

52-6

"Programmatic Spent
Nuclear Fuel
Management &
Idaho National Engineering
Laboratory Environmental
Restoration & Waste
Management Programs Final EIS"



1. INTRODUCTION

The U.S. Department of Energy (DOE) is evaluating its options for two separate decisions pertinent to the management of the spent nuclear fuel (SNF) for which the a result, this Environmental Impact Statement (EIS) is divided into two parts. Vol programmatic (DOE-wide) approaches to the management of DOE's SNF; Volume 2 discuss approaches for environmental restoration and waste management activities at the Idaho Laboratory, including SNF management. This EIS has been prepared in accordance with Environmental Policy Act and its applicable implementing regulations (40 CFR Parts CFR Part 1021).

The DOE's proposed action for Volume 1 is to safely, efficiently, and responsibly and projected quantities of DOE's SNF through the year 2035, pending ultimate disposition been developed to support DOE's decisionmaking on the most appropriate location for strategies for managing DOE's SNF until its ultimate disposition is determined and planning purposes, it has been assumed that decisions regarding ultimate disposition long as 40 years to implement. The general environmental consequences of managing configurations at various sites are summarized in this volume.

Volume 1 is supported by site-specific appendices (under separate cover) that information on the consequences of management activities under each alternative at (Appendix A); Idaho National Engineering Laboratory (Appendix B); Savannah River Site (Appendix C); naval SNF management facilities, including management of naval SNF at (Appendix D); other generator/storage sites (Appendix E); and the Oak Ridge Reservation Test Site (Appendix F). This EIS does not select site-specific technical management Appendices A through F. The management options are representative of potential action sites under consideration.

Volume 2 addresses the Environmental Restoration and Waste Management Programs National Engineering Laboratory. DOE objectives for the next 10 years are to mitigate operations through environmental restoration and to treat, store, or dispose of waste Engineering Laboratory in a way that minimizes future adverse impacts.

Volume 3 summarizes the comments that DOE received on the Draft EIS during the period and provides responses to those comments. Volume 3 also discusses the external comments resulted in changes to this EIS and describes how to find specific comment responses.

a. The Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement (EIS)

1.1 Overview of Spent Nuclear Fuel in the DOE Complex

This section is an introduction to the nature, types, and quantities of DOE SNF and storage of SNF; and the current program structure as it existed in April 1995. What SNF is not included in this EIS as DOE SNF.

1.1.1 What is Spent Nuclear Fuel

Nuclear reactors use a process called fission to generate heat to produce electrical power to propel Navy ships and submarines. Production reactors have been used to produce materials at DOE facilities and radioisotopes for industrial and medical use. Some government facilities, and commercial establishments use nuclear reactors for research purposes, as well. Fuel that has been withdrawn from a nuclear reactor following fission elements of which have not been separated, is called spent nuclear fuel, or SNF. It includes uranium/neptunium target materials, blanket subassemblies, pieces of fuel, and debris.

fuel/targets (that is, fuel/targets with radiation levels low enough to permit hand remote operations), even though slightly irradiated, are not included. This material along with the other excess nuclear materials.

1.1.1.1 Configuration of Nuclear Fuel.

The fuel in a nuclear reactor consists of fuel assemblies that may range in number from one to several hundred, depending upon the reactor size and fuel assemblies. Fuel assemblies are constructed in many configurations consist of the fuel matrix, cladding, and structural hardware.

The fuel matrix contains the fissionable material (typically uranium oxide or matrix form is typically plates or cylindrical pellets. For gas-cooled reactors, particles. The cladding is the encapsulation (typically zirconium, aluminum, or steel the fuel, confining and protecting it. For gas-cooled reactors, this may be a ceramic particles.

The structural parts of a fuel assembly hold fuel in the proper configuration (typically water) over the fuel. Structural hardware is generally nickel alloys, stainless aluminum, or, for gas-cooled reactors, graphite. The size of a fuel assembly ranges from a kilogram (2.2 pounds) and a length of less than 1 meter (3 feet) to a weight of more (1,000 pounds) and a length of more than 3 meters (10 feet). Figure 1-1 illustrates an element.

Figure 1-1. Representative reactor fuel assembly and element.

1.1.1.2 Properties of Spent Nuclear Fuel.

When it is initially removed from a reactor, SNF is highly radioactive. A fraction of the initial mass of fissionable material (uranium converted into fission products, some of which are radioactive with half-lives ranging from thousands of years. At the time of withdrawal from the reactor, most of the radioactive fission products with very short half-lives. The radioactivity from SNF decreases rapidly after irradiation. After 1 year, the levels are about 1 percent of that at the time of removal. Levels have decreased by another factor of 10.

The radiation of most concern from SNF is gamma rays. Although the radiation is high, the gamma-ray intensities are readily reduced by shielding fuel elements with lead, steel, and water. The thickness of the required shielding is dependent on the source, the desired protection level, and the density of the shielding material. Requirements for concrete or lead are much smaller than for water.

The radioactivity produces heat, and the assemblies must be cooled for a period following removal from the reactor to prevent excessive fuel temperatures from being reached. SNF removed from reactors has been stored in water pools for a period of 3 to 18 months before transfer to other facilities for storage or processing. Storage systems are designed to maintain criticality (nuclear chain reaction).

Many fuel elements that are now SNF, particularly production reactor fuel, were dissolved in nitric acid for uranium-235 and plutonium recovery. Because the fuels are stored for short-term storage, prolonged storage sometimes presents problems. For example, sodium aluminum-clad fuels, corrode during prolonged storage in water pools unless the water pool is carefully controlled. Corrosion can result in cladding failures and the release of fission products, especially radioactive gases and readily soluble isotopes.

1.1.1.3 SNF Management Vulnerabilities.

Prolonged storage of some types of SNF has resulted in deterioration of the cladding, degradation of the fuel matrix, or other significant environmental, safety, and health concerns. DOE reported its evaluation of Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel in November 1993 (DOE 1993a). This evaluation was followed by a Plan of Action to Resolve Spent Fuel Vulnerabilities in February 1994, which identified three phases to resolve the vulnerabilities (DOE 1994a). This Phase I Action Plan, which addresses the most urgent activities, was

Phase II Action Plan was released April 1994 for public comment (DOE 1994b). The EIS was issued in October 1994 (DOE 1994c). Phases I, II, and III corrective actions include DOE SNF storage sites. Examples of corrective action projects include installing a new storage pool water quality at the Savannah River Site; transferring fuel from an old pool to a newer pool at the Idaho National Engineering Laboratory; removal of all fuel and 105-K basins at the Hanford Site.

Some of the SNF Action Plan activities could potentially result in emission and health effects are not individually analyzed because their impacts are no greater than the management activities reported and analyzed for each site in Volume 1 and the respective EIS. Successful completion of the corrective actions would reduce the potential for health effects to the workers and public and minimize degradation to the environment.

In addition to the Spent Fuel Working Group report on vulnerabilities and the action to resolve the identified vulnerabilities, the Defense Nuclear Facilities Safety Board Recommendation 94-1 (Conway 1994) calling for DOE to develop an expedited schedule to address identified vulnerabilities across the DOE complex. Recommendation 94-1 was critical in correcting known SNF management deficiencies. Further, Recommendation 94-1 lacks of prioritization of corrective actions and lack of an integrated systems approach to address identified SNF management issues. DOE has developed a plan for implementing Recommendation 94-1 across the DOE complex. DOE's Implementation Plan (DOE 1995a) for Recommendation 94-1 was submitted to the Defense Nuclear Facilities Safety Board on February 28, 1995. The plan prioritizes corrective actions to remedy known deficiencies utilizing a DOE cost-effective approach and considering limited budgets. The plan focuses on fulfilling outstanding commitments (for example, court-ordered milestones) and fully recognizes the urgency regarding SNF management issues.

1.1.2 DOE Spent Nuclear Fuel Management

For the purposes of this document, SNF is separated into two categories: DOE-managed SNF. The management of commercial SNF (with a few special-case exceptions) is outside the scope of this EIS and is not discussed further herein.

Since 1943, DOE and its predecessor agencies have generated more than 100,000 metric tons of heavy metal (MTHM) of SNF, of which about 2,700 metric tons remains. This SNF was generated from various programs in different types of reactors, including DOE defense production reactors, naval reactors, and DOE test and experimental reactors. In addition, DOE has accepted SNF from non-DOE sources, including United States university research reactors, special power reactors, and selected foreign research reactors.

