the power pool capacity margin: HWR: 0.62 MHTGR: 0.45 Large ALWR: 1.14 Small ALWR: 0.67 Full APT: 4.15 Phased APT: 2.72	• The percent of the power pool capacity margin: HWR: 0.72 MHTGR: 0.53 Large ALWR: 1.32 Small ALWR: 0.77 Full APT: 4.79 Phased APT: 3.14	• The percent of the power pool capacity margin: HWR: 1.47 MHTGR: 1.14 Large ALWR: 2.46 Small ALWR: 1.50 Full APT: 12.44 Phased APT: 8.15	• The percent of the power pool capacity margin: HWR: 2.09 MHTGR: 1.53 Large ALWR: 3.84 Small ALWR: 2.24 Full APT: 13.93 Phased APT: 9.13	• The percent of the power pool capacity margin: HWR: 0.49 MHTGR: 0.35 Large ALWR: 0.92 Small ALWR: 0.50 Full APT: 5.27 Phased APT: 3.40
Site Infrastructure—Tritium Supply Alone				
• The tritium supply alone would reduce the peak load requirement above by 16 MWe for all technologies.	• The tritium supply alone would reduce the peak load requirement above by 16 MWe for all technologies.	• The tritium supply alone would reduce the peak load requirement above by 16 MWe for all technologies.	• The tritium supply alone would reduce the peak load requirement above by 16 MWe for all technologies.	• No tritium supply alone.
Water Resources—No Action				
• Under No Action there would be no impacts to water resources.	• Under No Action there would be no impacts to water resources.	• Under No Action there would be no impacts to water resources.	• Under No Action there would be no impacts to water resources.	• Under No Action there would be no impacts to water resources.
Water Resources—Collocated Tritium Supply and Recycling				
• Surface water would not be used during construction.	• Surface water would not be used during construction.	• The construction surface water use (MGY) and corresponding percentage increase by technology: HWR: 23 (1 percent) MHTGR: 19 (1 percent) Large ALWR: 35 (2) percent) Small ALWR: 22 (1 percent) APT: 10 (<1 percent)	• Surface water would not be used during construction.	• Surface water would not be used during construction.

TABLE ES-1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 3 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Water Resources—Collocated Tritium Supply and Recycling		
• The construction groundwater use (MGY) by technology: HWR: 23 MHTGR: 19 Large ALWR: 35 Small ALWR: 22 APT: 10	• The construction groundwater use (MGY) by technology: HWR: 23 MHTGR: 19 Large ALWR: 35 Small ALWR: 22 APT: 10	• Groundwater would not be affected by construction or operation.	• Groundwater would not be used during construction. The construction reclaimed wastewater use (MGY) by technology: HWR: 23 MHTGR: 19 Large ALWR: 35 Small ALWR: 22 APT: 10	• The construction groundwater use (MGY) by technology: HWR: 21 Large ALWR: 33 Small ALWR: 20 MHTGR: 18 APT: 8
• The total percent of groundwater use increase during construction by technology: HWR: 1 MHTGR: 1 Large ALWR: 2 Small ALWR: 1 Full APT: <1 Phased APT: <1	• The total percent of groundwater use increase during construction by technology: HWR: 3 MHTGR: 3 Large ALWR: 5 Small ALWR: 3 Full APT: 1 Phased APT: 1	• No groundwater use.	• The total percent of reclaimed wastewater use increase during construction by technology: HWR: <1 MHTGR: <1 Large ALWR: <1 Small ALWR: <1 Full APT: <1 Phased APT: <1	• The total percent of groundwater use increase during construction by technology: HWR: <1 MHTGR: <1 Large ALWR: 1 Small ALWR: <1 Full APT: <1 Phased APT: <1
• Surface water would not be used during operation.	• Surface water would not be used during operation.	• The operation surface water use (MGY) and corresponding percentage increase by technology: HWR: 5,914 (320 percent) MHTGR: 4,014 (217 percent) Large ALWR: 16,014 (866 percent) Small ALWR: 7,214 (390 percent) Full APT: 1,214 (66 percent) Phased APT: 784 (42 percent)	• Surface water would not be used during operation.	• The operation surface water use (MGY) and corresponding percentage increase by technology: HWR: 5,888 (30 percent) MHTGR: 4,006 (20 percent) Large ALWR: 15,946 (78 percent) Small ALWR: 7,186 (36 percent) Full APT: 1,229 (6 percent) Phased APT: 799 (4 percent)

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 4 of 32]

INEL	NTS	ORR	PANTEX	SRS
Water Resources—Collocated Tritium Supply and Recycling				
• No blowdown discharges to surface water.	• No blowdown discharges to surface water.	• Blowdown discharges (MGY) to surface waters by technology: HWR: 2,314 MHTGR: 1,618 Large ALWR: 6,202 Small ALWR: 2,818 Full APT: 250 Phased APT: 178	• No blowdown discharges to surface water.	• Blowdown discharges (MGY) to surface waters by technology: HWR: 2,304 MHTGR: 1,608 Large ALWR: 6,192 Small ALWR: 2,808 Full APT: 240 Phased APT: 158
• Groundwater requirements (MGY) and corresponding percentage increase during operation by technology: HWR: 62 (3 percent) MHTGR: 44 (2 percent) Large ALWR: 104 (5 percent) Small ALWR: 64 (3 percent) Full APT: 1,214 (61 percent) Phased APT: 784 (39 percent)	• Groundwater requirements (MGY) and corresponding percentage increase during operation by technology: HWR: 62 (9 percent) MHTGR: 44 (7 percent) Large ALWR: 104 (16 percent) Small ALWR: 64 (10 percent) Full APT: 1,214 (181 percent) Phased APT: 784 (117 percent)	• Groundwater would not be used for operation.	• No groundwater would be used for operation. Reclaimed wastewater (MGY) and corresponding percentage increase during operation by technology: HWR: 62 (1 percent) MHTGR: 44 (1 percent) Large ALWR: 104 (2 percent) Small ALWR: 64 (2 percent) Full APT: 1,214 (28 percent) Phased APT: 784 (18 percent)	• Groundwater requirements (MGY) and corresponding percentage increase during operation by technology: HWR: 63 (2 percent) MHTGR: 45 (1 percent) Large ALWR: 105 (3 percent) Small ALWR: 65 (2 percent) Full APT: 22 (<1 percent) Phased APT: 22 (<1 percent)
Total groundwater use increase for HWR, MHTGR, and ALWR would be <1 percent of the INEL groundwater allotment; for the APT approximately 11 percent.	The HWR, MHTGR, ALWR, and APT would not adversely affect aquifer water levels.			

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 5 of 32]

INEL	NTS	ORR	PANTEX	SRS
Water Resources—Tritium Supply Alone				
• The groundwater requirement would be 1.5 MGY less than for collocation during construction and 14 MGY less during operation for all technologies. No surface water would be used.	• The groundwater requirement would be 1.5 MGY less than for collocation during construction and 14 MGY less during operation for all technologies. No surface water would be used.	• No groundwater would be used. Total surface water requirement would be 1.5 MGY less than for collocation during construction and 37 MGY less during operation for all technologies.	• The available reclaimed wastewater requirement would be 1.5 MGY less than for collocation during construction and 14 MGY less during operation for all technologies. No surface water or groundwater would be used.	• No tritium supply alone.
Biotic Resources—No Action				
• Under No Action there would be no impacts to biotic resources.	• Under No Action there would be no impacts to biotic resources.	• Under No Action there would be no impacts to biotic resources.	• Under No Action there would be no impacts to biotic resources.	• Under No Action there would be no impacts to biotic resources.
Biotic Resources—Collocated Tritium Supply and Recycling				
• Wetlands and aquatic resources would not be affected.	• Wetlands and aquatic resources would not be affected.	• Without appropriate mitigation measures, increased stream flow from operational discharges could affect wetland and aquatic plant communities.	• Without appropriate mitigation measures, playa wetlands could be degraded by discharges, aquatic resources would not be affected.	• Without appropriate mitigation measures, construction and operational discharges to an onsite stream could affect wetland and aquatic communities.
• No Federal-listed threatened or endangered species would be affected during construction or operation, but several Federal candidates or state-listed species may be affected.	• One Federal-listed threatened species, the desert tortoise, could be affected during construction and operation. Several Federal candidate or state-listed species may be affected.	• No Federal-listed threatened or endangered species would be affected during construction or operation, but several Federal candidates or state-listed species may be affected.	• One Federal-listed threatened species, the bald eagle, and several Federal candidate or state-listed species may be affected by construction activities.	• No Federal-listed threatened or endangered species would be affected during construction or operation, but several Federal candidates or state-listed species may be affected.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 6 of 32]

