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"Tritium Supply
& Recycling"

Final Programmatic Environmental Impact Statement (PEIS) for Tritium Supply and Recycling

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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

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

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Acronyms

APT	Accelerator Production of Tritium
ALWR	Advanced Light Water Reactor
CEQ	Council on Environmental Quality
DOE	Department of Enegy
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 (D Office of the Assistant Secretary for Defense Programs (DP) would prepare a program environmental impact statement (PEIS) examining alternatives for the reconfiguratio 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 Reco ration Study, a detailed examination of alternatives for the future Complex. Becaus 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 tod Therefore, the Department separated the Reconfiguration PEIS into two PEISs: a PEIS Tritium Supply and Recycling; and a Stockpile Stewardship and Management PEIS. The Supply and Recycling Proposal is analyzed in this PEIS. The Stockpile Stewardship a Management Proposal is currently being analyzed in a separate PEIS being prepared b

Another issue, which was once part of reconfiguration, was the storage of all weapons-usable fissile materials, primarily highly enriched uranium and plutonium. early 1994 the Secretary established a Department-wide program for developing recom mendations and for directing implementation of decisions concerning disposition of nuclear materials. This program was recognized in the FY 1995 Defense Authorization 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 closely related (connected) to disposition, the long-term storage analysis that had part of the Reconfiguration PEIS was moved into the program for Long-Term Storage a Disposition of Weapons-Usable Fissile Materials. As a result, a third PEIS, the Lon Storage and Disposition of Weapons-Usable Fissile Materials PEIS, is being prepared analyze alternatives for the long-term storage of all weapons-usable fissile materi primarily highly-enriched uranium and plutonium. That PEIS will also address the disposition of plutonium declared surplus to national defense needs by the Presiden 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. Tr a man-made radioactive isotope of hydrogen, is an essential component of every warh the current and projected U.S. nuclear weapons stockpile. These warheads depend on to perform as designed. Tritium decays at a rate of 5.5 percent per year and must b replaced periodically as long as the Nation relies on a nuclear deterrent. Currentl Complex does not have the capability to produce the required amounts of tritium, ye projections require that new tritium be available by approximately 2011. The Tritiu Supply and Recycling Programmatic Environmental Impact Statement evaluates the siti construction, and operation of tritium supply technology alternatives and recycling facilities at each of five candidate sites: the Idaho National Engineering Laborato (INEL), the Nevada Test Site (NTS), the Oak Ridge Reservation (ORR), the Pantex Pla the Savannah River Site (SRS). The PEIS assesses the environmental impacts of all reasonable alternatives discussed in the following section, including NoAction.

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 recy consists of recovering residual tritium from weapons components, purifying it, and refilling weapons components with both recovered and new tritium when it becomesava

Figure (Page ES-2)
Figure ES-1. - Current and Former Nuclear Weapons Complex Sites

Under the No Action alternative, DOE would not establish a new tritium supply capab The current inventory of tritium would decay and DOE would not meet stockpile requi of tritium. This would be contrary to DOE's mission as specified by the Atomic Ener of 1954, as amended. Alternatives for new tritium supply and recycling facilities consist of four different tritium supply technologies and five locations as shown i figure ES-2. The four technologies proposed to provide a new supply of tritium are Water Reactor (HWR), Modular High Temperature Gas-Cooled Reactor (MHTGR), Advanced Water Reactor (ALWR), and Accelerator Production of Tritium (APT). Both Large (1,30 MWe) and Small (600 MWe) options for the ALWR are evaluated as well as a phased app for the APT. The use of an existing commercial light water reactor that would be us irradiation services or purchased and converted for tritium production is also incl as an alternative for longterm 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 t

environmental impacts associated with using one or more commercial light water reactors for tritium production as a contingency in the event of a national emergen Specific commercial reactors are not identified in thePEIS.

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 multipurpose reactor. Throughout the PEIS, references to and discussion of impacts 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. Th multipurpose ALWR would operate the same as the uranium-fueled tritium production A 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 pluton Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to pro 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-fue tritium production ALWR for this scenario. For a modular gas-cooled multipurpose re twice as many reactor modules would be needed both to meet tritium requirements and burn plutonium. A plutonium Pit Disassembly/Conversion/Fuel Fabrication Facility al would be needed. Thus, the potential environmental impacts for a multipurpose gas-c reactor are expected to be substantially greater than a uranium-fueled tritium prod gas-cooled reactor.

The PEIS evaluates alternative tritium supply technologies against a baseline triti requirement (i.e., a specific quantity of tritium, the exact amount of which is classified). Understanding the concept of the baseline tritium requirement is cruci understanding the alternatives and the analysis in the PEIS. The baseline tritium requirement is the amount necessary to support the 1994 Nuclear Weapons Stockpile P which is based on a START II stockpile level of approximately 3,500 accountable wea 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 1991. This is the tritium requirement "baseline" which the tritium supply technolog 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; (2) a surge tritium requirement to replace any tritium which might be used in the e 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 Pla reconstitute the entire reserve in a 5-year period. The steady-state component acco for approximately 50 percent of the baseline tritium requirement, while the surge a for the remaining 50 percent. Tritium supply technologies being evaluated must be a support the steadystate tritium requirement (a specific quantity of tritium every y and make up for any lost tritium reserves.

Figure (Page ES-4)
Figure ES-2.- Tritium Supply and Recycling Alternatives

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 p involves preparing information to support programmatic decisions on siting and tech This includes preparing this PEIS and the associated Record of Decision (ROD). The include the following programmatic decisions:

- Whether to build new tritium supply andnew 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-specif National Environmental Policy Act of 1969 (NEPA) requirements which would focus on the facility would be placed and construction and operation impacts. The third phas involve constructing, testing, and certifying the selected tritium supply and recyc facilities, leading to full operation. Present planning requires the tritium facili be fully operational by the year 2010 with new tritium available for use approximat 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. schedule will be subject to change and include reassessments required by congressio authorizations and appropriations. Although the individual schedules of any activit or projects may overlap, the current uncertainty associated with any given activity project requires that assumptions be made regarding the time periods used in the PE 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 and 2009, and an operational period, beginning in approximately 2010, of 40years. A the design life of the tritium supply and recycling facilities has not yet been det mined by engineering studies, the assumption of an operational period of approximat years is consistent with the operating periods used in prior DOE NEPA documents for similar new facilities. Projectlevel tiered NEPA documents would identify in detail specific construction and operational periods for each project implemented.

AGENCY PREFERRED ALTERNATIVE

The Council on Environmental Quality (CEQ) Regulations require an agency to identif preferred alternative(s) in the Final Environmental Impact Statement (40 CFR 1502.1 The preferred alternative is the alternative which the agency believes would fulfil statutory mission, giving consideration to environmental, economic, technical, and factors. Consequently, to identify a preferred alternative, the Department has deve information on potential environmental impacts, costs, technical risks, and schedul 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 Suppl Recycling Technical Reference Report which is available in the appropriate DOE Read Rooms for public review.

Based upon the analysis presented in the documents identified above, the Department 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) pu an existing commercial light water reactor or irradiation services with an option t purchase the reactor for conversion to a defense facility; (2) design, build, and t critical components of an accelerator system for tritium production. Within a three period, the Department would select one of the alternatives to serve as the primary of tritium. The other alternative, if feasible, would be developed as a back-up tritiumsource.

Savannah River Site has been designated as the preferred site for an accelerator, s one be built. The preferred alternative for tritium recycling and extraction activi to remain at the Savannah River Site with appropriate consolidation and upgrading o 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 rei this principle in his July 3, 1993, radio address to the Nation. Tritium was used i design process to enhance the yield of nuclear weapons and allow for the production smaller or more powerful warheads to satisfy the needs of modern delivery systems. result, the United States' strategic nuclear systems are based on designs that use tritium. Therefore, the Nation requires a reliable tritium supply source. Tritium h relatively short radioactive half-life of 12.3 years. Because of this relatively ra radioactive decay, tritium must be replenished periodically in nuclear weapons to e that they will function as designed. Over the past 40 years, DOE has built and oper reactors to produce tritium and other nuclear materials for weapons purposes. Today 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 devel and maintaining the capability to produce nuclear materials such as tritium, which 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 Nuclear Weapons Stockpile Plan. Figure ES-3 depicts the Nuclear Weapons Stockpile P process.

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

The Nuclear Weapons Stockpile Plan is normally forwarded annually from the Secretar the Departments of Energy and Defense via the National Security Council to the Pres for approval. The Nuclear Weapons Stockpile Plan reflects the size and composition stockpile needed to defend the United States and provides an assessment of DOE's ab to support the proposed stockpile. Many factors are considered in the development o Nuclear Weapons Stockpile Plan, including the status of the currently approved stoc arms control negotiations and treaties, Congressional constraints, and the status o nuclear material production and fabrication facilities. Revisions of the Nuclear We 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, authorize weapons production and retirement through fiscal year 1999. The analysis in this PE based on the requirements of the 1994 Nuclear Weapons Stockpile Plan which is based START II stockpile levels (approximately 3,500 accountable weapons). The 1994 Nucle Weapons Stockpile Plan represents the latest official guidance for tritium requirem Nuclear Weapons Stockpile Plan for 1995 has not yet been issued. Appendix CA, which classified, contains quantitative projections for tritium requirements based on the Nuclear Weapons Stockpile Plan, and details of the transportation analysis.

Even with a reduced nuclear weapons stockpile and no identified requirements for ne nuclear weapons production in the foreseeable future, an assured long-term tritium and recycling capability will be required. Presently, no source of new tritium is a able. The effectiveness of the U.S. nuclear deterrent capability depends not only o Nation's current stockpile of nuclear weapons or those it can produce, but also on 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 trit requirements by recycling tritium from weapons retired from the Nation's nuclear we stockpile. However, because tritium decays relatively quickly, recycling can only m tritium demands for a limited time. Current projections, derived from classified projections of future stockpile scenarios, indicate that recycled tritium will adeq support the Nation's nuclear weapons stockpile until approximately 2011 (figure ES- After that time, without a new tritium supply source, it would be necessary to util strategic reserve of tritium in order to maintain the readiness of the nuclear weap stockpile. The strategic reserve of tritium contains a quantity of tritium maintain emergencies and contingencies. In such a scenario, if the strategic tritium reserve 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 tritiu supply source into operation. The analysis indicates that it could take approximate years to research, develop, design, construct, and test a new tritium supply source new tritium production can begin. Thus, in order to have reasonable confidence that 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 requir meet a statutory deadline of March 1, 1995, to issue a PEIS addressing tritium supp alternatives (Public Law 103-160, section 3145). That deadline was met by the issua 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 be submitted to Congress to close out DOE's obligation with respect to the intent o 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 en May 15, 1995. However, comments were accepted as late as June 23, 1995. During the period, public hearings were held in Las Vegas,NV; Washington,DC; Pocatello, ID; Oa Ridge,TN; NorthAugusta, SC; and Amarillo,TX. Two hearings were held at each locatio addition, the public was encouraged to provide comments via mail, fax, electronic bulletin board (Internet), and telephone (tollfree 800-number). During public revie the Draft PEIS a majority of the comments regarded concerns that alternatives and/o candidate sites were not given the correct amount of consideration on factors inclu 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 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 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 cooling;

The socioeconomic impacts, both positive and negative, of locating or failing to lo facility at one of the candidate sites;

Figure (Page ES-8)
Figure ES-3. - Nuclear Weapons Stockpile Plan Process

Figure (Page ES-9)
Figure ES-4. - Estimated Tritium Inventory and Reserve Requirements.

The generation, storage, and disposal of radioactive and hazardous wastes (includin 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 t decisions based on all associated programs and activities concurrently;

The need for decisions to be based on many different factors, including environment 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 No the Federal Register (60 FR 44327) to include the purchase of irradiation services commercial reactor as a reasonable alternative. The Draft PEIS considered this an unreasonable alternative because of the long-standing policy of the United States t civilian nuclear facilities should not be utilized for military purpose and nonproliferation concerns. Nonetheless, the Draft PEIS included an evaluation of th environmental impacts of irradiation services using an existing commercial reactor make tritium. Because of public comments on the Notice, public review of the Draft and further consideration of nonproliferation issues, purchase of irradiation servi evaluated in the PEIS as a reasonable alternative. During the extended comment peri 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 follo areas: severe accidents and design-basis accidents for all tritium supply technolog site-specific environmental impacts of a dedicated power plant for the Accelerator Production of Tritium (APT); revisions to water resources sections; site-specific a of the multi-purpose reactor that could produce tritium, burn plutonium as fuel, an produce electricity; and the commercial reactor alternative, specifically the purch 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 co questioning the apparent severity and frequency of the accident consequences shown the Draft PEIS. Additional analyses were performed to accurately estimate the impac a more reasonable design-basis accident and these results have been included in the PEIS.

The analyses of impacts of severe reactor accidents were also revised. The Draft PE presented the impacts of a single severe accident for each of the reactor technolog Since accident consequences vary greatly depending on the selected accident frequen value, a spectrum of severe accidents with a range of frequencies was used to perfo more representative analysis for each technology. The new analyses presented reflec probable effects of a set of accidents for each reactor rather than the single acci 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 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 t facility as a result of the proposed action) and quantitative impacts to noninvolve workers (workers collocated at the site independent of the proposed action). For in workers, impacts were addressed qualitatively, explaining the significant risk for exposure and fatality and that mitigative features would be provided in the design 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 t 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 nonin worker.

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

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

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

A more detailed analysis of the multi-purpose reactor has been included in the Fina Since the multi-purpose reactor would use plutonium fuel, an analysis of the constr impacts of a Pit Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility to su multi-purpose ALWR has been incorporated in the site-specific analysis for each of candidate sites. Impacts of just the pit disassembly/conversion part of the facilit included for the multi-purpose MHTGR since this technology already includes a fuel fabrication component. For the operation of a multi-purpose reactor, additional det regarding the impacts on atmospheric emissions, liquid emissions, water requirement socioeconomics, human health (for both normal operations and accidents), waste mana and intersite transportation has been included in the site-specific analysis.

Analysis and a discussion of potential impacts have been expanded and included in t PEIS on the alternative of DOE purchasing an existing operating commercial reactor an incomplete reactor and converting it to production of tritium for defense purpos 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 produ 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 either be collocated with the new supply facilities or DOE could use the existing t recycling facilities at SRS after upgrade. For the alternatives at SRS, DOE would u existing recycling facilities at SRS, which would be upgraded to support the tritiu mission.

Technologies

Of the tritium supply technologies considered by DOE for the production of tritium 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 electri power production but lack tritium production experience and development of tritium technology. The APT technology, which has an operating history in research and deve programs, also has no tritium production experience and only recent development of targets.

Since both the MHTGR and the ALWR were originally developed to produce electricity as such have steam turbines as an integral part of their designs, the PEIS evaluate environmental effects of both of these technologies with turbines included. The act sale of steam or generation of electricity by DOE would be covered in the site-spec tiered NEPA documents if either of these technologies is chosen. The general impact the transmission lines necessary to carry this generated electricity are discussed. 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 presented. As both the MHTGR and the ALWR technologies could also be used for the u disposition of plutonium, the general impacts of operating these two technologies w plutonium-uranium fuel is presented in the PEIS.

Heavy Water Reactor. The HWR would be a low pressure, low temperature reactor whose purpose would be to produce tritium. The HWR would use heavy water as the reactor c and moderator. Because of the low temperature of the exit coolant, a power conversi 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 other facilities required for the supply and extraction of tritium.

The HWR complex would cover approximately 260acres and the entire area would be sur by a security fence. The main reactor would be about 10stories high and other assoc buildings would range from one story to three stories in height. The cooling towers vary in height, depending on the type of cooling towers utilized. The cooling tower which serves as a holding pond for the cooling towers, would cover approximately 2 In this PEIS, dry sites such as INEL, NTS, and Pantex which lack plentiful surface sources would use mechanical draft dry cooling towers while wet sites such as ORR a 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
- Steel Consumption
  45,000 to 68,000 tons

The conceptual design of the HWR complex includes a fuel and target fabrication fac to assemble fuel and target rods that are used in the reactor core; a tritium targe processing facility to extract and collect tritium from irradiated targets; an inte spent fuel storage building to store used target and fuel rods; a general services building for administrative purposes; and a security infrastructure to control acce the complex. Figure ES-5 shows a representative drawing of an HWR complex with mech ical draft cooling towers for illustrative purposes only. The number and arrangemen buildings and support areas are descriptive only and can change significantly as de 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 fac would consist of two attached structures: a process building and a support building 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 emer power facility to house diesel generators or gas turbines for short-term emergency to support safety related loads in the event of temporary failure of the offsite po supply; a reactor containment building to limit any operational or accidental relea radioactivity; an emergency core cooling system to makeup coolant for heat removal event of a loss of coolant or a loss of pumping; an emergency shutdown system with rods independent of the reactor control rods; a neutron poison system to inject neu absorbing material into the moderator tank; and a backup system to remove heat from reactor if the primary coolant fails to circulate.

Construction of the HWR would take somewhat less than 8 years and require approxima 2,320workers during the peak construction period. Once constructed, approximately 1

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 MH would use helium gas as a core coolant and graphite as a moderator. Because of the temperature of the exit coolant, a power conversion facility designed to produce el tricity is an integral part of the design and is included in the analysis. In addit the reactor building and the power conversion building, the MHTGR complex would con several buildings and other facilities required for the supply and extraction of tr

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 ve 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 i diameter and 75 feet high. Each reactor vessel would contain a reactor core, reflec 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 oth associated facilities within the MHTGR complex would range in height from one to th stories. Two cooling towers would be needed and their height would vary, depending type of cooling towers that are utilized. In this PEIS dry sites (INEL, NTS, and Pa would use mechanical draft dry cooling towers and wet sites (ORR and SRS) would use natural draft wet cooling towers.

Figure (Page ES-13)
Figure ES-5. - Heavy Water Reactor Facility (Typical).

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

Construction of the MHTGR would take about 9years and require approximately 2,210 w during the peak construction period. One to 2 years would be needed after construct 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. Additiona 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 ma contributor to potential environmental impacts for this scenario. The PEIS contains assessment of these potential environmental impacts.

Advanced Light Water Reactor. The ALWR would be a high temperature, high pressure r whose primary purpose would be to produce tritium. There are two options for the pr ALWR technology: a Large ALWR (1,300 MWe) and a Small ALWR (600MWe). The large and

options would be chosen from the following four candidates: a large or small pressu water reactor; or a large or small boiling water reactor. All ALWR options would us (regular) water as the reactor coolant and moderator. Like the MHTGR, a power conve facility (steam turbine) is an integral part of the design for the ALWR because of high temperature of the exit coolant and is included in the analysis. In addition t reactor building, the ALWR complex would consist of several support buildings and o facilities for the supply and extraction of tritium.

The ALWR complex would cover approximately 350acres 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 height. The differences between the large and small options are primarily in the po output of the reactors. Both of the small reactors are rated at 600MWe, while the l options are rated at 1,300MWe. The physical sizes of the large and small options fo of the technologies are generally the same.

In addition to the reactor, the ALWR complex would include an interim spent fuel st building, a waste treatment facility, a tritium target processing facility, warehou and a power conversion facility. Unlike the other technologies, the ALWR would not fuel fabrication facility since fuel rods would be obtained from offsite sources. F ES-7 shows a representative drawing of an ALWR complex with a natural draft cooling shown for illustrative purposes only. The number and arrangements of buildings and areas are descriptive only and can change significantly as design progresses. The t target processing facility would consist of the following two attached structures: processing building and a support building. The process building would include the extraction processes, laboratory, and other activities associated with handling tri The support building would contain offices, maintenance areas, and nonradioactive ventilation systems. The type of cooling tower used depends upon where the ALWR wer located. In this PEIS, dry sites (INEL, NTS, and Pantex) would use mechanical draft cooling towers and wet sites (ORR and SRS) would use natural draft wet cooling towe

Figure (Page ES-15)
Figure ES-6. - Modular High Temperature Gas-Cooled Reactor Facility (Typical).

Figure (Page ES-16)
Figure ES-7. - Advanced Light Water Reactor Facility (Typical).

The design of the ALWR would incorporate numerous safety features such as: an emerg power facility to house diesel generators or gas turbines for short-term emergency to support safety-related loads in the event of temporary failure of the offsite po supply; a reactor containment building to limit any release of radioactivity; an em core cooling system to makeup coolant in the event of a loss of coolant or a loss o 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 w for the Large ALWR and 2,200 workers for the Small ALWR during the peak constructio 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 w 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 multi-purpose ALWR woul operate essentially the same as a uranium-fueled tritium production ALWR. Therefore environmental impacts from operation of a multi-purpose ALWR would be expected to b unchanged from the tritium production ALWR. To burn plutonium in an ALWR, a plutoni Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to pro the mixed-oxide fuel rods for the ALWR, and would be the major contributor to poten 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 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 prim purpose would be to produce tritium. The APT accelerates a proton beam in a long tu one of two target/blanket assemblies located in separate target stations. There are target/blanket concepts being considered in the conceptual design of the Full APT: helium-3 target and the spallation-induced lithium conversion target.

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

The preconceptual design of the APT complex includes: a target building that would either the helium-3 or the spallation-induced lithium conversion target chambers lo in a subterranean structure at the same level as the accelerator; a tritium process facility to extract tritium from the targets; a klystron remanufacturing and mainte 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 su areas are illustrative and can change significantly as designprogresses.

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

Construction of the APT would take about 5 years and require approximately 2,760 wo 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 syste checkout of the accelerator prior to actual tritium production. Operation of the AP 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). Ex

of the facility could be possible at a later date in order to increase tritium prod to the baseline requirements if necessary. The helium-3 target is the primary targe the Phased APT option.

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

Commercial pressurized water reactors are high-temperature, high-pressure reactors use ordinary light water as the coolant and moderator and are capable of generating 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 mill per year using an assumed annual capacity factor of 62percent. A typical commercial water reactor facility includes the reactor building, spent fuel storage facilities cooling towers, a switchyard for the transmission of generated electricity, mainten buildings, administrative buildings, and security facilities. Acreage for existing operating commercial light water reactor facilities varies in size from a low of 84 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 of pumping; an emergency shutdown system with safety rods independent of the reacto control rods; and a backup system to remove heat from the reactor if the primary co 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 rea were purchased, these facilities could potentially be constructed along with the fi construction of thereactor.

Figure (Page ES-19)
Figure ES-8. - Accelerator Production of Tritium Facility Site Layout (Typical).

A commercial reactor would also be capable of performing the triple play" missions producing tritium, burning plutonium, and generating electricity. The multi-purpose commercial reactor would operate essentially the same as a uranium-fueled tritium production commercial reactor. Therefore, the environmental impacts from operation multi-purpose commercial reactor would be expected to be unchanged from the tritium production commercial reactor. To burn plutonium in a commercial reactor, a plutoni Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to pro the mixed-oxide fuel rods for the commercial reactor, and would be the major contri 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 tri for use in nuclear weapons. This mission includes the steps necessary to empty rese (small pressure vessels containing tritium installed in nuclear weapons), recover t tritium, provide new gas mixtures according to specifications, and reclaim usable reservoirs. Additionally, the tritium recycling facility would perform a full range analytical, physical, and environmental tests to ensure that the quality and integr all reservoirs are maintained throughout their operational life. It would also prov for appropriate waste management, including storage, treatment, and disposal of tritiated wastes.

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

Reservoirs that have been filled with tritium and sealed would be transferred to th auxiliary building for finishing, where they would be decontaminated, leak tested, inspected, marked, measured for tritium content, and, if required, combined with va parts necessary for final assembly. The reservoirs would then be placed in storage 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, a research and development reservoirs. In general, tests on reservoirs filled with tr would be performed in the tritium processing building, while tests on other bottles 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 opt for new or upgraded recycling facilities.

New Recycling Facilities. If the tritium supply and recycling facilities are locate any site other than SRS, new recycling facilities would have to be constructed (fig 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, wo be a hardened facility designed with systems to contain tritium releases should the occur. The second building, the auxiliary building, would house nontritium and extr small amounts of working tritium. These buildings would be located within a 202-acr area.

Figure (Page ES-21)
Figure ES-9.- New Tritium Recycling Facility (Typical)

Upgrade of Recycling Facilities at Savannah River Site. If the tritium supply facil are located at SRS or at one of the other sites without a collocated recycling faci the existing tritium recycling facilities would be upgraded. The upgrade, presented here, called the unconsolidated upgrade, would result in no buildings being closed consolidation of tritium handling activities. Buildings 232-H, 232-1H, 234-H, 238-H 249-H (figure ES-10), would be upgraded to meet DOE Order 5480.28, Natural Phenomen Hazards Mitigation. These upgrades would involve adding wall and cross bracings to existing beams, strengthening some exterior walls, and reinforcing existing buildin frames. Additionally, Building 232-H would require an anchor for the service area r slab as well as an upgrade to the Radiation Control and Monitoring System. Building would require upgrades to its reservoir storage encased safes which are used to pro filled reservoirs during high winds and earthquakes. No additional acreage would be required for these upgrades, and no upgrade modifications would be required for bui 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 b to buildings 232-1H, 234-H, 238-H, and 249-H. Additionally, Building 233-H would re 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 nucle reactors or partially completed reactors is a potential candidate site for the trit supply mission. Currently, 109 commercial nuclear power plants are located at 71 si 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. Approxim 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 o sites have 50-mile population densities of less than 200 persons per square mile an 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 1,000 acres and an additional 12 sites are in the 1,000 to 2,000acre range. Thus, a 60 percent of the plant sites encompass 500 to 2,000 acres. The larger land-use are associated with plant cooling systems that include reservoirs, artificial lakes, an buffer areas.

Idaho National Engineering Laboratory

In 1949, INEL was established in the southeastern Idaho desert 50 miles west of Ida Falls. Situated on approximately 570,000 acres in four counties, the site is used t build, and operate nuclear facilities. INEL is one of DOE's primary centers for res 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, v 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, r systems, and overall safety. Currently, there are four reactors in use, three of wh are in continuous operation.