In 1992, the Secretary of Energy directed the DOE to develop an integrated, long-term SNF management program. This program is assessing DOE's SNF and fuel storage facilities, consolidating many existing SNF activities into one program, deciding the most appropriate and reliable facility operation, and ensuring that issues associated with SNF are resolved safely. Solutions to the storage questions may require changes in the management strategies such as the construction of new facilities and stabilization of certain fuel. DOE has established a programmatic objective to define a management path and proceed toward the safe management of DOE-managed SNF, as outlined in DOE (1994d). A number of activities are currently in progress to address this objective. Appendix J, Spent Nuclear Fuel Management, provides an overview of technologies for SNF management.

a. The Atomic Energy Act of 1954, as amended, gives DOE the responsibility and ultimate authority for SNF. The Nuclear Waste Policy Act of 1982, as amended sets up the process for disposing of commercial nuclear power reactor SNF in a mined geologic repository and makes provisions for the ultimate disposition of that SNF. It also specifies the procedures for ultimate disposition of level waste and SNF.

b. Quantities of fresh nuclear fuel, SNF, and targets are traditionally expressed in terms of heavy metal (typically uranium), without the inclusion of other materials, such as moderators and structural materials. A metric ton equals approximately 2,200 pounds.

For various reasons, including the lack of characterization data on the integrity of certain SNF types and the fact that the acceptance criteria for ultimate disposition of SNF by DOE cannot yet make all the decisions for the full 40-year period. Therefore, this EIS is relating to deciding the locations of future SNF management activities.

DOE faces a number of major programmatic and site-specific decisions regarding SNF management over the next 40 years including

Where should DOE locate specific SNF management activities? Broadly, the include managing the SNF where it is and minimizing shipments; consolidat limited number of sites (the Decentralization, 1992/1993 Planning Basis, 4A and 4B alternatives); or consolidating the SNF at a central site.

What capabilities, facilities, and technologies are needed for SNF manager identified the need for SNF interim storage sites and must select appropr for meeting these needs under each of the SNF siting alternatives.

What research and development activities should support the SNF management

1.1.2.1 Current and Projected Spent Nuclear Fuel Inventories.

Table 1-1 summarizes the current inventories of SNF at DOE and other facilities and those projected to be ge 2035. These estimates are based on assumptions regarding reasonably foreseeable fu and the generation rates of SNF for which DOE is responsible. The principal SNF ge sites for SNF are described below and in Appendices A through F. Figure 1-2 illust well as representative points of entry for foreign fuels under consideration in thi

1.1.2.2 DOE Facilities.

During the last four decades, DOE and its predecessor agencies have transported, received, reprocessed, and stored SNF at various facilities in the nat Three of the DOE facilities have primary responsibility for managing DOE SNF; sever roles in SNF management.

Table 1-1. Spent nuclear fuel inventory.a

Generator or storage site ^b	Existing (1995)		Future increases (through 2035)		
	MTHMc	Percent	MTHMc	Percent	MTHM
DOE Sites					
Hanford Site	2132.44	80.6	0.00	0.0	2132
Idaho National Engineering Laboratory	261.23	9.9	12.92	13.5	274.
Savannah River Site	206.27	7.8	0.00	0.0	206.
Oak Ridge Reservation	0.65	<0.1	1.13	1.2	1.78
Other DOE Sites	0.78	<0.1	1.50	1.6	2.28
Naval Nuclear Propulsion Reactors	0.00 ^d	0.0	55.00	57.6	55.0
Foreign Research Reactor	0.00	0.0	21.70	22.7	21.7
Non-DOE Domestic					
Domestic Research and Test Reactors ^e	2.22	<0.1	3.28	3.4	5.50
Special-Case Commercial SNF at non-DOE locations ^f	42.69	1.6	0	0	42.6
Total^{g,h}	2646.27		95.53		2741
Percent of 2035 total	96.5		3.5		100.

a. Source: Wichmann (1995). Changes to the spent nuclear fuel (SNF) inventory cc Environmental Impact Statement were made to reflect updated inventories at domestic to remove materials that are contact-handled (i.e., materials unirradiated or sligh b. The Nevada Test Site does not currently store or generate SNF and is not expect c. MTHM = metric tons of heavy metal. One MTHM equals approximately 2,200 pounds. d. Existing inventory of naval SNF (10.23 MTHM) is included in the Idaho National e. Includes research reactors at commercial, university, and government facilities f. The total inventory of SNF from special-case commercial reactors is 186.41 MTHM

here is just that stored at the Babcock & Wilcox Research Center, Fort St. Vrain Re Demonstration Project. The remaining special-case commercial SNF is stored at the Laboratory, Oak Ridge Reservation, Hanford Site, and Savannah River Site and is inc table) for those sites.

g. Changes to the fuel inventory occurred due to recalculation of the Idaho Nation inventory at the Experimental Breeder Reactor-II and Hot Fuel Examination Facility handled fuel.

h. Numbers may not sum due to rounding.

Figure 1-2. Locations of principal spent nuclear fuel generators and storage sites years, until production was halted in 1989. Hanford's production reactors (includi N Reactor and Single-Pass Reactor) have generated 2100 MTHM of the existing DOE SNF actions at Hanford are focused on improving worker health and safety and protecting management activities include reducing water contamination levels, performing physi to assure facility safety for near-term storage, characterizing SNF condition, and for storage and/or ultimate disposition.

The SNF at facilities associated with the Hanford Site include N-Reactor SNF, SNF, Shippingport Core II SNF, Fast Flux Test Facility SNF, and miscellaneous speci experimental SNF. As shown in Table 1-1, the Hanford Site currently stores over 80 the current complex-wide SNF.

Idaho National Engineering Laboratory-The Idaho National Engineering Labc one of the principal centers in the DOE complex for nuclear research and developmen include continued safe storage of SNF, continued reactor operations, and onsite fue identified vulnerabilities.

As a result of its historic mission, the Idaho National Engineering Laboratory managing SNF for over 40 years. This site is the home of the Expanded Core Facilit Facility, which are central to the Navy's nuclear propulsion program. Currently, t 261 MTHM (about 10 percent) of DOE's SNF from a variety of DOE programs and a limit commercial and foreign sources.

Savannah River Site-The Savannah River Site was constructed in the early produce the basic materials used in nuclear weapons-primarily plutonium and tritium

Savannah River's production reactors have generated about 150 MTHM of the exis Most of the SNF from Savannah River Site reactor operations is stored underwater in reactor storage basins. These reactor disassembly basins were originally intended of production reactor SNF. Some of the SNF stored at Savannah River consists of ur steel or zirconium alloy, which Savannah River Site cannot process without facility activities include improving the use of existing storage facilities to provide for less corrosion-resistant aluminum-clad SNF. DOE currently manages approximately 20 8 percent) of its SNF at the Savannah River Site.

Oak Ridge Reservation-The Oak Ridge Reservation was originally developed the Manhattan Project-the effort to build the first nuclear weapons. The missions facilities include weapons dismantlement, storage of enriched uranium, maintaining technology research and development, and environmental management. Less than 1 MTH DOE's SNF is either in storage or being generated at several facilities at the Oak

Other Department of Energy Sites-A number of other DOE sites also store S principally from experimental and test reactors that have operated at many Departme Four of these DOE sites storing SNF are as follows:

Argonne National Laboratory-East has one reactor that is being decontamina decommissioned. This site currently manages 0.08 MTHM of SNF.

Brookhaven National Laboratory is generating and storing SNF at two facili Brookhaven High Flux Beam Reactor and the Brookhaven Medical Research Rea operating at the present time. This site currently manages 0.24 MTHM of

Los Alamos National Laboratory has SNF at the Omega West Reactor, which ha down since December 1992. There is 0.014 MTHM of SNF in storage at Los A

Sandia National Laboratories have reactors that operate as needed. These generate small quantities (0.4 MTHM) of SNF when shut down and defueled.

1.1.2.3 Navy Nuclear Propulsion Program.

Naval SNF is removed from naval reactors at shipyards and prototype sites and placed in shielded shipping containers. Since 19 nuclear-powered naval vessels and prototypes has been transported from shipyards an Naval Reactors Facility at the Idaho National Engineering Laboratory. The SNF is t shielded shipping containers and placed into a water pool at the Expended Core Faci each naval fuel assembly receives, as a minimum, an internal and external visual ex it performed as designed and to identify anomalies that would warrant more detailec examination, the SNF is loaded into shielded containers and transferred to the Idah Plant for storage.