INEL	NTS	ORR	PANTEX	SRS
Biotic Resources—Collocated Tritium Supply and Recycling				
• The ferruginous hawk could lose foraging habitat equal to the amount of land disturbed for each technology during construction and operation. The Townsend's western big-eared bat may roost and forage throughout the disturbed area during construction and forage at stormwater retention ponds during operation.	• The ferruginous hawk could lose foraging habitat equal to the amount of land disturbed for each technology during construction and operation. The loggerhead shrike could lose foraging and breeding habitats as well. Neither species should be adversely affected due to the large extent of nearby suitable habitat.	• Four state-listed raptors could lose potential nesting and foraging habitat equal to the amount of disturbed land for each technology; however this type of habitat is abundant in the area. The Tennessee dace and hellbender, both state-listed, could be affected by construction.	• The black tern, white-faced ibis, ferruginous hawk, loggerhead shrike, and bald eagle could lose foraging and/or nesting habitat equal to the amount of land disturbed for each technology during construction. The swift fox could lose potential foraging and denning habitat. The Texas horned lizard could be impacted during land clearing activities.	• The potentially affected species include the awned meadow-beauty, green-fringed orchid, Florida false loosestrife, beak-rush, star-nosed mole and the eastern tiger salamander, which could lose foraging habitat equal to the disturbed land during construction for each technology.
Socioeconomics—No Action				
• Under No Action INEL employment decreased by 1,000 persons between 1990 and 1994 to 10,100 persons, and will remain at this level through 2020.	• Under No Action NTS employment decreased by 1,170 persons between 1990 and 1994 to 6,850 persons, and will remain at this level through 2020.	• Under No Action ORR employment decreased by 300 persons between 1990 and 1994 to 15,000 persons, and it will remain at this level through 2020.	• Under No Action Pantex employment increased by 1,000 persons between 1990 and 1994 to 3,400 persons. It will decrease to 1,790 in 2010 and is expected to remain at this level through 2020.	• Under No Action SRS employment decreased by 2,000 persons between 1990 and 1994 to 20,300 persons. It will decrease to 16,900 by 2010 and is expected to remain at this level through 2020.
• Under No Action employment in the regional economic area is expected to grow by less than 1 percent annually through 2009 and then decrease by less than 1 percent annually through 2020.	• Under No Action employment in the regional economic area is expected to grow by less than 1 percent annually through 2009 and then continue to increase by less than 1 percent annually through 2020.	• Under No Action employment in the regional economic area is expected to grow by less than 1 percent annually through 2009 and decrease by less than 1 percent annually through 2020.	• Under No Action employment in the regional economic area is expected to grow by less than 1 percent annually through 2020.	• Under No Action employment in the regional economic area is expected to grow by less than 1 percent annually between 2001 and 2020.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 7 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Socioeconomics—No Action		
• Under No Action unemployment is expected to be at 6.4 percent between 2001 and 2020. Per capita income is expected to increase from $17,800 to $20,900.	• Under No Action unemployment is expected to be at 5 percent between 2001 and 2020. Per capita income is expected to increase from $23,600 to $25,100.	• Under No Action unemployment is expected to be at 6.2 percent between 2001 and 2020. Per capita income is expected to increase from $17,900 to $20,700.	• Under No Action unemployment is expected to be at 4.6 percent between 2001 and 2020. Per capita income is expected to increase from $22,300 to $25,700.	• Under No Action unemployment is expected to be at 4.8 percent between 2001 and 2020. Per capita income is expected to increase from $18,300 to $21,000.
• Under No Action the average annual population and housing increase is expected to be less than 1 percent through 2010.	• Under No Action the average annual population and housing increase is expected to be 1 percent through 2020.	• Under No Action the average annual population and housing increase is expected to be 1 percent through 2009 and less than 1 percent between 2010 and 2020.	• Under No Action the average annual population and housing increase is expected to be less than 1 percent through 2020.	• Under No Action the average annual population and housing increase is expected to be less than 1 percent through 2010.
• Population is expected to reach 207,300 in 2010 and 215,200 in 2020.	• Population is expected to reach 1,020,900 in 2010 and 1,103,500 in 2020.	• Population is expected to reach 561,000 in 2010 and 586,000 in 2020.	• Population is expected to reach 205,100 in 2010 and 209,000 in 2020.	• Population is expected to reach 454,900 in 2010 and 473,000 in 2020.
• Under No Action total revenues and expenditures for ROI counties, cities, and school districts is expected to increase by an annual average of less than 1 percent from 2001 to 2020.	• Under No Action total revenues and expenditures for ROI counties, cities, and school districts is expected to increase by an annual average of less than 1 percent to 5 percent between 2001 and 2005, and by 1 to 2 percent between 2005 and 2010. Between 2010 and 2020, annual increases of less than 1 percent are expected.	• Under No Action total revenues and expenditures for ROI counties, cities, and school districts is expected to increase by an annual average of approximately 1 percent or less through 2020.	• Under No Action total revenues and expenditures for ROI counties, cities, and school districts is expected to increase by an annual average of less than 1 percent through 2020.	• Under No Action total revenues and expenditures for ROI counties, cities, and school districts is expected to increase by an annual average of less than 1 percent through 2020.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 8 of 32]

INEL	NTS	ORR	PANTEX	SRS
Socioeconomics—Collocated Tritium Supply and Recycling				
• The increase in employment during peak construction in the regional economic area by technology: HWR: 7,500 MHTGR: 7,200 ALWR: 10,800 APT: 8,750	• The increase in employment during peak construction in the regional economic area by technology: HWR: 9,500 MHTGR: 9,100 ALWR: 13,700 APT: 11,100	• The increase in employment during peak construction in the regional economic area by technology: HWR: 8,300 MHTGR: 8,000 ALWR: 12,000 APT: 9,700	• The increase in employment during peak construction in the regional economic area by technology: HWR: 7,600 MHTGR: 7,300 ALWR: 10,900 APT: 8,800	• The increase in employment during peak construction in the regional economic area by technology: HWR: 7,200 MHTGR: 6,900 ALWR: 10,800 APT: 8,500
• The increase in employment during full operation in the regional economic area by technology: HWR: 4,900 MHTGR: 4,900 ALWR: 4,700 APT: 4,100	• The increase in employment during full operation in the regional economic area by technology: HWR: 5,500 MHTGR: 5,500 ALWR: 5,200 APT: 4,600	• The increase in employment during full operation in the regional economic area by technology: HWR: 5,200 MHTGR: 5,100 ALWR: 4,900 APT: 4,300	• The increase in employment during full operation in the regional economic area by technology: HWR: 5,300 MHTGR: 5,300 ALWR: 5,000 APT: 4,400	• The increase in employment during full operation in the regional economic area by technology: HWR: 2,400 MHTGR: 2,300 ALWR: 2,100 APT: 1,600
• The decrease in unemployment during full operation in the regional economic area by technology: HWR: 1.8 percent MHTGR: 1.8 percent ALWR: 1.7 percent APT: 1.5 percent	• The decrease in unemployment during full operation in the regional economic area by technology: HWR: 0.7 percent MHTGR: 0.7 percent ALWR: 0.6 percent APT: 0.6 percent	• The decrease in unemployment during full operation in the regional economic area by technology: HWR: 0.6 percent MHTGR: 0.6 percent ALWR: 0.6 percent APT: 0.5 percent	• The decrease in unemployment during full operation in the regional economic area by technology: HWR: 2.1 percent MHTGR: 2.1 percent ALWR: 1.9 percent APT: 1.8 percent	• The decrease in unemployment during full operation in the regional economic area by technology: HWR: 0.3 percent MHTGR: 0.2 percent ALWR: 0.2 percent APT: 0.2 percent
Radiological and Hazardous Chemical Impacts During Normal Operation—No Action				
• Under No Action, the dose to the maximally exposed member of the public for emissions of radiation from 1 year of operation is $6.0x10^{-3}$ mrem. The risk of fatal cancer from 40 years of operation is $1.2x10^{-7}$.	• Under No Action, the dose to the maximally exposed member of the public for emissions of radiation from 1 year of operation is 0.04 mrem. The risk of fatal cancer from 40 years of operation is $8.1x10^{-7}$.	• Under No Action, the dose to the maximally exposed member of the public for emissions of radiation from 1 year of operation is 3.9 mrem from atmospheric release and 14 mrem from liquid release. The risk of fatal cancer from 40 years of operation is $7.8x10^{-5}$ and $2.7x10^{-4}$, respectively.	• Under No Action, the dose to the maximally exposed member of the public for emissions of radiation from 1 year of operation is $1.3x10^{-3}$ mrem. The risk of fatal cancer from 40 years of operation is $2.6x10^{-8}$.	• Under No Action, the dose to the maximally exposed member of the public for emissions of radiation from 1 year of operation is 2.8 mrem from atmospheric release and 0.077 from liquid release. The risk of fatal cancer from 40 years of operation is $5.6x10^{-5}$ and $1.5x10^{-6}$, respectively.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 9 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—No Action				
• The population dose of 0.037 person-rem from total site operations in 2030 would result in 7.4×10^{-4} fatal cancer over 40 years of operation.	• The population dose of 8.2×10^{-3} person-rem from total site operations in 2030 would result in 1.6×10^{-4} fatal cancer over 40 years of operation.	• The population dose of 57 person-rem from total site operations in 2030 would result in 1.1 fatal cancer over 40 years of operation.	• The population dose of 5.7×10^{-4} person-rem from total site operations in 2030 would result in 1.1×10^{-5} fatal cancer over 40 years of operation.	• The population dose of 250 person-rem from total site operations in 2030 would result in 4.9 fatal cancers over 40 years of operation.
• Under No Action the average annual dose to a site worker is 30 mrem with a risk of fatal cancer of 4.8×10^{-4} from 40 years of operation. The annual dose of 220 person-rem to total site workforce would result in 3.5 fatal cancers over 40 years of operation.	• Under No Action the average annual dose to a site worker is 5 mrem with a risk of fatal cancer of 7.8×10^{-5} from 40 years of operation. The annual dose of 3 person-rem to total site workforce would result in 0.048 fatal cancer over 40 years of operation.	• Under No Action the average annual dose to a site worker is 17 mrem with a risk of fatal cancer of 2.8×10^{-4} from 40 years of operation. The annual dose of 320 person-rem to total site workforce would result in 5.1 fatal cancers over 40 years of operation.	• Under No Action the average annual dose to a site worker is 15 mrem with a risk of fatal cancer of 2.4×10^{-4} from 40 years of operation. The annual dose of 37 person-rem to total site workforce would result in 0.59 fatal cancers over 40 years of operation.	• Under No Action the average annual dose to a site worker is 32 mrem with a risk of fatal cancer of 5.2×10^{-4} from 40 years of operation. The annual dose of 480 person-rem to total site workforce would result in 7.7 fatal cancers over 40 years of operation.
Radiological and Hazardous Chemical Impacts During Normal Operation—No Action				
• Under No Action for emission of hazardous chemicals, the chemical Hazard Index (HI) is 1.7×10^{-4} with no cancer risk to the maximally exposed member of the public. The site worker HI is 0.021 with no cancer risk.	• Under No Action for emission of hazardous chemicals, the chemical HI is 0 with no cancer risk to the maximally exposed member of the public or site worker.	• Under No Action for emission of hazardous chemicals, the chemical HI is 0.36 with no cancer risk to the maximally exposed member of the public. The site worker HI is 0.26 with no cancer risk.	• Under No Action for emission of hazardous chemicals, the chemical HI is 3.7×10^{-3} with a cancer risk of 1.8×10^{-9} to the maximally exposed member of the public. The site worker HI is 0.26 with a cancer risk of 7.7×10^{-7}.	• Under No Action for emission of hazardous chemicals the chemical HI is 0.7 with a cancer risk of 3.3×10^{-5} to the maximally exposed member of the public. The site worker HI is 1.8 and the cancer risk is 5.9×10^{-3}. The HI value for the public is within regulatory limits, however, the worker HI exceeds OSHA's action level of 1.0. The cancer risk to both the public and site worker exceeds the typical threshold of regulatory concern of 1.0×10^{-6}.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 10 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—Collocated Tritium Supply and Recycling				
• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 0.29 (5.9×10^{-6}) MHTGR: 0.19 (3.8×10^{-6}) Large and Small ALWR: 0.36 (7.3×10^{-6}) APT (He-3): 0.11 (2.3×10^{-6}) APT (SILC): 0.16 (3.3×10^{-6})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 0.31 (6.2×10^{-6}) MHTGR: 0.21 (4.1×10^{-6}) Large and Small ALWR: 0.40 (8.0×10^{-6}) APT (He-3): 0.13 (2.6×10^{-6}) APT (SILC): 0.18 (3.6×10^{-6})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 7.1 (1.4×10^{-4}) MHTGR: 5.7 (1.1×10^{-4}) Large ALWR: 8.8 (1.8×10^{-4}) Small ALWR: 7.6 (1.5×10^{-4}) APT (He-3): 4.3 (8.6×10^{-5}) APT (SILC): 5.0 (1.0×10^{-4})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 3.8 (7.6×10^{-5}) MHTGR: 2.4 (4.8×10^{-5}) Large ALWR: 4.9 (9.8×10^{-5}) Small ALWR: 4.8 (9.6×10^{-5}) APT (He-3): 1.4 (2.9×10^{-5}) APT (SILC): 2.1 (4.2×10^{-5})	• The annual dose in mrem to the maximally exposed member of the public from total site operations from atmospheric release and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 3.4 (6.9×10^{-5}) MHTGR: 3.0 (5.9×10^{-5}) Large ALWR: 3.9 (7.8×10^{-5}) Small ALWR: 3.6 (7.1×10^{-5}) APT (He-3): 2.5 (4.9×10^{-5}) APT (SILC): 2.8 (5.6×10^{-5})
• No liquid releases.	• No liquid releases.	• The annual dose in mrem to the maximally exposed member of the public from total site operation would be 14 mrem from liquid releases for each technology. The associated risk of fatal cancer from 40 years of operation would be 2.7×10^{-4} for all technologies, except for the ALWRs (2.8×10^{-4}).	• No liquid releases.	• The annual dose in mrem to the maximally exposed member of the public from total site operation from liquid releases, and associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 0.16 (3.3×10^{-6}) MHTGR: 0.077 (1.5×10^{-6}) Large ALWR: 0.16 (3.3×10^{-6}) Small ALWR: 0.26 (5.3×10^{-6}) APT (for either target system): 0.077 (1.5×10^{-6})
• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40 years of operation by technology:	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40 years of operation by technology:	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40 years of operation by technology:	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40 years of operation by technology:	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40 years of operation and by technology:

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 11 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—Collocated Tritium Supply and Recycling				
HWR: 53 (1.1) MHTGR: 37 (0.73) Large ALWR: 73 (1.5) Small ALWR: 71 (1.4) APT (He-3): 23 (0.45) APT (SILC): 32 (0.64)	HWR: 0.20 ($4.0x10^{-3}$) MHTGR: 0.13 ($2.6x10^{-3}$) Large ALWR: 0.24 ($4.9x10^{-3}$) Small ALWR: 0.25 ($5.1x10^{-3}$) APT (He-3): 0.08 ($1.6x10^{-3}$) APT (SILC): 0.11 ($2.3x10^{-3}$)	HWR: 82 (1.6) MHTGR: 76 (1.5) Large ALWR: 90 (1.8) Small ALWR: 87 (1.7) APT (He-3): 68 (1.4) APT (SILC): 73 (1.5)	HWR: 28 (0.55) MHTGR: 16 (0.31) Large ALWR: 37 (0.73) Small ALWR: 35 (0.69) APT (He-3): 9.2 (0.18) APT (SILC): 14 (0.27)	HWR: 300 (6.1) MHTGR: 260 (5.2) Large ALWR: 340 (6.8) Small ALWR: 310 (6.2) APT (He-3): 220 (4.4) APT (SILC): 250 (4.9)
• The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance by technology: HWR: 33 ($5.2x10^{-4}$) MHTGR: 31 ($5.0x10^{-4}$) Large ALWR: 49 ($7.9x10^{-4}$) Small ALWR: 41 ($6.6x10^{-4}$) APT (He-3): 33 ($5.2x10^{-4}$) APT (SILC): 33 ($5.2x10^{-4}$)	• The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance by technology: HWR: 34 ($5.4x10^{-4}$) MHTGR: 26 ($4.2x10^{-4}$) Large ALWR: 140 ($2.3x10^{-3}$) Small ALWR: 92 ($1.5x10^{-3}$) APT (He-3): 34 ($5.5x10^{-4}$) APT (SILC): 36 ($5.7x10^{-4}$)	• The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance by technology: HWR: 19 ($3.0x10^{-4}$) MHTGR: 18 ($2.9x10^{-4}$) Large ALWR: 26 ($4.2x10^{-4}$) Small ALWR: 22 ($3.6x10^{-4}$) APT (He-3): 18 ($3.0x10^{-4}$) APT (SILC): 19 ($3.0x10^{-4}$)	• The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance by technology: HWR: 25 ($4.0x10^{-4}$) MHTGR: 22 ($3.5x10^{-4}$) Large ALWR: 68 ($1.1x10^{-3}$) Small ALWR: 46 ($7.4x10^{-4}$) APT (He-3): 25 ($3.9x10^{-4}$) APT (SILC): 25 ($4.0x10^{-4}$)	• The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance by technology: HWR: 34 ($5.4x10^{-4}$) MHTGR: 33 ($5.3x10^{-4}$) Large ALWR: 42 ($6.7x10^{-4}$) Small ALWR: 38 ($6.1x10^{-4}$) APT (for either target system): 33 ($5.3x10^{-4}$)
• The annual dose in person-rem to the total site workforce and (fatal cancers) from 40 years of operation by technology: HWR: 261 (4.2) MHTGR: 250 (4.0) Large ALWR: 392 (6.3) Small ALWR: 322 (5.2) APT (He-3): 260 (4.2) APT (SILC): 262 (4.2)	• The annual dose in person-rem to the total site workforce and (fatal cancers) from 40 years of operation by technology: HWR: 44 (0.70) MHTGR: 33 (0.53) Large ALWR: 180 (2.8) Small ALWR: 100 (1.7) APT (He-3): 43 (0.69) APT (SILC): 45 (0.72)	• The annual dose in person-rem to the total site workforce and (fatal cancers) from 40 years of operation by technology: HWR: 360 (5.8) MHTGR: 350 (5.6) Large ALWR: 490 (7.9) Small ALWR: 420 (6.7) APT (He-3): 360 (5.8) APT (SILC): 362 (5.8)	• The annual dose in person-rem to the total site workforce and (fatal cancers) from 40 years of operation by technology: HWR: 78 (1.2) MHTGR: 67 (1.1) Large ALWR: 210 (3.3) Small ALWR: 140 (2.2) APT (He-3): 77 (1.2) APT (SILC): 79 (1.3)	• The annual dose in person-rem to the total site workforce and (fatal cancers) from 40 years of operation by technology: HWR: 520 (8.3) MHTGR: 510 (8.2) Large ALWR: 650 (10) Small ALWR: 580 (9.3) APT (He-3): 520 (8.3) APT (SILC): 522 (8.4)
• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 12 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—Collocated Tritium Supply and Recycling				
• For chemicals, the HI for the maximally exposed member of the public and site worker by technology: **Public** HWR: 2.1×10^{-4} MHTGR: 1.8×10^{-4} Large and Small ALWR: 6.3×10^{-4} APT (for either target system): 1.8×10^{-4} Cancer Risk: 0	• For chemicals, the HI for the maximally exposed member of the public and site worker by technology: **Public** HWR: 6.3×10^{-6} MHTGR: 2.2×10^{-7} Large and Small ALWR: 7.7×10^{-5} APT (for either target system): 1.8×10^{-7} Cancer Risk: 0	• For chemicals, the HI for the maximally exposed member of the public and site worker by technology: **Public** HWR: 0.36 MHTGR: 0.36 Large and Small ALWR: 0.38 APT (for either target system): 0.36 Cancer Risk: 0	• For chemicals, the HI for the maximally exposed member of the public and site worker by technology: **Public** HWR: 4.1×10^{-3} MHTGR: 3.7×10^{-3} Large and Small ALWR: 7.5×10^{-3} APT (for either target system): 3.8×10^{-3} Cancer Risk: 1.8×10^{-9}	• For chemicals, the HI for the maximally exposed member of the public and site worker by technology: **Public** HWR: 0.7 MHTGR: 0.7 Large and Small ALWR: 0.7 APT (for either target system): 0.7 Cancer Risk: 3.3×10^{-5}
Worker HWR: 0.031 MHTGR: 0.021 Large and Small ALWR: 0.13 APT (for either target system): 0.021 Cancer Risk: 0	**Worker** HWR: 3.2×10^{-3} MHTGR: 3.4×10^{-5} Large and Small ALWR: 0.038 APT (for either target system): 3.4×10^{-5} Cancer Risk: 0	**Worker** HWR: 0.27 MHTGR: 0.32 Large and Small ALWR: 0.35 APT (for either target system): 0.26 Cancer Risk: 0	**Worker** HWR: 0.26 MHTGR: 0.26 Large and Small ALWR: 0.26 APT (for either target system): 0.26 Cancer Risk: 7.7×10^{-7}	**Worker** HWR: 1.8 MHTGR: 1.8 Large and Small ALWR: 1.9 APT (for either target system): 1.8 Cancer Risk: 5.9×10^{-3}
All values are within regulatory limits.	All values are within regulatory limits.	All values are within regulatory limits.	All values are within regulatory limits.	The HI value for the public is within regulatory limits, however the HI value to the worker exceeds the action level of 1.0 based on OSHA's exposure limits. Cancer risks to the public and site workers both exceed the typical threshold of regulatory concern of 1.0×10^{-6}. This is due to No Action and not the proposed action.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 13 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—Tritium Supply Alone				
• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 0.18 (3.7×10^{-6}) MHTGR: 0.08 (1.6×10^{-6}) Large and Small ALWR: 0.25 (5.1×10^{-6}) APT (He-3):0.0048 (1.0×10^{-7}) APT (SILC): 0.05 (1.1×10^{-6})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 0.19 (3.8×10^{-6}) MHTGR: 0.09 (1.7×10^{-6}) Large and Small ALWR: 0.28 (5.6×10^{-6}) APT (He-3): 0.01 (2.0×10^{-7}) APT (SILC): 0.06 (1.2×10^{-6})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 4.3 (8.4×10^{-5}) MHTGR: 2.9 (5.4×10^{-5}) Large ALWR: 6.0 (1.2×10^{-4}) Small ALWR: 4.8 (9.4×10^{-5}) APT (He-3): 1.5 (3.0×10^{-5}) APT (SILC): 2.2 (4.4×10^{-5})	• The annual dose in mrem to the maximally exposed member of the public from total site operations and the associated (risk of fatal cancer) from 40 years of operation by technology: HWR: 2.4 (4.8×10^{-5}) MHTGR: 1.0 (2.0×10^{-5}) Large ALWR: 3.5 (7.0×10^{-5}) Small ALWR: 3.4 (6.8×10^{-5}) APT (He-3): 0.048 (1.0×10^{-6}) APT (SILC): 0.7 (1.4×10^{-5})	• No tritium supply alone.
• No liquid release.	• No liquid release.	• The annual dose to the maximally exposed member of the public from total site operations including any technology would be 14 mrem from liquid releases, and the associated risk of fatal cancer from 40 years of operation would be 2.7×10^{-4}.	• No liquid release.	• No tritium supply alone.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 14 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological and Hazardous Chemical Impacts During Normal Operation—Tritium Supply Alone				
• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40 years of operation by technology: HWR: 31 (0.66) MHTGR: 15 (0.29) Large ALWR: 51 (1.1) Small ALWR: 49 (0.96) APT (He-3): 1.0 (0.01) APT (SILC): 10 (0.2)	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40 years of operation by technology: HWR: 0.13 (2.6x10^{-3}) MHTGR: 0.06 (1.2x10^{-3}) Large ALWR: 0.17 (3.5x10^{-3}) Small ALWR: 0.18 (3.7x10^{-3}) APT (He-3): 0.01 (2.0x10^{-4}) APT (SILC): 0.04 (9.0x10^{-4})	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40 years of operation by technology: HWR: 71 (1.4) MHTGR: 65 (1.3) Large ALWR: 79 (1.6) Small ALWR: 76 (1.5) APT (He-3): 57 (1.2) APT (SILC): 62 (1.3)	• The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40 years of operation by technology: HWR: 19 (0.37) MHTGR: 7 (0.13) Large ALWR: 28 (0.55) Small ALWR: 26 (0.51) APT (He-3): 0.2 (3.9x10^{-3}) APT (SILC): 5 (0.09)	• No tritium supply alone.
The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance, including the following technology: HWR: 34 (5.4x10^{-4}) MHTGR: 33 (5.3x10^{-4}) Large ALWR: 52 (8.3x10^{-4}) Small ALWR: 43 (6.9x10^{-4}) APT (He-3): 34 (5.4x10^{-4}) APT (SILC): 34 (5.5x10^{-4})	The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance, including the following technology: HWR: 47 (7.5x10^{-4}) MHTGR: 37 (6.0x10^{-4}) Large ALWR: 220 (3.5x10^{-3}) Small ALWR: 130 (2.2x10^{-3}) APT (He-3): 48 (7.7x10^{-4}) APT (SILC): 51 (8.2x10^{-4})	The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance, including the following technology: HWR: 19 (3.0x10^{-4}) MHTGR: 19 (3.0x10^{-4}) Large ALWR: 26 (4.3x10^{-4}) Small ALWR: 23 (3.7x10^{-4}) APT 19 (for either target system): (3.0x10^{-4})	The average annual dose in mrem to a site worker and (fatal cancer risk) from 40 years of operation that are associated with total site performance, including the following technology: HWR: 28 (4.5x10^{-4}) MHTGR: 24 (3.9x10^{-4}) Large ALWR: 78 (1.3x10^{-3}) Small ALWR: 53 (8.6x10^{-4}) APT (He-3): 28 (4.4x10^{-4}) APT (SILC): 29 (4.6x10^{-4})	• No tritium supply alone.
• The annual dose in person-rem to the total site workforce and (fatal cancers) over 40 years of operation by technology: HWR: 260 (4.2) MHTGR: 250 (4.0) Large ALWR: 390 (6.3) Small ALWR: 320 (5.2) APT (He-3): 258 (4.1) APT (SILC): 261 (4.2)	• The annual dose in person-rem to the total site workforce and (fatal cancers) over 40 years of operation by technology: HWR: 42 (0.67) MHTGR: 31 (0.50) Large ALWR: 180 (2.8) Small ALWR: 98 (1.7) APT (He-3): 41 (0.66) APT (SILC): 44 (0.70)	• The annual dose in person-rem to the total site workforce and (fatal cancers) over 40 years of operation by technology: HWR: 360 (5.8) MHTGR: 350 (5.6) Large ALWR: 490 (7.9) Small ALWR: 420 (6.7) APT (He-3): 360 (5.8) APT (SILC): 362 (5.8)	• The annual dose in person-rem to the total site workforce and (fatal cancers) over 40 years of operation by technology: HWR: 76 (1.2) MHTGR: 65 (1.1) Large ALWR: 210 (3.3) Small ALWR: 140 (2.2) APT (He-3): 75 (1.2) APT (SILC): 78 (1.2)	• No tritium supply alone.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 15 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Radiological and Hazardous Chemical Impacts During Normal Operation—Tritium Supply Alone		
• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• All radiological doses to the public and site workers are within regulatory limits.	• No tritium supply alone.
• For collocation, relative percent reductions of the HI to the maximally exposed member of the public and site worker by technology: **Public** HWR: 0.3 MHTGR: 0.03 ALWR: 0.01 APT: 0.03 Cancer Risk: 0 **Worker** HWR: 0.02 MHTGR: 0.2 ALWR: 0.04 APT: 0.2 Cancer Risk: 0 All values are within regulatory limits.	• For collocation, relative percent reductions of the HI to the maximally exposed member of the public and site worker by technology: **Public** HWR: 1.4 MHTGR: 41 ALWR: 0.12 APT: 51 Cancer Risk: 0 **Worker** HWR: 0.5 MHTGR: 50 ALWR: 0.04 APT: 50 Cancer Risk: 0 All values are within regulatory limits.	• For collocation, relative percent reductions of the HI to the maximally exposed member of the public and site worker by technology: **Public** HWR: 0.01 MHTGR: 0.01 ALWR: 0.01 APT: 0.01 Cancer Risk: 0 **Worker** HWR: 0.015 MHTGR: 0.013 ALWR: 0.011 APT: 0.015 Cancer Risk: 0 All values are within regulatory limits.	• For collocation, relative percent reductions of the HI to the maximally exposed member of the public and site worker by technology: **Public** HWR: 10.3 MHTGR: 10.6 ALWR: 9.3 APT: 10.6 Cancer Risk: 1.8×10^{-9} **Worker** HWR: 0.003 MHTGR: 0.003 ALWR: 0.003 APT: 0.003 Cancer Risk: 7.7×10^{-7} All HI values are within regulatory limits.	• No tritium supply alone.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 16 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
The estimated cancer risk and if an accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at site boundary for the low-to-moderate consequence/high probability tritium supply technology accident would be:	The estimated cancer risk and if an accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at site boundary for the low-to-moderate consequence/high probability tritium supply technology accident would be:	The estimated cancer risk and if an accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at site boundary for the low-to-moderate consequence/high probability tritium supply technology accident would be:	The estimated cancer risk and if an accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at site boundary for the low-to-moderate consequence/high probability tritium supply technology accident would be:	The estimated cancer risk and if an accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at site boundary for the low-to-moderate consequence/high probability tritium supply technology accident would be:
Cancer Risk (per year) HWR: 8.1×10^{-9} MHTGR: 1.3×10^{-10} Large ALWR: 5.0×10^{-11} Small ALWR: 6.8×10^{-11} APT: negligible	**Cancer Risk (per year)** HWR: 4.2×10^{-9} MHTGR: 5.5×10^{-11} Large ALWR: 2.2×10^{-11} Small ALWR: 3.0×10^{-11} APT: negligible	**Cancer Risk (per year)** HWR: 6.8×10^{-8} MHTGR: 1.1×10^{-9} Large ALWR: 4.3×10^{-10} Small ALWR: 5.8×10^{-10} APT: negligible	**Cancer Risk (per year)** HWR: 6.2×10^{-9} MHTGR: 1.0×10^{-10} Large ALWR: 3.9×10^{-11} Small ALWR: 5.2×10^{-11} APT: negligible	**Cancer Risk (per year)** HWR: 2.3×10^{-8} MHTGR: 3.0×10^{-10} Large ALWR: 1.3×10^{-10} Small ALWR: 2.0×10^{-10} APT: negligible
Cancer Fatalities HWR: 8.1×10^{-6} MHTGR: 5.1×10^{-9} Large ALWR: 5.0×10^{-6} Small ALWR: 6.8×10^{-6} APT: negligible	**Cancer Fatalities** HWR: 4.2×10^{-6} MHTGR: 2.2×10^{-9} Large ALWR: 2.2×10^{-6} Small ALWR: 3.0×10^{-6} APT: negligible	**Cancer Fatalities** HWR: 6.8×10^{-5} MHTGR: 4.4×10^{-8} Large ALWR: 4.3×10^{-5} Small ALWR: 5.8×10^{-5} APT: negligible	**Cancer Fatalities** HWR: 6.2×10^{-6} MHTGR: 4.0×10^{-9} Large ALWR: 3.9×10^{-6} Small ALWR: 5.2×10^{-6} APT: negligible	**Cancer Fatalities** HWR: 2.3×10^{-5} MHTGR: 1.2×10^{-8} Large ALWR: 1.3×10^{-5} Small ALWR: 2.0×10^{-5} APT: negligible