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

Figure (Page ES-23)
Figure ES-10. - Tritium Recycling Facilities Upgrades
at Savannah River Site (Generalized).

Nevada Test Site

In 1950, NTS was established in southern Nevada 65miles northwest of Las Vegas, on approximately 864,000 acres of land. NTS is operated by several management and oper contractors under the direction of the Nevada Operations Office. The site is a remo secure facility for conducting underground testing of nuclear weapons and evaluatin effects of nuclear weapons on military communications, electronics, satellites, sen and other materials. Approximately one-third of the land is used for nuclear weapon

testing, one-third is reserved for future missions, and one-third is used for resea development and other facility requirements. In October 1992, the underground nucle testing was halted, yet the site maintains the capability and infrastructure necess to resume testing if authorized by the President. The infrastructure to continue re development, and testing is being maintained (albeit at lower levels).

Facilities at NTS include nuclear device assembly, diagnostic canister assembly, ha liquid spill, and the Radioactive Waste Management Site. In addition, DOE is evalua Yucca Mountain, an area on the border of the site, as a potential repository for sp 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 ma facilities: Oak Ridge National Laboratory; Y-12 Plant (Y-12); and the K-25 site (th former Oak Ridge Gaseous Diffusion Plant). Oak Ridge National Laboratory missions i 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 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 inclu dismantling of nuclear weapons components returned from the Nation's stockpile, maintaining nuclear production capability (primarily uranium and lithium) and stock support, storing special nuclear materials, and providing special manufacturing sup DOE programs. Operational space at Y-12 is being downsized in response to the reduc workloads.

Pantex Plant

Pantex is located 17 miles northeast of Amarillo, TX, on approximately 10,000 acres site served as a conventional bomb plant during World War II. After the war, the si sold to Texas Technological College (Texas Tech) but was repurchased by the Army in 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 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 wea assembly, disassembly, testing, quality assurance, repair, and disposal of nonnucle components; and development work in support of design laboratories. Due to recent reductions in the Nation's stockpile, Pantex has developed the interim capability f sealed pit storage of nuclear materials. Pantex is the only DOE facility that can e 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 The major nuclear facilities at SRS have included fuel and target fabrication facil nuclear material production reactors; chemical separation plants used for recovery plutonium and plutonium isotopes; a uranium fuel reprocessing area; and the Savanna Technology Center, which provides processsupport.

SRS is the Nation's primary facility for tritium recycling operations, which provid tritium for weapons in the nuclear stockpile. Recycled tritium is delivered to Pant weapons assembly and directly to DOD to replace expired tritium reserves. In the pa produced tritium but only tritium recycling operations continue at the Replacement Facility. Other activities at SRS include interim storage of plutonium, waste manag 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, must maintain a nuclear weapons production, maintenance, and surveillance capacity consistent with the President's Stockpile Plan. For the proposed action, the follow alternatives were considered but eliminated from detailed study for the reasons sta

Purchase of Tritium From Foreign Sources

DOE has considered the purchase of tritium from other sources, including foreign na Conceptually, the purchase of tritium from foreign governments could provide a fraction of the tritium requirement. However, while there is no national policy aga purchase of defense materials from foreign sources, DOE has determined that the unc tainties associated with obtaining tritium from foreign sources render this alterna 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 wh tritium supply was assured, when underground nuclear testing was being conducted, a military needs required that the warheads be optimized in terms of weight and volum Replacing these warheads with new ones that would use little or no tritium for the reason of reducing overall tritium demand would be infeasible and unreasonable. Wit underground nuclear testing to verify their safety and reliability, new warhead des cannot deviate very far from current designs that require the use of tritium. Even underground testing to facilitate new designs and a fully operational production co it would still take many years to build enough warheads to replace the enduring sto Therefore, replacing the enduring stockpile of warheads with new designs would most take longer and could cost more than constructing and operating a new tritium suppl facility. Because neither the President nor the Congress has approved that the gove embark on a costly and expansive design, testing, and construction program solely t 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 nuc reactors over the past 50 years. The majority of these reactors were designed to as the development of nuclear research and safety standards development. DOE has also constructed nuclear reactors to produce the materials required to support the produ and maintenance of nuclear weapons and has constructed nuclear reactors in support Naval PropulsionProgram.

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. S then, numerous experimental and research reactors were constructed for a variety of purposes, including material tests, new reactor concepts, and safety experiments. O four DOE research reactors are currently operational: the High Flux Isotope Reactor ORR; the High Flux Beam Reactor at Brookhaven National Laboratory; and the Experime Breeder Reactor-II and the Advanced Test Reactor at INEL. In addition, there are so power/critical facilities supporting medical research (at Brookhaven) and supportin reactor core configuration research (at Argonne National Laboratory-West at INEL). these facilities is large enough to produce the amount of tritium required to suppo projected stockpile requirements. All are fully or partially committed to existing programs, and were constructed in the early 1960s, rendering their design life reli 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 th

potential for producing any significant quantities of tritium: the Fast Flux Test F at the Hanford Site. This facility was designed and constructed to perform material research for the national liquid-metal breeder reactor program. This small (440-meg thermal (MWt)) experimental reactor, based on liquid-metal reactor technology, coul after substantial core and cooling system modifications, as well as target technolo development, have the potential to supply a significant percentage of the steady st tritium requirement. The Fast Flux Test Facility, however, was designed in the late 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 design 20-year lifetime has been completed. While technically possible to expand th lifetime, in the year 2010 the facility would be at the end of even the extended li Relying on the ability to further modify and operate the Fast Flux Test Facility we the middle of the next century is not a reasonablealternative.

DOE also constructed and operated more than a dozen nuclear reactors for production 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 operatio Of those reactors specifically designed to produce nuclear materials for the nuclea weapons program, the K-Reactor at SRS is the only remaining reactor which could be of returning to operation. It is currently in a "cold stand-by state" and has not b operated since 1988. The reactor was shut down for major environmental, safety, and upgrades, to comply with today's stringent standards. DOE discontinued the K-Reacto Restart Program when the reduced need for tritium to support a smaller stockpile de the need for tritium. In this context-reliance upon the ability to upgrade and oper well into the middle of the next century-a first generation reactor designed in the 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 currently operates six national facilities. Of the existing research accelerators, 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 pow accelerator beams in the 800 kilowatt (kW) range. A production accelerator facility utilizing continuous wave operation, would be required to deliver a high power prot beam of 100 megawatts (MW) for tritium production. None of the existing research ac tors could be reasonably upgraded to meet the long-term, assured tritium requiremen

Alternative Sites

The process of determining these reasonable tritium supply alternative sites has be evolutionary, starting with the engineering studies and criteria developed by the N Production Reactor program, then utilizing additional criteria and considerations f Reconfiguration Program, information related to changing missions at DOE sites, and 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 acce expertise, would be a reasonable site for a tritium producing accelerator.

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

It may be possible that an APT could use nonevaporative cooling towers, which would greatly reduce the water requirements. However, there is sufficient technical uncer regarding the feasibility and practicality of using non-evaporative cooling towers continuous wave APT to render this option unacceptable as a source for the Nation's supply of tritium. The other five sites being analyzed in this PEIS could reasonabl support the water requirements of the APT using evaporative cooling towers and, thu

would not incur the technical uncertainty and risk of Los Alamos National Laborator Thus, DOE has concluded that Los Alamos National Laboratory is not a reasonable sit an accelerator to produce tritium.

REDUCED TRITIUM REQUIREMENTS

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

ENVIRONMENTAL RESOURCE IMPACT METHODS

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

Land Resources

Land Use. Land use impacts are assessed based on the extent and type of land that w 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 o respective tritium supply technologies and recycling facilities upon the projected infrastructure capacities. These assessments focus upon power requirements, road ne rail interfaces, and fuel requirements. The basis for the PEIS assessment is the su and demand projections of the U.S. electric utilities published annually by the Nor American Electric Reliability Council.

Air Quality and Acoustics

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

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

Water Resources

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

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

Groundwater. Groundwater resource impacts are assessed based on the effects on aqui groundwater usage, and groundwater quality within the regions. Total groundwater us the facility and projections of future usage are added to project water requirement determine the short and long-term impacts associated with construction and operatio 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 d to unique geological features and subsidence caused by groundwater withdrawal, landslide, or shifting. Potential seismic impacts are assessed based on the locatio capable faults and the history of the seismicity of the site areas. Soil types at t proposed project sites are described and the capability of supporting construction the proposed structures assessed.

Biotic Resources

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

Terrestrial Resources. Impacts to wildlife are based on plant community loss, which associated with animal habitat. Also evaluated is the disturbance, displacement, or 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 a the knowledge that standard construction erosion and sedimentation control measures 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 efflu discharges are assessed in the same manner as wetlands. Impacts as a result of impi 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 si using information obtained from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and appropriate state agencies, along with site environmental an engineering data, is used to assess whether the various technologies would impact a 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 adversely affect National Register of Historic Places (NRHP) eligible resources, or loss of or destruction to important prehistoric resources.

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

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

Socioeconomics

The assessment of impacts on local and regional socioeconomic conditions and factor include population, employment, economy, housing, public finance, and transportatio The impact assessment is based on the degree to which changes in employment and population affect the local economy, housing market, public finance, and transporta The changes to these factors are projected to the year 2030 because it is assumed t after 2030 the impacts associated with the alternatives are negligibly different fr 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 calculat resultant health effects. The impacts on human health for workers and the public du normal operation and postulated accidents from various alternatives are assessed. M such as GENII and MACCS for airborne and liquid radioactive releases; CHEM-PLUS for and explosions; and SLAB for hazardous chemical releases were used to project impac Atmospheric dispersion modeling performed for the air quality section is also utili the evaluation of impacts to workers from radiological and hazardous chemicals.

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

The relative consequences of postulated accidents in the evaluation of each alterna are assessed. The accident analysis involves less detail than a formal Probabilisti Assessment and only addresses bounding accidents (high consequence, low probability a representative spectrum of possible operational accidents (low consequence but hi probability of occurrence). The technical approach for the selection of accidents i consistent with the DOE Office of NEPA Oversight Recommendations for the Preparatio Environmental Assessments and Environmental Impact Statements Guidance (May 1993), 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 a accident. Both probabilities and consequences are presented in the PEIS. The risk-contributing scenarios consider both design-basis and severe accidents. The sp

accidents consider the types of facilities.

Waste Management

The analysis addresses the waste types and waste volumes projected to be generated 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 applicable regulatory settings.

Pantex is the only site under consideration that does not have existing onsite low-waste disposal; the number of additional shipments required to transport low-level from Pantex to a DOE low-level waste disposal facility is estimated. The risk assoc 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 o shipments, and/or distance. Health impacts from the transportation of tritium, highly-enriched uranium, plutonium, heavy water, and LLW are presented. Radiologica health risks attributed to transport of tritium target rods from commercial reactor transport of highly-enriched uranium to potential HWR and MHTGR tritium supply site transport of plutonium pits to support the multipurpose MHTGR and ALWR, and the tra of low-level waste from Pantex to NTS are also addressed.

Environmental Justice

The environmental justice analysis addressed selected demographic characteristics o 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 the total population in the census tract, or where people of color comprise less th 50percent but greater than 25 percent of the total population in the census tract. 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 family of two). Impacts are assessed based on the analysis presented for each resou issue area for each tritium supply technology at each site. No disproportionately h and adverse human health or environmental effects on minority and low-income popula were identified.

Environmental IMPACTS

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

TablesES-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 are evaluated for every site except SRS. At SRS, impacts are evaluated for a tritiu supply with upgraded recycling and a tritium upgrade. In addition, impacts associat tritium supply alone alternatives are evaluated for all the candidate sites except supply alone alternative does not exist for SRS because of existing recycling facil The tritium upgrade is part of the supply alone alternatives at the other four cand sites (INEL, NTS, ORR, and Pantex) and the commercial reactor alternative. For the alone alternatives and the commercial reactor alternative, there would be minor imp associated with upgrading the facilities at SRS.

For comparison purposes, environmental concentrations of emissions and other potent environmental effects are presented with appropriate regulatory standards or guidel

However, the compliance with regulatory standards is not an assessment of the signi or severity of the environmental impact for NEPA purposes. The purpose of the analy environmental consequences is to identify the potential for environmental impacts. PEIS for Tritium Supply and Recycling (Volume I) discusses in detail the environmen assessment methods used and the factors considered in assessing environmental impac

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

To minimize repetition and be as concise as possible, the comparison of alternative tablesES-1 and ES-2 concentrate on the areas in which the public has expressed considerable interest and on programmatic factors important to DOE decisionmaking. ingly, the following resources are compared in tableES-1:

Land resources;

Site infrastructure;

Water resources (surface water and Groundwater);

Biotic resources (wetlands, aquatic resources, and threatened and endangered specie and/or species of concern);

Socioeconomics (employment during construction and operation and unemployment durin 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 var significantly from site to site or technology to technology.

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

Air Quality and Acoustics. Construction activities would result in exceedance of 24 PM10 and TSP standards. At all sites, air pollutant concentrations would increase d operation but would be within standards, and noise levels would increase during bot construction and operation.

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

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

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

Cultural and Paleontological Resources. Some NRHP-eligible resources may occur with proposed site; Native American resources may be affected by land disturbance and au visual intrusions; and some paleontological resources may be affected by constructi excavations deeper than 50 feet.

Other Socioeconomic Issues. Unemployment would decrease slightly in the economic st 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 income. Revenues and expenditures for most region-of-influence counties, cities, an school districts would increase during construction and operation. Traffic conditio would worsen slightly during construction and operation on main access routes to th sites.

MULTIPURPOSE ("TRIPLE PLAY") REACTOR

The Department's Office of Fissile Materials Disposition is preparing a PEIS addres the issue of how to dispose of plutonium that is excess to nuclear weapons requirem 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 Rec PEIS utilize uranium as the fuel source, and the analysis in this PEIS is based on 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 p reactor that could produce tritium, "burn" plutonium, and generate revenues through sale of electric power. Only the commercial reactor, ALWR, and MHTGR would be capab performing the triple play missions; the potential environmental impacts from these triple play reactors are summarized below. The discussion for the multipurpose ALWR 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 durin peak year of the 6-year construction period.

During operation, this facility would require approx imately 10 percent as much wat a large ALWR at a dry site, and would employ as many workers as the ALWR. Radiologi exposures to workers during normal operation would be kept as low as reasonably achievable, and would not be expected to exceed 50mrem per worker per year. If all 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 facility. The goal for the facility for public radiation exposure would be not to e 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 pl Criticality accidents, explosions, and fires could occur in such a facility, and re radiation to the environment. The use of plutonium in an ALWR would not significant affect the consequences of radioactivity releases from severe accidents, though the 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 operation therefore, impacts would not be expected to change significantly from those associa

with utilizing a uranium fueled reactor. This is based on a study conducted by the the Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Fuel in Light Water Reactors (August, 1976).

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

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

During operation of twice as many reactor modules, water requirements could increas percent. Impacts to groundwater would not change significantly from those expected the three module MHTGR at those sites that would use groundwater resources. The exp workforce increase would approximately double any socioeconomic impacts and radiati 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 accid consequences because fuel failures are not expected in any severe accident. Spent f 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 powe reactor is a reasonable alternative being evaluated to meet the stockpile tritium requirement mission. Production of tritium using irradiation services contracted fr commercial power reactors is also being evaluated as a reasonable alternative and 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 reacto employed for domestic electric power generation in the United States are convention light water reactors that use ordinary water as moderator and coolant. The potentia environmental impacts of the commercial light water reactor alternative are summari below.

The option to purchase an operating commercial power reactor or finish construction partially complete commercial reactor to support the stockpile tritium requirement have similar impacts. The reactor technologies and characteristics would be the sam However, some additional land use impacts may occur to incorporate security infrast 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 zo requirements, new fencing, security buildings, and road access restrictions or construction of new roads.

The environmental impacts of completing construction of an unfinished commercial nu 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 com- pletion (45 percent to 85 percent) was used. Environmental impacts from the upgrade existing site infrastructure to support renewed construction activities would be mi Completing construction of a nuclear reactor would result in impacts from air emiss increased worker numbers, and waste generation and management. Air emissions would temporary and would not be expected to significantly affect air quality in the proj 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 com 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 haza and nonhazardous wastes. Typical hazardous wastes generated during the completion o construction phase would include paints, solvents, acids, oils, and degreasers. Adv environmental impacts from management and disposal of these wastes would not be exp

The commercial reactor alternatives for producing tritium would result in additiona environmental impacts from the changes in the reactor operational characteristics d 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 requi physical changes to the reactor core, which could range from replacement of burnabl poison elements with DOE target elements to the replacement of fuel rods with DOE t assemblies. Core changes could alter the accident basis and would modify the source The estimated additional core tritium content in curies per reactor at the end of t irradiation period would be 3.2x107 for a single reactor. Because of the reduced bu 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 increase of approximately 9 percent for a single reactor. The number of personnel w 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 effl would be expected to change (particularly for tritium). Estimates for expected incr of gaseous tritium effluent range from 5,740 Ci per year for a single reactor to 3, per year in the multiple reactor scenario. Estimated increases of liquid tritium ef ranges from 1,460 Ci per year for a single reactor to 935 Ci per year per reactor i multiple reactor scenario.

Waste. Additional activities associated with the handling, processing, and shipping target assemblies would be expected to increase waste generation rates at the comme reactor site. An estimated 164yd3 per year of LLW per reactor would be expected. Th would be approximately a 50-percent increase for a typical plant. No increase in mi 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 singl reactor case, 137 additional spent fuel assemblies (40yd3, assuming 8ft3/assembly) be generated each year. This amounts to approximately 58 metric tons of heavy metal additional fuel assemblies represent more than a 3-fold increase over the average o assemblies (24 metric tons of heavy metal) for a typical pressurized commercial lig water reactor. The change to 12-month refueling cycles with full core discharge wou accelerate the consumption of available spent nuclear fuel pool storage and would r earlier use of additional storage alternatives such as dry storage at some commerci reactor sites.

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

Radiological Impacts

Normal Operations. The impact from adding tritium targets to a commercial reactor w 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 wou occur if all of the tritium were produced at that site. The impacts would lessen at given site if multiple sites are used.

Considering that the arithmetic mean annual radiation dose to people who lived with 50-mile radius of a commercial nuclear power plant in 1991 was about 1.2 person-rem and 0.95 person-rem from airborne and liquid releases, respectively) and the median 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 r and less than the drinking water limit of 4mrem. It is estimated that the changes i radioactive releases associated with the production of tritium in a single reactor result in an annual dose increase of 0.51 person-rem to the 50-mile population. Thi would result in a calculated increase of 0.10 fatal cancer in this population as th result of 40years of reactor operation. There would be a slightly larger increase i total number of fatal cancers in the several population groups for the multiple rea scenario compared with the single reactor, but the calculated risk to an individual 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) h selected. If the results of the impacts analysis indicates exceedances of either NE and/or drinking water limits, the reactor's radioactive waste management system wou revised to reduce the effluent to acceptablelimits.

Transportation/Handling. Assuming that an inventory of 500target rods would be accu for shipment at one time in NRC-approved fuel assembly shipping casks, and one cask transport truck, approximately 12 shipments per year would occur. The curie content truck would be approximately 2.7x106. The upper bound radiological consequences of accident during transportation from a single site to SRS might incur an additional 240person-rem per year.

QUALITATIVE COMPARISON

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

For some of the resource areas evaluated in the PEIS, the analyses indicate that th no major differences in the environmental impacts among the tritium supply technolo site alternatives. Resource areas where no major differences exist, or where potent environmental impacts are small, are: land resources, air quality, water resources, geology and soils, biotic resources, and socioeconomics. For these resource areas, general conclusion is particularly true when comparing the operational impacts of t tritium supply facilities. For construction, this general conclusion is also partic true when comparing among the various types of new tritium supply facilities (e.g., 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 irradiation services or purchase and conversion of an existing commercial reactor), environmental impacts of the latter are clearly less because the facility already exists, and, thus, there are minimal construction-related environmental impacts. Fo

tritium recycling, this also applies when comparing the existing tritium recycling facilities at SRS against constructing a new tritium recycling facility at another

For other resource areas evaluated in the PEIS, the analyses indicate that there ar notable environmental impact differences. Resource areas where notable differences are: site infrastructure (electrical requirements), human health (from radiological impacts due to accidents), and wastes generated. Each of these resource areas is di 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 facil the future. The PEIS acknowledges, and qualitatively discusses, these potential "av environmental impacts. The APT, and to a significantly lesser degree the HWR, would energy consumers. The PEIS assesses the environmental impacts of providing power to energy consumers. Thus, in terms of environmental impacts, there could be approxima 1,800 MWe of difference (i.e., ALWR generating 1,300 MWe versus an APT consuming 50 between the tritium supply technologies. For commercial reactors that already exist 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 poten 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 order of once every millions of years at most. Based upon the PEIS analyses of the technologies, the ALWR could cause the largest potential impacts to human health fr severe accidents, while the MHTGR would have the smallest potential impacts. Becaus APT does not utilize fissile materials, and there is no significant decay heat, the 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 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 impact human health. Because ORR and SRS have larger populations within 50 miles of the pr facilities, these two sites have greater potential human health impacts than the ot sites. Because there are virtually no radiological consequences from any APT accide there are no grounds for discrimination among sites in the case of the APT. It is, essence, site neutral with respect to potential impacts to human health.

Generated Wastes

Spent Fuel Generation. All of the tritium supply reactor technologies would generat fuel. While the MHTGR would generate the greatest volume of spent fuel (because of graphite moderator), the residual heavy metal content of spent fuel from the ALWR w be the greatest. Reactors providing irradiation services would not generate additio 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 n change fuel cycles. However, if only a single reactor were used (irradiation servic purchased and converted), additional spent fuel would likely be generated because t reactor's refueling cycle would be shortened. The APT is not a reactor and would no generate spentfuel.

Low-level Waste. None of the alternatives would generate unacceptably large amounts low-level waste. However, of the alternatives, the HWR would create the most low-le waste in 1 year (almost 5times as much as any other reactor alternative). The APT w 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, excep Pantex, all sites have the ability to handle and dispose of low-level nuclear waste site. Low-level nuclear waste generated at Pantex would need to be shipped to anoth for disposal.

Table ES-1.-Summary Comparison of Environmental Impacts of Tritium Supply Technolog Recycling [Page 1 of 32]

INEL	NTS	ORR
		Land 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 t would be no impac use or visual res
		Land Resources-Collocated Tri
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 disturba technology: HWR: 260 acres MHGTR: 360 acres ALWR: 350 acres APT: 173 acres Recycling: 202 ac
		Site Infrastruct
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 t electrical load r would reduce by 1,304MWe. Annual consumption would by 11,641,800 MWh year.
		Site Infrastructure-Collocated
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	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	The change in cur capacity (MWe) fo technology: HWR: 1,237 less MHGTR: 1,252 less Large ALWR: 1,192 Small ALWR: 1,236 Full APT: 738 les

Phased APT: 320	Phased APT: 364	Phased APT: 933 1

Site Infrastructure-Collocated

The percent of the power pool capacity margin:	The percent of the power pool capacity margin:	The percent of th pool capacity mar
HWR: 0.62	HWR: 0.72	HWR: 1.47
MHTGR: 0.45	MHTGR: 0.53	MHTGR: 1.14
Large ALWR: 1.14	Large ALWR: 1.32	Large ALWR: 2.46
Small ALWR: 0.67	Small ALWR: 0.77	Small ALWR: 1.50
Full APT: 4.15	Full APT: 4.79	Full APT: 12.44
Phased APT: 2.72	Phased APT: 3.14	Phased APT: 8.15

Site Infrastructure-Tr

The tritium supply alone would reduce the peak load requirement above by 16MWe for

Water Resource

Under No Action there would be no impacts to water resources.

Water Resources-Collocated Tr

Surface water would not be used during construction.
(MGY) and corresponding percentage.

		increase by techn
-	-	HWR: 23 (1 percen
		MHTGR: 19 (1 perc
		Large ALWR: 35 (2
		Small ALWR: 22 (1
		APT: 10 (<1 perce

Water Resources-Collocated Tr

The construction groundwater use (MGY) by technology affected by construction or us used during construction.

HWR: 23	HWR: 23	-
MHTGR: 19	MHTGR: 19	
Large ALWR: 35	Large ALWR: 35	
Small ALWR: 22	Small ALWR: 22	
APT: 10	APT: 10	

The total percent of groundwater use increase during construction by technology:No

HWR: 1	HWR: 3
MHTGR: 1	MHTGR: 3
Large ALWR: 2	Large ALWR: 5
Small ALWR: 1	Small ALWR: 3
Full APT: <1	Full APT: 1
Phased APT: <1	Phased APT: 1

Surface water would not be used during operation. The operation surface water use (MGY) and corresponding percentage increase by technology:

-	-	HWR: 5,914 (320 p
		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)

Water Resources-Collocated Tr

No blowdown discharges to surface water.
(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
Groundwater requirements (MGY) and corresponding percentage increase during operation by technology:	Groundwater requirements (MGY) and corresponding percentage increase during operation by technology:	Groundwater would used for operatio
HWR: 62 (3 percent) MHTGR: 44 (2 percent) Large ALWR: 104 (5 percent) Small ALWR: 64 (3 percent) Full APT: 1,214 (61 percent) PhasedAPT:784 (39 percent)	HWR: 62 (9 percent) MHTGR: 44 (7 percent) Large ALWR: 104 (16 percent) Small ALWR: 64 (10 percent) Full APT: 1,214 (181 percent) PhasedAPT: 784 (117 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.	-

Water Resources-Trit

The groundwater requirement would be 1.5 MGY. No groundwater would be used. The Total surface water wastewater requirement less than for collocation requirement would be would be 1.5MGY less during construction and 14MGY less during operation for all technologies. No surface water would be used.	1.5MGY less than for col- 14MGY less during operation for all technologies. No surface water would be used.	than for collocat location during c and 37 MGY less d operation for all gies.

Biotic Resource

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 t would be no impac biotic resources.