Currently, four naval shipyards and one commercial shipyard (Norfolk, Puget Sc Pearl Harbor, and Newport News) and the Kesselring Site support the refueling of nu prototypes. Other naval shipyards that formerly supported defuelings and refueling Mare Island, are being closed because of military base closure decisions. An exist constructed to support the refueling of nuclear-powered aircraft carriers, is locat of the Puget Sound Naval Shipyard. To date, the facility has been used for refueli demonstrations and testing. The facility contains a radiologically controlled, hig Personnel Support Building, which provides office and other nonradiological support bay structure contains the water pool and general work areas. At Newport News, SNF vessels and temporarily stored near the removal site before transport.

1.1.2.4 Foreign Research Reactors.

In accordance with national nuclear nonproliferation goals, DOE has accepted (and is considering the renewal of the policy to accept) SN uranium of United States origin that was used in foreign research reactors. In Apr accept up to 409 additional SNF elements from eight foreign research reactors in se for storage at the Savannah River Site. One hundred fifty-three of these elements before an order by the court in the case of South Carolina v. O'Leary, No. 3:94-241 Carolina January 27, 1995) preventing the receipt of additional shipments. That or to the United States Court of Appeal for the Fourth Circuit. The United States Gov considering the acceptance of SNF from approximately 40 nations. This foreign rese estimated to amount to 21.7 MTHM and is the subject of the Environmental Impact Sta Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent N Section 1.2.5), due to be published in 1995.

1.1.2.5 Non-DOE Domestic.

This category includes non-DOE domestic, licensed facilities, including training, research, and test reactors at university, commercial establish government-owned installations for which DOE has contractual obligations to accept provides additional detail on these sites. These locations currently have less tha 1 percent of the existing DOE SNF.

Domestic Research and Test Reactors-Fifty-seven domestic non-DOE faciliti been licensed by the U.S. Nuclear Regulatory Commission, 38 of which are expected t of DOE SNF during the next 40 years. These facilities include colleges, universiti commercial establishments in the United States that use reactors for educational an reactors are of several different types and are used for training, experimentation, science and engineering. Some of these research sites have limited storage capacit rates. Table 1-2 provides a summary of these locations, the SNF currently at these of SNF they currently have stored plus projected generation through the year 2035.

Special-Case Commercial Power Reactors-DOE also has taken possession of S assemblies and complete or sectioned SNF rods from various commercial nuclear power be used to support DOE-sponsored research and development programs. By way of a

Table 1-2. Summary of domestic research and test reactors.

Type	Number of locations	MTHMa (RODb)	MTHMa (2035)
Universitiesc	29	2.01	4.96

Government, non-DOEc	5	0.11	0.42
Commericalc	4	0.10	0.12
Total	38	2.22	5.50

- a. MTHM = metric tons of heavy metal.
- b. ROD = Record of Decision, June 1995.
- c. See Appendix E of Volume 1 of this EIS for a discussion of these locations.

three-party agreement among the Public Services Company of Colorado, General Atomic Energy Commission, the DOE has agreed to provide dry storage at the Idaho National Laboratory for eight segments of Fort St. Vrain SNF (approximately 1,920 SNF elements of this SNF have been transported to the Idaho National Engineering Laboratory; the being stored at the Fort St. Vrain site. Other SNF in this category includes SNF f (Shippingport and Peach Bottom Unit 1); SNF used for destructive and nondestructive testing; SNF remaining at the West Valley Demonstration Project; SNF from fuel perf Babcock & Wilcox Research Center; and special-case SNF debris (Three-Mile Island Un Table 1-3 summarizes the types and quantities of special-case commercial power storage. This SNF currently is in storage at either the West Valley Demonstration New York, the Babcock & Wilcox Research Center in Lynchburg, Campbell County, Virgi Vrain facility in Colorado. Additionally, special-case commercial SNF (such as frc Peach Bottom, and Shippingport) is also stored at the Hanford Site, Idaho National Savannah River Site, and Oak Ridge Reservation.

1.1.3 Technologies for the Management of Spent Nuclear Fuel

DOE must safely manage SNF until its ultimate disposition. Some SNF, such as was designed for long-term operation and to survive combat conditions; therefore, i enough to retain its integrity during prolonged storage. Commercial reactor fuel i suitable for prolonged storage. The DOE will not select SNF technologies on the ba EIS. These technology-based decisions are most appropriately dealt with on a fuel specific basis.

Table 1-3. Special-case commercial power reactor spent nuclear fuel (SNF).

Storage location	Category	SNF in storage ^a
West Valley, NY	Light-water reactor fuel	125 elements
Lynchburg, VA	Light-water reactor partial fuel elements	3 full-length rods and 17 rods
Fort St. Vrain, CO	High-temperature gas-cooled reactor fuel	1,464 elements

- a. No additions projected through 2035.
- b. MTHM = metric tons of heavy metal. One MTHM equals approximately 2,200 pounds. of SNF currently at these locations is 43 MTHM.)

1.1.3.1 Storage.

Interim storage may be accomplished with either dry or wet storage technology. Wet storage normally involves the use of belowgrade water-filled pools. Dry storage shielded container for aboveground storage. Dry storage technologies range from th hold only a few fuel elements, to vaults that are capable of holding a large quanti normally constructed of steel or reinforced concrete, and vaults are normally const storage, a number of similar concepts have been used for commercial power reactor-t suitable for some of the DOE SNF. While both wet and dry storage are being evaluat management, dry storage has several unique advantages when heat dissipation is not advantages include lower emissions, simpler operation, lower cost, shorter times fc

and capability for licensing by the U.S. Nuclear Regulatory Commission, if required

1.1.3.2 Stabilization.

Stabilization may be necessary to provide safe interim storage of SNF. Stabilization technologies can be placed in three broad categories: containerization, fissile material separation, and processing with fissile material separation. Containerization processes such as canning, coating, and passivation. Canning involves placing the SNF in a durable construction (such as stainless steel). Coating involves depositing a protective layer to inhibit corrosion. Passivation involves treating the SNF to place exposed surfaces in a protective environment when the SNF is stored in either water or air.

Processing without fissile material separation involves processes such as direct element or oxidation of the fuel elements. Oxidation involves separation of the fuel from the cladding using oxygen at elevated temperatures [up to 800C (1,472F)]. The principal process for processing with fissile material separation is aqueous processing. Aqueous processing involves grinding down the fuel through mechanical means (shearing, chopping, cutting) or chemical means (acid dissolution, combustion, hydrolysis) and then chemically separating the fuel constituents. Aqueous processing would normally be followed by a vitrification process. The waste is processed into a glass or ceramic form. The Savannah River Site currently processes aluminum-clad fuel.

Appendix J provides more details on fuel management technologies. Appendices K and L provide details on the storage and stabilization technologies evaluated for each of the potential sites. These technologies are representative of those discussed above. This EIS uses the impact of these technologies to illustrate, at a programmatic level, the characteristics of implementing each programmatic alternative.

The DOE will conduct additional National Environmental Policy Act reviews for development and characterization activities that help select technologies for placement suitable for interim storage and ultimate disposition.

1.1.3.3 Transportation.

Depending on the SNF management options selected, some of the SNF may be moved one or more times before being transported. SNF is transported in massive shielded casks that can weigh above 100 tons. These casks must conform to both U.S. Nuclear Regulatory Commission and U.S. Department of Transportation regulations. Shipment by both rail and truck is common, with the chief advantage of rail being the ability to transport heavier, massive casks to transport more SNF per shipment.

The casks serve two functions: (a) providing gamma radiation shielding from the SNF so that the radiation level outside the casks meets regulatory requirements, and (b) providing containment of the SNF even in case of accidents. The casks are designed to withstand severe accidents. Because the SNF is generally metallic in form, most of the radiation is contained in the metal fuel even in maximum foreseeable transportation accidents. The risks to both rail and truck have been evaluated many times, most recently in Appendix I of this EIS, and have been found to be acceptable.

1.1.3.4 Ultimate Disposition.

In the Nuclear Waste Policy Act, as amended, Congress established a national policy for disposal of high-level waste and commercial SNF and directed DOE to characterize the Yucca Mountain site in Nevada for suitability as a national United States repository. That Act authorizes disposal of DOE SNF, as well as commercial SNF, in the first repository, subject to a limit on repository capacity and the payment of appropriate costs. For all other purposes, the DOE assumes that some or all of the SNF in its inventory that satisfies the acceptance criteria could be placed in the first geologic repository developed under the Act of 1982, as amended.