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 17 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
• The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50 miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50 miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50 miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50 miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50 miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:
Cancer Risk (per year) HWR: 7.4×10^{-5} MHTGR: 5.0×10^{-7} Large ALWR: 3.8×10^{-7} Small ALWR: 6.2×10^{-7} APT: negligible	**Cancer Risk (per year)** HWR: 1.2×10^{-6} MHTGR: 1.7×10^{-8} Large ALWR: 7.3×10^{-9} Small ALWR: 1.0×10^{-8} APT: negligible	**Cancer Risk (per year)** HWR: 7.5×10^{-4} MHTGR: 1.1×10^{-5} Large ALWR: 4.6×10^{-6} Small ALWR: 6.4×10^{-6} APT: negligible	**Cancer Risk (per year)** HWR: 2.6×10^{-5} MHTGR: 3.0×10^{-7} Large ALWR: 1.5×10^{-7} Small ALWR: 2.1×10^{-7} APT: negligible	**Cancer Risk (per year)** HWR: 7.3×10^{-4} MHTGR: 6.3×10^{-6} Large ALWR: 3.8×10^{-6} Small ALWR: 6.0×10^{-6} APT: negligible
Cancer Fatality HWR: 0.074 MHTGR: 2.0×10^{-5} Large ALWR: 0.038 Small ALWR: 0.062 APT: negligible	**Cancer Fatality** HWR: 1.2×10^{-3} MHTGR: 6.8×10^{-7} Large ALWR: 7.3×10^{-4} Small ALWR: 1.0×10^{-3} APT: negligible	**Cancer Fatality** HWR: 0.75 MHTGR: 4.3×10^{-4} Large ALWR: 0.46 Small ALWR: 0.64 APT: negligible	**Cancer Fatality** HWR: 0.026 MHTGR: 1.2×10^{-5} Large ALWR: 0.015 Small ALWR: 0.021 APT: negligible	**Cancer Fatality** HWR: 0.73 MHTGR: 2.5×10^{-4} Large ALWR: 0.037 Small ALWR: 0.6 APT: negligible

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 18 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
• The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to a worker located 1,000 meters from the release for a low-to- moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to a worker located 1,000 meters from the release for a low-to- moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to a worker located 1,000 meters from the release for a low-to- moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to a worker located 1,000 meters from the release for a low-to- moderate consequence/high probability accident of a tritium supply technology would be:	• The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to a worker located 1,000 meters from the release for a low-to- moderate consequence/high probability accident of a tritium supply technology would be:
Cancer Risk (per year) HWR: $1.1x10^{-7}$ MHTGR: $3.3x10^{-9}$ Large ALWR: $1.0x10^{-9}$ Small ALWR: $1.3x10^{-9}$ APT: negligible	**Cancer Risk (per year)** HWR: $2.8x10^{-8}$ MHTGR: $8.3x10^{-10}$ Large ALWR: $3.1x10^{-10}$ Small ALWR: $3.9x10^{-10}$ APT: negligible	**Cancer Risk (per year)** HWR: $1.6x10^{-7}$ MHTGR: $4.8x10^{-9}$ Large ALWR: $1.6x10^{-9}$ Small ALWR: $2.1x10^{-9}$ APT: negligible	**Cancer Risk (per year)** HWR: $1.2x10^{-8}$ MHTGR: $3.8x10^{-10}$ Large ALWR: $1.2x10^{-10}$ Small ALWR: $1.6x10^{-10}$ APT: negligible	**Cancer Risk (per year)** HWR: $2.9x10^{-7}$ MHTGR: $8.5x10^{-9}$ Large ALWR: $2.8x10^{-9}$ Small ALWR: $3.6x10^{-9}$ APT: negligible
Cancer Fatality HWR: $1.1x10^{-4}$ MHTGR: $1.3x10^{-7}$ Large ALWR: $1.0x10^{-4}$ Small ALWR: $1.3x10^{-4}$ APT: negligible	**Cancer Fatality** HWR: $2.8x10^{-5}$ MHTGR: $3.3x10^{-8}$ Large ALWR: $3.1x10^{-5}$ Small ALWR: $3.9x10^{-5}$ APT: negligible	**Cancer Fatality** HWR: $1.6x10^{-4}$ MHTGR: $1.9x10^{-7}$ Large ALWR: $1.6x10^{-4}$ Small ALWR: $2.1x10^{-4}$ APT: negligible	**Cancer Fatality** HWR: $1.2x10^{-5}$ MHTGR: $1.5x10^{-8}$ Large ALWR: $1.2x10^{-5}$ Small ALWR: $1.6x10^{-5}$ APT: negligible	**Cancer Fatality** HWR: $2.9x10^{-4}$ MHTGR: $3.4x10^{-7}$ Large ALWR: $2.8x10^{-4}$ Small ALWR: $3.6x10^{-4}$ APT: negligible