Biotic Resources-Collocated Tr

Wetlands and aquatic resources would not be affected.	Wetlands and aquatic resources would not be affected.	Without appropria tion measures, in stream flow from tional discharges affect wetland an plant communities
No Federal-listed threat-ened or endangered species would be affected during construction or operation, but several Federal candi-dates or state-listed species may be affected.	One Federal-listed threat-ened species, the desert tortoise, could be affected during construction and operation. Several Federal candidate or state-listed species may be affected.	No Federal-listed ened or endangere would be affected construction or o but several Feder dates or state-li may be affected.
		Biotic Resources-Collocated Tr
The ferruginous hawk could lose foraging habitat equal to the amount of land disturbed for each technol-ogy 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 technol-ogy 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 could lose potent and foraging habi to the amount of land for each tec however this type is abundant in th Tennessee dace an bender, both stat could be affected struction.
		Socioeconomics
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 O employment decrea 300 persons betwe and 1994 to 15,00 and it will remai level through 202
Under No Action employ-ment in the regional economic area is expected to grow by less than 1percent annually through 2009 and then decrease by less than 1 percent annually through 2020.	Under No Action employ-ment in the regional economic area is expected to grow by less than 1percent annually through 2009 and then continue to increase by less than 1percent annually through 2020.	Under No Action e ment in the regio economic area is to grow by less t 1percent annually 2009 and decrease than 1percent ann through 2020.
		Socioeconomics
Under No Action unem-ployment is expected to be at 6.4 percent between 2001 and 2020. Per capita income is expected to increase from	Under No Action unem-ployment is expected to be at 5 percent between 2001 and 2020. Per capita income is expected to increase from	Under No Action u ployment is expec at 6.2 percent be and 2020. Per cap is expected to in

$17,800 to $20,900.	$23,600 to $25,100.	$17,900 to $20,70
Under No Action the average annual population and housing increase is expected to be less than 1percent through 2010.	Under No Action the average annual population and housing increase is expected to be 1percent through 2020.	Under No Action t average annual po and housing incre expected to be 1p through 2009 and 1percent between 2020.
Under No Action the average annual population and housing increase is expected to be less than 1percent 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 exp reach 561,000 in 586,000 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 1percent 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 1percent 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 t revenues and expe for ROI counties, school districts to increase by an average of approx 1percent or less 2020.
		Socioeconomics-Collocated Tri
The increase in employment during peak construction in the regional economic area by technology:	The increase in employment during peak construction in the regional economic area by technology:	The increase in e during peak const the regional econ by technology:
HWR: 7,500 MHTGR: 7,200 ALWR: 10,800 APT: 8,750	HWR: 9,500 MHTGR: 9,100 ALWR: 13,700 APT: 11,100	HWR: 8,300 MHTGR: 8,000 ALWR: 12,000 APT: 9,700
The increase in employment during full operation in the regional economic area by technology:	The increase in employment during full operation in the regional economic area by technology:	The increase in e during full opera regional economic technology:
HWR: 4,900 MHTGR: 4,900 ALWR: 4,700 APT: 4,100	HWR: 5,500 MHTGR: 5,500 ALWR: 5,200 APT: 4,600	HWR: 5,200 MHTGR: 5,100 ALWR: 4,900 APT: 4,300
The decrease in unemployment during full operation in the regional economic area by technology:	The decrease in unemployment during full operation in the regional economic area by technology:	The decrease in u ment during full in the regional e area by technolog
HWR: 1.8 percent MHTGR: 1.8 percent ALWR: 1.7 percent	HWR: 0.7 percent MHTGR: 0.7 percent ALWR: 0.6 percent	HWR: 0.6 percent MHTGR: 0.6 percen ALWR: 0.6 percent

APT: 1.5 percent	APT: 0.6 percent	APT: 0.5 percent
	Radiological and Hazardous Chemical Impa	
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 0.04mrem. The risk of fatal cancer from 40 years of operation is 8.1x10-7.	Under No Action, to the maximally member of the pub emissions of radi 1 year of operati 3.9mrem from atmo release and 14 mr liquid release. T fatal cancer from operation is 7.8x 2.7x10-4, respect
	Radiological and Hazardous Chemical Impa	
The population dose of 0.037 person-rem from total site operations in 2030 would result in 7.4x10-4 fatal cancer over 40 years of operation.	The population dose of 8.2x10-3 person-rem from total site operations in 2030 would result in 1.6x10-4 fatal cancer over 40 years of operation.	The population do person-rem from t operations in 203 result in 1.1 fat over 40 years of
Under No Action the average annual dose to a site worker is 30 mrem with a risk of fatal cancer of 4.8x10-4 from 40 years of operation. The annual dose of 220 person-rem to total site workforce would result in 3.5 fatal cancers over 40years of operation.	Under No Action the average annual dose to a site worker is 5 mrem with a risk of fatal cancer of 7.8x10-5 from 40 years of operation. The annual dose of 3person-rem to total site workforce would result in 0.048 fatal cancer over 40years of operation.	Under No Action t average annual do worker is 17 mrem risk of fatal can 2.8x10-4 from 40 operation. The an of 320 person-rem site workforce wo in 5.1 fatal canc 40years of operat
	Radiological and Hazardous Chemical Impa	
Under No Action for emission of hazardous chemicals, the chemical Hazard Index (HI) is 1.7x10-4 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 f emission of hazar chemicals, the ch is 0.36 with no c the maximally exp member of the pub site worker HI is no cancer risk.
-	-	-

Radiological and Hazardous Chemical Impacts During Norm

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:	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:	The annual dose i the maximally exp member of the pub total site operat associated (risk cancer) from 40 y operation by tech
HWR: 0.29 (5.9x10-6) MHTGR: 0.19 (3.8x10-6) Large and Small ALWR: 0.36 (7.3x10-6) APT (He-3): 0.11 (2.3x10-6) APT (SILC): 0.16 (3.3x10-6)	HWR: 0.31 (6.2x10-6) MHTGR: 0.21 (4.1x10-6) Large and Small ALWR: 0.40 (8.0x10-6) APT (He-3): 0.13 (2.6x10-6) APT (SILC): 0.18 (3.6x10-6)	HWR: 7.1 (1.4x10- MHTGR: 5.7 (1.1x1 Large ALWR: 8.8 (Small ALWR: 7.6 (APT (He-3): 4.3 (APT (SILC): 5.0 (
No liquid releases.	No liquid releases.	The annual dose i the maximally exp member of the pub total site operat 14 mrem from liqu releases for each ogy. The associat fatal cancer from operation would b for all technolog for the ALWRs (2.
-	-	-
The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40years of operation by technology:	The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) from 40years of operation by technology:	The 50-mile popul dose in person-re total site operat and (fatal cancer 40years of operat technology:

Radiological and Hazardous Chemical Impacts During Norm

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 Small ALWR: 87 (1 APT (He-3): 68 (1 APT (SILC): 73 (1
The average annual dose in mrem to a site worker and (fatal cancer risk) from 40years of operation that	The average annual dose in mrem to a site worker and (fatal cancer risk) from 40years of operation that	The average annua mrem to a site wo (fatal cancer ris 40years of operat

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 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)

All radiological doses to the public and site workers are within regulatory limits.

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 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)

All radiological doses to the public and site workers are within regulatory limits.

are associated wi performance by te

HWR: 19 (3.0x10-4
MHTGR: 18 (2.9x10
Large ALWR: 26 (4
Small ALWR: 22 (3
APT (He-3): 18 (3
APT (SILC): 19 (3

The annual dose i rem to the total workforce and (fa cancers) from 40 operation by tech

HWR: 360 (5.8)
MHTGR: 350 (5.6)
Large ALWR: 490 (
Small ALWR: 420 (
APT (He-3): 360 (
APT (SILC): 362 (

All radiological public and site w within regulatory

Radiological and Hazardous Chemical Impacts During Norm

For chemicals, the HI for the maximally exposed member of the public and site worker by technology:

Public
HWR: 2.1x10-4
MHTGR: 1.8x10-4
Large and Small ALWR: 6.3x10-4
APT (for either target system): 1.8x10-4
Cancer Risk: 0

Worker
HWR: 0.031
MHTGR: 0.021
Large and Small ALWR: 0.13
APT (for either target system): 0.021
Cancer Risk: 0

All values are within regulatory limits.

For chemicals, the HI for the maximally exposed member of the public and site worker by technology:

Public
HWR: 6.3x10-6
MHTGR: 2.2x10-7
Large and Small ALWR: 7.7x10-5
APT (for either target system): 1.8x10-7
Cancer Risk: 0

Worker
HWR: 3.2x10-3
MHTGR: 3.4x10-5
Large and Small ALWR: 0.038
APT (for either target system): 3.4x10-5
Cancer Risk: 0

All values are within regulatory limits.

For chemicals, th the maximally exp member of the pub site worker by te

Public
HWR: 0.36
MHTGR: 0.36
Large and Small A 0.38
APT (for either t 0.36
Cancer Risk: 0

Worker
HWR: 0.27
MHTGR: 0.32
Large and Small A 0.35
APT (for either t system): 0.26
Cancer Risk: 0

All values are wi tory limits.

Radiological and Hazardous Chemical Impacts Du

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 (3.7x10-6)
MHTGR: 0.08 (1.6x10-6)
Large and Small ALWR: 0.25(5.1x10-6)
APT(He-3):0.0048 (1.0x10-7)
APT (SILC): 0.05 (1.1x10-6)

No liquid release.

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 (3.8x10-6)
MHTGR: 0.09 (1.7x10-6)
Large and Small ALWR: 0.28(5.6x10-6)
APT (He-3): 0.01 (2.0x10-7)
APT (SILC): 0.06 (1.2x10-6)

No liquid release.

The annual dose i
the maximally exp
member of the pub
total site operat
associated (risk
cancer) from 40 y
operation by tech

HWR: 4.3 (8.4x10-
MHTGR: 2.9 (5.4x1
Large ALWR: 6.0 (
Small ALWR: 4.8 (
APT (He-3): 1.5 (
APT (SILC): 2.2 (

The annual dose t
maximally exposed
of the public fro
operations includ
nology would be 1
from liquid relea
associated risk o
from 40 years of
would be 2.7x10-4

Radiological and Hazardous Chemical Impacts Du

The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40years 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 average annual dose in mrem to a site worker and (fatal cancer risk) from 40years of operation that are associated with total site performance, including the following technology:

HWR: 34 (5.4x10-4)

The 50-mile population dose in person-rem from total site operations in 2030 and (fatal cancers) over 40years 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 average annual dose in mrem to a site worker and (fatal cancer risk) from 40years of operation that are associated with total site performance, including the following technology:

HWR: 47 (7.5x10-4)

The 50-mile popul
dose in person-re
total site operat
and (fatal cancer
40years of operat
technology:

HWR: 71 (1.4)
MHTGR: 65 (1.3)
Large ALWR: 79 (1
Small ALWR: 76 (1
APT (He-3): 57 (1
APT (SILC): 62 (1

The average annua
mrem to a site wo
(fatal cancer ris
40years of operat
are associated wi
performance, incl
following technol

HWR: 19 (3.0x10-4

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 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)

All radiological doses to the public and site workers 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: 0.3
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.

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 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)

All radiological doses to the public and site workers 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.

MHTGR: 19 (3.0x10
Large ALWR: 26 (4
Small ALWR: 23 (3
APT 19 (for eithe
system): (3.0x10-

The annual dose i
rem to the total
workforce and (fa
cancers) over 40
operation by tech

HWR: 360 (5.8)
MHTGR: 350 (5.6)
Large ALWR: 490 (
Small ALWR: 420 (
APT (He-3): 360 (
APT (SILC): 362 (

Radiological and Hazardous Chemical Impacts Du

All radiological
public and site w
within regulatory

For collocation,
percent reduction
to the maximally
member of the pub
site worker by te

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 wi
tory limits.

Radiological Impacts from Accide

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: 8.1x10-9
MHTGR: 1.3x10-10
Large ALWR: 5.0x10-11
Small ALWR: 6.8x10-11
APT: negligible
Cancer Fatalities
HWR: 8.1x10-6
MHTGR: 5.1x10-9
Large ALWR: 5.0x10-6
Small ALWR: 6.8x10-6
APT: negligible

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: 4.2x10-9
MHTGR: 5.5x10-11
Large ALWR: 2.2x10-11
Small ALWR: 3.0x10-11
APT: negligible
Cancer Fatalities
HWR: 4.2x10-6
MHTGR: 2.2x10-9
Large ALWR: 2.2x10-6
Small ALWR: 3.0x10-6
APT: negligible

The estimated can and if an acciden the increase in t hood of cancer fa maximally exposed ual at site bound low-to-moderate c quence/high proba tritium supply te accident would be

Cancer Risk (per
HWR: 6.8x10-8
MHTGR: 1.1x10-9
Large ALWR: 4.3x1
Small ALWR: 5.8x1
APT: negligible
Cancer Fatalities
HWR: 6.8x10-5
MHTGR: 4.4x10-8
Large ALWR: 4.3x1
Small ALWR: 5.8x1
APT: negligible

Radiological Impacts from Accide

The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:

Cancer Risk (per year)
HWR: 7.4x10-5
MHTGR: 5.0x10-7
Large ALWR: 3.8x10-7
Small ALWR: 6.2x10-7
APT: negligible
Cancer Fatality
HWR: 0.074
MHTGR: 2.0x10-5
Large ALWR: 0.038
Small ALWR: 0.062
APT: negligible

The estimated cancer risk (fatalities per year) and if the accident occurred, total cancer fatalities for population residing within 50miles for a low-to-moderate consequence/high probability accident of a tritium supply technology would be:

Cancer Risk (per year)
HWR: 1.2x10-6
MHTGR: 1.7x10-8
Large ALWR: 7.3x10-9
Small ALWR: 1.0x10-8
APT: negligible
Cancer Fatality
HWR: 1.2x10-3
MHTGR: 6.8x10-7
Large ALWR: 7.3x10-4
Small ALWR: 1.0x10-3
APT: negligible

The estimated can (fatalities per y the accident occu cancer fatalities tion residing wit 50miles for a low moderate consequence/high proba accident of a tri technology would

Cancer Risk (per
HWR: 7.5x10-4
MHTGR: 1.1x10-5
Large ALWR: 4.6x1
Small ALWR: 6.4x1
APT: negligible
Cancer Fatality
HWR: 0.75
MHTGR: 4.3x10-4
Large ALWR: 0.46
Small ALWR: 0.64
APT: negligible

Radiological Impacts from Accide

The estimated cancer risk

The estimated cancer risk

The estimated can

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 Fatality
HWR: 1.1x10-4
MHTGR: 1.3x10-7
Large ALWR: 1.0x10-4
Small ALWR: 1.3x10-4
APT: negligible

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: 2.8x10-8
MHTGR: 8.3x10-10
Large ALWR: 3.1x10-10
Small ALWR: 3.9x10-10
APT: negligible
Cancer Fatality
HWR: 2.8x10-5
MHTGR: 3.3x10-8
Large ALWR: 3.1x10-5
Small ALWR: 3.9x10-5
APT: negligible

and if the accide
the increase in t
hood of cancer fa
worker located 1,
from the release
to- moderate cons
quence/high proba
accident of a tri
technology would

Cancer Risk (per
HWR: 1.6x10-7
MHTGR: 4.8x10-9
Large ALWR: 1.6x1
Small ALWR: 2.1x1
APT: negligible
Cancer Fatality
HWR: 1.6x10-4
MHTGR: 1.9x10-7
Large ALWR: 1.6x1
Small ALWR: 2.1x1
APT: negligible

Radiological Impacts from Accide

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: 6.5x10-9
MHTGR: 9.4x10-10
Large ALWR: 3.5x10-10
Small ALWR: 3.6x10-10
APT(He-3): 4.4x10-15
APT (SILC): 9.2x10-14
Cancer Fatality
HWR: 7.1x10-4
MHTGR: 5.9x10-5
Large ALWR: 2.3x10-3
Small ALWR: 2.3x10-3
APT(He-3): 6.2x10-9
APT (SILC): 1.3x10-7

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: 1.8x10-8
MHTGR: 2.7x10-9
Large ALWR: 8.3x10-10
Small ALWR: 9.8x10-10
APT(He-3): 1.2x10-14
APT (SILC): 2.3x10-13
Cancer Fatality
HWR: 2.0x10-3
MHTGR: 1.7x10-4
Large ALWR: 5.5x10-3
Small ALWR: 6.3x10-3
APT(He-3): 1.7x10-8
APT (SILC): 3.3x10-7

The estimated can
and if the accide
the increase in t
hood of cancer fa
maximally exposed
ual at the site b
the high conseque
probability accid
tritium supply te
would be:

Cancer Risk (per
HWR: 1.4x10-7
MHTGR: 2.4x10-8
Large ALWR: 3.1x1
Small ALWR: 6.6x1
APT(He-3): 9.5x10
APT (SILC): 1.6x1
Cancer Fatality
HWR: 0.015
MHTGR: 1.5x10-3
Large ALWR: 0.02
Small ALWR: 0.042
APT(He-3): 1.3x10
APT (SILC): 2.2x1

Radiological Impacts from Accide

The estimated cancer risk (fatalities per year) and if the accident occurred, the

The estimated cancer risk (fatalities per year) and if the accident occurred, the

The estimated can
(fatalities per y
the accident occu

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: 1.4x10-5
MHTGR: 2.9x10-6
Large ALWR: 5.5x10-8
Small ALWR: 6.4x10-7
APT(He-3): 7.4x10-12
APT (SILC):6.7x10-11
Cancer Fatality
HWR: 1.6
MHTGR: 0.18
Large ALWR: 0.36
Small ALWR: 4.1
APT(He-3):1.0x10-5
APT (SILC): 9.4x10-5

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: 1.4x10-6
MHTGR: 2.8x10-7
Large ALWR: 5.3x10-9
Small ALWR: 6.1x10-8
APT(He-3): 7.0x10-13
APT (SILC): 6.4x10-12
Cancer Fatality
HWR: 0.15
MHTGR: 0.017
Large ALWR: 0.035
Small ALWR: 0.39
APT(He-3): 9.9x10-7
APT (SILC): 9.0x10-6

total cancer fata
population residi
50 miles for high
quence/low probab
accidents of a tr
technology would

Cancer Risk (per
HWR: 1.2x10-4
MHTGR: 2.3x10-5
Large ALWR: 9.4x1
Small ALWR: 5.1x1
APT(He-3): 6.8x10
APT (SILC): 7.4x1
Cancer Fatality
HWR: 13
MHTGR:1.4
Large ALWR: 6.2
Small ALWR: 33
APT(He-3): 9.6x10
APT (SILC): 1.0x1

Radiological Impacts from Accide

The estimated cancer risk to a worker located 1,000meters 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: 3.2x10-7
MHTGR: 1.1x10-7
Large ALWR: 5.0x10-9
Small ALWR: 1.5x10-8
APT(He-3): 4.4x10-13
APT (SILC): 6.7x10-12
Cancer Fatality
HWR: 0.034
MHTGR: 6.7x10-3
Large ALWR: 0.033
Small ALWR: 0.094
APT(He-3): 6.1x10-7
APT (SILC): 9.4x10-6

The impact of tritium extraction and recycling are presented in appendix I.

The estimated cancer risk to a worker located 1,000meters 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: 2.8x10-7
MHTGR: 8.1x10-8
Large ALWR: 4.5x10-9
Small ALWR: 1.4x10-8
APT(He-3): 3.2x10-13
APT (SILC): 4.8x10-12
Cancer Fatality
HWR: 0.031
MHTGR: 5.0 x 10-3
Large ALWR: 0.03
Small ALWR: 0.087
APT(He-3): 4.5x10-7
APT (SILC): 6.7x10-6

The impact of tritium extraction and recycling are presented in appendix I.

The estimated can
a worker located
1,000meters from
release and if th
occurred, the inc
likelihood of can
for a high conseq
probability accid
tritium supply te
would be:

Cancer Risk (per
HWR: 3.2x10-7
MHTGR: 1.1x10-7
Large ALWR: 4.9x1
Small ALWR: 1.6x1
APT(He-3): 4.3x10
APT (SILC): 6.2x1
Cancer Fatality
HWR: 0.035
MHTGR: 7.1x10-3
Large ALWR: 0.032
Small ALWR: 0.1
APT(He-3): 6.0x10
APT (SILC): 8.7x1

The impact of tri
extraction and re
presented in appe

		Waste Managemen
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 nonhazard-ous.	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, would continue to spent nuclear fue following waste t TRU, low-level, m and low-level, ha and nonhazardous.
		Waste Management-Collocated Tr
Spent nuclear fuel would be generated by all technolo-gies, except APT.	Spent nuclear fuel would be generated by all technolo-gies, except APT.	Spent nuclear fue generated by all gies, 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 storage facilitie required. For tri recycling phaseou there would be no
Liquid LLW would be generated by all technolo-gies except APT, in the following quantities:	Liquid LLW would be generated for all technolo-gies except APT, in the following quantities:	Liquid LLW genera would increase fo nologies except A increase over No (587,000 GPY) wou
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 GP MHTGR: 525,000 GP Large ALWR: 5,000,000 GPY Small ALWR: 790,0 GPY
Existing/planned treatment facility may be adequate for all technologies, except the Large ALWR, which would require a new treatment	New treatment facilities would be required. For tritium recycling phaseout at SRS, there would be no change.	New treatment fac would be required tritium recycling at SRS, there wou change.
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 generat would increase an additional onsite disposal area.
		Waste Management-Collocated Tr
The increase over No Action	The increase over No Action	The increase over

(5,100 yd3 per year) and the additional LLW disposal area would be:	(42,400 yd3 per year) and the additional LLW disposal area would be:	(9,300 yd3 per ye additional LLW di area would be:
facility. For tritium recycling phaseout at SRS, there would be no change.		
HWR: 5,550 yd3 (0.6 acres) MHTGR: 1,650 yd3 (0.2 acres) Large ALWR: 1,060 yd3 (0.2 acres) Small ALWR: 1,010 yd3 (0.1 acres) APT: 894 yd3 (0.1 acres)	HWR: 5,550 yd3 (0.6 acres) MHTGR: 1,650 yd3 (0.2 acres) Large ALWR: 1,060 yd3 (0.2 acres) Small ALWR: 1,010 yd3 (0.1 acres) APT: 894 yd3 (0.1 acres)	HWR: 5,550 yd3 (1.2 acres) MHTGR: 1,650 yd3 (0.35 acres) Large ALWR: 1,060 (0.4 acres) Small ALWR: 1,010 (0.2 acres) APT: 894 yd3 (0.2 acres)
-	-	-
For tritium recycling phaseout, 350 yd3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	For tritium recycling phaseout, 350 yd3 per year decrease in solid LLW at SRS. LLW disposal facility life extended.	For tritium recyc phaseout, 350 yd3 decrease in solid SRS. LLW disposal life extended.
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 liquid mixed LLW tion over No Acti (470,000 GPY) fro recycling facilit generated. Existi treatment facilit adequate.
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 recyc phaseout at SRS, liquid mixed LLW no longer be gene
		Waste Management-Collocated Tr
Solid mixed LLW genera-tion increase over No Action (655 yd3 per year) would be:	Solid mixed LLW genera-tion increase over No Action (5,460 yd3 per year) would be:	Solid mixed LLW g tion increase ove (11,100 yd3 per y be:
HWR: 122 yd3 MHTGR: 3 yd3 Large ALWR: 8 yd3 Small ALWR: 8 yd3 APT: 9 yd3	HWR: 122 yd3 MHTGR: 3 yd3 Large ALWR: 8 yd3 Small ALWR: 8 yd3 APT: 9 yd3	HWR: 122 yd3 MHTGR: 3 yd3 Large ALWR: 8 yd3 Small ALWR: 8 yd3 APT: 9 yd3
HWR may require new or	Organic mixed waste	Existing/planned

expanded treatment and storage facilities.	treatment capability would be required.	facilities would adequate.
For tritium recycling phaseout, 2 yd3 per year decrease in solid mixed LLW at SRS.	For tritium recycling phaseout, 2 yd3 per year decrease in solid mixed LLW at SRS.	For tritium recyc phaseout, 2 yd3 p decrease in solid LLW at SRS.
Solid hazardous waste generation increase over No Action (308 yd3 per year) would be:	Solid hazardous waste generation increase over No Action (20 yd3 per year) would be:	Solid hazardous w eration increase Action (1,150 yd3 would be:
HWR: 41 yd3 MHTGR: 101 yd3 Large ALWR: 36 yd3 Small ALWR: 36 yd3 APT: 4 yd3	HWR: 41 yd3 MHTGR: 101 yd3 Large ALWR: 36 yd3 Small ALWR: 36 yd3 APT: 4 yd3	HWR: 41 yd3 MHTGR: 101 yd3 Large ALWR: 36 yd Small ALWR: 36 yd APT: 4 yd3
		Waste Management-Collocated Tr
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 waste facilities adequate.
For tritium recycling phaseout, 1 yd3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	For tritium recycling phaseout, 1 yd3 per year decrease in hazardous waste at SRS. Decrease in offsite hazardous waste shipments.	For tritium recyc phaseout, 1 yd3 p decrease in hazar at SRS. Decrease hazardous waste s
Liquid sanitary waste would be generated:	Liquid sanitary waste would be generated:	Liquid sanitary w ation would incre No Action (483 MG
HWR: 62.3 MGY MHTGR: 44.3 MGY Large ALWR: 104 MGY Small ALWR: 64.3 MGY APT: 260 MGY	HWR: 62.3 MGY MHTGR: 44.3 MGY Large ALWR: 104 MGY Small ALWR: 64.3 MGY APT: 260 MGY	HWR: 2,380 MGY MHTGR: 1,660 MGY Large ALWR: 6,320 Small ALWR: 2,880 APT: 269 MGY
New treatment facilities would be required.	New treatment facilities would be required.	New treatment fac would be required
For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facil-	For tritium recycling phaseout, 32 MGY decrease in liquid sanitary waste at SRS. Decrease would occur over time as recycling facil-	For tritium recyc phaseout, 32 MGY in liquid sanitar SRS. Decrease wou over time as recy