Although beyond the scope of this EIS, two broad strategies may at this point be considered for the ultimate disposition of DOE SNF. The DOE could (a) work toward direct disposal of DOE SNF in a geologic repository, or (b) chemically dissolve the fuel and produce a waste form (such as vitrified fuel) for repository disposal. Variations on these broad strategies are also possible, and are being given consideration. It is possible that some of DOE's SNF could qualify for direct disposal in a geologic repository.

characterization and, if appropriate, preparation programs would be necessary, and coordinated with plans to develop one or more repositories.

Sufficient quantity and quality of information is still not available to determine if the Yucca Mountain site is a suitable candidate for geologic disposal of SNF and high-level waste. The DOE, however, is in the early planning stages for a repository EIS, which is pursuant to the directives of the Nuclear Waste Policy Act of 1982, as amended. The DOE issued in mid-1995 a formal notice of its intent to prepare this analysis. The repository EIS will evaluate potential environmental impacts, based on the best available information available, and to support the Secretary's recommendation to the President, as required by the Nuclear Waste Policy Act of 1982. The repository EIS will examine the site-specific environmental impacts from construction and eventual closure of the repository, including potential post-closure radiological impacts. Until the repository EIS is complete, no final decision could be made concerning whether the site is accepted in a geologic repository.

As part of its SNF management program, DOE would (a) stabilize the SNF as needed for interim storage, (b) characterize the existing SNF inventory to assess compliance with acceptance criteria as they are developed, and (c) determine what processing, if any, is needed. Decisions regarding the actual disposition of DOE's SNF would follow applicable provisions of the National Environmental Policy Act, and would be subject to licensing by the U.S. Nuclear Regulatory Commission. This "path forward" would be implemented so as to minimize impacts on the schedule. The current planning assumption is that any DOE material (vitrified high-level waste and selected for emplacement in the first repository would be disposed of by the first repository. Disposition of the remaining DOE SNF and vitrified high-level waste that is not emplaced in the first repository would not be decided until the DOE recommendation on the need for a second repository is complete. The DOE would consider such factors as the physical and statutory limits of the first repository. The National Environmental Policy Act of 1982, as amended, requires DOE to make that recommendation between January 1, 2010.

Except perhaps for a need to develop them further, the technologies described and safe storage are available for the management of SNF and appear adequate to meet the requirements for disposal. Disposal in a repository, for example, may require canning, canistering, or processing the fuel to create a vitrified waste form. Resource recovery requires separating the fissile material from the waste and producing a stable waste form. These requirements have already been applied and are under continued development in several countries. Once the appropriate technologies can be identified and finalized to ensure safe disposal in an acceptable form for ultimate disposal.

1.2 Relationship to Other

National Environmental Policy Act Documents

DOE currently has a range of National Environmental Policy Act reviews planned or underway that are interrelated with or tier from this SNF management review. Because the scope of this review includes a wide variety of proposals, multiple National Environmental Policy Act reviews are necessary. Related reviews are identified in Table 1-4. Figure 1-3 graphically presents the relationship of the various National Environmental Policy Act reviews. Discussion in the following section is primarily on reviews with an interrelationship with this SNF management review. The reviews listed in Table 1-4 are site-specific reviews of SNF management, or individual project reviews that have a relationship to SNF management.

Table 1-4. Major National Environmental Policy Act (NEPA) reviews related to Volume 1 of the Environmental Impact Statement (EIS) as of March 1995.

Site	Subject
DOE (Headquarters)	Waste Management Programmatic EIS
	Programmatic EIS for Tritium Supply and Recycling
	Stockpile Stewardship and Management EIS
	EIS for a potential repository at Yucca Mountain for disposal of high-level radioactive waste

EIS on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Research Reactor Spent Nuclear Fuel

Storage and Disposition of Weapons-Usable Fissile Materials

Fabrication and Deployment of a Multi-Purpose Canister-Based System Management of Civilian Spent Nuclear Fuel

U.S. Navy Short-Term Storage of Naval Spent Nuclear Fuel (SNF)
West Valley Management of SNF in Storage at the West Valley Demonstration Project
Demonstration onsite dry storage)
Project

Savannah River West Valley Demonstration Project Completion and Site Closure
Urgent-Relief Acceptance of Foreign Research Reactor SNF

Oak Ridge Interim Management of Nuclear Materials at Savannah River Site
Reservation High Flux Isotope Reactor SNF storage reracking

Idaho National High Flux Isotope Reactor Dry Storage Pad
Engineering Programmatic SNF and Idaho National Engineering Laboratory Environment
Laboratory Restoration and Waste Management, Volume 2

Fort St. Vrain Fuel Shipments to the Idaho Chemical Processing Plant

Test Area North Pool Stabilization Project (also known as Dry Cask Storage Project)

Nevada Test Site Nevada Test Site and Other Off-Site Test Locations Within the State
Site-Wide EIS

Hanford Site 105-KE and 105-KW Basins Fuel Encapsulation and Repackaging, 100-K Basins

Transfer of Plutonium Uranium Extraction Plant and N-Reactor Irradiation Encapsulation and Storage at the K-Basins

Shutdown of the Fast Flux Test Facility

Relocating TRIGA Reactor Fuel from 308 Building (covers SNF, light fuel, and unirradiated fuel)

Characterization of Stored Defense Production SNF and Associated Material at Hanford Site, Richland, Washington

Hanford SNF Management EIS

Preparation of an EIS for Management of SNF from the K-basins at the Site, Richland, Washington

- a. The Nuclear Weapons Complex Reconfiguration Study was replaced by two separate Programmatic EIS for Tritium Supply and Recycling and the Stockpile Stewardship and Environmental Assessment (EA): A concise public document provided by a Federal agency determining whether to prepare an EIS or a Finding of No Significant Impact (FONSI)
- b. After the FONSI was issued, one shipment of foreign research reactor fuel was a State of South Carolina resulted in an order preventing the receipt of additional shipments 2419-0 (D.S.C. January 27, 1995). That order is currently on appeal to the United States District Court.
- c. The EA and FONSI were determined by the District Court to be inadequate. Volun- tarily, the DOE is preparing an EIS for the management of SNF from the Fort St. Vrain fuel.
- d. TRIGA: Training, research, and isotope reactors built by General Atomics.

Figure 1-3. Interrelationships of National Environmental Policy Act reviews relate to the management of DOE SNF. This review and the Record of Decision will be summarized in the DOE Waste Management Programmatic EIS, currently in development. Programmatic EIS for nuclear weapons disposition and weapons-usable fissile materials will also provide input to the DOE Waste Management Programmatic EIS. This SNF EIS will provide input to the EIS for the management of SNF from foreign research reactors. Except for special-case commercial reactors, comme

evaluated in this SNF EIS. DOE is also preparing an EIS for a multipurpose canister National Environmental Policy Act reviews for DOE and commercial SNF will be prepared. Table 1-4 and Figure 1-3 also identify site- or project-specific National Environmental Policy Act reviews currently planned or underway. This Volume 1 is a DOE-wide programmatic EIS that provides a range of strategic alternatives for the management of SNF. As such, this document is intended to provide National Environmental Policy Act review of related and potential National Environmental Policy Act documentation, DOE is able to look at the overall group of connected actions. Lower-tier reviews provide more specific and detailed reviews and projects that stem from the programmatic decisions. The tiering of National Environmental Policy Act reviews as they relate to this SNF management review is shown schematically in Figure 1-1. This programmatic EIS does not replace site-specific or project-specific National Environmental Policy Act documentation, except where adequate coverage is provided in this EIS to evaluate impacts. For the Idaho National Engineering Laboratory, the site-specific documentation is provided in Volume 2 of this EIS.

1.2.1 Waste Management Programmatic Environmental Impact Statement

DOE is currently analyzing nationwide and site-specific alternative strategies for DOE's waste management program. The nationwide analyses will be part of the Waste Management Programmatic Environmental Impact Statement (PEIS) (previously known as Waste Management Programmatic Environmental Impact Statement). This PEIS evaluates proposed actions regarding the

Type, size, and number of waste storage, treatment, and disposal facilities to be built, including the transportation network

Proposed action formulating and implementing an integrated Waste Management

Alternative configurations for each waste type (except hazardous waste) to provide a framework for siting future facilities at specific locations.