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 19 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
- The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at the site boundary for the high consequence/low probability accidents of a tritium supply technology would be: **Cancer Risk (per year)** HWR: 6.5×10^{-9} MHTGR: 9.4×10^{-10} Large ALWR: 3.5×10^{-10} Small ALWR: 3.6×10^{-10} APT(He-3): 4.4×10^{-15} APT (SILC): 9.2×10^{-14} **Cancer Fatality** HWR: 7.1×10^{-4} MHTGR: 5.9×10^{-5} Large ALWR: 2.3×10^{-3} Small ALWR: 2.3×10^{-3} APT(He-3): 6.2×10^{-9} APT (SILC): 1.3×10^{-7}	- The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at the site boundary for the high consequence/low probability accidents of a tritium supply technology would be: **Cancer Risk (per year)** HWR: 1.8×10^{-8} MHTGR: 2.7×10^{-9} Large ALWR: 8.3×10^{-10} Small ALWR: 9.8×10^{-10} APT(He-3): 1.2×10^{-14} APT (SILC): 2.3×10^{-13} **Cancer Fatality** HWR: 2.0×10^{-3} MHTGR: 1.7×10^{-4} Large ALWR: 5.5×10^{-3} Small ALWR: 6.3×10^{-3} APT(He-3): 1.7×10^{-8} APT (SILC): 3.3×10^{-7}	- The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at the site boundary for the high consequence/low probability accidents of a tritium supply technology would be: **Cancer Risk (per year)** HWR: 1.4×10^{-7} MHTGR: 2.4×10^{-8} Large ALWR: 3.1×10^{-9} Small ALWR: 6.6×10^{-9} APT(He-3): 9.5×10^{-14} APT (SILC): 1.6×10^{-12} **Cancer Fatality** HWR: 0.015 MHTGR: 1.5×10^{-3} Large ALWR: 0.02 Small ALWR: 0.042 APT(He-3): 1.3×10^{-7} APT (SILC): 2.2×10^{-6}	- The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at the site boundary for the high consequence/low probability accidents of a tritium supply technology would be: **Cancer Risk (per year)** HWR: 9.5×10^{-8} MHTGR: 1.6×10^{-8} Large ALWR: 2.3×10^{-9} Small ALWR: 4.6×10^{-9} APT(He-3): 6.4×10^{-14} APT (SILC): 1.0×10^{-12} **Cancer Fatality** HWR: 0.010 MHTGR: 1.0×10^{-3} Large ALWR: 0.015 Small ALWR: 0.029 APT(He-3): 9.0×10^{-8} APT (SILC): 1.4×10^{-6}	- The estimated cancer risk and if the accident occurred, the increase in the likelihood of cancer fatality to the maximally exposed individual at the site boundary for the high consequence/low probability accidents of a tritium supply technology would be: **Cancer Risk (per year)** HWR: 6.0×10^{-9} MHTGR: 1.0×10^{-9} Large ALWR: 2.0×10^{-10} Small ALWR: 2.9×10^{-10} APT(He-3): 4.1×10^{-15} APT (SILC): 7.3×10^{-14} **Cancer Fatality** HWR: 6.6×10^{-4} MHTGR: 6.3×10^{-5} Large ALWR: 1.3×10^{-3} Small ALWR: 1.9×10^{-3} APT(He-3): 5.7×10^{-9} APT (SILC): 1.0×10^{-7}

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 20 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
• The estimated cancer risk (fatalities per year) and if the accident occurred, the total cancer fatalities for the population residing within 50 miles for high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, the total cancer fatalities for the population residing within 50 miles for high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, the total cancer fatalities for the population residing within 50 miles for high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, the total cancer fatalities for the population residing within 50 miles for high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk (fatalities per year) and if the accident occurred, the total cancer fatalities for the population residing within 50 miles for high consequence/low probability accidents of a tritium supply technology would be:
Cancer Risk (per year) HWR: 1.4×10^{-5} MHTGR: 2.9×10^{-6} Large ALWR: 5.5×10^{-8} Small ALWR: 6.4×10^{-7} APT(He-3): 7.4×10^{-12} APT (SILC): 6.7×10^{-11}	**Cancer Risk (per year)** HWR: 1.4×10^{-6} MHTGR: 2.8×10^{-7} Large ALWR: 5.3×10^{-9} Small ALWR: 6.1×10^{-8} APT(He-3): 7.0×10^{-13} APT (SILC): 6.4×10^{-12}	**Cancer Risk (per year)** HWR: 1.2×10^{-4} MHTGR: 2.3×10^{-5} Large ALWR: 9.4×10^{-7} Small ALWR: 5.1×10^{-6} APT(He-3): 6.8×10^{-11} APT (SILC): 7.4×10^{-10}	**Cancer Risk (per year)** HWR: 1.5×10^{-5} MHTGR: 3.0×10^{-6} Large ALWR: 1.1×10^{-7} Small ALWR: 6.7×10^{-7} APT(He-3): 8.9×10^{-12} APT (SILC): 9.6×10^{-11}	**Cancer Risk (per year)** HWR: 5.1×10^{-5} MHTGR: 1.0×10^{-5} Large ALWR: 2.6×10^{-7} Small ALWR: 2.3×10^{-6} APT(He-3): 2.8×10^{-11} APT (SILC): 2.7×10^{-10}
Cancer Fatality HWR: 1.6 MHTGR: 0.18 Large ALWR: 0.36 Small ALWR: 4.1 APT(He-3): 1.0×10^{-5} APT (SILC): 9.4×10^{-5}	**Cancer Fatality** HWR: 0.15 MHTGR: 0.017 Large ALWR: 0.035 Small ALWR: 0.39 APT(He-3): 9.9×10^{-7} APT (SILC): 9.0×10^{-6}	**Cancer Fatality** HWR: 13 MHTGR: 1.4 Large ALWR: 6.2 Small ALWR: 33 APT(He-3): 9.6×10^{-5} APT (SILC): 1.0×10^{-3}	**Cancer Fatality** HWR: 1.7 MHTGR: 0.19 Large ALWR: 0.72 Small ALWR: 4.3 APT(He-3): 1.3×10^{-5} APT (SILC): 1.3×10^{-4}	**Cancer Fatality** HWR: 5.5 MHTGR: 0.63 Large ALWR: 1.7 Small ALWR: 14 APT(He-3): 3.9×10^{-5} APT (SILC): 3.8×10^{-4}

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 21 of 32]