ities are transitioned.	ities are transitioned.	ities are transit
		Waste Management-Collocated Tr
Solid sanitary waste generation would increase over No Action (68,000 yd3 per year):	Solid sanitary waste generation would increase over No Action (7,000 yd3 per year):	Solid sanitary wa tion would increa Action (77,000 yd
HWR: 15,000 yd3 MHTGR: 14,800 yd3 Large ALWR: 14,300 yd3 Small ALWR: 11,600 yd3 APT: 8,640 yd3	HWR: 15,000 yd3 MHTGR: 14,800 yd3 Large ALWR: 14,300 yd3 Small ALWR: 11,600 yd3 APT: 8,640 yd3	HWR: 15,000 yd3 MHTGR: 14,800 yd3 Large ALWR: 14,30 Small ALWR: 11,60 APT: 8,640 yd3
Onsite landfill design life would be reduced or require expansion.	Onsite landfill design life would be reduced or require expansion.	Onsite landfill d would be reduced expansion.
For tritium recycling phaseout at SRS, 7,800 yd3 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 yd3 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 recyc phaseout at SRS, per year decrease sanitary waste at Decrease would oc time as recycling are transitioned. life would be ext
For tritium recycling phaseout at SRS, 6,800 yd3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	For tritium recycling phaseout at SRS, 6,800 yd3 per year decrease in other solid nonhazardous waste at SRS. Decrease in shipments to offsite recyclers.	For tritium recyc phaseout at SRS, per year decrease solid nonhazardou SRS. Decrease in to offsite recycl
		Waste Management-Tri
No change to the impacts for spent nuclear fuel. For tritium recycling upgrade at SRS there would be no change.	No change to the impacts for spent nuclear fuel. For tritium recycling upgrade at SRS there would be no change.	No change to the for spent nuclear For tritium recyc upgrade at SRS th be no change.
		Waste Management-Tri
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 for liquid LLW. For tritium recyc upgrade at SRS th be no change.
The increase in solid LLW generation over No Action (5,100 yd3 per year) and the additional onsite LLW	The increase in solid LLW generation over No Action (42,400 yd3 per year) and the additional onsite LLW	The increase in s generation over N (9,300 yd3 per ye additional onsite

disposal area:	disposal area:	disposal area:
HWR: 5,200 yd3 (0.6 acres) MHTGR: 1,300 yd3 (0.2 acres) Large ALWR: 710 yd3 (0.2 acres) Small ALWR: 660 yd3 (0.08 acres) APT: 544 yd3 (0.07 acres)	HWR: 5,200 yd3 (0.6 acres) MHTGR: 1,300 yd3 (0.15 acres) Large ALWR: 710 yd3 (0.2 acres) Small ALWR: 660 yd3 (0.09 acres) APT: 544 yd3 (0.07 acres)	HWR: 5,200 yd3 (1.1 acres) MHTGR: 1,300 yd3 (0.3 acres) Large ALWR: 710 y (0.3 acres) Small ALWR: 660 y (0.2 acres) APT: 544 yd3 (0.1 acres)
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recyc upgrade at SRS th be no change.
Liquid mixed LLW would no longer be generated.	Liquid mixed LLW would no longer be generated.	Liquid mixed LLW no longer be gene
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recyc upgrade at SRS th be no change.
		Waste Management-Tri
Solid mixed LLW generation would increase over No Action (655 yd3 per year):	Solid mixed LLW generation would increase over No Action (5,460 yd3 per year):	Solid mixed LLW g would increase ov Action (11,100 yd
HWR: 120 yd3 MHTGR: 1 yd3 Large ALWR: 6 yd3 Small ALWR: 6 yd3 APT: 7 yd3	HWR: 120 yd3 MHTGR: 1 yd3 Large ALWR: 6 yd3 Small ALWR: 6 yd3 APT: 7 yd3	HWR: 120 yd3 MHTGR: 1 yd3 Large ALWR: 6 yd3 Small ALWR: 6 yd3 APT: 7 yd3
Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change.	Impacts would remain the same as collocated tritium supply and recycling. For tritium recycling upgrade at SRS there would be no change.	Impacts would rem same as collocate supply and recycl For tritium recyc upgrade at SRS th be no change.
Hazardous waste generation would increase over No Action (308 yd3 per year):	Hazardous waste generation would increase over No Action (20 yd3 per year):	Hazardous waste g would increase ov Action (1,150 yd3
HWR: 40 yd3	HWR: 40 yd3	HWR: 40 yd3

MHTGR: 100 yd3 Large ALWR: 35 yd3 Small ALWR: 35 yd3 APT: 3 yd3	MHTGR: 100 yd3 Large ALWR: 35 yd3 Small ALWR: 35 yd3 APT: 3 yd3	MHTGR: 100 yd3 Large ALWR: 35 yd Small ALWR: 35 yd APT: 3 yd3
Use of existing/planned hazardous waste facilities may be feasible. . . . . For tritium recycling upgrade at SRS there would be no change.	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 upgrade at SRS there would be no change.	Existing/planned waste facilities adequate. . . . . For tritium recyc upgrade at SRS th be no change.
		Waste Management-Tri
Liquid sanitary waste generation would increase:	Liquid sanitary waste generation would increase:	Liquid sanitary w ation would incre No Action (483 MG
HWR: 48 MGY MHTGR: 30 MGY Large ALWR: 90 MGY Small ALWR: 50 MGY APT: 245 MGY	HWR: 48 MGY MHTGR: 30 MGY Large ALWR: 90 MGY Small ALWR: 50 MGY APT: 245 MGY	HWR: 2,350 MGY MHTGR: 1,630 MGY Large ALWR: 6,290 Small ALWR: 2,850 APT: 245 MGY
Impacts would remain the same as collocated tritium supply and recycling.	Impacts would remain the same as collocated tritium supply and recycling.	Impacts would rem same as collocate supply and recycl
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recyc upgrade at SRS th be no change.
Solid sanitary waste generation would increase over No Action (68,000 yd3 per year):	Solid sanitary waste generation would increase over No Action (7,000 yd3 per year):	Solid sanitary wa tion would increa Action (77,000 yd
HWR: 7,600 yd3 MHTGR: 7,400 yd3 Large ALWR: 6,900 yd3 Small ALWR: 4,200 yd3 APT: 1,240 yd3	HWR: 7,600 yd3 MHTGR: 7,400 yd3 Large ALWR: 6,900 yd3 Small ALWR: 4,200 yd3 APT: 1,240 yd3	HWR: 7,600 yd3 MHTGR: 7,400 yd3 Large ALWR: 6,900 Small ALWR: 4,200 APT: 1,240 yd3
Onsite landfill design life would be reduced or require expansion.	Onsite landfill design life would be reduced or require expansion.	Onsite landfill d would be reduced expansion.
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recyc upgrade at SRS th be no change.

		Waste Management-Tri
Other solid nonhazardous waste would be recycled.	Other solid nonhazardous waste would be recycled.	Other solid nonha waste would be re
For tritium recycling upgrade at SRS there would be no change.	For tritium recycling upgrade at SRS there would be no change.	For tritium recyc upgrade at SRS th be no change.
		Intersite Transp
Under No Action negligible tritium transport.	Under No Action negligible tritium transport.	Under No Action n tritium transport
		Intersite Transport-Collocated
The relative transportation risk of tritium is 29 percent lower than the existing No Action case for all technologies.	The relative transportation risk of tritium is 30 percent lower than the existing No Action case for all technologies.	The relative tran risk of tritium i lower than the ex Action case for a gies.
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 potential cancer fatalities per year for transporting tritiated heavy water are 3.57x10-5 for the HWR and 6.63x10-6 for APT.	The potential can ties per year for tritiated heavy w 3.57x10-5 for the 6.63x10-6 for APT
		Intersite Transport-Collocated
No intersite transport of low-level waste.	No intersite transport of low-level waste	No intersite tran low-level waste.
-	-	-

		Intersite Transport-Tr
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 trans tritium is about greater than No A to transporting v tritium to SRS.
No intersite transport of LLW.	No intersite transport of LLW.	No intersite tran LLW.
		Intersite Transport-Tr
-	-	-
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 can ties per year for tritiated heavy w 1.4x10-5 for the 6.63x10-6 for APT

Table E.S-2.-Summary Comparison of Environmental Impacts of the Commercial Light Wa

Advanced Light Water Reactor porting highly enriched	Complete Construction of a Commercial Reactor	Purchase or Single
		Construction
Construction would result in short-term exceedance of 24-hour PM10 and TSP standards.	Construction related air emissions would increase but would be smaller than ALWR and of shorter	There wou to constr at the pl

for the HWR and MHTGR alternatives from ORR to INEL is 5.1x10-4.	duration. Emissions would be temporary and would not be expected to significantly affect air quality in the project site area.	and targe be constr would be be expect air quali
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.	Construct facility facility years ove
Hazardous waste generated from construction activities would be approximately 930 yd3.	Hazardous waste generated from construction activities would be substantially less than an ALWR.	The annua hazardous construct target fa be approx
Advanced Light Water Reactora	Complete Construction of a Commercial Reactor	Purchase or Single
		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 th mission t reactor w water con
Operation would require approximately 830 workers.	Operation would require approximately 830workers.	Operation 72additio existing
Approximately 193 dry storage assemblies of spent fuel would be generated and: - 710 yd3 of LLW - 6 yd3 of mixed waste.	Approximately 193 dry storage assemblies of spent fuel would be generated and: - 490 yd3 of LLW -the amount of mixed waste would be similar to the ALWR.	Approxima assemblie generated - 160 yd3 - no addi be genera
Worker exposure for all personnel would be approximately 170person-rem per year.	Worker exposure for all personnel would be approximately 240person-rem.	Worker ex for all p
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 p the emiss year of g 1,460curi tritium o sions.
Radiological releases associated with production of tritium would result in an annual dose of 90person-rem to the 50-mile population.	Radioactive releases associated with production of tritium would be similar to the ALWR.	Radioacti with prod result in 0.5person ulation.
For a high consequence/low probability accident, approximately 1.7cancer fatalities and a risk of 2.6x10-7 cancer fatalities per year could result.	Similar to ALWR.	No substa quences o expected.

DOE/EIS-0161

Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling

Volume I

United States Department of Energy
Office of Reconfiguration

October 1995

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
October 1995

Changes to the Draft PEIS that are less than a paragraph, are shown in double under 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 Rec

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

Stephen M. Sohinki, Director
Office of Reconfiguration
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585
Attention: TSR PEIS
Telephone: (202) 586-0838

For general information on the DOE National Environmental Policy Act process, write

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
Telephone: (202) 586-4600 or leave a message at (800) 472-2756

ABSTRACT: Tritium, a radioactive gas used in all of the Nation's nuclear weapons, h replaced periodically in order for the weapon to operate as designed. Currently, th required amounts of tritium within the Nuclear Weapons Complex.

The PEIS for Tritium Supply and Recycling evaluates the alternatives for the siting tritium supply and recycling facilities at each of five candidate sites: the Idaho Nevada Test Site, the Oak Ridge Reservation, the Pantex Plant, and the Savannah Riv tritium supply and recycling facilities consist of four different tritium supply te Modular High Temperature Gas-Cooled Reactor, Advanced Light Water Reactor, and Acce Tritium. The PEIS also evaluates the impacts of the DOE purchase of an existing ope commercial light water reactor or the DOE purchase of irradiation services contract reactors. Additionally, the PEIS includes an analysis of multipurpose reactors that plutonium, and produce electricity.

Evaluation of impacts on land resources, site infrastructure, air quality and acous

soils, biotic resources, cultural and paleontological resources, socioeconomics, ra impacts during normal operation and accidents to workers and the public, waste mana are included in the assessment.

PUBLIC COMMENTS: In preparing the Final PEIS, DOE considered comments received by m hearings, transcribed from messages recorded by telephone, and those transmitted vi interactive public hearings were held in April 1995 at the following locations wher identified during discussions were summarized by notetakers: Washington, DC; Las Ve Tennessee; Pocatello, Idaho; North Augusta, South Carolina; and Amarillo, Texas.

List of Figures

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ACRONYMS, ABBREVIATIONS, AND CONVERSION CHARTS

Acronyms, Abbreviations, and Conversion Charts

Acronyms and Abbreviations

APT	Accelerator Production of Tritium
ALWR	Advanced Light Water Reactor
AQCR	Air Quality Control Region
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
D&D	decontamination and decommissioning
DOD	Department of Defense
DOE	Department of Enegy
DOI	Department of the Interior
DOT	Department of Transportation
DP	DOE Office of the Assistant Secretary for Defense Programs
EA	environmental assessment
EIS	environmental impact statement

EM	DOE Office of the Assistant Secretary for Environmental Management
EPA	Environmental Protection Agency
ES&H	environment, safety and health
HAP	hazardous air pollutants
HE	high explosive(s)
HEPA	high efficiency particulate air
HEU	highly enriched uranium
HI	Hazard Index
HLW	high-level waste
HQ	Hazard Quotient
HWR	Heavy Water Reactor
INEL	Idaho National Engineering Laboratory
IP	implementation plan
Leq	equivalent sound level
LLW	low-level waste
MHTGR	Modular High Temperature Gas-Cooled Reactor
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PEIS	programmatic environmental impact statement
PM10	particulate matter of aerodynarnic diameter less than 10 micrometers
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROI	region-of-influence
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SRS	Savannah River Site
START	Strategic Arms Reduction Treaty
TOC	total organic compounds
TRU	transuranic
TSCA	Toxic Substances Control Act
TSP	total suspended particulates
TSS	tritium supply site
USFWS	U.S. Fish and wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compounds
VRM	Visual Resource Management
WIPP	Waste Isolation Pilot Plant

Chemicals and Units of Measure

BGY	billion gallons per year
Btu	British thermal units
Ci	curie
CCl4	carbon tetrachloride
CO	carbon monoxide
CFC	chiorofluorocarbons
dB	decibel

dBA	decibel A-weighted
DCE	1, 2-dichlororethylene
F	Fahrenheit
ft^2	square feet
ft^3	cubic feet
ft^3/s	cubic feet per second
g	gram
gal	gallon
GPD	gallons per day
gpm	gallons per minute
GPY	gallons per year
HCFC-22	chlorodifluoromethane
HMX	cyclotetramethylenetetranitramine or 1, 3, 5, 7-tetranitro-l, 3,5, 7-tetr
hr	hour
kg	kilogram
kV	kilovolt
kVA	kilovolt-ampere
kW	kilowatt
kWh	kilowatt hour
lb	pound
lb/hr	pounds per hour
lb/yr	pounds per year
Li	lithium
mCi	millicurie (one-thousandth of a curie)
mCi/nil	millicurie per milliliter
mg	milligram (one-thousandth of a gram)
mg/l	milligram per liter
MGD	million gallons per day
MGY	million gallons per year
mrem	millirem (one-thousandth of a rem)
MVA	megavolt-ampere
MW	megawatt
Mwe	megawatt electric
Mwh	megawatt hour
MWt	megawatt thermal
nCi	nanocurie (one-billionth of a curie)
nCi/g	nanocuries per gram
NO2	nitrogen dioxide
NOx	nitrogen oxides
O3	ozone
Pb	lead
PCB	polychlorinated biphenyl
pCi	picocurie (one-trillionth of a curie)
pCi/l	picocuries per liter
PETN	pentaeryritoltetramtrate
ppb	parts per billion
ppm	parts per million
Pu	plutonium
RDX	cyclotrimethylenetrinitrainine
rem	roentgen equivalent man
SO2	sulfur dioxide
TATB	triaminotrinitrobenzene
TCA	1,1, 1-trichloroethane
TCE	trichloroethylene
TNT	trinitrotoluene
U	uranium
yd^3	cubic yards
uCi	microcurie (one-millionth of a curie)
uCi/g	microcuries per gram
ug	microgram (one-millionth of a gram)
ug/kg	micrograms per kilogram
ug/l	micrograms per liter
ug/m3	micrograms per cubic meter
um	micron or micrometer (one-millionth of a meter)

Metric Conversion Chart

To Convert Into Metric			To Convert Out of Metric		
If you Know	Multiply By	To Get	If you Know	Multiply By	To Ge
Length					
inches	2.54	centimeters	centimeters	0.3937	inch
feet	30.48	centimeters	centimeters	0.0328	fe
feet	0.3048	meters	meters	3.281	fe
yards	0.9144	meters	meters	1.0936	yar
miles	1.60934	kilometers	kilometers	0.6214	mil
Area					
Sq. inches	6.4516	sq. centimeters	Sq. centimeters	0.155	Sq. inch
Sq. feet	0.092903	Sq. meters	Sq. meters	10.7639	Sq. fe
Sq. yards	0.8361	Sq. meters	Sq. meters	1.196	Sq. yar
acres	0.40469	hectares	hectares	2.471	acr
Sq. miles	2.58999	Sq. kilometers	Sq. kilometers	0.3861	Sq. mil
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounc
gallons	3.7854	liters	liters	0.26417	gallo
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic fe
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yar
Weight					
ounces	28.3495	grams	grams	0.03527	ounc
pounds	0.4536	kilograms	kilograms	2.2046	poun
short tons	0.90718	metric tons	metric tons	1.1023	short to
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahren

Metric Prefixes

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000=10^18
peta-	P	1 000 000 000 000 000=10^15
tera-	T	1 000 000 000 000=10^12
giga-	G	1 000 000 000=10^9
mega-	M	1 000 000=10^6
kilo-	k	1 000=10^3
hecto-	h	100=i0^2
deka	da	10=10^1
deci-	d	0.1=10^-1
centi-	c	0.01=10^-2
milli-	m	0.001=10^-3
micro-	u	0.000 001=10^-6
nano-	n	0.000 000 001=10^-9
pico-	p	0.000 000 000 001=10^-12
femto-	f	0.000 000 000 000 001=10^-15
atto-	a	0.000 000 000 000 000 001=10^-18

SUMMARY

INTRODUCTION

In January 1991, the Secretary of Energy announced that the Department of Energy (D Office of the Assistant Secretary for Defense Programs (DP) would prepare a program environmental impact statement (PEIS) examining alternatives for the reconfiguratio the Nation's Nuclear Weapons Complex (Complex). The framework for the Reconfigurati was described in the January 1991 Nuclear Weapons Complex Reconfiguration Study, a detailed examination of alternatives for the future Complex. Because of the signifi changes in the world since January 1991, especially with regard to projected future requirements for the United States nuclear weapons stockpile, the framework describ the Nuclear Weapons Reconfiguration Study does not exist today. Therefore, the Depa has separated the Reconfiguration PEIS into two PEISs: a Tritium Supply and Recycli PEIS; and a Stockpile Stewardship and Management PEIS. The Tritium Supply and Recyc Proposal is analyzed in this PEIS. The Stockpile Stewardship and Management Proposa 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 fissile materials, primarily highly enriched uranium and plutonium. In early 1994 t Secretary established a Departmentwide program for developing recommendations and f directing implementation of decisions concerning disposition of excess nuclear mate This program was recognized in the FY 1995. Defense Authorization Bill which direct 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 closely related (connected) to disposition, the long-term storage analysis that had part of the Reconfiguration PEIS was moved into the program for Long-Term Storage a Disposition of Weapons-Usable Fissile Materials. As a result of this, a third PEIS, Storage and Disposition of Weapons-Usable Fissile Materials PEIS, is being prepared analyze alternatives for the long-term storage of all weapons-usable fissile materi primarily highly enriched uranium and plutonium. That PEIS will also address the disposition of plutonium declared surplus to national defense needs by the Presiden EIS for the disposition of surplus highly enriched uranium is also being prepared.

Tritium Supply and Recycling Proposal

The DOE proposes to provide tritium supply and recycling facilities for the Complex Complex is a set of interrelated facilities supporting the research, development, d manufacture, testing, and maintenance of the Nation's nuclear weapons and the subse dismantlement of retired weapons. The Complex consisted of 11 sites located in ten (figure S-1). Hanford and Idaho National Engineering Laboratory (INEL) are currentl part of the Complex. Defense missions have been terminated at the Rocky Flats Plant Plant, and the Pinellas Plant. Tritium supply deals with the production of new trit either a reactor or an accelerator by irradiating target materials with neutrons an subsequent extraction of the tritium in pure form for its use in nuclear weapons. T recycling consists of recovering residual tritium from weapons components, purifyin and refilling weapons components with both recovered and new tritium when it become available.

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.

Figure (Page S-2)
Figure S-1.-Current and Former Nuclear Weapons Complex Sites.

There is now no capability to produce the required amounts of tritium within the Co Tritium, with a half-life of 12.3 years, is necessary for all weapons that remain i stockpile. Thus, tritium must be replaced periodically as long as the Nation relies nuclear deterrent. Current projections require that a new source of tritium be avai by 2009 and new tritium be available for stockpile use by 2011. This Tritium Supply 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 use of an existing commercial light reactor that would be used for irradiation services or purchased and converted for production is also included as an alternative for long-term tritium supply.

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

This PEIS also addresses the environmental impacts of an Advanced Light Water React (ALWR) or modular gas-cooled reactor used as a multipurpose reactor. A commercial r could also be used as a multipurpose reactor. Throughout the PEIS, reference to and discussion of impacts for the multipurpose ALWR are also applicable to a multipurpo commercial reactor. A multipurpose ("triple play") reactor is defined as one capabl producing tritium, "burning" plutonium, and generating revenues through the sale of electric power. 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 similar to that from the t 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 A multipurpose reactor, and would be the major contributor to potential environmental impacts greater than that for uranium-fueled tritium production ALWR. For a modular gas-cooled multipurpose reactor, twice as many reactor modules would be needed both meet tritium requirements and to burn plutonium. A plutonium Pit Disassembly/Conver Facility would also 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 triti requirement (i.e., a specific quantity of tritium, the exact amount of which is classified). Understanding the concept of the baseline tritium requirement is cruci understanding the alternatives and the analysis in the PEIS. The baseline tritium requirement is the amount necessary to support the 1994 Nuclear Weapons Stockpile P which is approved by the President as discussed in section 1.1. In this PEIS, the b tritium requirement is approximately 3/8ths the tritium requirement that was analyz the New Production Reactor Draft EIS published in April 1991. This is the tritium requirement "baseline" which the tritium supply technologies must support, and agai 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; (2) a surge tritium requirement to replace any tritium which might be used in the e

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 Pla reconstitute the entire reserve in a 5-year period. The steady-state component acco for approximately 50 percent of the baseline tritium requirement, while the surge a for the remaining 50 percent. Tritium supply technologies being evaluated must be a support the steady-state tritium requirement (a specific quantity of tritium every and make up for any lost tritiumreserves.

Under No Action, DOE would not establish a new tritium supply capability. The curre inventory of tritium would decay and DOE would not meet stockpile requirements of t This alternative would be contrary to DOE's mission as specified by the Atomic Ener of 1954, as amended. Alternatives for new tritium supply and recycling facilities consist of four different tritium supply technologies and five locations as shown i figure S-2.

Figure (Page S-4)
Figure S-2.-Tritium Supply and Recycling Alternatives.

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

Whether to build new tritium supply and new or upgraded tritium recycling facilitie

Where to locate new tritium supply and recycling facilities; and

Which technologies to employ for tritium supply.

Time Frame of Proposed Action:

1999 to 2009-Construction.

2010-Initial Operation.

2010 to 2050-Full Operation.

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

Following publication of the ROD, DOE will develop a schedule as part of the plan t implement the ROD decision. The schedule will be subject to change and include reassessments required by congressional authorizations and appropriations. Because many uncertainties associated with this proposal, assumptions were made regarding t periods used in the PEIS analyses. For example, the PEIS assumes an environmental b period for construction between 1999 and 2009, and an operational period beginning 2010 and extending for 40 years. Project-level NEPA documents will identify in deta specific construction and operational periods for each project implemented.

AGENCY PERFERRED ALTERNATIVE

The Council on Environmental Quality (CEQ) Regulations require an agency to identif preferred alternative(s) in the Final Environmental Impact Statement (40 CFR 1502.1 The preferred alternative is the alternative which the agency believes would fulfil statutory mission, giving consideration to environmental, economic, technical, and factors. Consequently, to identify a preferred alternative, the Department has deve information on potential environmental impacts, costs, technical risks, and schedul

risks for the alternatives under consideration.

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

Based upon the analysis presented in the documents identified above, the Department 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) pu an existing commercial light water reactor or irradiation services with an option t purchase the reactor for conversion to a defense facility; (2) design, build, and t critical components of an accelerator system for tritium production. Within a three period, the Department would select one of the alternatives to serve as the primary of tritium. The other alternative, if feasible, would be developed as a back-up tritiumsource.

Savannah River Site has been designated as the preferred site for an accelerator, s one be built. The preferred alternative for tritium recycling and extraction activi to remain at the Savannah River Site with appropriate consolidation and upgrading o 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 rei this principle in his July 3, 1993, radio address to the Nation. Tritium was used i design process to enhance the yield of nuclear weapons and allows for the productio smaller or more powerful warheads to satisfy the needs of modern delivery systems. result, the United States strategic nuclear systems are based on designs that use t and, consequently, require a reliable tritium supply source. Tritium has a relative short radioactive half-life of 12.3 years. Because of this relatively rapid radioac decay, tritium must be replenished periodically in nuclear weapons to ensure that t will function as designed. Over the past 40 years, DOE has built and operated 14 re to produce nuclear materials for weapons purposes, including tritium. Today, none o reactors are operational, and no tritium has been produced since 1988.

Pursuant to the Atomic Energy Act of 1954, as amended, DOE is responsible for devel and maintaining the capability to produce tritium and other nuclear materials, whic 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 Nuclear Weapon Stockpile Plan (section 1.4.1).