The alternatives are structured to ensure analysis of the impacts of the mixed waste management alternatives will be defined in the site treatment plans developed pursuant to the Federal Facility

The Draft Waste Management PEIS is scheduled to be available for public and agency comment by mid-1995. Although the DOE Waste Management PEIS was originally intended to provide programmatic analyses of alternatives for SNF management, these analyses are also provided in the Waste Management PEIS. The Waste Management PEIS is expected to summarize and consider, as part of its analysis, the environmental consequences, the impacts of the SNF alternatives identified in this

1.2.2 Programmatic Environmental Impact Statement for Tritium Supply and Recycling

The Nuclear Weapons Complex Reconfiguration Program has evolved considerably since the issuance of the Notice of Intent to prepare a Nuclear Weapons Complex Reconfiguration PEIS was issued. DOE has now separated the Nuclear Weapons Complex Reconfiguration EIS into two programs: (a) a PEIS for Tritium Supply and Recycling (expected completion in November 1995) and (b) a PEIS for Stewardship and Management PEIS. In the original Notice of Intent, DOE proposed to reconfigure the Nation's nuclear weapons complex to be smaller, less diverse, and less expensive to operate. This offered the advantage of enabling the closure and remediation of the Mound and Rockwell sites. No new plutonium or highly enriched uranium storage facilities were envisioned. A new plutonium production facility was being planned as part of a separate New Production Reactor Program. The New Production Reactor Program was incorporated into the Reconfiguration PEIS. DOE's decision to reconfigure the Nation's nuclear weapons complex since then for many reasons, but primary among them is the end of the Cold War. The reconfiguration includes the significant reduction in the size of the Nation's stockpile of nuclear weapons and the requirements for production of tritium.

Accordingly, the Tritium Supply and Recycling PEIS addresses alternatives associated with tritium production and the recycling of tritium recovered from weapons being retired. Alternative technologies for producing tritium are planned to be analyzed at five locations: the Nevada Test Site, River Site, Oak Ridge Reservation, the Pantex Plant, the Idaho National Engineering Laboratory, and the Nevada Test Site). The PEIS was issued in draft form February 28, 1995.

1.2.3 Stockpile Stewardship and Management Environmental Impact Statement

The Stockpile Stewardship and Management Environmental Impact Statement was ori the Nuclear Weapons Complex Reconfiguration Programmatic Environmental Impact State 1.2.2). DOE expects to begin the scoping process for the Stockpile Stewardship and 1995. Stockpile stewardship includes activities required to maintain a high level reliability, and performance of nuclear weapons in the absence of underground testi test weapons if directed by the President. Stockpile management activities include repair, or replacement of weapons in the existing stockpile. The review will take information on current and projected future stockpile requirements.

1.2.4 Storage and Disposition of Weapons-Usable Fissile Materials Programmatic

Environmental Impact Statement

In response to the President's Nonproliferation and Export Control Policy issue the Department created a separate Department-wide project for developing recommenda directing implementation of decisions concerning disposition of excess nuclear mate DOE proposes to develop a comprehensive national policy for the management and disp materials (primarily separated plutonium and highly enriched uranium, but also othe including neptunium, americium, and uranium-233) that are no longer required for mi

1.2.5 Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research

Reactor Spent Nuclear Fuel Environmental Impact Statement

DOE proposes to adopt and implement a policy concerning management of SNF conta uranium that originated in the United States and was used by foreign research react policy, the United States may manage approximately 22,750 elements (19.2 MTHM) of h uranium or low-enriched uranium SNF during a 10-year period from foreign research r approximately 40 nations. Alternative methods of implementing the proposed action alternative are being analyzed in an EIS. DOE will not make a final decision on th these foreign research reactors until after the EIS for the Proposed Nuclear Weapon Concerning Foreign Research Reactor SNF and this programmatic SNF EIS are both comp these EISs are scheduled to be completed in 1995.

The proposed action would support the nuclear nonproliferation policy of the Un removing the highly enriched uranium from these reactors from international commerc of this policy could result in the receipt of foreign research reactor SNF at one c entry and overland transport to one or more DOE sites for storage and/or processing

1.2.6 Fabrication and Deployment of a Multipurpose Canister-Based System for the

Management of Civilian Spent Nuclear Fuel Environmental Impact Statement

This environmental impact statement is addressing the potential environmental i with alternative systems for storage and transport of SNF assemblies for civilian a will analyze the following: (a) manufacturing of multipurpose canister system comp and handling of SNF as it is transferred to canisters or casks, (c) canister transf storage of SNF in canisters and casks at the reactor sites, (e) SNF transport from hypothetical monitored retrievable storage facility and/or repository, (f) handling hypothetical monitored retrievable storage facility, and (g) surface activities inv disposal of SNF at a repository.

The multipurpose canister-based technology may have application for DOE and Nav

1.2.7 Environmental Impact Statement for a Potential Repository at Yucca Mountain for

Disposal of High-Level Radioactive Waste

Under the Nuclear Waste Policy Act of 1982, as amended, DOE is investigating the Yucca Mountain, Nevada, site as the nation's first licensed geologic repository for radioactive waste. The Nuclear Waste Policy Act of 1982, as amended, requires that of a repository site to the President must be accompanied by an EIS. DOE has tentatively issued a Notice of Intent for the repository EIS for 1995 and the Record of Decision for 200 potential disposal site for DOE SNF.

1.3 Scope of this Volume

1.3.1 Scoping Process

On October 22, 1990, DOE published a Notice of Intent in the Federal Register to prepare a PEIS addressing environmental restoration and waste management (including activities across the entire DOE complex. DOE then invited the public to submit written comments on the scope of the PEIS, held 23 scoping meetings across the country, and issued a draft Implementation Plan in January 1992 reflecting the comments provided. DOE held six regional public workshops in January 1992. The Implementation Plan and recorded public comments given at these workshops. The final PEIS was issued in January 1994 and addressed the comments received from scoping workshops.

On October 5, 1992, DOE published a Notice of Intent to prepare an EIS for Environmental Restoration and Waste Management at the Idaho National Engineering Laboratory in Idaho. The notice invited Government agencies and the public to participate in five scoping meetings in Idaho and to provide written comments. Oral testimony from the meetings was transcribed and available at DOE public reading rooms. The comment period lasted from October 5, 1992, to October 19, 1992.

On September 3, 1993, DOE published a Notice of Opportunity to Comment in the Federal Register proposing to expand the scope of the Idaho National Engineering Laboratory Environmental Restoration and Waste Management EIS to include impacts related to transportation, receipt, process, and disposal of SNF at locations other than the Idaho National Engineering Laboratory. This comment period began on September 3, 1993, and ended on October 4, 1993. Government agencies and the public were invited to provide comments on the DOE Programmatic SNF and the Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS. A toll-free telephone number was provided for questions, requests for documents or other information, and for the public to submit comments that were transcribed for DOE's consideration. The Implementation Plan (issued in May 1993, and amended on May 9, 1994) for this EIS summarizes these comments and DOE's responses.

As existing large-scale SNF management operations, the Hanford Site at Richland, Washington; the Idaho National Engineering Laboratory in southeastern Idaho; and the Savannah River Site in South Carolina, were logically identified as reasonable site alternatives for SNF management in the 1993, Implementation Plan. In addition, four Navy shipyards and the Kesselring Site (New York) with years of SNF handling experience were identified for consideration in the EIS. The four Navy shipyards are the Norfolk Naval Shipyard, Portsmouth, Virginia; the Portsmouth Naval Shipyard, Kittery, Maine; the Pearl Harbor Naval Shipyard, Honolulu, Hawaii; and the Puget Sound Naval Shipyard, Bremerton, Washington.

In response to public scoping comments, DOE committed to consider other sites for SNF management in an effort to broaden the range of reasonable alternatives for locations at which SNF management could be conducted. DOE developed a screening process, which resulted in selection of the Yucca Mountain, near Oak Ridge, Tennessee, and Nevada Test Site, near Mercury, Nevada, as alternatives for regionalized or centralized SNF management (DOE-ID 1994). The EIS was amended on May 9, 1994, to reflect this addition.