INEL	NTS	ORR	PANTEX	SRS
Radiological Impacts from Accidents—Tritium Supply Technology				
• The estimated cancer risk to a worker located 1,000 meters from the release and if the accident occurred, the increase in the likelihood of cancer fatality for a high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk to a worker located 1,000 meters from the release and if the accident occurred, the increase in the likelihood of cancer fatality for a high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk to a worker located 1,000 meters from the release and if the accident occurred, the increase in the likelihood of cancer fatality for a high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk to a worker located 1,000 meters from the release and if the accident occurred, the increase in the likelihood of cancer fatality for a high consequence/low probability accidents of a tritium supply technology would be:	• The estimated cancer risk to a worker located 1,000 meters from the release and if the accident occurred, the increase in the likelihood of cancer fatality for a high consequence/low probability accidents of a tritium supply technology would be:
Cancer Risk (per year) HWR: 3.2×10^{-7} MHTGR: 1.1×10^{-7} Large ALWR: 5.0×10^{-9} Small ALWR: 1.5×10^{-8} APT(He-3): 4.4×10^{-13} APT (SILC): 6.7×10^{-12}	**Cancer Risk (per year)** HWR: 2.8×10^{-7} MHTGR: 8.1×10^{-8} Large ALWR: 4.5×10^{-9} Small ALWR: 1.4×10^{-8} APT(He-3): 3.2×10^{-13} APT (SILC): 4.8×10^{-12}	**Cancer Risk (per year)** HWR: 3.2×10^{-7} MHTGR: 1.1×10^{-7} Large ALWR: 4.9×10^{-9} Small ALWR: 1.6×10^{-8} APT(He-3): 4.3×10^{-13} APT (SILC): 6.2×10^{-12}	**Cancer Risk (per year)** HWR: 2.2×10^{-7} MHTGR: 5.0×10^{-8} Large ALWR: 3.5×10^{-9} Small ALWR: 1.1×10^{-8} APT(He-3): 1.9×10^{-13} APT (SILC): 2.7×10^{-12}	**Cancer Risk (per year)** HWR: 2.1×10^{-7} MHTGR: 5.1×10^{-8} Large ALWR: 3.4×10^{-9} Small ALWR: 1.1×10^{-8} APT(He-3): 1.9×10^{-13} APT (SILC): 2.7×10^{-12}
Cancer Fatality HWR: 0.034 MHTGR: 6.7×10^{-3} Large ALWR: 0.033 Small ALWR: 0.094 APT(He-3): 6.1×10^{-7} APT (SILC): 9.4×10^{-6}	**Cancer Fatality** HWR: 0.031 MHTGR: 5.0×10^{-3} Large ALWR: 0.03 Small ALWR: 0.087 APT(He-3): 4.5×10^{-7} APT (SILC): 6.7×10^{-6}	**Cancer Fatality** HWR: 0.035 MHTGR: 7.1×10^{-3} Large ALWR: 0.032 Small ALWR: 0.1 APT(He-3): 6.0×10^{-7} APT (SILC): 8.7×10^{-6}	**Cancer Fatality** HWR: 0.024 MHTGR: 3.1×10^{-3} Large ALWR: 0.023 Small ALWR: 0.07 APT(He-3): 2.6×10^{-7} APT (SILC): 3.8×10^{-6}	**Cancer Fatality** HWR: 0.023 MHTGR: 3.2×10^{-3} Large ALWR: 0.023 Small ALWR: 0.067 APT(He-3): 2.7×10^{-7} APT (SILC): 3.8×10^{-6}
The impact of tritium extraction and recycling are presented in appendix I.	The impact of tritium extraction and recycling are presented in appendix I.	The impact of tritium extraction and recycling are presented in appendix I.	The impact of tritium extraction and recycling are presented in appendix I.	The impact of tritium extraction and recycling are presented in appendix I.
Waste Management—No Action				
• Under No Action, INEL would continue to manage spent nuclear fuel and the following waste types: high-level, TRU, low-level, mixed TRU and low-level, hazardous, and nonhazardous.	• Under No Action, NTS would continue to manage the following waste types: TRU, low-level, mixed TRU and low-level, hazardous, and nonhazardous.	• Under No Action, ORR would continue to manage spent nuclear fuel and the following waste types: TRU, low-level, mixed TRU and low-level, hazardous, and nonhazardous.	• Under No Action, Pantex would continue to manage the following waste types: low-level, mixed low-level, hazardous, and nonhazardous.	• Under No Action, SRS would continue to manage spent nuclear fuel and the following waste types: high-level, TRU, low-level, mixed TRU and low-level, hazardous, and nonhazardous.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 22 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Collocated Tritium Supply and Recycling				
• Spent nuclear fuel would be generated by all technologies, except APT.	• Spent nuclear fuel would be generated by all technologies, except APT.	• Spent nuclear fuel would be generated by all technologies, except APT.	• Spent nuclear fuel would be generated by all technologies, except APT.	• For collocated tritium supply and upgraded recycling facilities, spent nuclear fuel would be generated by all technologies, except APT.
New spent nuclear fuel storage facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New spent nuclear fuel storage facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New spent nuclear fuel storage facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New spent nuclear fuel storage facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New spent nuclear fuel storage facilities would be required.
• Liquid LLW would be generated by all technologies except APT, in the following quantities:	• Liquid LLW would be generated for all technologies except APT, in the following quantities:	• Liquid LLW generation would increase for all technologies except APT. The increase over No Action (587,000 GPY) would be:	• Liquid LLW generation would increase for all technologies except APT. The increase over No Action (400 GPY) would be:	• Liquid LLW would be generated for all technologies except APT, in the following quantities:
HWR: 2,100,000 GPY MHTGR: 525,000 GPY Large ALWR: 5,000,000 GPY Small ALWR: 790,000 GPY	HWR: 2,100,000 GPY MHTGR: 525,000 GPY Large ALWR: 5,000,000 GPY Small ALWR: 790,000 GPY	HWR: 2,100,000 GPY MHTGR: 525,000 GPY Large ALWR: 5,000,000 GPY Small ALWR: 790,000 GPY	HWR: 2,100,000 GPY MHTGR: 525,000 GPY Large ALWR: 5,000,000 GPY Small ALWR: 790,000 GPY	HWR: 2,100,000 GPY MHTGR: 525,000 GPY Large ALWR: 5,000,000 GPY Small ALWR: 790,000 GPY
Existing/planned treatment facility may be adequate for all technologies, except the Large ALWR, which would require a new treatment facility. For tritium recycling phaseout at SRS, there would be no change.	New treatment facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New treatment facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New treatment facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New treatment facilities would be required.
• Solid LLW generation would increase and require additional onsite LLW disposal area.	• Solid LLW generation would increase and require additional onsite LLW disposal area.	• Solid LLW generation would increase and require additional onsite LLW disposal area.	• Solid LLW generation would increase and require additional onsite LLW disposal area at NTS.	• Solid LLW generation would increase for all technologies and require additional onsite LLW disposal area.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 23 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Collocated Tritium Supply and Recycling				
• The increase over No Action (5,100 yd^3 per year) and the additional LLW disposal area would be: HWR: 5,550 yd^3 (0.6 acres) MHTGR: 1,650 yd^3 (0.2 acres) Large ALWR: 1,060 yd^3 (0.2 acres) Small ALWR: 1,010 yd^3 (0.1 acres) APT: 894 yd^3 (0.1 acres)	• The increase over No Action (42,400 yd^3 per year) and the additional LLW disposal area would be: HWR: 5,550 yd^3 (0.6 acres) MHTGR: 1,650 yd^3 (0.2 acres) Large ALWR: 1,060 yd^3 (0.2 acres) Small ALWR: 1,010 yd^3 (0.1 acres) APT: 894 yd^3 (0.1 acres)	• The increase over No Action (9,300 yd^3 per year) and the additional LLW disposal area would be: HWR: 5,550 yd^3 (1.2 acres) MHTGR: 1,650 yd^3 (0.35 acres) Large ALWR: 1,060 yd (0.4 acres) Small ALWR: 1,010 yd^3 (0.2 acres) APT: 894 yd^3 (0.2 acres)	• The increase over No Action (25 yd^3 per year) and the additional LLW shipments to NTS would be: HWR: 5,550 yd^3 (92 shipments) MHTGR: 1,650 yd^3 (27 shipments) Large ALWR: 1,060 yd^3 (32 shipments) Small ALWR: 1,010 yd^3 (18 shipments) APT: 894 yd^3 (16 shipments) Additional LLW disposal area at NTS would be the same as in NTS alternatives.	• The increase over No Action (5,100 yd^3 per year) and the additional LLW disposal area would be: HWR: 5,200 yd^3 (0.4 acres) MHTGR: 1,300 yd^3 (0.1 acres) Large ALWR: 710 yd^3 (0.06 acres) Small ALWR: 660 yd^3 (0.05 acres) APT: 544 yd^3 (0.05 acres)
For tritium recycling phaseout, 350 yd^3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	For tritium recycling phaseout, 350 yd^3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	For tritium recycling phaseout, 350 yd^3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	For tritium recycling phaseout, 350 yd^3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	No tritium recycling phaseout.
• Small quantity (6 GPY) of liquid mixed LLW from recycling facility would be generated. Existing/planned treatment facilities would be adequate.	• Small quantity (6 GPY) of liquid mixed LLW from recycling facility would be generated. Organic mixed waste treatment capability would be required.	• Small quantity (6 GPY) in liquid mixed LLW generation over No Action (470,000 GPY) from recycling facility would be generated. Existing/planned treatment facilities would be adequate.	• Small quantity (6 GPY) in liquid mixed LLW generation over No Action (403 GPY) from recycling facility would be generated. Existing/planned treatment facilities would be adequate.	• No increase in liquid mixed LLW generation from upgraded recycling facility.
For tritium recycling phaseout at SRS, 6 GPY of liquid mixed LLW would no longer be generated.	For tritium recycling phaseout at SRS, 6 GPY of liquid mixed LLW would no longer be generated.	For tritium recycling phaseout at SRS, 6 GPY of liquid mixed LLW would no longer be generated.	For tritium recycling phaseout at SRS, 6 GPY of liquid mixed LLW would no longer be generated.	No tritium recycling phaseout.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 24 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Collocated Tritium Supply and Recycling				
• Solid mixed LLW generation increase over No Action (655 yd^3 per year) would be: HWR: 122 yd^3 MHTGR: 3 yd^3 Large ALWR: 8 yd^3 Small ALWR: 8 yd^3 APT: 9 yd^3	• Solid mixed LLW generation increase over No Action (5,460 yd^3 per year) would be: HWR: 122 yd^3 MHTGR: 3 yd^3 Large ALWR: 8 yd^3 Small ALWR: 8 yd^3 APT: 9 yd^3	• Solid mixed LLW generation increase over No Action (11,100 yd^3 per year) would be: HWR: 122 yd^3 MHTGR: 3 yd^3 Large ALWR: 8 yd^3 Small ALWR: 8 yd^3 APT: 9 yd^3	• Solid mixed LLW generation increase over No Action (5 yd^3 per year) would be: HWR: 122 yd^3 MHTGR: 3 yd^3 Large ALWR: 8 yd^3 Small ALWR: 8 yd^3 APT: 9 yd^3	• Solid mixed LLW generation increase over No Action (151 yd^3 per year) would be: HWR: 120 yd^3 MHTGR: 1 yd^3 Large ALWR: 6 yd^3 Small ALWR: 6 yd^3 APT: 7 yd^3
HWR may require new or expanded treatment and storage facilities.	Organic mixed waste treatment capability would be required.	Existing/planned treatment facilities would be adequate.	HWR would require new or expanded treatment and storage facilities.	HWR may require new or expanded treatment and storage facilities. Other technologies may require expanded treatment capacity.
For tritium recycling phaseout, 2 yd^3 per year decrease in solid mixed LLW at SRS.	For tritium recycling phaseout, 2 yd^3 per year decrease in solid mixed LLW at SRS.	For tritium recycling phaseout, 2 yd^3 per year decrease in solid mixed LLW at SRS.	For tritium recycling phaseout, 2 yd^3 per year decrease in solid mixed LLW at SRS.	No tritium recycling phaseout.
• Solid hazardous waste generation increase over No Action (308 yd^3 per year) would be: HWR: 41 yd^3 MHTGR: 101 yd^3 Large ALWR: 36 yd^3 Small ALWR: 36 yd^3 APT: 4 yd^3	• Solid hazardous waste generation increase over No Action (20 yd^3 per year) would be: HWR: 41 yd^3 MHTGR: 101 yd^3 Large ALWR: 36 yd^3 Small ALWR: 36 yd^3 APT: 4 yd^3	• Solid hazardous waste generation increase over No Action (1,150 yd^3 per year) would be: HWR: 41 yd^3 MHTGR: 101 yd^3 Large ALWR: 36 yd^3 Small ALWR: 36 yd^3 APT: 4 yd^3	• Solid hazardous waste generation increase over No Action (63 yd^3 per year) would be: HWR: 41 yd^3 MHTGR: 101 yd^3 Large ALWR: 36 yd^3 Small ALWR: 36 yd^3 APT: 4 yd^3 per year	• Hazardous waste generation increase over No Action (13 yd^3 per year) would be: HWR: 40 yd^3 MHTGR: 100 yd^3 Large ALWR: 35 yd^3 Small ALWR: 35 yd^3 APT: 3 yd^3