The Nuclear Weapons Stockpile Plan is normally forwarded annually from the Secretar the Department of Defense (DOD) and DOE via the National Security Council to the Pr for approval. The Nuclear Weapons Stockpile Plan reflects the size and composition stockpile needed to defend the United States and provides an assessment of the DOE' ability to support the proposed stockpile. Many factors are considered in the devel of the Nuclear Weapons Stockpile Plan, including the status of the currently approv stockpile, arms control negotiations and treaties, Congressional constraints, and t status of the nuclear material production and fabrication facilities. Revisions of Nuclear Weapons Stockpile Plan could be issued when any of the factors indicate the 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 this PEIS is based on the requirements of the 1994 Nuclear Weapons Stockpile Plan w based on START II stockpile levels (approximately 3,500 accountable weapons). The 1 Nuclear Weapons Stockpile Plan represents the latest official guidance for tritium requirements. A Nuclear Weapons Stockpile Plan for 1995 has not yet been issued. Ap 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 ne nuclear weapons production in the foreseeable future, an assured long-term tritium and recycling capability will be required. Presently, no source of new tritium is a able. The effectiveness of the United States nuclear deterrent capability depends n on the Nation's current stockpile of nuclear weapons or those it can produce, but a its ability to reliably and safely provide the tritium needed to support these weap

Until a new tritium supply source is operational, DOE will continue to support trit requirements by recycling tritium from weapons retired from the Nation's nuclear we stockpile. However, because tritium decays relatively quickly, recycling can only m tritium demands for a limited time. Current projections, derived from classified pr tions of future stockpile scenarios, indicate that recycled tritium will adequately support the Nation's nuclear weapons stockpile until approximately 2011. After that 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 stockp The strategic reserve of tritium contains a quantity of tritium maintained for emer and contingencies. In such a scenario, once the strategic tritium reserve was deple the nuclear deterrent capability would degrade because the weapons in the stockpile not be capable of functioning as designed. Eventually, the nuclear deterrent would lost. The proposed tritium supply and recycling facilities would provide the capabi produce tritium safely and reliably in order to meet the Nation's defense requireme well into the 21stcentury while also complying with environment, safety, and health standards.

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.

DOE has analyzed the activities that must take place in order to bring a new tritiu supply source into operation. The analysis indicates that it could take approximate years to research, develop, design, construct, and test a new tritium supply source new tritium production can begin. Thus, in order to have reasonable confidence that Nation will be able to maintain an effective nuclear deterrent, prudent management dictates that DOE proceed with the proposed action now.

Changes from the Draft Programmatic Environmental Impact Statement

The 60-day public comment period for the Draft PEIS began on March 17, 1995, and en May 15, 1995. However, comments were accepted as late as June 23, 1995. During the period, public hearings were held in Las Vegas, NV; Washington, DC; Pocatello, ID; Ridge, TN; North Augusta, SC; and Amarillo,TX. Two hearings were held at each locat addition, the public was encouraged to provide comments via mail, fax, electronic b board (Internet), and telephone (toll-free 800-number).

During public review of the Draft PEIS a majority of the comments regarded concerns alternatives and/or candidate sites were not given the correct amount of considerat factors including cost and technical feasibility. Although these concerns made up t majority of the comments, many others involved the resources analyzed, NEPA and reg tory issues, and DOE and Federal policies as they related to the PEIS. The major is identified by commentors included the following:

The electrical requirements of the various alternatives, particularly the APT, and potential for the ALWR and MHTGR 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 cooling;

The socioeconomic impacts, both positive and negative, of locating or failing to lo

facility at one of the candidate sites;

The generation, storage, and disposal of radioactive and hazardous wastes (includin 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 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 environment 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 No the Federal Register (60 FR 44327) to include the purchase of irradiation services commercial reactor as a reasonable alternative. The Draft PEIS considered this an unreasonable alternative because of the long-standing policy of the United States t civilian nuclear facilities should not be utilized for military purpose and nonproliferation concerns. Nonetheless, the Draft PEIS included an evaluation of th environmental impacts of irradiation services using an existing commercial reactor make tritium. Because of public comments on the Notice, public review of the Draft and further consideration of nonproliferation issues, purchase of irradiation servi evaluated in the PEIS as a reasonable alternative. During the extended comment peri there were two major issues of concern raised:

License and regulatory implications; and

Non-proliferation concerns.

Revisions in the Final PEIS include additional discussion and analysis in the follo areas: severe accidents and design-basis accidents for all tritium supply technolog site-specific environmental impacts of a dedicated power plant for the Accelerator Production of Tritium (APT); revisions to water resources sections; site-specific a of the multipurpose reactor that could produce tritium, burn plutonium as fuel, and produce electricity; and the commercial reactor alternative, specifically the purch 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 was reevaluated as a result of public com questioning the apparent severity and frequency of the accident consequences shown the Draft PEIS. Additional analyses were performed to accurately estimate the impac a more reasonable design-basis accident and these results have been included in the PEIS.

The analyses of impacts of severe reactor accidents was also revised. The Draft PEI presented the impacts of a single severe accident for each of the reactor technolog Since accident consequences vary greatly depending on the selected accident frequen value, a spectrum of severe accidents with a range of frequencies was used to perfo more representative analysis for each technology. The new analyses reflect the prob effects of a set of accidents for each reactor rather than the single accident scen

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 more severe initiating event, a lower frequency, and a higher consequence than the analysis presented in the Draft PEIS.

Additionally, the Final PEIS has been modified to include a qualitative discussion 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 impa noninvolved workers (workers collocated at the site independent of the proposed act For involved workers, impacts were addressed qualitatively, explaining the signific risk for exposure and fatality and that mitigative features would be provided in th 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 t 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 nonin worker.

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

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

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

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

Analysis and a discussion of potential impacts have been expanded and included in t PEIS on the alternative of DOE purchasing an existing operating commercial reactor an incomplete reactor and converting it to production of tritium for defense purpos 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 produ of tritium using DOE targets.

Alternatives

The alternatives considered for tritium supply and recycling consist of four differ supply technologies and five locations (figure S-2). The four technologies to provi new supply of tritium are: Heavy Water Reactor (HWR), Modular High Temperature Gas-Reactor (MHTGR), Advanced Light Water Reactor (ALWR), and Accelerator Production of Tritium (APT). The five candidate sites evaluated for such a facility are INEL, Nev Test Site (NTS), Oak Ridge Reservation (ORR), Pantex Plant, and Savannah River Site

No Action

To satisfy NEPA requirements, No Action is presented for comparison with the action alternatives. Under No Action, DOE would not establish a new tritium supply capabil the current inventory of tritium would decay, and DOE would not meet stockpile requirements. The current DOE missions at each candidate site are assumed to contin under No Action.

Tritium Supply and Recycling

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

Technologies

Heavy Water Reactor. The HWR would be a low pressure, low temperature reactor whose purpose would be to produce tritium. The HWR would use heavy water as the reactor c and moderator. Because of the low temperature of the exit coolant, a power conversi system designed to produce electrical power as an option would not be feasible. The conceptual design of the HWR complex includes a fuel and target fabrication facilit tritium target processing facility, an interim spent fuel storage building, a gener services building, and a security infrastructure. The HWR complex would cover approximately 260 acres. Construction of the HWR would take somewhat less than 8 ye require approximately 2,320workers during the peak construction period. Operation o 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. Three reactors would be required to produce the goal quantities of tritium. The MHTGR wou helium gas as a core coolant and graphite as a moderator. Because of the high tempe of the exit coolant, a power conversion facility designed to produce electricity is integral part of the design and is included in the analysis. The design of the MHTG complex, in addition to three reactors, would include a fuel and target fabrication facility, a tritium target processing facility, helium storage buildings, waste tre facilities, spent fuel storage facility, a general services building, a security infrastructure, and a power conversion facility consisting of three turbine-generat associated electrical control equipment. The MHTGR complex would cover approximatel 360acres. Construction of the MHTGR would take about 9 years and require approximat 2,210workers during the peak construction period. Operation of the MHTGR would requ approximately 910 workers.

A modular gas-cooled reactor like the MGTGR 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 version Facility would be needed. Additionally, because tritium production decrease significantly in a plutonium-fueled gas-cooled reactor, twice as many reactor modul would be necessary in order to produce the steady-state tritium requirements. This doubling of reactor modules would be the major contributor to potential environment impacts for this scenario. The PEIS contains an assessment of these potential environmental impacts.

Range of Selected Construction
Requirements for Tritium Supply
Technologies:

Electrical Energy Demand:

40,000 to 120,000 MWh

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 a 5 to 9 year period)

Steel Consumption:
45,000 to 68,000 tons

Advanced Light Water Reactor. The ALWR would be a high temperature, high pressure r whose primary purpose would be to produce tritium. There are two options for the AL technology: a Large ALWR (1,300MWe) and a Small ALWR (600MWe). The large and small include four candidates: a large or small pressurized water reactor or a large or s boiling water reactor. All ALWR options would use light (regular) water as the reac coolant and moderator. Like the MHTGR, a power conversion facility is an integral p the design for the ALWR because of the high temperature of the exit coolant. The de the ALWR complex would include an interim spent fuel storage building, a waste trea facility, a tritium target processing facility, warehouses, a power conversion faci and security infrastructure. Unlike the other technologies, the ALWR would not have fabrication facility since fuel rods would be obtained from offsite sources. The AL complex would cover approximately 350 acres. Construction of the ALWR would take ab years and require approximately 3,500workers for the Large ALWR and 2,200workers fo Small ALWR during the peak construction period. Operation of the Large ALWR would r approximately 830 workers and the Small ALWR would require approximately 500workers

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 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 plutoni Disassembly/Conversion/Mixed-Oxide Fuel Fabrication Facility would be needed to pro the mixed-oxide fuel rods for the ALWR, and would be the major contributor to poten environmental impacts for this scenario. This PEIS contains an assessment of these potential environmental impacts.

Accelerator Production of Tritium. The APT would be a linear accelerator whose purp would be to produce tritium. The APT accelerates a proton beam in a long tunnel tow of two target/blanket assemblies located in separate target stations. There are two target/blanket concepts being considered in the conceptual design of the APT: the spallation-induced lithium conversion target and the helium-3 target. The accelerat 3,940 feet in length, would be housed in a concrete tunnel buried 40 to 50feet underground. The APT facility would require a peak electrical load of approximately MWe to produce the 3/8 goal tritium quantity, and 355 MWe to produce the steady-sta tritium requirement. The conceptual design of the APT complex would include: a targ building that would house the target chambers located in a subterranean structure a same level as the accelerator; a tritium processing facility to extract tritium fro targets; a klystron remanufacturing and maintenance facility; waste treatment build treat all generated wastes; security infrastructures and various administration, operation, and maintenance facilities. The APT complex would cover approximately 17 acres. Construction of the APT would take about 5 years and require approximately 2 workers during the peak construction period. Operation of the APT would require approximately 624 workers. A phased construction approach to the APT is also an opt

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

Commercial pressurized water reactors are high-temperature, high-pressure reactors

use ordinary light water as the coolant and moderator and are capable of generating amounts of electricity through a steam turbine generator. The range of electrical production for these plants is approximately 390 million to 6,900 million kWh per y using an assumed annual capacity factor of 62percent. A typical commercial light wa reactor facility includes the reactor building, spent fuel storage facilities, cool 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 ranges from a low of 84 to a hi 30,000.

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

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 rea were purchased, these facilities could potentially be constructed along with the fi construction of thereactor.

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

SITES

Commercial Light Water Reactor. The commercial light water reactor alternative does include a specific site for analysis in the PEIS. Therefore, any one of the existin operating commercial nuclear reactors or partially completed reactors is a potentia candidate site for the tritium supply mission. Currently, 109 commercial nuclear po plants are located at 71 sites in 32 of the contiguous states. Of these, 53 sites a located east of the Mississippi River. No commercial nuclear power plants are locat Alaska or Hawaii. Approximately one-half of these 71 sites contain two or three nuc 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 o sites have 50-mile population densities of less than 200 persons per square mile an 80 percent have 50-mile densities of less than 500 persons per square mile.

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

Idaho National Engineering Laboratory. INEL was established in 1949 and currently o approximately 570,000 acres near Idaho Falls, ID. INEL performs research and develo activities on reactor performance; conducts materials testing and environmental mon activities; performs research and development activities for the processing of wast conducts breeder reactor research; and is a naval reactor training site. There are currently no defense program missions at INEL.

Nevada Test Site. NTS was established in 1950 and currently occupies approximately

acres located 65 miles northwest of Las Vegas, NV. The site has conducted undergrou testing of nuclear weapons and evaluations of the effects of nuclear weapons on mil communications systems, electronics, satellites, sensors, and other materials. In October 1992, underground nuclear testing was halted, yet the site maintains the capability and infrastructure necessary to resume testing if authorized by the President. There are currently two defense program missions at NTS: maintain underg nuclear testing program capabilities and maintain nuclear emergency search team pro capabilities.

Range of Selected Operation Requirements
for Tritium Supply Technologies:

Electrical Energy Demand:
260,000 to 3,740,000MWh 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 80yd3 per year

Oak Ridge Reservation. ORR was established in 1942 as part of the World War II Manh Project and is located on approximately 35,000 acres within the city boundaries of Ridge, TN. It includes three major facilities: Oak Ridge National Laboratory; Y-12 (Y-12); and the K-25 Site (the former Oak Ridge Gaseous Diffusion Plant). Y-12 is t primary location of defense program missions. The Y-12 assignment includes the dism of nuclear weapons components returned from the Nation's arsenal, maintaining nucle production capability and stockpile support, storing special nuclear materials, and providing special manufacturing support to DOE programs. In addition to the four de program missions identified above, ORR also has the mission to fabricate uranium an lithium components and parts for nuclear weapons.

Pantex Plant. Pantex was established in 1951 and currently occupies approximately 1 acres near Amarillo, TX. The current defense program missions at Pantex are to asse and disassemble nuclear weapons; perform weapons repair, modification, and disposal conduct stockpile evaluation and testing; and provide interim storage for plutonium Pantex is the only DOE facility that can execute the final assembly of a nuclear we for the Department of Defense (DOD) stockpile.

Savannah River Site. SRS was established in 1950 as a nuclear materials production and occupies approximately 198,000 acres south of Aiken, SC. The major nuclear faci at SRS have included fuel and target fabrication facilities; nuclear material produ reactors; chemical separation plants used for recovery of plutonium and uranium iso a uranium fuel processing area; and the Savannah River Technology Center that provi process support. The current defense program mission at SRS is to process tritium a conduct tritium recycling and reservoir filling in support of stockpile requirement also has the mission to process backlog targets and spent nuclear fuel.

Alternatives Considered But Eliminated From Detailed Study

By law, DOE is required to support the Nuclear Weapons Stockpile Plan. In order to this, DOE must maintain a nuclear weapons production, maintenance, and surveillance capacity consistent with the President's Stockpile Plan. For the proposed action, t

following alternatives were considered but eliminated from detailed study for the reasons stated below.

Purchase Tritium From Foreign Sources. DOE has considered the purchase of tritium f other sources, including foreign nations. Conceptually, the purchase of tritium fro foreign governments could provide a fraction of the tritium requirement. However, w there is no national policy against purchase of defense materials from foreign sour DOE has determined that the uncertainties associated with obtaining tritium from fo 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 endu stockpile were designed and built in an era when the tritium supply was assured, wh underground nuclear testing was being conducted, and when military needs required t warheads be optimized in terms of weight and volume. Replacing these warheads with ones that would use little or no tritium for the sole reason of reducing overall tr demand would be infeasible and unreasonable. Without underground nuclear testing to verify their safety and reliability, new warhead designs cannot deviate very far fr current designs which require the use of tritium. Even with underground testing to facilitate new designs and a fully operational production complex, it would still t many years to build enough warheads to replace the enduring stockpile. Therefore, replacing the enduring stockpile of warheads with new designs would most likely tak longer and could cost more than constructing and operating a new tritium supply fac Because neither the President nor the Congress has approved that the government emb a costly and expansive design, testing, and construction program solely to eliminat tritium requirements, weapons redesign to use less or no tritium is not a reasonabl short or long-term alternative.

Use of Existing Department of Energy Reactors or Accelerators. DOE (and its predece agencies) has designed, constructed, and operated many nuclear reactors over the pa years. The majority of these reactors were designed to assist in the develment of nuclear research and safety standards development. DOE has also constructed nuclear reactors to produce the materials required to support the production and maintenanc nuclear weapons and has constructed nuclear reactors in support of the Naval Propul Program.

Among the first experimental reactors were the water boiler at Los Alamos National Laboratory and CP-3 at Argonne National Laboratory-West, which were completed in 19 Since then, numerous experimental and research reactors were constructed for a vari of purposes, including material tests, new reactor concepts, and safety experiments four DOE research reactors are currently operational: the High Flux Isotope Reactor Ridge Reservation (ORR); the High Flux Beam Reactor at Brookhaven National Laborato the Experimental Breeder Reactor-II and the Advanced Test Reactor at the Idaho Nati Engineering Laboratory (INEL). In addition, there are some low power/critical facil supporting medical research (at Brookhaven) and supporting reactor core configurati research (at Argonne National Laboratory-West at INEL). None of these facilities is 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 co structed in the early 1960s, rendering their design life reliability unsuitable for time frame required for a new, assured, long-term tritium supply facility.

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

DOE also constructed and operated more than a dozen nuclear reactors for production 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 operatio Of those reactors specifically designed to produce nuclear materials for the nuclea weapons program, the K-Reactor at SRS is the only remaining reactor which could be of returning to operation. It is presently in a "cold stand-by state" and has not b operated since 1988. The reactor was shut down for major environmental, safety, and upgrades, to comply with today's stringent standards. DOE discontinued the K-Reacto Restart Program when the reduced need for tritium to support a smaller stockpile de the need for tritium. In this context, reliance upon the ability to upgrade and ope well into the middle of the next century a first generation reactor designed in the 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 currently operates six national facilities. Of the existing research accelerators, 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 pow accelerator beams in the 800 kilowatt (kW) range. A production accelerator facility utilizing continuous wave operation, would be required to deliver a high power prot beam of 100 megawatt (MW) for tritium production. None of the existing research accelerators could be reasonably upgraded to meet the long-term, assured tritium requirements.

Alternative Sites. Section 3.3.1 describes the process that was carried out to iden the range of reasonable site alternatives for the tritium supply and recycling faci that are considered in this PEIS. The process of determining these reasonable triti supply alternative sites has been evolutionary, starting with the engineering studi criteria developed by the New Production Reactor program, then utilizing additional criteria and considerations from the Reconfiguration Program, information related t changing missions at DOE sites, and input from public scoping.

During the preparation of this 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 acce expertise, would be a reasonable site for a tritium producing accelerator.

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

It may be possible that an APT could use nonevaporative cooling towers which would reduce the water requirements. However, there is sufficient technical uncertainty regarding the feasibility and practicality of using nonevaporative cooling towers f continuous wave APT to render this option unacceptable as a source for the Nation's supply of tritium. The other five sites being analyzed in this PEIS could reasonabl support the water requirements of the APT using evaporative cooling towers and, thu would not incur the technical uncertainty and risk of Los Alamos National Laborator Thus, DOE has concluded that Los Alamos National Laboratory is not a reasonable sit an accelerator to produce tritium (LADOE1994a:1).

REDUCED TRITIUM REQUIREMENTS

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

Environmental impacts

In accordance with CEQ regulations, the environmental consequences discussions prov the analytical detail for comparisons of environmental impacts associated with the various tritium supply technologies and recycling facilities. Discussions are provi for each DOE site and each environmental resource and relevant issues that could be affected.

For comparison purposes, environmental concentrations of emissions and other potent environmental effects are presented with appropriate regulatory standards or guidel However, the compliance with regulatory standards is not necessarily an indication the significance or severity of the environmental impact for NEPA purposes.

The purpose of the analysis of environmental consequences is to identify the potent for environmental impacts. The environmental assessment methods used and the factor considered in assessing environmental impacts are discussed in section 4.1, environ mental resource methodologies, and in the appropriate appendixes. The potential for impacts to a given resource or relevant issue is described in the introduction to e section within the site discussions (sections 4.2 through 4.10). A brief narrative summary of the impacts by site and resource or relevant issues follows.

For the resource or issue area, the summary presents the range of impacts (high and and associated technology collocated with tritium recycling. For a more detailed su comparison of impacts for the tritium supply and recycling alternatives, the reader referred to section 3.6 and appendix I.

Idaho National Engineering Laboratory

Land Resources. Construction and operation of a tritium supply would disturb betwee 173acres(APT) and 360acres(MHTGR). Collocation of tritium recycling would require a additional 202acres during construction and 196 acres during operation. Siting any tritium supply technologies alone or collocated with recycling at INEL would be consistent with site development plans. No visual impacts are expected.

Site Infrastructure. New site infrastructure (e.g., roads and transmission lines) w required to support all technologies. The power requirements would exceed the curre electrical requirements of 93 MWe by 11 MWe (MHTGR) to 515 MWe(APT).

Air Quality and Acoustics. Construction activities would result in exceedance of 24 PM10 and state TSP standards. Air pollutant concentrations would increase during op but would be within standards. An increase in onsite noise would result from constr and operation of a tritium supply. Offsite noise impacts would be negligible.

Water Resources. Surface waters would not be affected by construction or operation. Groundwater use would range from 10MGY(APT) to 35 MGY (Large ALWR) during construct Operation water requirements would range from 44MGY(MHTGR) to 1,214 MGY (APT). Tota groundwater use for all the reactor technologies except APT would be less than 1 pe of the INEL groundwater allotment. The APT total groundwater use for operation repr sents approximately 11 percent of the INEL groundwater allotment.

Geology and Soils. Construction and operation would neither affect nor be affected geological conditions. The soil disturbed area would range from 375 (APT) and 562 a (MHTGR). Soil erosion due to wind and stormwater runoff would be minor.

Biotic Resources. During construction and operation, terrestrial resources would be affected by the disturbance of between 375 (APT) and 562acres (MHTGR) of habitat. I from salt drift are possible with the APT. Wetlands and aquatic resources would not affected. No Federal-listed, threatened, or endangered species would be affected, b several Federal candidate or state-listed species may be affected.

Cultural and Paleontological Resources. Some NRHP-eligible prehistoric and historic

resources may occur within the disturbed area. Native American resources may be aff by land disturbance and audio or visual intrusions. The HWR and ALWR would not be expected to affect paleontological resources. However, the MHTGR and APT may affect paleontological resources where excavations could extend down to 50 feet or deeper.

Socioeconomics. Employment in the economic study area would increase by 7,200 (MHTG 10,800persons (either ALWR) during peak construction. Employment during full operat would increase in the economic study area by 4,100 (APT) to 4,900 persons (HWR and Unemployment would decrease from 6.4 percent, the projected baseline, to 4.5 percen all technologies during peak construction and 4.9 (APT) to 4.6 percent (HWR and MHT during full operation. Per capita income would increase by an annual average of approximately 1 percent during peak construction and full operation for every techn except HWR, which would increase by 1 to 2 percent during peak construction and 2 p during full operation.

Population and housing demand within the region of influence would increase by betw 2(APT) and 9percent(ALWR) during construction and approximately 2 percent for all technologies during operation.

For every technology except ALWR, total revenues and expenditures for most region-of-influence (ROI) counties, cities, and school districts would increase by annual average of between 2 and less than 1percent through 2005 and between 1 and 0 percent through 2010. For either ALWR, total revenues and expenditures within the r of influence would increase between 4 and less than 1 percent in the first 3 years construction and decrease 1 to 2 percent annually through 2020. Total revenues and expenditures for all technologies would increase by annual averages of less than 1 percent through 2020.

Traffic conditions on access roads to INEL are expected to degrade due to increased traffic and congestion, particularly on U.S. Route 20/26, the primary access route.

Radiological and Hazardous Chemical Impacts During Normal Operation and Accidents. dose to the maximally exposed member of the public from total site operation for 1 would range from 0.11 (APT with helium-3 target) to 0.36 (ALWR) mrem. The associate of fatal cancer from 40 years of operation would range from 2.3x10-6 to 7.3x10-6,respectively.

The annual 50-mile population dose from total site operation in 2030 would range fr 23(APT with helium-3 target) to 73person-rem (LargeALWR) and could result in 0.45 t fatal cancers over 40years of operation.

The average annual dose to a site worker would range from 31 (MHTGR) to 49 mrem (La ALWR) with the associated risk of fatal cancer from 40 years of operation ranging f 5.0x10-4 to 7.9x10-4, respectively. The annual dose to the total site workforce wou range from 250 (MHTGR) to 392 person-rem (Large ALWR) and could result in 4 to 6.3 cancers over 40 years of operation. All doses to the public and to site workers are regulatory limits.

Any exposures to site workers and the public resulting from emissions of hazardous chemicals are expected to be within regulatory limits and have negligible cancer ri

For low-to-moderate consequence/ high probability accidents, the consequences and r associated with the APT are negligible. For the technology with the most severe consequences, the HWR, the increased likelihood of cancer fatality to a maximally e individual at the site boundary would be 8.1x10-6. Given the accident probability o 1.0x10-3 per year, the cancer risk would be 8.1x10-9 per year. For the population r within 50 miles of the accident (150,000), the associated cancer risk would be 7.4x per year. If this accident occurred, this exposure would result in 0.074 cancer fatalities. The increased likelihood of cancer fatality to a worker located 1,000 m from the release point would be 1.1x10-4. The cancer risk to the worker would be 1. per year.

For high consequence/low probability accidents, the consequences to a maximally exp individual at the site boundary is small for the APT. The technology with the most

severe consequences to the general population is the Small ALWR. For Small ALWR hig consequence/low probability accidents, the increased likelihood of cancer fatality maximally exposed individual at the site boundary would be 2.3x10-3 with an associa cancer risk of 3.6x10-10 per year. For the population residing within 50 miles of t accident (150,000), the associated cancer risk would be 6.4x10-7 per year. If this accident occurred, this exposure would result in 4.1 cancer fatalities. The increas likelihood of cancer fatality to a worker located 1,000 meters from the release poi would be 0.094. The cancer risk to the worker would be 1.5x10-8 per year.