1.3.2 Scope

1.3.2.1 Programmatic Spent Nuclear Fuel Disposition.

1.3.2.4 Programmatic Spent Nuclear Fuel Transportation.

The EIS includes an analysis of the potential impacts of SNF transportation, including safety and emergency preparedness review of the safety record for past SNF transportation activity is included, along with transportation impacts from normal transport and from transportation accidents.

Transportation modes and routes deemed reasonable for SNF shipment have been an estimate potential risks to worker safety, public health, and the environment. Fees that place restrictions on certain aspects of SNF shipment and limits on shipment size and number of shipments have been accounted for in the analyses. Hazardous materials for each shipment of SNF, include information on the carrier, the materials involved and the containers.

The potential impacts of transporting nuclear fuel for ultimate disposition will appropriate National Environmental Policy Act documentation. Therefore, an alternative directly to a repository is not considered in this EIS.

1.3.2.5 Special-Case Commercial Fuels.

This EIS addresses the management of certain small quantities of special-case commercial SNF for which DOE has responsibility. Some are being managed at DOE facilities; some are being managed at non-DOE facilities.

1.3.2.6 Naval Spent Nuclear Fuel.

This EIS addresses the impacts of and alternatives to transporting, receiving, and storing SNF from naval reactors (Navy warships and a number of sites across the country, including sites near the point of refueling or includes alternative sites for naval fuel examination, as well as the possibility of examination. This EIS addresses existing naval SNF inventories and fuel to be generated refuelings and defuelings.

1.4 Response to Public Comments

Volume 3, Response to Public Comments, was added to this EIS to fully address a public comments. In addition, DOE considered public comments, along with other factors programmatic need, technical feasibility, and cost, in arriving at DOE's preferred public comment period for the Draft EIS, more than 1,430 individuals, agencies, and DOE with comments. A broad spectrum of private citizens; businesses; local, state, Native American tribes; and public interest groups are represented within this volume. Comments were received from all affected DOE and shipyard communities.

Volume 3 summarizes the comments on the EIS received by DOE during the public comment and provides responses to those comments. In addition, Volume 3 explains how public the selection of the preferred alternatives, discusses the extent to which public comment to the EIS, and describes how to find specific comment summaries and responses in the

Responses to comments consist of two parts. The first part summarizes the comments; the second part responds to the comment(s). Identical or similar comment(s) were frequently from one commentator and, in such cases, DOE grouped the comments and prepared a single group. This summarization was also appropriate due to the large volume of comments.

In compliance with National Environmental Policy Act and Council on Environmental regulations, public comments on the Draft EIS were assessed and considered both individually collectively by DOE and the Navy. Some comments resulted in modifications in the EIS; why comments did not warrant further response. Most comments not requiring a change in a response to correct factual misinterpretations, to explain or communicate the scope of the EIS, to explain the relationship of the EIS to other related policies, to explain the relationship of the EIS to other related National Environmental Policy Act issues, to refer commentors to information in the EIS, to answer technical questions, or to address issues. The Record of Decision will include the decision made by the Secretary of

consider public comments on the Draft EIS.

1.4.1 How DOE Considered Public Comments in the National Environmental Policy Act

Process

As required in the Council on Environmental Quality regulations [40 CFR 1502.14] preferred alternatives are identified in the Final EIS. The preferred alternatives identified based on the consideration of environmental impacts, regulatory compliance, programmatic missions, public issues and concerns, national security and defense, and public input considered in the decisionmaking and preferred alternatives selection process. Public desires, and opinions regarding the activities addressed in the EIS and expectation management decisions on complex-wide programmatic SNF management and environmental waste management programs at the Idaho National Engineering Laboratory. Public input development of performance factors, defined as desirable attributes or characteristics, relative acceptability of alternatives, which were used to select candidate preferred alternatives were then evaluated against a number of technical sensitivities, including public perception of environmental impact, indicated stakeholder implementation flexibility, regulatory risk, SNF processing potential, environmental resistance to implementation, and fairness. DOE's preferred alternative reflects that SNF should be actively managed in preparation for ultimate disposition. In addition, DOE supports the implementation of a path forward for the ultimate disposition of SNF, as determined by the public. The EIS, including its preferred alternatives, will be considered along with other factors, in arriving at a decision to be documented in a formal Record of Decision.

1.4.2 Changes to the Environmental Impact Statement Resulting from Public Comment

A major purpose of the National Environmental Policy Act is to promote efforts to eliminate damage to the environment by ensuring informed decisionmaking on major Federal actions significantly affecting the quality of the human environment. Consideration of public comments in the EIS helps to ensure that the EIS is an adequate decisionmaking tool; accordingly, DOE has responded, as appropriate, in response to public comments. While a number of specific issues identified by commentors, none of the issues or concerns identified new reasonable alternative actions that resulted in significant change in the results of the analysis of the potential environmental impacts.

Based on review of public comments, coupled with the consultations held with commentors as well as State and tribal governments, the main EIS enhancements include the following: Seismic and water resources discussions were reviewed, clarified, and enhanced; additional alternative sites, and current data and analyses were added to Volumes 1 and 2; A discussion of potential accidents caused by a common initiator was added; stabilizing some of DOE's SNF (specifically from the N Reactor) by processing at facilities located overseas was added, thus enhancing the processing option in the EIS. An analysis of barge transportation was added to the EIS, with respect to transporting N-Reactor fuel to a shipping point for overseas processing, as well as the potential transport of Brookhaven National Laboratory SNF to another site. In addition, an analysis of shipboard fires was added, primarily in response to comments related to receiving SNF containing uranium of U.S. origin from foreign sources.

In Volume 2 of the EIS, the air quality analysis was revised to upgrade the baseline conditions and impacts of alternatives in terms of the amount of Prevention of Significant Deterioration (PSD) increment consumed, thus updating the baseline conditions for the Idaho National Engineering Laboratory. Additionally, the Waste Experimentation Facility project summary was enhanced and clarified. This EIS was also revised to reflect current projections of employment, including the projected downsizing of the Idaho National Engineering Laboratory due to contractor consolidation.

In response to public comments, a brief summary of the results of a separate cost analysis of the various alternatives was added to the EIS, although the cost analysis was performed independently of the EIS for additional purposes. The discussion regarding the management of Fort St. Vrain SNF currently stored in Colorado was expanded. As committed to in the Draft EIS, the evaluation and discussion of environmental justice has been expanded in both Volumes 1 and 2 of the EIS. This analysis

interim DOE guidance in the absence of interagency policy in this regard and public comments received regarding environmental justice. Consultation with Native American tribes is reflected in the environmental justice analysis, various sections of the EIS, as appropriate.

Other enhancements include a clarification that potential shipment of SNF of U.S. origin from foreign research reactors consists of a bounding estimate in addition, as a result of public comments, Volume 1 of the EIS was enhanced to show the relationship between current DOE National Environmental Policy Act actions and the relationship between the EIS and the Spent Fuel Vulnerability Assessment. Likewise, the relationship between the EIS and the Spent Fuel Vulnerability Assessment is clarified in this EIS. With respect to the naval SNF, Appendix D of Volume 1 more fully explains the import of naval SNF and to discuss potential effects at naval shipyards.





2. PURPOSE AND NEED FOR AGENCY ACTION

DOE, according to the Atomic Energy Act of 1954, as amended, is responsible for maintaining a capability to manage nuclear materials [Atomic Energy Act Sections 110 and 111]. During the last four decades, DOE and its predecessor agencies have transported, reprocessed approximately 100,000 MTHM of SNF from various sources, including DOE reactors; the Naval Nuclear Propulsion Program; DOE, university, and other research reactors; special case commercial power reactors; and certain foreign research reactors. Approximately 100 MTHM of additional SNF is projected to be received in the next 40 years in a wide range of enrichments, types, and conditions.

The end of the Cold War led DOE to reevaluate the scale of its weapons production, propulsion, and research missions. In April 1992, the Secretary of Energy directed the reprocessing of SNF for recovery and recycling of plutonium and highly enriched uranium from the nuclear weapons stockpile. In 1993, a DOE report (a) documented current and potential health and environmental vulnerabilities regarding existing DOE SNF storage facilities. The report identified degraded fuel cladding integrity and other problems that require action to ensure efficient and responsible management of SNF. As a result of the Secretary's directive and the information in the DOE report, the program is being reevaluated, and DOE is working to manage existing and projected quantities of spent nuclear fuel more efficiently, and responsibly manage existing and projected quantities of spent nuclear fuel pending ultimate disposition.