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 25 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Waste Management—Collocated Tritium Supply and Recycling		
Use of existing/planned hazardous waste facilities may be feasible.	Additional hazardous waste storage facilities may be required except for APT. APT may require expansion of existing/planned hazardous waste storage facilities.	Existing/planned hazardous waste facilities would be adequate.	Use of existing/planned hazardous waste facilities would be adequate.	Additional hazardous waste storage facilities may be required except for APT. APT may require expansion of existing/planned hazardous waste storage facilities.
For tritium recycling phaseout, 1 yd^3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	For tritium recycling phaseout, 1 yd^3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	For tritium recycling phaseout, 1 yd^3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	For tritium recycling phaseout, 1 yd^3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	No tritium recycling phaseout.
• Liquid sanitary waste would be generated: HWR: 62.3 MGY MHTGR: 44.3 MGY Large ALWR: 104 MGY Small ALWR: 64.3 MGY APT: 260 MGY	• Liquid sanitary waste would be generated: HWR: 62.3 MGY MHTGR: 44.3 MGY Large ALWR: 104 MGY Small ALWR: 64.3 MGY APT: 260 MGY	• Liquid sanitary waste generation would increase over No Action (483 MGY): HWR: 2,380 MGY MHTGR: 1,660 MGY Large ALWR: 6,320 MGY Small ALWR: 2,880 MGY APT: 269 MGY	• Liquid sanitary waste generation would increase over No Action (39.9 MGY): HWR: 62.3 MGY MHTGR: 44.3 MGY Large ALWR: 104 MGY Small ALWR: 64.3 MGY APT: 260 MGY	• Liquid sanitary waste generation would increase over No Action (186 MGY): HWR: 2,350 MGY MHTGR: 1,630 MGY Large ALWR: 6,290 MGY Small ALWR: 2,850 MGY APT: 245 MGY
New treatment facilities would be required.	New treatment facilities would be required.	New treatment facilities would be required.	New treatment facilities would be required.	New treatment facilities would be required.
• For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned.	• For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned.	• For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned.	• For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned.	• No tritium recycling phaseout.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 26 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Collocated Tritium Supply and Recycling				
• Solid sanitary waste generation would increase over No Action (68,000 yd^3 per year): HWR: 15,000 yd^3 MHTGR: 14,800 yd^3 Large ALWR: 14,300 yd^3 Small ALWR: 11,600 yd^3 APT: 8,640 yd^3	• Solid sanitary waste generation would increase over No Action (7,000 yd^3 per year): HWR: 15,000 yd^3 MHTGR: 14,800 yd^3 Large ALWR: 14,300 yd^3 Small ALWR: 11,600 yd^3 APT: 8,640 yd^3	• Solid sanitary waste generation would increase over No Action (77,000 yd^3 per year): HWR: 15,000 yd^3 MHTGR: 14,800 yd^3 Large ALWR: 14,300 yd^3 Small ALWR: 11,600 yd^3 APT: 8,640 yd^3	• Solid sanitary waste generation would increase over No Action (734 yd^3 per year): HWR: 15,000 yd^3 MHTGR: 14,800 yd^3 Large ALWR: 14,300 yd^3 Small ALWR: 11,600 yd^3 APT: 8,640 yd^3	• Solid sanitary waste generation would increase over No Action (80,000 yd^3 per year): HWR: 7,600 yd^3 MHTGR: 7,400 yd^3 Large ALWR: 6,900 yd^3 Small ALWR: 4,200 yd^3 APT: 1,240 yd^3
Onsite landfill design life would be reduced or require expansion.	Onsite landfill design life would be reduced or require expansion.	Onsite landfill design life would be reduced or require expansion.	Offsite (city of Amarillo) landfill design life would be reduced or require expansion.	Onsite landfill design life would be reduced or require expansion.
For tritium recycling phaseout at SRS, 7,800 yd^3 per year decrease in solid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned. Landfill life would be extended.	For tritium recycling phaseout at SRS, 7,800 yd^3 per year decrease in solid sanitary waste at SRS.. Decrease would occur over time as recycling facilities are transitioned. Landfill life would be extended.	For tritium recycling phaseout at SRS, 7,800 yd^3 per year decrease in solid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned. Landfill life would be extended.	For tritium recycling phaseout at SRS, 7,800 yd^3 per year decrease in solid sanitary waste at SRS. Decrease would occur over time as recycling facilities are transitioned. Landfill life would be extended.	No tritium recycling phaseout.
For tritium recycling phaseout at SRS, 6,800 yd^3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	For tritium recycling phaseout at SRS, 6,800 yd^3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	For tritium recycling phaseout at SRS, 6,800 yd^3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	For tritium recycling phaseout at SRS, 6,800 yd^3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	No tritium recycling phaseout.
Waste Management—Tritium Supply Alone				
• No change to the impacts for spent nuclear fuel.	• No change to the impacts for spent nuclear fuel.	• No change to the impacts for spent nuclear fuel.	• No change to the impacts for spent nuclear fuel.	No tritium recycling phaseout.
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 27 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Tritium Supply Alone				
• No change to the impacts for liquid LLW. For tritium recycling upgrade at SRS there would be no change.	• No change to the impacts for liquid LLW. For tritium recycling upgrade at SRS there would be no change.	• No change to the impacts for liquid LLW. For tritium recycling upgrade at SRS there would be no change.	• No change to the impacts for liquid LLW. For tritium recycling upgrade at SRS there would be no change.	• No tritium recycling phaseout.
• The increase in solid LLW generation over No Action (5,100 yd^3 per year) and the additional onsite LLW disposal area: HWR: 5,200 yd^3 (0.6 acres) MHTGR: 1,300 yd^3 (0.2 acres) Large ALWR: 710 yd^3 (0.2 acres) Small ALWR: 660 yd^3 (0.08 acres) APT: 544 yd^3 (0.07 acres) For tritium recycling upgrade at SRS there would be no change.	• The increase in solid LLW generation over No Action (42,400 yd^3 per year) and the additional onsite LLW disposal area: HWR: 5,200 yd^3 (0.6 acres) MHTGR: 1,300 yd^3 (0.15 acres) Large ALWR: 710 yd^3 (0.2 acres) Small ALWR: 660 yd^3 (0.09 acres) APT: 544 yd^3 (0.07 acres) For tritium recycling upgrade at SRS there would be no change.	• The increase in solid LLW generation over No Action (9,300 yd^3 per year) and the additional onsite LLW disposal area: HWR: 5,200 yd^3 (1.1 acres) MHTGR: 1,300 yd^3 (0.3 acres) Large ALWR: 710 yd^3 (0.3 acres) Small ALWR: 660 yd^3 (0.2 acres) APT: 544 yd^3 (0.1 acres) For tritium recycling upgrade at SRS there would be no change.	• The increase in solid LLW generation over No Action (25 yd^3 per year) and the additional onsite LLW shipments to NTS: HWR: 5,200 yd^3 (86 shipments) MHTGR: 1,300 yd^3 (22 shipments) Large ALWR: 710 yd^3 (26 shipments) Small ALWR: 660 yd^3 (13 shipments) APT: 544 yd^3 (10 shipments) Additional LLW disposal area at NTS would be the same as in NTS tritium supply alone alternatives. For tritium recycling upgrade at SRS there would be no change.	• No tritium supply alone at SRS.
• Liquid mixed LLW would no longer be generated. For tritium recycling upgrade at SRS there would be no change.	• Liquid mixed LLW would no longer be generated. For tritium recycling upgrade at SRS there would be no change.	• Liquid mixed LLW would no longer be generated. For tritium recycling upgrade at SRS there would be no change.	• Liquid mixed LLW would no longer be generated. For tritium recycling upgrade at SRS there would be no change.	• No tritium supply alone at SRS.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 28 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Tritium Supply Alone				
• Solid mixed LLW generation would increase over No Action (655 yd^3 per year): HWR: 120 yd^3 MHTGR: 1 yd^3 Large ALWR: 6 yd^3 Small ALWR: 6 yd^3 APT: 7 yd^3	• Solid mixed LLW generation would increase over No Action (5,460 yd^3 per year): HWR: 120 yd^3 MHTGR: 1 yd^3 Large ALWR: 6 yd^3 Small ALWR: 6 yd^3 APT: 7 yd^3	• Solid mixed LLW generation would increase over No Action (11,100 yd^3 per year): HWR: 120 yd^3 MHTGR: 1 yd^3 Large ALWR: 6 yd^3 Small ALWR: 6 yd^3 APT: 7 yd^3	• Solid mixed LLW generation would increase over No Action (5 yd^3 per year): HWR: 120 yd^3 MHTGR: 1 yd^3 Large ALWR: 6 yd^3 Small ALWR: 6 yd^3 APT: 7 yd^3	• No tritium supply alone at SRS.
Impacts would remain the same as collocated tritium supply and recycling.	Impacts would remain the same as collocated tritium supply and recycling.	Impacts would remain the same as collocated tritium supply and recycling.	Impacts would remain the same as collocated tritium supply and recycling.	
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	
• Hazardous waste generation would increase over No Action (308 yd^3 per year): HWR: 40 yd^3 MHTGR: 100 yd^3 Large ALWR: 35 yd^3 Small ALWR: 35 yd^3 APT: 3 yd^3	• Hazardous waste generation would increase over No Action (20 yd^3 per year): HWR: 40 yd^3 MHTGR: 100 yd^3 Large ALWR: 35 yd^3 Small ALWR: 35 yd^3 APT: 3 yd^3	• Hazardous waste generation would increase over No Action (1,150 yd^3 per year): HWR: 40 yd^3 MHTGR: 100 yd^3 Large ALWR: 35 yd^3 Small ALWR: 35 yd^3 APT: 3 yd^3	• Hazardous waste generation would increase over No Action (63 yd^3 per year): HWR: 40 yd^3 MHTGR: 100 yd^3 Large ALWR: 35 yd^3 Small ALWR: 35 yd^3 APT: 3 yd^3	• No tritium supply alone at SRS.
Use of existing/planned hazardous waste facilities may be feasible.	Additional hazardous waste storage facilities may be required except for APT. APT may require expansion of existing/planned hazardous waste storage facilities.	Existing/planned hazardous waste facilities would be adequate.	Use of existing/planned hazardous waste facilities would be adequate.	
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 29 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Waste Management—Tritium Supply Alone		
• Liquid sanitary waste generation would increase: HWR: 48 MGY MHTGR: 30 MGY Large ALWR: 90 MGY Small ALWR: 50 MGY APT: 245 MGY Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change.	• Liquid sanitary waste generation would increase: HWR: 48 MGY MHTGR: 30 MGY Large ALWR: 90 MGY Small ALWR: 50 MGY APT: 245 MGY Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change.	• Liquid sanitary waste generation would increase over No Action (483 MGY): HWR: 2,350 MGY MHTGR: 1,630 MGY Large ALWR: 6,290 MGY Small ALWR: 2,850 MGY APT: 245 MGY Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change.	• Liquid sanitary waste generation would increase over No Action (39.9 MGY): HWR: 48 MGY MHTGR: 30 MGY Large ALWR: 90 MGY Small ALWR: 50 MGY APT: 245 MGY Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change	• No tritium supply alone SRS.
• Solid sanitary waste generation would increase over No Action (68,000 yd^3 per year): HWR: 7,600 yd^3 MHTGR: 7,400 yd^3 Large ALWR: 6,900 yd^3 Small ALWR: 4,200 yd^3 APT: 1,240 yd^3 Onsite landfill design life would be reduced or require expansion. For tritium recycling upgrade at SRS there would be no change.	• Solid sanitary waste generation would increase over No Action (7,000 yd^3 per year): HWR: 7,600 yd^3 MHTGR: 7,400 yd^3 Large ALWR: 6,900 yd^3 Small ALWR: 4,200 yd^3 APT: 1,240 yd^3 Onsite landfill design life would be reduced or require expansion. For tritium recycling upgrade at SRS there would be no change.	• Solid sanitary waste generation would increase over No Action (77,000 yd^3 per year): HWR: 7,600 yd^3 MHTGR: 7,400 yd^3 Large ALWR: 6,900 yd^3 Small ALWR: 4,200 yd^3 APT: 1,240 yd^3 Onsite landfill design life would be reduced or require expansion. For tritium recycling upgrade at SRS there would be no change.	• Solid sanitary waste generation would increase over No Action (734 yd^3 per year): HWR: 7,600 yd^3 MHTGR: 7,400 yd^3 Large ALWR: 6,900 yd^3 Small ALWR: 4,200 yd^3 APT: 1,240 yd^3 Offsite (city of Amarillo) landfill design life would be reduced or require expansion. For tritium recycling upgrade at SRS there would be no change.	• No tritium supply alone SRS.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 30 of 32]