Waste Management. Spent nuclear fuel would be generated by the HWR, MHTGR, and ALWR require a new storage facility. The APT would not generate spent fuel. Liquid LLW w generated by every technology except APT. Existing treatment facility may be adequa all technologies except the Large ALWR. Solid LLW would be generated and require be 3(APT and Small ALWR) and 15 acres per year (HWR) of onsite LLW disposal area. The generation of liquid mixed LLW would be negligible for all technologies. Solid mixe would increase by 3yd3 per year (MHTGR) to 122yd3 per year (HWR). The HWR increase require new or expanded treatment and storage facilities.

Hazardous waste generation would increase by approximately 4yd3 per year (APT) to 1 per year (MHTGR). The use of existing hazardous waste management facilities is feas All technologies would generate liquid sanitary waste and require new treatment facilities. Solid sanitary waste generation would increase by 8,640yd3 per year (AP 15,000yd3 per year (HWR). Existing landfill design life would be reduced or require expansion. Other solid nonhazardous wastes would be recycled.

Intersite Transport. For all technologies, the relative risk associated with transp tritium is 29 percent lower than the existing case (No Action) because the distance travelled is shorter. The potential cancer fatalities per year for transporting tri heavy water is 3.57x10-5 (HWR) and 6.63x10-6 (APT) for both tritium supply alone an supply with recycling. There is no intersite transport of LLW for any technology. T risk of transporting new tritium for supply alone is about 2 percent greater than N Action (due to transporting new tritium to SRS). The annual risk from transporting highly-enriched uranium fuel feed material (HWR and MHTGR alternatives) from ORR to is 5.1x10-4 fatalities.

Nevada Test Site

Land Resources. Construction and operation of a tritium supply would disturb betwee (APT) and 360 acres (MHTGR). Collocation of tritium recycling would require an addi 202acres during construction and 196 acres during operations. Siting any of the tri supply technologies alone or collocated with recycling at NTS would be consistent w site development plans. Some visual impacts are expected.

Site Infrastructure. New site infrastructure (e.g., roads and transmission lines) w required to support all technologies. The power requirements would exceed the curre electrical requirement of 28 MWe by 55 MWe (MHTGR) to 559 MWe(APT).

Air Quality and Acoustics. Construction activities would result in exceedance of 24 PM10 and state TSP standards. Air pollutant concentrations would increase during op but would be within standards. An increase in onsite noise would result from constr and operation of a tritium supply. Offsite noise impacts would be negligible.

Water Resources. Surface waters would not be affected by construction or operation. Groundwater use would range from 10MGY (APT) to 35 MGY (Large ALWR) during construc Operation water requirements would range from 44 MGY (MHTGR) to 1,214 MGY (APT). To site groundwater withdrawals would not exceed the lowest estimated aquifer recharge rate.

Geology and Soils. Construction and operation would neither affect nor be affected geological conditions. The soil disturbed area would range from 375(APT) to 562acres(MHTGR). Soil erosion due to wind and stormwater runoff would be minor.

Biotic Resources. During construction and operation, terrestrial resources would be

affected by the disturbance of between 375(APT) and 562acres (MHTGR)of habitat. Imp from salt drift are possible with the APT. Wetlands and aquatic resources would not affected. One Federal-listed, threatened species, the desert tortoise, may be affec several Federal candidate or state-listed species may also be affected.

Cultural and Paleontological Resources. Some NRHP-eligible prehistoric and historic resources may occur within the disturbed area. Native American resources may be aff by land disturbance and audio or visual intrusions. Paleontological resources may a be affected.

Socioeconomics. Employment in the economic study area would increase by 9,100 (MHTG 13,700persons (either ALWR) during peak construction. Employment during full operat would increase in the economic study area by 4,600 (APT) to 5,500 persons (HWR and Unemployment would decrease from 5 percent, the projected baseline, to between 3.9 during peak construction and to between 4.3 (HWR) and 4.4 percent (APT) during full operation. Per capita income would increase by an annual average of approximately 1 during peak construction and full operation for each technology.

Population and housing demand within the ROI would increase by between 1 percent (H MHTGR, and APT) and 2 percent (ALWR) during construction and by less than 1 percent all technologies during operation.

For each technology, total revenues and expenditures for all region of influence co cities, and school districts would increase by annual averages of between 4 and les 1 percent through 2005, between 1 and 2 percent through 2010, and by less than 1 pe annually through 2020.

Traffic conditions on access roads to NTS are expected to degrade due to increased traffic and congestion, particularly on Mercury Highway, the primary access route.

Radiological and Hazardous Chemical Impacts During Normal Operation and Accidents. dose to the maximally exposed member of the public from total site operation for 1 would range from 0.13 (APT with helium-3 target) to 0.4 (ALWR) mrem. The associated of fatal cancer from 40 years of operation would range from 2.6x10-6 to 8.0x10-6,respectively.

The annual 50-mile population dose from total site operation in 2030 could range fr (APT with helium-3 target) to 0.25(SmallALWR) person-rem and could result in 1.6x10 5.1x10-3 fatal cancers over 40 years of operation.

The average annual dose to a site worker would range from 26 (MHTGR) to 140 (Large mrem with the associated risk of fatal cancer from 40 years of operation ranging fr 4.2x10-4 to 2.3x10- 3, respectively. The annual dose to the total site workforce wo range from 33 (MHTGR) to 180 (Large ALWR) person-rem and could result in 0.53 to 2. cancers over 40 years of operation. All doses to the public and to site workers are regulatory limits.

Any exposures to site workers and the public resulting from emissions of hazardous chemicals are expected to be within regulatory limits and have negligible cancer ri

For low-to-moderate consequence/high probability accidents associated with operatio consequences and risks associated with the APT are negligible. For the technology w most severe consequences, the HWR, the increased likelihood of cancer fatality to a maximally exposed individual at the site boundary would be 4.2x10-6. Given the acci probability of 1.0x10-3 per year, the cancer risk would be 4.2x10-9 per year. For t population residing within 50 miles of the accident (18,000), the associated cancer would be 1.2x10-6 per year. If this accident occurred, this exposure would result i 1.2x10-3 cancer fatalities. The increased likelihood of cancer fatality to a worker located 1,000 meters from the release point would be 2.8x10-5. The cancer risk to t worker would be 2.8x10-8 per year.

For high consequence/low probability accidents associated with operation, the conse to a maximally exposed individual at the site boundary would be small for the APT. technology with the most severe consequences to the general population is the Small

For Small ALWR high consequence/low probability accidents, the increased likelihood cancer fatality to a maximally exposed individual at the site boundary would be 6.3 with an associated cancer risk of 9.8x10-10 per year. For the population residing w 50 miles of the accident (18,000), the associated cancer risk would be 6.1x10-8 per If this accident occurred, this exposure would result in 0.39 cancer fatalities. Th increased likelihood of cancer fatality to a worker located 1,000 meters from the r point would be 0.087. The cancer risk to the worker would be 1.4x10-8 per year.

Waste Management. Spent nuclear fuel would be generated by the HWR, MHTGR, and ALWR require a new storage facility. The APT would not generate spent fuel. Liquid LLW w generated by every technology except APT and would require new or separate treatmen facilities. Solid LLW would be generated and require between 2.5 (APT and Small ALW 13.5 acres per year (HWR) of onsite LLW disposal area. Liquid mixed LLW would be ge by each technology and would require an organic mixed waste treatment capability. S mixed LLW would increase by 3(MHTGR) to 122yd3per year(HWR) and would require an or mixed waste treatment capability.

Hazardous waste generation would increase by 4(APT) to 101yd3peryear(MHTGR). Separa expanded hazardous waste management facilities may be required for all technologies the APT. All technologies would generate liquid sanitary waste and require new or s treatment facilities. Solid sanitary waste generation would increase by 8,640(APT) 15,000yd3 per year (HWR). Existing landfill design life would be reduced or require expansion. Other solid nonhazardous wastes would be recycled.

Intersite Transport. For all technologies, the relative risk associated with transp tritium is 30 percent lower than the existing case (No Action) because the distance travelled is shorter. The potential cancer fatalities per year from transporting tr heavy water is 3.57x10-5 (HWR) and 6.63x10-6 (APT). There is no intersite transport for any technology. The risk of transporting new tritium for supply alone is about percent greater than No Action (due to transporting new tritium to SRS). The annual from transporting highly-enriched uranium fuel feed material (HWR and MHTGR alter-natives) from ORR to NTS is 5.1x10-4 fatalities.

Oak Ridge Reservation

Land Resources. Construction and operation of a tritium supply technology would dis between 173(APT) and 360acres(MHTGR). Collocation of tritium recycling would requir additional 202 acres during construction and 196 acres during operation. Siting any the tritium supply technologies alone or collocated with recycling at ORR would dis some land designated as National Environmental Research Park. Some visual impacts areexpected.

Site Infrastructure. No new site infrastructure (e.g., roads and transmission lines be required to support any technologies. The power requirements would be less than current site electrical requirement of 1,411 MWe by 1,252 MWe (MHTGR) to 738MWe (AP

Air Quality and Acoustics. Construction would result in exceedance of 24-hour PM10 state TSP standards. Air pollutant concentrations would increase during operation b would be within standards. An increase in onsite noise would result from constructi and operation of a tritium supply. Offsite noise impacts would be negligible.

Water Resources. Surface water use would range from 10 (APT) to 35 MGY (Large ALWR) construction. Operation surface water requirements would range from 1,214(APT) to 16,014MGY (Large ALWR). These represent increases of between less than 1 and 2 perc during construction and 66 and 866 percent during operation. Blowdown discharges to surface waters would range from 250(APT) to 6,202MGY(Large ALWR). Groundwater would affected by construction or operation.

Geology and Soils. Construction and operation would neither affect nor be affected geological conditions. The soil disturbed area would range from 375(APT) to 562acres(MHTGR). Soil erosion due to wind and stormwater runoff would be minor.

Biotic Resources. During construction and operation, terrestrial resources would be

affected by the disturbance of between 375(APT) and 562acres(MHTGR) of habitat. Sal from an evaporative cooling system could impact an additional limited acreage for a technologies. Increased stream flow from construction and operational discharges co affect wetland and aquatic plant communities. No Federal-listed, threatened, or endangered species would be affected, but several state-listed species may be affec

Cultural and Paleontological Resources. Some NRHP-eligible prehistoric and historic resources are expected to occur within the disturbed area. Native American resource be affected by land disturbance and audio or visual intrusions. Paleontological resources may be affected, but impacts would benegligible.

Socioeconomics. Employment in the economic study area for collocated tritium supply recycling would increase between 8,000(MHTGR) and 12,000persons(ALWR) during constr Employment during operation would increase in the economic study area between 4,300 and 5,200persons(HWR). Unemployment would decrease from 6.2percent, the projected baseline, to between 4.8(ALWR) and 5.2percent(HWR and MHTGR) during construction an between 5.6 (HWR, MHTGR, and ALWR) and 5.7 percent (APT) during operation. Per capi income would increase by an average of 1 percent for all technologies during constr and operation.

Population and housing demand in the ROI would increase by less than 1 percent duri construction and operation for all technologies.

For each technology, total revenues and expenditures for most ROI counties, cities, school districts would increase by annual averages of approximately 1 percent or le through 2010, and by less than 1percent through 2020.

Traffic conditions on access roads to ORR are expected to degrade due to increased traffic and congestion, particularly on Bear Creek Road, the primary access route.

Radiological and Hazardous Chemical Impacts During Normal Operation and Accidents. dose to the maximally exposed member of the public from total site operation for 1 would range from 4.3(APT with helium-3 target) to 8.8mrem(Large ALWR) for atmospher release and would be 14 mrem for liquid release for all technologies. The associate of fatal cancer from 40 years of operation would be 8.6x10-5, 1.8x10-4, and 2.7x10- (2.8x10-4for ALWRs), respectively.

The annual 50-mile population dose from total site operation in 2030 would range fr 68(APT with helium-3 target) to 90person-rem(Large ALWR) and could result in 1.4 to fatal cancers over 40years of operation.

The average annual dose to a site worker would range from 18 (MHTGR) to 26 mrem (La ALWR) with the associated risk of fatal cancer from 40 years of operation ranging f 2.9x10-4 to 4.2x10-4, respectively. The annual dose to the total site workforce wou range from 350 (MHTGR) to 490 (Large ALWR) person-rem and could result in 5.6 to 7. cancers over 40 years of operation. All doses to the public and to site workers are regulatory limits.

Any exposures to site workers and the public resulting from emissions of hazardous chemicals are expected to be within regulatory limits and have negligible cancer ri

For low-to-moderate consequence/ high probability accidents associated with operati consequences and risks associated with the APT are negligible. For the technology w the most severe consequences, the HWR, increased likelihood of cancer fatality to a maximally exposed individual at the site boundary would be of 6.8x10-5. Given the a probability of 1.0x10-3 per year, the cancer risk would be 6.8x10-8 per year. For t population residing within 50 miles of the accident (1,062,000), the associated can risk would be 7.5x10-4 per year. If this accident occurred, this exposure would res 0.75 cancer fatalities. The increased likelihood of cancer fatality to a worker loc 1,000 meters from the release point would be 1.6x10-4. The cancer risk to the worke be 1.6x10-7 per year.

For high consequence/low probability accidents associated with operation, the consequences to a maximally exposed individual at the site boundary would be small

APT. The technology with the most severe consequences to the general population is Small ALWR. For Small ALWR high consequence/low probability accidents, the increase likelihood of cancer fatality to a maximally exposed individual at the site boundar would be 0.042 with an associated cancer risk of 6.6x10-9 per year. For the populat residing within 50 miles of the accident (1,062,000), the associated cancer risk wo 5.1x10-6 per year. If this accident occurred, this exposure would result in 33 canc fatalities. The increased likelihood of cancer fatality to a worker located 1,000 m from the release point would be 0.10. The cancer risk to the worker would be 1.6x10 year.

Waste Management. Spent nuclear fuel would be generated by the HWR, MHTGR, and ALWR require a new storage facility. The APT would not generate spent fuel. All technolo except the APT would generate liquid LLW and require a new treatment facility. All technologies would generate solid LLW and require between 0.6 (APT) and 3.5 (HWR) a per year of onsite LLW disposal area. The increase in liquid and solid mixed LLW ge tion would have minimal impact and could be handled with existing/planned facilitie

Hazardous waste generation would increase by 4 yd3 per year (APT) to 101yd3 per yea (MHTGR) and could be handled with existing/planned facilities. Liquid nonhazardous sanitary waste generation would increase from 260(APT) to 6,310MGY (Large ALWR) and require additional treatment facilities. Solid nonhazardous sanitary waste generati would increase between 8,640(APT) and 15,000yd3 per year (HWR). Existing landfill d life would be reduced or require expansion. Other solid nonhazardous wastes would b recycled.

Intersite Transport. For all technologies, the relative risk of transporting tritiu percent lower than the existing case (No Action) because the distance travelled is shorter. The potential cancer fatalities per year from transporting triated heavy w 3.57x10-5 (HWR) and 6.63x10-6 (APT). There is no intersite transport of LLW for any technology. The risk of transporting new tritium for supply alone is about 2 percen greater than No Action (due to transporting new tritium to SRS).

Pantex

Land Resources. Construction and operation of a tritium supply would disturb betwee 173(APT) and 360 acres (MHTGR). Collocation of tritium recycling would require an additional 202acres during construction and 196 acres during operation. Siting any tritium supply technologies alone or collocated with recycling at Pantex would be c tent with site development plans. No visual impacts are expected.

Site Infrastructure. No roads or railroads would be required to support any technol but all would require new transmission lines. The power requirements would exceed t current site electrical requirement of 13 MWe by 61 MWe (MHTGR) to 565 MWe (APT).

Air Quality and Acoustics. Construction activities would result in exceedance of 24 PM10 standard. Air pollutant concentrations would increase during operation but wou within standards. An increase in onsite noise would result from construction and operation of a tritium supply. Offsite noise impacts would be negligible.

Water Resources. Surface waters and groundwater would not be affected by constructi operation. Reclaimed sanitary wastewater use would range from 10 MGY (APT) to 35 MG (Large ALWR) during construction. Operation water requirements would range from 43(to 1,214MGY (APT).

Geology and Soils. Construction and operation would neither affect nor be affected geological conditions. The soil disturbed area for collocated tritium supply and re would range from 375(APT) to 562acres (MHTGR). Soil erosion due to wind and stormwa runoff would be minor.

Biotic Resources. During construction and operation, terrestrial resources would be affected by the disturbance of 375(APT) to 562 acres (MHTGR) of habitat. Impacts fr drift are possible with the APT. Playa wetlands could be degraded by discharges. Aq resources would not be affected. One federal-listed species, the bald eagle, could

temporarily affected during construction, and several Federal candidate or state-li species may also be affected.

Cultural and Paleontological Resources. Some NRHP-eligible prehistoric and historic resources may occur within the disturbed area. Native American resources may be aff by land disturbance and audio or visual intrusions. Paleontological resources may a be affected.

Socioeconomics. Employment in the economic study area would increase by 7,300 (MHTG 10,900persons (either ALWR) during peak construction. Employment during full operat would increase in the economic study area by 4,400(APT) to 5,300 persons (HWR and M Unemployment would decrease from 4.6 percent, the projected baseline, to between 2. all technologies) during peak construction and to between 2.5 (HWR and MHTGR) and 2 percent (APT) during full operation. Per capita income would increase by no more th percent during peak construction and full operation.

Population and housing demand within the region of influence would increase by betw 3(HWR and MHTGR) and 7 percent (ALWR) during construction and between 1percent (APT 2(HWR, MHTGR, ALWR) during operation.

Total revenues and expenditures for most region of influence counties, cities, and districts would increase by annual averages of 1 percent to 3 percent through 2005 decrease annually by 1 percent until 2010. Between 2010 and 2020, total revenues an expenditures for all technologies would increase at annual averages of less than 1 percent.

Traffic conditions on access roads to Pantex are expected to degrade due to increas worker traffic and congestion, particularly on Farm-to-Market Road 683, the primary route.

Radiological and Hazardous Chemical Impacts During Normal Operation and Accidents. dose to the maximally exposed member of the public from total site operation with a collocated supply and recycling facility for 1 year would range from 1.4(APT with h target) to 4.9mrem (LargeALWR). The associated risk of fatal cancer from 40 years o operation would range from 2.9x10- 5 to 9.8x10-5, respectively.

The annual 50-mile population dose from total site operation in 2030 would range fr (APT with helium-3 target) to 37 (Large ALWR) person-rem and could result in 0.18 t fatal cancers over 40years of operation.

The average annual dose to a site worker would range from 22 (MHTGR) to 68 (Large A mrem with the associated risk of fatal cancer from 40 years of operation ranging fr 3.5x10-4 to 1.1x10-3, respectively. The annual dose to the total site workforce wou range from 67 (MHTGR) to 210 (Large ALWR) person-rem and could result in 1.1 to 3.3 cancers over 40 years of operation.

Although the noncancer adverse health effects to the public and onsite workers are regulatory health limits, No Action cancer risks to the public and the onsite worke emissions of hazardous chemicals exceed the accepted regulatory threshold level of 1.0x10-6 annually. Potential mitigation, such as chemical substitution, can minimiz health risks.

For low-to-moderate consequence/high probability accidents associated with operatio consequences and risks associated with the APT are negligible. For the technology w the most severe consequences, the HWR, the increased likelihood of cancer fatality maximally exposed individual at the site boundary would be 6.2x10-6. Given the acci probability of 1.0x10-3 per year, the cancer risk would be 6.2x10-9 per year. For t population residing within 50 miles of the accident (287,000), the associated cance would be 2.6x10-5 per year. If this accident occurred, this exposure would result i cancer fatalities. The increased likelihood of cancer fatality to a worker located meters from the release point would be 1.2x10-5. The cancer risk to the worker woul 1.2x10-8 per year.

For high consequence/low probability accidents associated with operation, the conse

to a maximally exposed individual at the site boundary are small for the APT. The technology with the most severe consequences to the general population is the Small For Small ALWR high consequence/low probability accidents, the increased likelihood cancer fatality to a maximally exposed individual at the site boundary would be 0.0 an associated cancer risk of 4.6x10-9 per year. For the population residing within miles of the accident (287,000), the associated cancer risk would be 6.7x10-7 per y this accident occurred, this exposure would result in 4.3 cancer fatalities. The in likelihood of cancer fatality to a worker located 1,000 meters from the release poi would be 0.070. The cancer risk to the worker would be 1.1x10-8 per year.

Waste Management. Spent nuclear fuel would be generated by the HWR, MHTGR, and ALWR would require a new storage facility. The APT would not generate spent fuel. Genera liquid LLW would increase for all technologies except the APT and require new treat facilities. Solid LLW generation would increase for all technologies, requiring a n staging facility and between 16(APT) and 92 (HWR) additional LLW shipments to NTS. to the NTS alternative for the additional LLW disposal area required at NTS. The in generation of liquid mixed LLW could be handled with existing/planned facilities. S mixed LLW generation would increase from 3yd3 per year (MHTGR) to 122yd3 per year (The HWR increase would require expansion of existing and planned treatment and stor facilities.

Hazardous waste generation would increase from 4(APT) to 101yd3 per year (MHTGR). L sanitary waste generation would increase for all technologies and would require new treatment facilities. Solid sanitary waste generation would increase by 8,640(APT) 15,000yd3 per year (HWR). Existing offsite landfill design life would be reduced or require expansion. Other solid nonhazardous wastes would be recycled.

Intersite Transport. The risk of transporting tritium is zero since there is no int transportation with collocating supply and recycling for all technologies at Pantex potential cancer fatalities per year from transporting tritiated heavy water is 3.5 (HWR) and 6.63x10-6 (APT). For intersite transportation of LLW, credible accidents associated with locating tritium supply and recycling at Pantex would result in fat cancers per year from radiological releases varying from 5.2x10-9(APT) to 3.0x10-8(and from 6.9x10-5 (APT) to 4.0x10-4 fatalities per year (HWR) from non-radiological causes. For intersite transportation of LLW, credible accidents associated with loc tritium supply alone at Pantex would result in fatal cancers per year from radiolog releases varying from 3.25x10-9 (APT) to 2.8x10-8 (HWR) and from 4.30x10-5 (APT) to 3.70x10-4 (HWR) fatalities per year from non-radiological causes. The risk of trans porting of new tritium for supply alone is about 2 percent greater than that for No (due to transporting new tritium to SRS). The annual risk from transporting highly-enriched uranium fuel feed material (HWR and MHTGR alternatives) from ORR to is 5.1x10-4 fatalities.

Savannah River Site

Land Resources. Construction and operation of a tritium supply technology with the upgraded recycling facility would disturb between 173 (APT) and 360acres (MHTGR). T of an evaporative cooling tower would result in visible plumes during certain atmos conditions.

Site Infrastructure. New site infrastructure (e.g., roads and transmission lines) w required to support all technologies. The power requirements would range from excee the current site electrical requirement 130 MWe by 350 MWe (APT) to current site electrical requirement by being less than the 104 MWe (Large ALWR).

Air Quality and Acoustics. Construction activities would result in exceedance of 24 PM10 standards. Air pollutant concentrations would increase during operation but wo be within standards. An increase in onsite noise would result from construction and operation of a tritium supply. Offsite noise impacts would be negligible.

Water Resources. Surface water would not be required for construction. Operation su water requirements would range from 1,229(APT) to 15,946MGY (Large ALWR) and repres increases of between 6 and 78 percent during operation, respectively. The generatio

sanitary waste would range from 0.3(APT) to 28 MGY (Large ALWR) during construction 7(APT) to 90MGY(LargeALWR) during operation, respectively. Blowdown discharges to surface waters would range from 240(APT) to 6,192MGY (Large ALWR). Groundwater use increase by 33MGY during construction and 90 MGY (Large ALWR) during operation, representing increases of 1and 3 percent, respectively.

Geology and Soils. Construction and operation would neither affect nor be affected geological conditions. The area of disturbed soil would range from 200(APT) to 387acres(MHTGR). Soil erosion due to wind and stormwater runoff would be minor.

Biotic Resources. Terrestrial resources would be affected by the disturbance of bet 173(APT) and 360acres (MHTGR) and of habitat. Salt drift from an evaporative coolin system could impact an additional limited acreage for all technologies. Constructio operational discharges to an onsite stream could affect wetland and aquatic communi No Federal-listed, threatened, or endangered species would be affected, but several state-listed species may be affected.

Cultural and Paleontological Resources. Three NRHP-eligible historic sites occur wi the area that would be disturbed during construction. No historic resources would b affected. Native American resources may be affected by land disturbance and audio o visual intrusions. Paleontological resources may be affected, but impacts would be negligible.

Socioeconomics. Employment in the economic study area would increase between 6,900(and 10,800persons (ALWR) during construction. Employment during operation would inc in the economic study area between 1,600(APT) and 2,400persons (HWR). Unemployment decrease from 4.8percent, the projected baseline, to between 3.9(HWR, ALWR, and APT 4percent(MHTGR) during construction and to between 4.5(HWR) and 4.6percent(MHTGR, A and APT) during operation. Per capita income would increase by an average of approx mately 1percent for all technologies during construction and operation.

Population and housing demand within the ROI would increase by between less than 1 (HWR, MHTGR, APT) and less than 3 percent (ALWR) during construction and by less th 1percent for all technologies during operation.

Total revenues and expenditures for most ROI counties, cities, and school districts increase by an annual average of less than 1 percent through 2020 for all technolog except for the ALWR. For the ALWR, revenues and expenditures would increase between less than 1 percent through and 2005 and then remain flat until 2010. Between 2010 2020, total revenues and expenditures would increase by annual averages of less tha 1percent.

Traffic conditions on access roads to SRS are expected to degrade due to increased traffic and congestion, particularly on South Carolina Route 125, the primary acces route.