As part of establishing an effective SNF Management Program, DOE needs to make strategic decisions for the management of SNF for the next 40 years, including (a) management activities, after evaluating existing and potential locations, (b) the facilities, and technologies for SNF management, and (c) the research and development needed to support the SNF Management Program.

Volume 1 of this EIS focuses on strategies for where to conduct SNF management activities. Decisions on the site-specific and technical implementation of the program, and the timing of implementation, would be made after subsequent, tiered National Environmental Policy Act reviews, as described below.

a. Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental, Safety and Health Impacts (DOE 1993b.)





3. ALTERNATIVES

Chapter 3 describes a range of programmatic alternatives for managing the DOE within the DOE complex and at non-DOE generator sites. These alternatives also are projected to be generated through the year 2035. Figure 1-2, given in Chapter 1, is the United States where DOE SNF is being generated and stored.

The five alternatives analyzed in Volume 1 of this EIS are summarized in the box to the right. These alternatives, which are consistent with the alternatives under consideration for the DOE Waste Management Programmatic EIS, present a range of programmatic approaches for managing existing and projected SNF inventories. The alternatives involve varying amounts of SNF shipments, levels of fuel stabilization, numbers and types of storage facilities, and the scope of research and development efforts for SNF management technologies.

Summary of Alternatives for the Management of DOE Spent Nuclear Fuel

No Action

Take minimum actions required for safe and secure management of SNF at or close to the generation site or current storage location.

Decentralization

Store most SNF at or close to the generation site or current storage location, with limited shipments to DOE facilities.

1992/1993 Planning Basis

Transport and store newly generated SNF at the Idaho National Engineering Laboratory or Savannah River Site. Consolidate some existing fuels at the Idaho National Engineering Laboratory or at the Savannah River Site.

Regionalization

Distribute existing and projected SNF among DOE sites based primarily on fuel type (Regionalization 4A) or geographic location (Regionalization 4B).

Centralization

Manage all existing and projected SNF inventories at one site until ultimate disposition.

The programmatic action that DOE ultimately selects is not necessarily limited to the alternatives presented. A hybrid alternative could, for example, be developed that combines one or more of the five alternatives analyzed. Moreover, the programmatic decision-making process should consider site-specific SNF management options. If appropriate, the decisions would be made consistent with National Environmental Policy Act evaluations.

In developing the alternatives, the need to comply with applicable regulations and orders was assumed. Under some of the alternatives (for example, No Action and Decentralization), domestic research reactor SNF, and potential agreements to accept foreign r

Under all alternatives, actions to resolve outstanding SNF management deficiencies according to the Defense Nuclear Facilities Safety Board Recommendation 94-1 Implement be implemented as appropriate. The Defense Nuclear Facilities Safety Board 94-1 Implement be balanced with other factors such as budgetary constraints and public comments. DOE would consider ways to reduce costs for the management of SNF.

Some of the alternatives include references to transition periods. These can be of time needed to fully implement the alternative, if selected. Transition periods depending on the time required to plan, design, procure, or construct equipment and implement the alternative. Activities taking place during transition periods would be activities associated with one or more of the defined alternatives. Therefore, environmental transition period activities are bounded by the impacts assessment for the defined alternative.

The DOE SNF Management Program is intended to (a) provide interim storage and management of SNF at specified locations until ultimate disposition, (b) stabilize the fuel as required for safe storage and protection of human health (for both workers and the public), (c) increase capacity, replacing facilities that cannot meet current standards and provide additional capacity for SNF generated, (d) conduct research and development initiatives to support safe storage and (e) examine SNF generated by the Naval Nuclear Propulsion Program. The possibility of SNF into a form that meets the acceptance criteria of geologic repositories is beyond the scope of the subject of future National Environmental Policy Act review.

The planning period for this EIS is 40 years, beginning with the issuance of the Record of Decision (that is, baseline conditions in June 1995) and extending through the year 2035. The 40-year timeframe may be required to make and implement decisions on the ultimate disposition of SNF. Detailed impact analyses are performed for the time period from 1995 to 2005. Norms are then projected for the remaining 30 years.

Decisions as a result of this EIS apply to actions taken by DOE and the Navy during the Record of Decision through the interim storage period. At the present time, interim storage have been curtailed. However, limited shipments of SNF from Navy shipyards have occurred in preparation of the EIS. Shipments from sources such as universities and foreign research facilities for urgent relief have also occurred. These shipments are in accordance with existing facility compliance agreements, and Council on Environmental Quality regulations. If an alternative is selected in the Record of Decision, all such shipments would cease at the beginning of the transition period.

After considering a number of elements, DOE has identified Regionalization 4A as the preferred alternative. DOE arrived at its preferred alternative through a management process, which included developing screening and performance criteria. Requirements that an alternative must satisfy to be further evaluated; performance attributes or characteristics that help distinguish the relative merit of each alternative; and screening criteria. After applying the screening criteria, additional management criteria (nontechnical), discussed below, were used to arrive at the final preferred alternative.

The screening and performance criteria were developed considering the following: (a) environmental impact, (b) environmental regulatory compliance, (c) DOE and SNF management, (d) public comments, (e) national security mission, (f) cost, and (g) DOE mission.

Each alternative was first evaluated based on the following screening criteria:
Resolving vulnerabilities consistent with DOE's Plan of Action to Resolve Vulnerabilities (DOE 1994a, b, c)

Complying with all applicable Federal and state environmental laws and regulations, orders, and Federal facility agreements

Maintaining backup capabilities for SNF management to limit interruptions in program activities

Providing the capability for 100 percent examination of naval SNF

Providing technology development for SNF treatment, storage, and ultimate disposition

Those alternatives that did not satisfy all of the screening criteria were not considered. These were No Action, Decentralization A and B, and Centralization. The remaining alternatives, Planning Basis, Decentralization C, and Regionalization 4A and 4B, met all of the screening criteria and were then evaluated based on optimizing overall performance relative to the following performance criteria:

Minimizing transport of SNF

Minimizing environmental impact

Assuring lowest cost consistent with mission accomplishment

Maximizing support for DOE's National SNF Program to achieve safe storage for final disposition

Maximizing DOE's ability to honor new and historical commitments and contr

Applying these performance criteria, two of the four remaining alternati and Regionalization 4A, rated the highest, so they were determined to be candidates alternative. These candidate alternatives were then evaluated against a number of considerations, including environmental impact perception, indicated stakeholder pr factors, regulatory risk, SNF processing potential, environmental justice, and fair resulted in Regionalization 4A being identified as the preferred alternative, becau supports a path forward for ultimate disposition of the SNF. Additional informati be found in Section 3.1.4.

While the Nevada Test Site is analyzed in this EIS as an alternative site for activities, DOE did not consider it to be a preferred site for the management of SN Nevada's current role as the host site for the Yucca Mountain Site Characterization Test Site's lack of SNF management facilities and high-level waste infrastructure.

The DOE's preferred alternative is consistent with the Navy's preferred altern conduct refueling and defueling of nuclear-powered vessels and prototypes, and to t National Engineering Laboratory for full examination and interim storage, using the past. Details and analyses supporting the Navy's preferred alternative can be four Volume 1.

The remainder of this chapter is comprised of three sections. Section 3.1 sur and the implications for each site. Section 3.2 discusses the alternatives elimina Section 3.3 provides a brief comparison of the potential environmental impacts assc alternative.

3.1 Overview of Alternatives Considered

Section 3.1 and Tables 3-1 through 3-5 discuss the potential actions at each s implementing each of the alternatives.

Table 3-1. Summary of the No Action alternativeTable 3-2. Summary of the Decentrali

No Action Alternative

Take minimum actions required for safe and secure management of SNF at or close to the generation site or current storage location.

After an approximate 3-year transition period, no transport of SNF to or from DOE facilities would occur.

Stabilization activities would be limited to the minimum actions required to safely store SNF.

Naval reactor SNF would be stored at naval sites.

Facility upgrade/replacement and onsite fuel transfers would be limited to those necessary for safe interim storage.

Existing research and development activities would continue.

3.1.1 No Action

The No Action alternative is an alternative required under the Council on Environmental Quality regulations for implementing the National Environmental Policy Act of 1969. Under the No Action alternative, DOE would limit actions to the minimum necessary for safe and secure management of

SNF at the generation site or current storage location.