INEL	NTS	ORR	PANTEX	SRS
Waste Management—Tritium Supply Alone				
• Other solid nonhazardous waste would be recycled. For tritium recycling upgrade at SRS there would be no change.	• Other solid nonhazardous waste would be recycled. For tritium recycling upgrade at SRS there would be no change.	• Other solid nonhazardous waste would be recycled. For tritium recycling upgrade at SRS there would be no change.	• Other solid nonhazardous waste would be recycled. For tritium recycling upgrade at SRS there would be no change.	• No tritium supply alone at SRS.
Intersite Transport—No Action				
• Under No Action negligible tritium transport.	• Under No Action negligible tritium transport.	• Under No Action negligible tritium transport.	• Under No Action, the cancer fatalities per year of transporting limited-life components under accident conditions to and from SRS would be $1.0x10^{-8}$ from radiological effects.	• Under No Action the cancer fatalities per year of transporting limited-life components to/from Pantex is negligible under normal operation. Under accident conditions, the cancer fatalities per year of transporting limited-life components to/from Pantex would be $1.0x10^{-8}$ from radiological effects.
Intersite Transport—Collocated Tritium Supply and Recycling				
• The relative transportation risk of tritium is 29 percent lower than the existing No Action case for all technologies. • The potential cancer fatalities per year for transporting tritiated heavy water are $3.57x10^{-5}$ for the HWR and $6.63x10^{-6}$ for APT.	• The relative transportation risk of tritium is 30 percent lower than the existing No Action case for all technologies. • The potential cancer fatalities per year for transporting tritiated heavy water are $3.57x10^{-5}$ for the HWR and $6.63x10^{-6}$ for APT.	• The relative transportation risk of tritium is 13 percent lower than the existing No Action case for all technologies. • The potential cancer fatalities per year for transporting tritiated heavy water are $3.57x10^{-5}$ for the HWR and $6.63x10^{-6}$ for APT.	• The relative transportation risk of tritium is 0. • The potential cancer fatalities per year for transporting tritiated heavy water are $3.57x10^{-5}$ for the HWR and $6.63x10^{-6}$ for APT.	• The relative transportation risk of tritium is the same as the existing (No Action) case for all technologies. • There is no intersite transport of tritiated heavy water, therefore no transport cancer fatalities.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 31 of 32]

INEL	NTS	ORR	PANTEX	SRS
		Intersite Transport—Collocated Tritium Supply and Recycling		
• No intersite transport of low-level waste.	• No intersite transport of low-level waste	• No intersite transport of low-level waste.	• The cancer fatalities per year for credible accidents associated with intersite transport of low-level waste by technology: **Radiological** HWR: $3.0x10^{-8}$ MHTGR: $8.8x10^{-9}$ Large ALWR: $1.0x10^{-8}$ Small ALWR: $5.9x10^{-9}$ APT: $5.2x10^{-9}$ **Nonradiological** HWR: $4.0x10^{-4}$ MHTGR: $1.2x10^{-4}$ Large ALWR: $1.4x10^{-4}$ Small ALWR: $7.7x10^{-5}$ APT: $6.9x10^{-5}$	• No intersite transport of low-level waste.
		Intersite Transport—Tritium Supply Alone		
• The risk of transporting new tritium is about 2 percent greater than No Action due to transporting virgin tritium to SRS.	• The risk of transporting new tritium is about 2 percent greater than No Action due to transporting virgin tritium to SRS.	• The risk of transporting new tritium is about 2 percent greater than No Action due to transporting virgin tritium to SRS.	• The risk of transporting new tritium is about 2 percent greater than No Action due to transporting virgin tritium to SRS.	• No tritium supply alone.
• No intersite transport of LLW.	• No intersite transport of LLW.	• No intersite transport of LLW.	• Credible accidents associated with intersite transport of LLW would result in $3.3x10^{-9}$ to $2.8x10^{-8}$ fatal cancers per year from radiological releases and $4.3x10^{-5}$ to $3.7x10^{-4}$ fatal cancers per year from nonradiological releases. The cancer fatalities per year for each technology would be:	• No tritium supply alone.

TABLE ES–1.—*Summary Comparison of Environmental Impacts of Tritium Supply Technologies and Recycling* [Page 32 of 32]

INEL	NTS	ORR	PANTEX	SRS
Intersite Transport—Tritium Supply Alone				
			Radiological HWR: 2.8x10^{-8} MHTGR: 7.15x10^{-9} Large ALWR: 8.5x10^{-9} Small ALWR: 4.2x10^{-9} APT: 3.3x10^{-9} **Nonradiological** HWR: 3.7x10^{-4} MHTGR: 9.46x10^{-5} Large ALWR: 1.1x10^{-4} Small ALWR: 5.6x10^{-5} APT: 4.3x10^{-5}	
• The potential cancer fatalities per year for transporting tritiated heavy water are 1.4x10^{-5} for the HWR and 6.63x10^{-6} for APT.	• The potential cancer fatalities per year for transporting tritiated heavy water are 1.4x10^{-5} for the HWR and 6.63x10^{-6} for APT.	• The potential cancer fatalities per year for transporting tritiated heavy water are 1.4x10^{-5} for the HWR and 6.63x10^{-6} for APT.	• The potential cancer fatalities per year for transporting tritiated heavy water are 1.4x10^{-5} for the HWR and 6.63x10^{-6} for APT.	• No tritium supply alone.
• The annual risk from transporting highly enriched uranium fuel feed material for the HWR and MHTGR alternatives from ORR to INEL is 5.1x10^{-4}.	• The annual risk from transporting highly enriched uranium fuel feed material for the HWR and MHTGR alternatives from ORR to NTS is 5.1x10^{-4}.	• No intersite transport of highly enriched uranium fuel feed material.	• The annual risk from transporting highly enriched uranium fuel feed material for the HWR and MHTGR alternatives from ORR to PANTEX is 5.1x10^{-4}.	• The annual risk from transporting highly enriched uranium fuel feed material for the HWR and MHTGR alternatives from ORR to SRS is 5.1x10^{-4}.

TABLE E.S–2.—***Summary Comparison of Environmental Impacts of the Commercial Light Water Reactor Alternative*** **[Page 1 of 2]**

Advanced Light Water Reactor[a]	Complete Construction of a Commercial Reactor	Purchase Existing Reactor or Single Reactor Irradiation Services	Purchase Irradiation Services – Multiple (2) Reactors
	Construction		
• Construction would result in short-term exceedance of 24-hour PM_{10} and TSP standards.	• Construction related air emissions would increase but would be smaller than ALWR and of shorter duration. Emissions would be temporary and would not be expected to significantly affect air quality in the project site area.	• There would be no impacts related to construction from this alternative at the plant site. A new extraction and target fabrication facility would be constructed at SRS. Emissions would be temporary and would not be expected to significantly affect air quality in the project site area.	• There would be no impacts related to construction from this alternative at the plant site. A new extraction and target fabrication facility would be constructed at SRS. Emissions would be temporary and would not be expected to significantly affect air quality in the project site area.
• Total employment would be 12,600 worker-years over a 6-year period.	• Employment would require 3,530 to 5,730 worker-years over 5 years of construction for a 45 percent or 85 percent complete reactor, respectively.	• Construction of the extraction facility and target fabrication facility would require 326 worker-years over a 3 year period.	• Construction of the extraction facility and target fabrication facility would require 326 worker-years over a 3 year period.
• Hazardous waste generated from construction activities would be approximately 930 yd^3.	• Hazardous waste generated from construction activities would be substantially less than an ALWR.	• The annual average volume of hazardous waste generated from construction of the extraction and target fabrication facilities would be approximately 6 yd^3.	• The annual average volume of hazardous waste generated from construction of the extraction and target fabrication facilities would be approximately 6 yd^3.

TABLE E.S–2.—*Summary Comparison of Environmental Impacts of the Commercial Light Water Reactor Alternative* [Page 2 of 2]

Advanced Light Water Reactor[a]	Complete Construction of a Commercial Reactor	Purchase Existing Reactor or Single Reactor Irradiation Services	Purchase Radiation Services – Multiple (2) Reactors
	Operation		
• Operation would require approximately 16 billion gallons of water per year. No substantial impacts to surface water are expected.	• Operation would require approximately the same amount of water as the ALWR.	• Adding the tritium production mission to an operating commercial reactor would require no additional water consumption.	• Adding the tritium production mission to an operating commercial reactor would require no additional water consumption.
• Operation would require approximately 830 workers.	• Operation would require approximately 830 workers.	• Operation would require 72 additional workers over the existing plant workforce.	• Operation would require a total of 127 additional workers over the existing plant workforce.
• Approximately 193 dry storage assemblies of spent fuel would be generated and: – 710 yd^3 of LLW – 6 yd^3 of mixed waste.	• Approximately 193 dry storage assemblies of spent fuel would be generated and: – 490 yd^3 of LLW –the amount of mixed waste would be similar to the ALWR.	• Approximately 137 dry storage assemblies of spent fuel would be generated and: – 160 yd^3 of LLW – no additional mixed waste would be generated.	• Approximately 137 dry storage assemblies of spent fuel would be generated and: – 160 yd^3 of LLW – no additional mixed waste would be generated.
• Worker exposure for all personnel would be approximately 170 person-rem per year.	• Worker exposure for all personnel would be approximately 240 person-rem.	• Worker exposure would increase for all personnel by 48 person-rem.	• Worker exposure would increase for all personnel by 48 person-rem.
• Tritium production would result in the emission of approximately 6,840 curies per year of gaseous tritium and 1,740 curies per year of liquid tritium.	• Gaseous and liquid tritium emissions would be similar to ALWR.	• Tritium production would result in the emission of 5,740 curies per year of gaseous tritium and 1,460 curies per year of liquid tritium over the existing plant emissions.	• Tritium production would result in the emission of 3,680 curies per year per reactor of gaseous tritium and 935 curies per year per reactor of liquid tritium over the existing plant emissions.
• Radiological releases associated with production of tritium would result in an annual dose of 90 person-rem to the 50-mile population.	• Radioactive releases associated with production of tritium would be similar to the ALWR.	• Radioactive releases associated with production of tritium would result in an annual dose increase of 0.5 person-rem to the 50-mile population.	• Radioactive releases associated with production of tritium would result in an annual dose increase of 0.5 person-rem to the 50-mile population.
• For a high consequence/low probability accident, approximately 1.7 cancer fatalities and a risk of 2.6x10^{-7} cancer fatalities per year could result.	• Similar to ALWR.	• No substantial increase in consequences or risk from accidents is expected.	• No substantial increase in consequences or risk from accidents is expected.

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[a] For comparative purposes only, Large ALWR at SRS is presented.