Radiological and Hazardous Chemical Impacts During Normal Operation and Accidents. dose to the maximally exposed member of the public from total site operation for 1 would range from 2.5(APT with a helium-3 target) to 3.9mrem (Large ALWR) for atmosp release. The associated risk of fatal cancer from 40 years of operation would range 7.8x10-5 to 4.9x10-5, respectively. The dose from liquid releases from 1 year would from 0.077 mrem (MHTGR and APT) to 0.26 mrem (Small ALWR). The associated risk of f cancers from 40 years of operation would range from 1.5x10-6 to 5.3x10-6, respectiv

The annual 50-mile population dose from total site operation in 2030 would range fr 220(APT with the helium-3 target) to 340person-rem (Large ALWR) and could result in 6.8 fatal cancers over 40 years of operation, respectively.

The average annual site dose to a site worker would range from 33(MHTGR) to 42mrem ALWR) with the associated risk of fatal cancer from 40 years of operation ranging f 5.3x10-4 to 6.7x10-4, respectively. The annual dose to the total site workforce wou range from 510(MHTGR) to 650person-rem (Large ALWR) and could result in 8.2 to 10 f cancers over 40 years of operation,respectively.

Although the noncancer adverse health effects to the public are within regulatory h limits, the No Action worker effects from emission of hazardous chemicals exceed th limit. The No Action cancer risks to both the public and onsite workers exceed the generally accepted threshold of regulatory concern of 1x10-6.

For low-to-moderate consequence/high probability accidents associated with operatio consequences to a maximally exposed individual at the site boundary would be small the APT. The technology with the most severe consequences to the general population the HWR. For HWR low-to-moderate consequence/high probability accidents, the increa likelihood of cancer fatality to a maximally exposed individual at the site boundar be 2.3x10-5. Given the accident probability of 1.0x10-3 per year, the cancer risk w 2.3x10-8 per year. For the population residing within 50 miles of the accident (773 the associated cancer risk would be 7.3x10-4 per year. If this accident occurred, t exposure would result in 0.73 cancer fatalities. The increased likelihood of cancer fatality to a worker located 1,000 meters from the release point would be 2.9x10-4. cancer risk to the worker would be 2.9x10-7 per year.

For high consequence/low probability accidents associated with operation, the conse to a maximally exposed individual at the site boundary would be small for the APT. technology with the most severe consequences to the general population is the Small For Small ALWR high consequence/low probability accidents, the increased likelihood cancer fatality to a maximally exposed individual at the site boundary would be 1.9 with an associated cancer risk of 2.9x10-10 per year. For the population residing w 50 miles of the accident (773,000), the associated cancer risk would be 2.3x10-6 pe If this accident occurred, this exposure would result in 14 cancer fatalities. The increased likelihood of cancer fatality to a worker located 1,000 meters from the r point would be 0.067. The cancer risk to the worker would be 1.1x10-8 per year.

Waste Management. Spent nuclear fuel would be generated by the HWR, MHTGR, and ALWR require a new storage facility. The APT would not generate spent fuel. All technolo except the APT would generate liquid LLW and require a new treatment facility. All technologies would generate solid LLW and require between 1(APT) and 12acres per ye (HWR) of onsite LLW disposal area. No additional liquid mixed LLW would be generate the tritium supply technologies. The generation of solid mixed LLW would increase b per year (MHTGR) to 120yd3 per year (HWR). The HWR may require new or expanded trea and storage facilities.

Hazardous waste generation would increase by 3(APT) to 100yd3 per year (MHTGR) and require additional storage facilities except for APT. Liquid nonhazardous sanitary would increase by 245(APT) to 6,290MGY (Large ALWR) and require additional treatmen facilities. Solid nonhazardous sanitary waste generation would increase by 1,240(AP 7,600yd3 per year (HWR). Existing landfill design life would be reduced or require expansion. Other solid nonhazardous wastes would be recycled.

Intersite Transport. The risk associated with transportation of tritium when colloc supply and recycling is the same as No Action for all supply technologies. There is intersite transport of LLW for any supply technology. The annual risk from transpor highly-enriched uranium fuel feed material (HWR and MHTGR alternatives) from ORR to 5.1x10-4 fatalities.

Multipurpose ("Triple Play") Reactor

The Department's Office of Fissile Materials Disposition is preparing a PEIS addres the issue of how to dispose of plutonium that is excess to nuclear weapons requirem 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 PEIS for Tritium Suppl Recycling utilize uranium as the fuel source, and the analysis in this PEIS is base that design. Nonetheless, it is technically feasible to also use plutonium or pluto uranium-oxide (mixed-oxide) fuel for a tritium production reactor. Congress and commercial entities have expressed interest in developing a multipurpose ("triple p

reactor that could produce tritium, "burn" plutonium, and generate revenues through sale of electric power. Only the ALWR and MHTGR would be capable of performing the play missions; the potential environmental impacts from these triple play reactors summarized below.

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 durin peak year of the 6 year construction period.

During operation, this facility would require approximately 10 percent as much wate a large ALWR at a dry site, and would employ as many workers as the ALWR. Radiologi exposures to workers during normal operation would be kept as low as reasonably achievable, and would not be expected to exceed 50mrem per worker per year. If all 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 facility. The goal for the facility for public radiation exposure would be not to e 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 pl Criticality accidents, explosions, and fires could occur in such a facility, and re radiation to the environment. The use of plutonium in an ALWR would not significant affect the consequences of radioactivity releases from severe accidents, though the 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 operation therefore, impacts would not be expected to change significantly from those associa with utilizing a uranium fueled reactor. This is based on a study conducted by the the Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Fuel in Light Water Reactors.

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

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

During operation of twice as many reactor modules, water requirements could increas percent. Impacts to groundwater would not change significantly from those expected the three module MHTGR at those sites that would use groundwater resources. The exp workforce increase would approximately double any socioeconomic impacts and radiati 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 accid consequences because fuel failures are not expected in any severe accident. Spent f 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 powe reactor is a reasonable alternative being evaluated to meet the stockpile tritium requirement mission. Production of tritium using irradiation services contracted fr commercial power reactors is also being evaluated as a reasonable alternative and 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 reacto employed for domestic electric power generation in the United States are convention light water reactors, which use ordinary water as moderator and coolant. The potent environmental impacts of the commercial light water reactor alternative are summari below.

The option to purchase an operating commercial power reactor or finish construction partially complete commercial reactor to support the stockpile tritium requirement have similar impacts. The reactor technologies and characteristics would be the sam However, some additional land use impacts may occur to incorporate security infrast 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 zo requirements, new fencing, security buildings, and road access restrictions or construction of new roads.

The environmental impacts of completing construction of an unfinished commercial nu 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 existing site infrastructure to support renewed construction activities would be mi Completing construction of a nuclear reactor would result in impacts resulting from emissions, increased worker numbers, and waste generation and management. Air emiss would be temporary and would not be expected to significantly affect air quality in project area. The increase in construction workers would have potential impact on t local economy and area population, housing, and local services. Because a majority the nuclear power plant infrastructure and the power plant itself have already been completed using a much larger overall workforce and peak workforce, socioeconomic i are expected to be minor.

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

The commercial reactor alternatives for producing tritium would result in additiona environmental impacts from the changes in the reactor operational characteristics d 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 requi physical changes to the reactor core, which could range from replacement of burnabl poison elements with DOE target elements to the replacement of fuel rods with DOE t assemblies. Core changes could alter the accident basis and would modify the source The estimated additional core tritium content in curies per reactor at the end of t irradiation period would be 3.2x107 for a single reactor. Because of the reduced bu in the reactor core, the total fission products in each fuel rod would decrease.

Personnel Requirements. An estimated 75 additional personnel would be needed for a commercial nuclear power facility. The additional personnel would represent an incr approximately 9percent for a single reactor. The number of personnel would be small each commercial reactor site if multiple reactors were used.

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

Waste. Additional activities associated with the handling, processing, and shipping target assemblies would be expected to increase waste generation rates at the comme reactor site. An estimated 164yd3 per year of LLW per reactor would be expected. Th would be approximately a 50-percent increase for a typical plant. No increase in mi

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 singl reactor case, 137 additional spent fuel assemblies (40yd3, assuming 8ft3/assembly) be generated each year. This amounts to approximately 58 metric tons of heavy metal This represents more than a 3-fold increase over the average of 56 assemblies (24 m tons of heavy metal) for a typical pressurized commercial light water reactor. The to 12-month refueling cycles with full core discharge would accelerate the consumpt available spent nuclear fuel pool storage and would require earlier use of addition storage alternatives such as dry storage at some commercial reactor sites.

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

Radiological Impacts

Normal Operations. The impact from adding tritium targets to a commercial reactor w 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 wou occur if all of the tritium were produced at that site. The impacts would lessen at given site if multiple sites are used.

Considering that the arithmetic mean annual radiation dose to people who lived with 50-mile radius of a commercial nuclear power plant in 1991 was about 1.2 person-rem and 0.95 person-rem from airborne and liquid releases, respectively) and the median 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 r and less than the drinking water limit of 4mrem. It is estimated that the changes i radioactive releases associated with the production of tritium in a single reactor result in an annual dose increase of 0.51 person-rem to the 50-mile population. Thi would result in a calculated increase of 0.010 fatal cancer in this population as t result of 40 years of reactor operation. There would be a slightly larger increase total number of fatal cancers in the several population groups for the multiple rea scenario compared with the single reactor, but the risk to an individual member of public would be less because of the larger number of people exposed.

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

Transportation/Handling. Assuming that an inventory of 500target rods would be accu for shipment at one time in NRC-approved fuel assembly shipping casks, and one cask transport truck, approximately 12shipments per year would occur. The curie content truck would be approximately 2.7x106. the upper bound radiological consequences of accident during transportation from a single site to SRS might incur an additional 240person-rem per year.

Qualitative Comparison

To aid the reader in understanding the differences in environmental impacts among t alternatives (particularly the tritium supply technology alternatives i.e., HWR, MH ALWR, and commercial light water reactor), this section presents a brief, qualitati summary comparison of the alternatives. Chapter 3, tables 3.6-1 and 3.6-2 presents

quantitative comparisons of greater detail.

For some of the resource areas evaluated in the PEIS, the analyses indicate that th no major differences in the environmental impacts among the tritium supply technolo and site alternatives. Resource areas where no major differences exist, or where po environmental impacts are small, are: land resources, air quality, water resources, geology and soils, biotic resources, and socioeconomics. For these resource areas, general conclusion is particularly true when comparing the operational impacts of t tritium supply facilities. For construction, this general conclusion is also partic true when comparing among the various types of new tritium supply facilities (e.g., 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 irradiation services or purchase and conversion of an existing commercial reactor), environmental impacts of the latter are clearly less because the facility already exists, and, thus, there are minimal construction-related environmental impacts. Fo tritium recycling, this also applies when comparing the existing tritium recycling facilities at SRS against constructing a new tritium recycling facility at another

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

Site Infrastructure. Infrastructure and electrical capacity exists at each of the alternative sites to adequately support any of the tritium supply technology alternatives. Nonetheless, because the MHTGR and ALWR 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 facil the future. The PEIS acknowledges, and qualitatively discusses, these potential "av environmental impacts. The APT, and to a significantly lesser degree the HWR, would energy consumers. The PEIS assesses the environmental impacts of providing power to energy consumers. Thus, in terms of environmental impacts, there could be approxima 1,800 MWe of difference (i.e., ALWR generating 1,300 MWe versus an APT consuming 50 between the tritium supply technologies. For commercial reactors that already exist 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 poten 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 order of once every millions of years at most. Based upon the PEIS analyses of the technologies, the ALWR could cause the largest potential impacts to human health fr severe accidents, while the MHTGR would have the smallest potential impacts. Becaus APT does not utilize fissile materials, and there is no significant decay heat, the virtually no radiological consequences from any APT accidents.

Consequently, the APT would have the smallest potential impacts to human health fro accidents. The commercial reactor alternatives do not acquire any substantial risks 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 impact human health. Because ORR and SRS have larger populations within 50 miles of the pr facilities, these two sites have greater potential human health impacts than the ot sites. Because there are virtually no radiological consequences from any APT accide there are no grounds for discrimination among sites in the case of the APT. It is, essence, site neutral with respect to potential impacts to human health.

Generated Wastes

Spent Fuel Generation. All of the tritium supply reactor technologies would generat fuel. While the MHTGR would generate the greatest volume of spent fuel (because of graphite moderator), the residual heavy metal content of spent fuel from the ALWR w be the greatest. Reactors providing irradiation services would not generate additio 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 n change fuel cycles. However, if only a single reactor were used (irradiation servic purchased and converted), additional spent fuel would likely be generated because t reactor's refueling cycle would be shortened. The APT is not a reactor and would no generate spent fuel.

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

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CHAPTER 1: INTRODUCTION

Chapter 1 begins with a description of the Department of Energy's Tritium Supply an Recycling Proposal. This chapter also describes the Department of Energy's complian with the National Environmental Policy Act for tritium supply and recycling, time p considered in this analysis, and other Department of Energy National Environmental Act documents that are currently being prepared or are in the planning phase. Chapt includes discussions of the background of the Nuclear Weapons Complex Reconfigurati Program, recent changes affecting the Reconfiguration Program, the specific alterna analyzed in this document, the public participation process used to obtain public i the issues addressed in the Draft Programmatic Environmental Impact Statement, and changes made from the Draft Programmatic Environmental Impact Statement. The chapte concludes with the organization of the document.

1.1 The Tritium Supply and Recycling Proposal

The Department of Energy (DOE) proposes to provide tritium supply and recycling fac for the Nation's Nuclear Weapons Complex (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 perfo designed. Tritium decays at 5.5percent per year and must be replaced periodically a long as the Nation relies on a nuclear deterrent. The Complex does not have the capability to produce the required amounts of tritium. Projections require that new tritium be available by approximately 2011. This Tritium Supply and Recycling Programmatic Environmental Impact Statement (PEIS) evaluates the siting, constructi operation of tritium supply technology alternatives and recycling facilities at eac five candidate sites: the Idaho National Engineering Laboratory (INEL), Nevada Test (NTS), Oak Ridge Reservation (ORR), the Pantex Plant, and the Savannah River Site (This PEIS assesses the environmental impacts of all reasonable alternatives discuss below, 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 extrac the tritium in pure form for its use in nuclear weapons. Tritium recycling consists recovering residual tritium from weapons components, purifying it, and refilling we components with both recovered and new tritium when it becomes available.

Under No Action, DOE would not establish a new tritium supply capability. The curre inventory of tritium would decay and DOE would not meet stockpile requirements of t This would be contrary to DOE's mission as specified by the Atomic Energy Act of 19 amended. The current DOE missions assumed to continue under No Action are listed in section 3.3 for each candidate site.

Alternatives for new tritium supply and recycling facilities consist of four differ tritium supply technologies and five locations. The four technologies proposed to provide a new supply of tritium are Heavy Water Reactor (HWR), Modular High Tempera Gas-Cooled Reactor (MHTGR), Advanced Light Water Reactor (ALWR), and Accelerator Pr duction of Tritium (APT). Both Large (1,300 MWe) and Small (600 MWe) options for th are evaluated as well as a phased approach for the APT. Also included as an alterna the use of an existing commercial light water reactor that would be used for irradi services or purchased and converted for tritium production. Additionally, this Trit Supply and Recycling PEIS includes an assessment of the environmental impacts assoc 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 identified in this PEIS.

This PEIS also addresses the environmental impacts of an ALWR, modular gas-cooled r

or commercial light water reactor used as a multipurpose reactor. A multipurpose (" play") reactor is defined as one capable of producing tritium, "burning" plutonium, generating revenues through the sale of electric power.

1.2 Compliance with the National Environmental Policy Act for Tritium Supply and Re

DOE intends to comply with the National Environmental Policy Act (NEPA) for tritium supply and recycling in two phases. The first phase includes this PEIS and subseque Record of Decision (ROD). The second phase includes site-specific NEPA documents th would be tiered from this PEIS. Decisions will be based on relevant factors includi economic and technical considerations, DOE statutory mission requirements, and environmental impacts. As required by NEPA, this PEIS provides environmental analys support the ROD. In addition to the analysis in this PEIS, engineering studies will provide cost, schedule, and technical feasibility analyses for consideration in the These studies are presented in the Technical Reference Report.

The programmatic decisions needed to plan for tritium supply and recycling focus on and technology. Project-level decisions would focus on construction and operation impacts and would be made after subsequent site-specific tiered NEPA reviews are completed.

The ROD may include the following programmatic decisions:

Whether to build new tritium supply and new or upgraded tritium recycling facilitie

Where to locate new tritium supply and recycling facilities; and

Which technologies to employ for tritium supply.

The ROD will not include decisions regarding clean-up or waste management at phased facilities; the ultimate disposition of these facilities; or the long-term storage, treatment, and ultimate disposal of some wastes and spent fuel. These activities ar covered by separate NEPA documents (section 1.5). However, this PEIS does address t waste management implications of the alternatives considered to the extent needed t support programmatic decisions regarding the sites and technologies analyzed.

The design goals of any new processes and facilities will include achieving, to the greatest extent practicable, pollution prevention and waste minimization. In additi one of the design goals is to maximize the ease of ultimate decontamination and decommissioning (D&D). The ROD will identify the waste management implications on facility design for each of the alternatives and any future actions (including D&D)

In accordance with the Council on Environmental Quality (CEQ) regulations for imple NEPA (40 CFR 1500-1508), DOE intends to "tier" site-specific environmental analyses this PEIS for specific project proposals; therefore, subsequent proposed actions re specific facilities and their impacts are not analyzed in this PEIS. The "tiered" a and their related decision documents would be completed before project implementati could begin.

1.3 Time Period Considered in Analysis

The Tritium Supply and Recycling Proposal would proceed in three phases. The first involves preparing information to support programmatic decisions on siting and tech This includes preparing this PEIS and the associated ROD. During the second phase, would develop detailed designs and meet project-specific NEPA requirements to imple the programmatic decisions. The third phase would involve constructing, testing, an certifying the selected tritium supply and recycling facilities, leading to full operation. Present planning, requires the tritium facilities to be fully operationa the year 2010 with new tritium available for use approximately 1 year later. The PE includes analyses of providing tritium at an earlier date should that become necess

Following this PEIS, DOE would develop a schedule for implementing the ROD decision

schedule would be subject to change and include reassessments required by congressi authorizations and appropriations. Although the individual schedules of any activit projects may overlap, the current uncertainty associated with any given activity or project requires that assumptions be made regarding the time periods used in this P analysis.

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

1.4 Background

The Complex is a set of interrelated facilities supporting the research, developmen design, manufacture, testing, and maintenance of the Nation's nuclear weapons and t subsequent dismantlement of retired weapons. In the past, Complex facilities have p large numbers of nuclear weapons from new components. However, due to substantial r tions in the requirements for nuclear weapons, the Complex's current focus has shif weapon dismantlement, recycling nuclear materials used in building nuclear weapons, storing strategic materials for future use, and conducting surveillance and mainten activities to ensure the continued reliability and safety of the weapons in the Nat stockpile. The Complex consisted of 11 sites located in 10 states, as shown in figu 1.4-1. Hanford and INEL are currently not part of the Complex. Defense missions hav terminated at the Rocky Flats Plant, Mound Plant, and the Pinellas Plant.

1.4.1 Defense Program Mission

As a matter of national policy, Congress declared in the Atomic Energy Act of 1954 the development, use, and control of atomic energy shall be directed so as to make maximum contribution to the general welfare, subject at all times to the paramount objective of making the maximum contribution to the common defense and security. In addition, Congress assigned the nuclear weapons manufacturing and stockpile sustain role to the Atomic Energy Commission. Today that role resides with DOE.

The size of the Nation's nuclear weapons stockpile is determined on a year-to-year The Secretaries of Defense and Energy, in coordination with the Nuclear Weapons Cou jointly sign and submit the Nuclear Weapons Stockpile Memorandum. The Nuclear Weapo Stockpile Memorandum transmits the Nuclear Weapons Stockpile Plan to the President final approval. The Plan covers an 11-year period, specifies the types and quantiti weapons required, and sets limits on the size and nature of stockpile changes that made without additional approval from the President. As such, the Nuclear Weapons Stockpile Plan is the basis for all weapons planning in DOE. The President takes th Nuclear Weapons Stockpile Memorandum under advisement each year and issues a Nation Security Directive to DOE and the Department of Defense (DOD) approving the Nuclear Weapons Stockpile Plan for implementation. Figure 1.4.1-1 depicts the Nuclear Weapo Stockpile Memorandum process.

1.4.2 Evolution of the Tritium Supply and Recycling Proposal

The Tritium Supply and Recycling Proposal has evolved from the original Reconfigura Program. The original reconfiguration concept, changes over time, and reasons for t changes are discussed in detail in the revised Implementation Plan (IP) for the Tri Supply and Recycling PEIS and are outlined briefly below. A detailed discussion of current tritium supply proposal follows. Figure 1.4.2-1 depicts the evolution of th Reconfiguration Program and the Tritium Supply and Recycling Proposal.

Figure (Page 1-4)

Figure 1.4-1.-Current and Former Nuclear Weapons Complex Sites.

Figure (Page 1-5)
Figure 1.4.1-1.-Nuclear Weapons Stockpile Memorandum Process.

Figure (Page 1-6)
Figure 1.4.2-1.-Evolution of the Reconfiguration Program, 1991-1995.

The Complex is administered by the DOE Office of the Assistant Secretary for Defens Programs (DP) and consists of government-owned, contractor-operated facilities loca 11 sites around the country. Many of the facilities in the Complex were constructed than four decades ago and will need repairs, upgrades, and/or modifications to meet current environment, safety, and health (ES&H) requirements. Additionally, many of facilities were sized to meet stockpile requirements substantially larger and more diverse than current requirements or those expected in the future.

Congress, recognizing that a comprehensive rather than a piecemeal approach was nee address problems arising from an aging Complex, directed in the National Defense Authorization Act for fiscal years 1988 to 1989 (Public Law 100-180), that a study conducted and a plan prepared by the President to modernize the Complex. The produc this study, titled the U.S. Department of Energy Nuclear Weapons Complex Modernizat Report (December 1988), was submitted to Congress on January 12, 1989. The report c for extensive modernization of facilities over a 15 to 20-year period.

In September 1989, DOE established a Modernization Review Committee to review the assumptions and recommendations contained in the Modernization Report. Chaired by t Under Secretary, the committee was directed to reexamine the modernization issue an develop a program to address the issues already identified. In January 1991, this committee issued a report summarizing their findings. This study, entitled the Nucl Weapons Complex Reconfiguration Study (DOE/DP-0083), outlined a proposed future Com and charted the course necessary to achieve the goal of modernization. It included discussion of potential configurations of the future Complex, transitional activiti activities necessary for compliance with NEPA, and recommendations to improve manag of the Complex.

On February 11, 1991, DOE published a Notice of Intent (NOI) in the Federal Registe FR 5590) to prepare a PEIS, pursuant to NEPA, on reconfiguring the Complex. The NOI proposed to analyze the environmental impacts of the alternatives presented in the Nuclear Weapons Complex Reconfiguration Study.

In September 1991, the President made the first of three announcements involving significant reductions in the nuclear weapons stockpile. As a consequence of stockp reductions, decreased demand for tritium, and an increased supply of recovered trit from dismantled weapons, the urgency to develop a new tritium supply source was eas Consequently, on November 1, 1991, DOE announced its decision to incorporate the environmental impact analysis for the DOE New Production Reactor Capacity Proposal the Reconfiguration PEIS and include the new production reactor siting and technolo decisions in the Reconfiguration ROD. This action added the programmatic analysis o tritium supply capacity into the Reconfiguration PEIS. The New Production Reactor P was evaluating the potential environmental impacts of siting either an HWR, Light W Reactor, or MHTGR at Hanford, INEL, or SRS. It also considered the No Action altern of continuing tritium production at the K or L-Reactor at SRS. The New Production R Program, which was subsequently deferred, provided engineering and design informati use in the Reconfiguration PEIS.

In December 1991, the Secretary decided to separate the nonnuclear consolidation an originally part of the Reconfiguration PEIS, from the nuclear analysis. The reasons this included the potential for near-term, significant cost savings and the fact th nonnuclear consolidation decisions would neither affect nor be affected by the Reconfigurationdecisions.

On January 27, 1992, DOE provided the public notice of its plans to prepare an environmental assessment (EA) for its proposal to consolidate certain nonnuclear facilities in the Complex (57FR3046). These facilities manufacture nonnuclear parts

required for nuclear weapons and perform regular testing of individual components. Final EA was published on June 31, 1993 and a Finding of No Significant Impact was published in the Federal Register (58 FR 176) on September 14, 1993. Shortly therea DOE began implementing the Nonnuclear Manufacturing Consolidation Program. This act terminated the Complex mission at Mound, Pinellas, and Rocky Flats Environmental Technology Site (formerly known as Rocky Flats Plant). Activities previously perfor at these facilities will be consolidated primarily at the Kansas City Plant, with t remaining activities being relocated to SRS, Los Alamos National Laboratory, and Sa National Laboratories, New Mexico.

Further stockpile reductions, including the Strategic Arms Reduction Talks (START) Protocol, resulted in DOE reevaluating the Reconfiguration Program. On July 23, 199 revised NOI for the Reconfiguration PEIS was published in the Federal Register (58F 39528). This NOI described DOE's vision of a much smaller and more highly integrate Complex than originally planned. Additionally, long-term storage options for pluton highly enriched uranium were added to this PEIS analysis. In this regard, the alter of consolidated long-term storage facilities for plutonium and highly enriched uran was added, since weapons retirements were occurring in larger numbers and at a fast than was ever envisioned. In addition, the components were not being recycled into weapons, as they had been in the past. This situation placed increased importance o stewardship of existing special nuclear materials.

The Hanford Site was dropped and NTS was added as a candidate site for future weapo complex missions. DOE also added alternatives to consider upgrades and/or modificat existing facilities to meet the reduced workload requirements while still complying ES&H regulations. Upgrades and/or modifications were considered in addition to new facilities. The new facilities were downsized from previous plans and the option of integrating research, development, and testing activities into the plant designs an consideration of accelerator technology for the production of tritium were also add

In September and October 1993, DOE held a series of public scoping meetings followi issuance of the revised NOI. During the public scoping period, many members of the questioned why DOE was proceeding to analyze new weapons facilities in general, and component fabrication facilities in particular, given the lack of requirements for weapons and an otherwise limited workload. There appeared to be a perception among members of the public that the evaluation of new facilities in the PEIS indicated a intention to construct these facilities in a predetermined time frame. In addition, members of the public commented that DOE should address alternatives for the dispos of plutonium that is excess to strategic needs, in addition to alternatives for long-term storage.

DOE has concluded that the framework described in the Nuclear Weapons Complex Reconfiguration Study does not exist today. Contributing factors to this conclusion include public comments at the September and October 1993 PEIS scoping meetings; th that no new nuclear weapons production is required for the foreseeable future; budg constraints; and DOE's decision to prepare a PEIS on long-term storage and disposit weapons-usable fissile materials (59 FR 31985). As a result of these changed circumstances, DOE decided to separate the Reconfiguration PEIS into two PEISs: (1) Tritium Supply and Recycling PEIS to address the need for tritium and (2) a Stockpi Stewardship and Management PEIS to address the rest of the Complex (59 FR 54175).

1.5 Other National Environmental Policy Act Reviews

The Tritium Supply and Recycling PEIS has been coordinated with other NEPA document Programmatic NEPA documents currently in progress, recently completed, or in the planning phase are discussed in the following sections.

1.5.1 Stockpile Stewardship and Management Programmatic Environmental Impact Statem

The Stockpile Stewardship and Management PEIS, which is currently being prepared, i analyzing alternatives for the Department to fulfill its responsibilities for ensur the safety and reliability of the stockpile without underground nuclear testing. St

stewardship includes activities required to maintain a high-level of confidence in safety, reliability, and performance of nuclear weapons in the absence of undergrou testing and to be prepared to test weapons if directed by the President. Stockpile management activities include maintenance, evaluation, repair, or replacement of we in the existing stockpile.

An NOI to prepare the Stockpile Stewardship and Management PEIS was published in th Federal Register (60 FR 31291) on June 14, 1995. Eight public scoping meetings were around the country during June, July, and August 1995. The results of the scoping p and a discussion of the alternatives to be analyzed will be documented in the IP fo Stockpile Stewardship and Management PEIS expected to be published in October 1995.

1.5.2 Waste Management Programmatic Environmental Impact Statement

The Waste Management PEIS, which is currently being prepared, is analyzing alternat for managing the safe disposal of radioactive, hazardous, and mixed (i.e. radioacti hazardous) wastes. When completed, the PEIS will support DOE decisions on the manag of processes or facilities for treatment, storage, or disposal of radioactive, hazardous, or mixed wastes. An NOI to prepare the Waste Management PEIS was publish the Federal Register (55 FR 42633) on October 22, 1990. The results of the scoping process, which included public scoping meetings and public workshops on the Draft I a discussion of alternatives are documented in the Final IP for the Waste Managemen PEIS (DOE/EIS-0200) published in January 1994. The Draft PEIS was issued in Septemb 1995.

This PEIS addresses management of wastes and the facilities needed to accomplish an interim waste management mission in a manner that is consistent with future Environmental Management Program decisions. Additionally, this PEIS discusses ways minimize waste generation during operation. The Waste Management PEIS is also addre longer term management of wastes, including wastes that may be generated from long- tritium supply and recycling activities. Many technologies required for the ultimat treatment and disposal of DOE wastes must still be developed. This is an even longe effort and will follow decisions based on the Waste Management PEIS. Preparation of PEISs has been closely coordinated to ensure that any cross-cutting issues are full considered in the decision-making process.

1.5.3 Long-Term Storage and Disposition of Weapons-Usable Fissile Materials Program Environmental Impact Statement

The Long-Term Storage and Disposition of Weapons-Usable Fissile Materials PEIS, whi currently being prepared, is analyzing alternatives for the long-term storage of weapons-usable fissile materials, and the disposition of weapons-usable fissile mat declared surplus to national defense needs by the President. One of the alternative analyzed would utilize surplus plutonium as a fuel in existing, modified, or new nu reactors. The tritium supply technologies analyzed in this PEIS have the potential utilize surplus plutonium as a fuel. A discussion of disposing of plutonium in a ne tritium supply facility is discussed in appendix A.3. An NOI to prepare the Long-Te Storage and Disposition of Weapons-Usable Fissile Materials PEIS was published in t Federal Register (59 FR 31985) on June 21, 1994. The results of the scoping process included the public scoping workshops announced in the Federal Register (59 FR 3643 July 18, 1994, and a discussion of the alternatives to be analyzed were documented IP for the Long-Term Storage and Disposition of Weapons-Usable Fissile Materials PE (DOE/EIS-0229-IP) published in March 1995.

1.5.4 Site-Wide Environmental Support Statements

Site-Wide Environmental Impact Statement for the Continued Operation of the Pantex and Associated Storage of Nuclear Weapons Components. The Department is currently preparing the Site-Wide Environmental Impact Statement (EIS) for the Continued Oper of the Pantex Plant and Associated Storage of Nuclear Weapons Components. An amende was issued on June 23, 1995, (60 FR 32661) which announced modification in the scop

this EIS concerning the proposed action and alternatives for some of the Pantex operations. One of the announced modifications was for the alternative addressing t possible relocation of some or all of the Pantex operations to one or more sites.

The Pantex Site-Wide EIS is also analyzing alternatives to the interim storage of plutonium pits from disassembled weapons at Pantex pending decisions on their dispo The Draft Site-Wide EIS for the Continued Operation of the Pantex Plant and Associa Storage of Nuclear Weapons Components is expected to be completed in December 1995.

Site-Wide Environmental Impact Statement for the Nevada Test Site. The Site-Wide EI NTS (59FR40897) August 10, 1994, which is expected to be released for public review November 1995 evaluates resource management alternatives for NTS that would support current and future defense related missions, research and development, waste manage environmental restoration, infrastructure maintenance, and facility upgrades and alternative uses over the next 5 to 10years. The alternatives include: (1) No Actio continue existing missions and operations at the present level. No Action also incl the potential to resume underground nuclear testing and conducting other nuclear we related experiments at the site; (2) Expanded Use, which would maximize the use of in support of national programs of both defense and nondefense nature. National Def activities could include a resumption of underground nuclear testing with the requi support activities; conducting other nuclear weapons related experiments; the const and operation of various types of simulator facilities and other experimental test facilities; tritium production; plutonium storage and disposition; nuclear weapons and disassembly and similar activities that could be best conducted at a remote sit (3) Other alternatives such as variations of the No Action alternative.

1.5.5 Programmatic Spent Nuclear Fuel Management Environmental Impact Statement

In the ROD (60 FR 28680) for the Programmatic Spent Nuclear Fuel Management EIS, DO decided to regionalize spent nuclear fuel management by fuel type at three sites: H INEL, and SRS. The regionalization strategy will result in the inventory of spent n fuel (in metric tons of heavy metal) reaching 2,103 at Hanford, 426 at INEL, and 21 atSRS.

1.5.6 Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Spent Nuclear Fuel

DOE is preparing an EIS to evaluate the potential impacts of the adoption and implementation of a policy to accept foreign research reactor spent nuclear fuel th contains uranium enriched in the United States. Under the proposed policy, the Unit States would accept approximately 24,300 fuel elements of highly enriched uranium o low-enriched uranium from foreign research reactors in approximately 30 nations dur 10 to 15-year period. The implementation of this policy would result in the receipt spent nuclear fuel at one or more United States marine ports of entry and overland transport to one or more DOE sites.

1.6 Program Changes

A number of significant program changes have occurred since publication of the Nucl Weapons Complex Reconfiguration Study and the original NOI (56 FR 5590) to prepare PEIS. These changes include the following:

Long-Term Storage for Special Nuclear Materials. Since the original Reconfiguration Proposal was published, a significant number of weapons have been and will continue retired from the Nation's active nuclear weapons stockpile. Previously, the stockpi reductions mandated that relatively few weapons would be retired without replacemen Therefore, when the original NOI and IP were prepared, the long-term storage of the materials was not a contemplated mission requirement since disassembled components be recycled into new weapons. Presently, DOE does not have a long-term consolidated facility to store either plutonium or highly enriched uranium. Therefore, DOE is pr the Long-Term Storage and Disposition of Weapons-Usable Fissile Materials PEIS to a

long-term storage of these materials.

Siting Alternatives for Weapons Functions. In the original February 1992 IP for the Reconfiguration PEIS, Hanford, INEL, ORR, Pantex, and SRS were identified as reason alternative sites for the proposed reconfigured facilities. However, based upon reevaluation of the original proposal, DOE added NTS to this PEIS as a potential si the tritium supply and recycling facilities. NTS is a large, remote site that meets minimum qualification criteria (56 FR 5595) against which the other sites were evaluated, and it has a significant existing infrastructure that could accommodate functions. Additionally, Hanford was eliminated as a candidate site for the future Complex because nuclear weapons production functions at that site have been termina The site is now dedicated to the DOE Office of the Assistant Secretary for Environm Management (EM) activities.

Tritium Production. The New Production Reactor EIS was intended to assess Hanford, and SRS as alternative sites for new tritium supply. At the same time the decision made to eliminate Hanford, NTS was added to the list as a candidate site for a new supply. In addition, given the much smaller capacity needed to satisfy the tritium production requirements than originally contemplated, DOE concluded that ORR and Pa constitute reasonable candidate sites for tritium supply and recycling facilities. Therefore, ORR and Pantex were added to the list of candidate sites for these facil in this PEIS.

Weapons Complex Mission Changes. Since the publication of the original NOI, there h been changes within the Complex that have affected the No Action alternative in thi Some functions that were previously performed at particular sites can no longer be performed in existing facilities at those sites. More specifically, the K-Reactor a has been placed in cold standby with no planned provision for restart. This has effectively eliminated DOE's ability to produce tritium to support the projected st requirements. Consequently, at some point the nuclear deterrent capability of the N would either be lost or based upon weapons which would be significantly different f those in the current stockpile. This capability would not meet present mission requirements.

1.7 Public Participation

Public participation for the PEIS consisted of two primary activities: the scoping and the public comment process. CEQ regulations (40 CFR 1501.7) require "an early a process for determining the scope of issues to be addressed and for identifying the significant issues related to a Proposed Action." This is usually called the public scoping process. Section 1.7.1 briefly describes the scoping process and major issu identified for analysis in the PEIS.

1.7.1 The Scoping Process

Scoping for the Draft PEIS consisted of both internal DOE scoping and external publ scoping. Internal DOE scoping began with expert working groups that produced the U. Department of Energy Nuclear Weapons Modernization Report (December 1988) and the N Weapons Complex Reconfiguration Study. External scoping began after DOE completed t Nuclear Weapons Complex Reconfiguration Study and published an NOI in the Federal R (56 FR 5590) on February 11, 1991. The original NOI public scoping phase, which inc public meetings at potentially affected sites, ended September 30, 1991. The scopin process and results of the first NOI are discussed in detail in the February 1992 I (DOE/EIS-0161IP). A revised NOI (58 FR 39528) was published on July 23, 1993, and a tional public scoping was conducted through October 29, 1993. A Notice was publishe the Federal Register (59 FR 54175) on October 28, 1994, inviting public comment on proposal to separate the Reconfiguration PEIS into two separate PEISs.

Public scoping meetings for the revised NOI were conducted at 12 locations around t country to allow interested parties to present verbal comments and other informatio comments received through public scoping were organized and reviewed for considerat during the preparation of the revised IP and this PEIS. An extensive summary of all

comments received during the public scoping process, along with the planned scope a content of this PEIS, was published in the revised IP (DOE/EIS-0161IPREV).

1.7.2 Public Comment Process on the Draft Programmatic Environmental Impact Stateme

DOE's goal was to conduct the public comment process in a manner that encouraged discussion and mutual understanding of the NEPA process and the alternatives analyz the PEIS. After the Draft PEIS was published, a 60-day public comment period was he Changes to this PEIS that resulted from public comments during this process are des in section 1.7.2.1.

In February 1995, DOE published the Draft Programmatic Environmental Impact Stateme for Tritium Supply and Recycling evaluating the siting, construction, and operation tritium supply technology alternatives and recycling facilities at five candidate s within the Complex. The 60-day public comment period for the Draft PEIS began on Ma 1995, and ended on May 15, 1995. However, comments were accepted as late as June 23

During the comment period, public hearings were held in Washington, DC; Pocatello, Vegas, NV; North Augusta, SC; Oak Ridge, TN; and Amarillo, TX. Two hearings were he each location. In addition, the public was encouraged to provide comments via mail, electronic bulletin board (Internet), and telephone (toll-free 800 number). Figure shows the dates and locations of the hearings.

Figure (Page 1-12)
Figure 1.7.2-1.-Public Hearing Locations and Dates, 1995.

In response to public comments and feedback critical of DOE's traditional courtroom hearing format, the public hearings held for the Draft PEIS were conducted using a interactive format. The format chosen allowed for a two-way interaction between DOE the public; increased public awareness and understanding on project-related impacts discussed in the Draft PEIS; and encouraged informed public input and comments on t document. Neutral facilitators were present at the hearings to direct and clarify d cussions and comments.

All public hearing comment summaries were combined with comments received by mail, Internet, or telephone during the public comment period. Volume III of this PEIS, t comment response document, describes the public comment process in detail, presents comment summaries and responses, and provides copies of all commentsreceived.

1.7.3 Major Comments Received on Draft Programmatic Environmental Impact Statement

During public review of the Draft PEIS a large number of the comments received rega concerns that alternatives and/or candidate sites were not given the correct amount consideration on factors including cost and technical feasibility. Although these c made up the majority of the comments, many others involved the resources analyzed, and regulatory issues, and DOE and Federal policies as they related to the PEIS. Th issues identified by commentors include the following:

The electrical requirements of the various alternatives, particularly the APT, and 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 cooling;

The socioeconomic impacts, both positive and negative, of locating or failing to lo facility at one of the candidate sites;

The generation, storage, and disposal of radioactive and hazardous wastes (includin 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 t decisions based on all associated programs and activities concurrently;

The need for decisions to be based on many different factors, including environment 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 N in the Federal Register (60 FR 44327) to reopen the comment period for 21 days in o solicit comments on the Department's intention to include in the PEIS the purchase irradiation services from a commercial reactor as a reasonable alternative to produ tritium. During the extended comment period, there were two major issues of concern raised:

License and regulatory implications; and

Non-proliferation concerns.

All of the comments identified above are summarized and responded to in detail in c 3 of volume III. Substantial revisions to the PEIS resulting from public comments a discussed below.

Revisions in the Final PEIS include additional discussion and analysis in the follo areas: severe accidents and design-basis accidents for all tritium supply technolog site-specific environmental impacts of a dedicated power plant for the APT; revisio water resources sections; site-specific analysis of the multipurpose reactor that c produce tritium, burn plutonium as fuel, and produce electricity; and the commercia reactor alternative, specifically the purchase of an existing reactor and the purch irradiation services for DOE target rods to produce tritium. Each of these areas is discussed in more detail in the following section.

1.7.4 Changes from the Draft Programmatic Environmental Impact Statement

As a result of comments received on the Draft PEIS, several changes were incorporat this PEIS. Revisions to the document include additional discussion and analysis in following areas: severe accidents and design-basis accidents for all tritium supply technologies; site-specific environmental impacts of a dedicated power plant for th revisions to water resources sections; site-specific analysis of the multipurpose r that could produce tritium, burn plutonium as fuel, and produce electricity; purcha irradiation services from a commercial reactor; and analysis of producing tritium a earlier date in order to support a larger stockpile size.

Analysis of an ALWR design-basis accident was reevaluated as a result of public com questioning the apparent severity and frequency of the accident consequences shown the Draft PEIS. Additional analyses were performed to accurately estimate the impac a more reasonable design-basis accident and these results have been included in the PEIS in sections 4.1.3.9, 4.2.3.9, 4.3.3.9, 4.4.3.9, 4.5.3.9, 4.6.3.9, and appendix F.2.2.3.

The analyses of impacts of severe reactor accidents, located in the Final PEIS sect 4.1.3.9, 4.2.3.9, 4.3.3.9, 4.4.3.9, 4.5.3.9, 4.6.3.9, and appendix F.2.1.3 was revi Since accident consequences vary greatly depending on the selected frequency value, spectrum of severe accidents with a range of frequencies was used to perform a more representative analysis for each technology. The resulting impacts presented in thi section reflect the probable effects of a set of accidents for each reactor rather

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. A new accident anal presented in sections 4.1.3.9, 4.2.3.9, 4.3.3.9, 4.4.3.9, 4.5.3.9, 4.6.3.9, and app F.2.1.4 for the APT has a more severe initiating event, a lower frequency, and a hi consequence than the analysis presented in the Draft PEIS.

Additionally, PEIS sections 4.1.3.9, 4.2.3.9, 4.3.3.9, 4.4.3.9, 4.5.3.9, 4.6.3.9, a appendix E.2 have been modified to include a qualitative discussion of impacts to i workers (workers assigned to the facility and located in close proximity to the fac as a result of the proposed action) and quantitative impacts to noninvolved workers (workers collocated at the site independent of the proposed action).

Another change in the document is a more detailed description in section 4.8.2 of potential impacts of a dedicated power plant for the APT. The section has been modi indicate that site-specific impacts for the gas-fired power plant have been include each site in sections 4.2 through 4.6. The discussion of the site-specific cumulati impacts on land use, air quality, water resources, biotics, socioeconomics, human h and rail transport is presented within sections 4.2 through 4.6.

Based on public comments received at the hearings, two revisions were incorporated water resources sections for NTS and Pantex. For NTS, section 4.3.2.4 incorporated accurate recharge rates and information regarding the potential project use of the aquifer to present a more accurate impact on groundwater resources. The new data we utilized to revise section 4.3.3.4 and provide more accurate potential environmenta impacts to the NTS aquifer.

For Pantex, section 4.5.2.4 has been modified to include additional information on reclaimed sanitary wastewater sources, the Hollywood Road Wastewater Treatment Plan the Pantex Plant Wastewater Treatment Plant. Section 4.5.3.4 now includes the proje amount and availability of reclaimed water from each source and the impacts of usin reclaimed sanitary wastewater as a source of tritium supply cooling water

To present a more detailed analysis of the multipurpose reactor option, section 4.8 has been revised. Construction and operation impacts discussed in section 4.8.3.1 h been incorporated as additional discussion in the site-specific sections (sections through 4.6) at the end of each affected resource section for a multipurpose ALWR a MHTGR.

Additionally, as a result of public comments, DOE published on August 25, 1995 a No the Federal Register (60 FR 44327) to include the purchase of irradiation services commercial reactor as a reasonable alternative. The Draft PEIS considered this an unreasonable alternative because of the long-standing policy of the United States t civilian nuclear facilities should not be utilized for military purpose and nonproliferation concerns. Nonetheless, the Draft PEIS included an evaluation of th environmental impacts of irradiation services using an existing commercial reactor make tritium. Because of public comments on the Notice, public review of the Draft and further consideration of nonproliferation issues, purchase of irradiation servi is evaluated in the PEIS as a reasonable alternative.

Revisions have also been made in chapter 3.4 and sections 4.10 of this PEIS to prov additional information and analysis on the commercial reactor alternative. Analysis and a discussion of potential impacts has been expanded and included in this PEIS o alternative of DOE purchasing an existing operating commercial reactor or an incomp reactor and converting it to production of tritium for defense purposes.

A new section has also been added to the Final PEIS (section 4.11, providing tritiu earlier date). The new section evaluates the potential impacts of providing tritium earlier date to support a higher stockpile level. The new section was added because START II Treaty has not been ratified.

1.8 Organization of the Programmatic Environmental Impact Statement

This PEIS is divided into three volumes. Volume I contains the summary and the main and Volume II contains technical appendixes that provide supporting details for the analyses in Volume I along with additional project information. Volume III contains comments received on the Draft PEIS during the public review period and the DOE res A PEIS executive summary which is more detailed than the summary contained in this also available as a separate publication.

Volume I contains the summary and 10 chapters. Chapter 1 provides an introduction t Tritium Supply and Recycling Proposal and the approach to this PEIS. Chapter 2 pres the purpose of and need for the DOE's action. Chapter 3 describes the Tritium Suppl Recycling Proposal and alternatives. Chapter 4 includes discussions of the affected environment and environmental impacts of the alternatives, and chapter 5 contains environmental, occupational safety, and health permits and compliance requirements. remaining chapters contain references; a list of preparers; a list of agencies, organizations, and persons to whom copies of this PEIS were sent; a glossary; and a index.

Volume II contains nine appendixes of technical information in support of the environmental analyses presented in Volume I. These appendixes contain information following issues: nuclear facilities; air quality and acoustics; biotic resources; socioeconomics; human health; facility accidents; intersite transportation; environmental management; and summary comparison of environmental consequences of t tritium supply and recycling alternatives.

Volume III (Comment Response Document) contains a description of the public hearing process; how the comment response document is organized and instructions for its us brief summary of changes to the Draft PEIS; and all comments received and DOErespon

1.9 Preparation of the Programmatic Environmental Impact Statement

This PEIS has been prepared in accordance with Section 102(2)(c) of NEPA as amended U.S.C. 4321 et seq.), and implemented by regulations promulgated by the CEQ (40 CFR 1500-1508) and as provided in the DOE NEPA regulations (10 CFR 1021). The organizat this document (as described in section 1.8) is consistent with CEQ regulations (40 1502.10).

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CHAPTER 2: PURPOSE OF AND NEED FOR THE DEPARTMENT OF ENERGY'S ACTION

Chapter 2 discusses the Department of Energy's purpose and need to provide a tritiu supply and recycling capability.

2.1 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 rei this principle in his July 3, 1993, radio address to the Nation. Tritium was used i design process to enhance the yield of nuclear weapons and allows for the productio smaller or more powerful warheads to satisfy the needs of modern delivery systems. result, the United States strategic nuclear systems are based on designs that use t Thus, the Nation requires a reliable supply source of tritium to maintain the nucle weapon stockpile. Tritium has a relatively short radioactive half-life of 12.3 year Because of this relatively rapid radioactive decay, tritium must be replenished periodically in nuclear weapons to ensure that they will function as designed. Over past 40 years, the Department of Energy (DOE) has built and operated 14 reactors to produce nuclear materials, including tritium. Today, none of these reactors is operational, and no tritium has been produced since 1988.

Pursuant to the Atomic Energy Act of 1954, DOE is responsible for developing and maintaining the capability to produce nuclear materials such as tritium, that 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 Nuclear Weapons Stockpile Plan (section 1.4.1).

The Nuclear Weapons Stockpile Plan is normally forwarded annually from the Secretar the Department of Defense and DOE via the National Security Council to the Presiden approval. The Nuclear Weapons Stockpile Plan reflects the size and composition of t stockpile needed to defend the United States. The Nuclear Weapons Stockpile Plan pr 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 of the currently approved stockpile, arms control negotiations and treaties, Congressional constraints, and the status of the nuclear material production and fabri facilities. Revisions of the Nuclear Weapons Stockpile Plan could be issued when an the factors indicate the need to change requirements established in the annual docu The most current Nuclear Weapons Stockpile Plan, which was approved by President Cl on March 7, 1994, authorizes weapons production and retirement through fiscal year The analysis in this Programmatic Environmental Impact Statement (PEIS) is based on requirements of the 1994 Nuclear Weapons Stockpile Plan, which is based on START II stockpile levels (approximately 3,500 accountable weapons). The 1994 Nuclear Weapon Stockpile Plan represents the latest official guidance for tritium requirements. A Weapons Stockpile Plan for 1995 has not yet been issued. Appendix CA, which is clas contains quantitative projections for tritium requirements based on the 1994 Nuclea Weapons Stockpile Plan and details of a transportation analysis conducted by the Na Security Council of shipping routes involved in nuclear weapons production.

Even with a reduced nuclear weapons stockpile and no identified requirements for ne nuclear weapons production in the foreseeable future, an assured long-term tritium and recycling capability will be required to maintain the weapons determined to be for national defense under the prevailing Nuclear Weapons Stockpile Plan. Presently source of new tritium is available. The effectiveness of the United States' nuclear deterrent capability depends not only on the Nation's current stockpile of nuclear 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 trit requirements by recycling tritium from weapons retired from the Nation's nuclear we stockpile (section 3.4.1). However, because tritium decays relatively quickly, recy can only meet the tritium demands for a limited time. Current projections, derived classified projections of future stockpile scenarios, indicate that recycled tritiu will adequately support the Nation's nuclear weapons stockpile until approximately (figure 2.1-1). After that time, without a new tritium supply source, it would be necessary to use the strategic reserve of tritium to maintain the readiness of the weapons stockpile. The strategic reserve of tritium contains a quantity of tritium maintained for emergencies and contingencies. In such a scenario, once the strategi tritium reserve is depleted, the nuclear deterrent capability would degrade because all of the weapons in the stockpile would be capable of functioning as designed. Eventually, the nuclear deterrent would be lost. The proposed tritium supply and re facilities would provide the capability to produce tritium safely and reliably to m the Nation's defense requirements well into the 21st century while also complying w environment, safety, and health (ES&H) standards.

Figure (Page 2-2)
Figure 2.1-1.-Estimated Tritium Inventory and Reserve Requirements.

DOE has analyzed the activities that must take place to bring a new tritium supply 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 n tritium production can begin. Thus, to have reasonable confidence that the Nation w able to maintain an effective nuclear deterrent, prudent management dictates that D proceed with the proposed action now. In addition, DOE was required to meet a statu deadline of March 1, 1995, to issue a PEIS addressing tritium supply alternatives (Law 103-160, section 3145). That deadline was met by the issuance of the Draft Programmatic Environmental Impact Statement for Tritium Supply and Recycling in Feb 1995. Following public hearings, comments received have been considered in preparin Final PEIS, which will be submitted to Congress to close out DOE's obligation with to the intent of Public Law 103-160, section3145.

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