Under this alternative, small and large DOE sites, naval sites, university and other non-DOE domestic reactors, and foreign research reactors would all independently manage. Generally, after an appropriate transition period SNF shipments between sites for now would be discontinued, including those SNF shipments currently allowed by court ordered compliance agreements. Figure 3-1 indicates SNF inventories. The technology developed to SNF management, limited to activities already approved, would continue within DOE. Figure 3-1 shows the distribution of fuel from 1995 through 2035.

The following subsections highlight actions associated with the No Action alternative being considered for SNF management.

3.1.1.1 Hanford Site.

Under the No Action alternative at the Hanford Site, only those actions deemed necessary for the continued safe and secure management of the SNF would be considered. Existing SNF would be maintained close to its current storage locations and there would be no upgrades. Activities required to safely store SNF would continue.

Specific actions proposed for the near term include proceeding with the characterization of production reactor fuel to establish safe interim storage limits, containerizing the fuel in the basin by 1998, procuring the first 10 dry storage casks for the Fast Flux Test Facility cask storage if required for safety reasons (with emphasis on Fast Flux Test Facility sodium), and possibly consolidating SNF from defense production at the 105-KW reactor. Figure 3-1. Spent nuclear fuel distribution, location, and inventory for the No Action

3.1.1.2 Idaho National Engineering Laboratory.

For the No Action alternative, DOE would maintain SNF close to defueling or current storage locations with minimal facility upgrades. The Idaho National Engineering Laboratory would neither receive nor transport SNF during a transition period of about 3 years (see Section 3.1.1.6). After the transition period, SNF would be transferred to the Idaho National Engineering Laboratory, and the Expanded Chemical Processing Plant would be shut down. DOE would continue to transfer SNF to the Idaho Chemical Processing Plant until the existing storage capacity is used.

DOE would continue operating existing SNF-related facilities at the Idaho National Engineering Laboratory. Because of the deteriorated condition of some of the fuel stored under the Underwater Fuel Storage Facility, additional characterization and canning capabilities would be needed to stabilize the fuel for safe transport and subsequent storage. DOE has scheduled the purchase of new fuel characterization and canning equipment in the Irradiated Fuel Storage Facility to provide these capabilities. DOE would perform other required stabilization of SNF at the Idaho National Engineering Laboratory in either the Remote Analytical Laboratory or the Fluorinel Cell. DOE would not start any new projects to increase SNF interim storage capacity.

SNF research and development would be limited. Existing SNF management research and development projects would continue, but the development of technology for the ultimate storage would cease. Existing facilities, such as the Process Improvement Facility, the Remote Analytical Laboratory, and the Pilot Plant Facility, would support continuing research and development.

3.1.1.3 Savannah River Site.

For the No Action alternative, DOE would use the existing Savannah River Site facilities for extended wet storage of its current SNF inventory. The Savannah River Site would not transport any SNF offsite and would not receive any SNF. Only onsite rearrangement would take place. DOE would temporarily move fuel currently on the site to other facilities to accommodate facility upgrades.

Six Savannah River Site facilities are used for the storage of SNF: the Receiving Basin, K-Reactor Disassembly Basin, L-Reactor Disassembly Basin, P-Reactor Disassembly Basin, and H-Canyon. Most of the fuel is located in the Receiving Basin for Offsite Fuel,

Disassembly Basin, and the F-Canyon. DOE would accomplish onsite transfers as required for the safety of aluminum-clad fuel. The Receiving Basin for Offsite Fuels and an upgrade would be utilized for continued storage of this fuel. Additionally, DOE would place the aluminum cladding in degrading containers because of corrosion, to minimize the spread of radioactive material in case the cladding is breached. DOE would continue existing SNF-related research and development activities.

3.1.1.4 Oak Ridge Reservation.

Under the No Action alternative, the Oak Ridge National Laboratory, which is on the Oak Ridge Reservation, would generate and store SNF as a result of research activities. No SNF would be transported to the Oak Ridge Reservation, and SNF would be transported offsite. SNF would be stabilized, as necessary, to ensure safe storage. Research and development activities would continue as planned except that the alternate shutdown of the High Flux Isotope Reactor as a result of filling the existing SNF storage. Additional SNF management planning is not expected to be required for the Bulk Shielding Reactor through the year 2035. It is anticipated that the fuel now stored in the Tower Shielding Reactor No. II core would be moved to the Y-12 area at the Oak Ridge Reservation for storage. If this is not possible, additional storage space or cessation of reactor operations may be required after 2005. If the Advanced Neutron Source becomes operational in 2005, additional SNF interim storage space may be required.

3.1.1.5 Nevada Test Site.

The Nevada Test Site does not generate or store any SNF and would not receive any SNF under the No Action alternative. Therefore, this alternative does not require SNF storage at the Nevada Test Site.

3.1.1.6 Naval Nuclear Propulsion Program.

Under the No Action alternative, naval reactors would continue to be defueled and refueled as planned. In accordance with normal practice, SNF would be removed from the ships (or prototypes) and placed into shipping containers needed to prepare the naval SNF for storage because of its corrosion resistance, high radioactivity, and weight. The SNF would be stored in this condition at a location near the defueling site. Naval SNF would be defueled or refueled at Newport News Shipbuilding, a private shipyard located in Newport News, Virginia, which would be transported to the Norfolk Naval Shipyard, in Portsmouth, Virginia, which would be transported to the Idaho National Engineering Laboratory for detailed examination and storage.

Under this alternative, examination of naval SNF would ultimately cease. A transition period of approximately 3 years would be required to procure sufficient shipping containers to be removed by ongoing defueling or refueling. During this period, naval SNF would continue to be transported to the Idaho National Engineering Laboratory for detailed examination and storage. After the transition period, naval SNF would no longer be transported to the Idaho National Engineering Laboratory for examination and subsequent storage; the SNF removed from naval reactors would remain at the naval sites. In addition, the Expanded Core Facility at the Idaho National Engineering Laboratory would be shut down.

3.1.1.7 Other Generator/Storage Locations.

Under the No Action alternative, the SNF generated and/or stored at DOE research and non-DOE research reactors and other locations would be transported offsite. For the purposes of this analysis, it is assumed that SNF from non-DOE reactors would not be transported to the United States under this alternative. DOE research reactor storage capacity could continue operating as planned. If the onsite storage capacity is expanded, new plans would have to be considered, including potential cessation of operations if storage capacity limits are reached.

The No Action alternative would also affect the management of SNF from nuclear DOE is obligated to store. For this alternative, the SNF would remain at these sites performed, as necessary, to ensure safe storage. Loss of access to the Idaho National Laboratory for storage of its SNF has already resulted in the construction of new onsite SNF storage. Therefore, implementation of the No Action alternative would have no additional impact of SNF at Fort St. Vrain.

3.1.2 Decentralization

Decentralization Alternative

Store most SNF at or close to the generation site or current storage location, with limited shipments to DOE facilities.

DOE SNF shipments would be limited to the following:

- SNF stored or generated at universities and non-DOE facilities
- Potential foreign research reactor fuel.

SNF processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

Some facilities would be upgraded/replaced and additional storage capacity required by the alternative would be constructed.

Onsite fuel transfers would occur for improved safe storage.

Research and development activities would be undertaken for SNF management, including stabilization technology.

Three options for naval fuel

- No inspection fuel remains close to refueling/defueling site
- Limited inspection at Puget Sound Naval Shipyard
- Full inspection at the Idaho National Engineering Laboratory followed by storage close to refueling/defueling site.

Under the Decentralization alternative, DOE would (a) maintain existing SNF in storage at current locations, and (b) store new SNF at or near the site of generation, thereby reducing the amount of fuel transported before a decision on ultimate disposition. This alternative differs from the No Action alternative by slightly increasing shipments to DOE sites and developing or upgrading facilities. Table 3-2 summarizes the basic actions at each site under this alternative. Actions that would improve management of SNF would be undertaken. SNF processing and research and development would be performed. Fuel may be transported for safety or research purposes. Figure 3-2 identifies the movement of fuel from 1995 through 2035 under from non-DOE locations would be transported to one of the major existing sites for managed by DOE would remain at its current location until a decision on final disposition has evaluated three options for SNF management under this alternative, based on the that would be performed on the SNF. In general, naval SNF would be stored at the Newport News Shipbuilding would be transferred to the Norfolk Naval Shipyard.

3.1.2.1 Hanford Site.

Under the Decentralization alternative, the near-term activities at the Hanford Site include those activities identified under the No Action alternative, a development and upgrades, and SNF processing research and development. In addition activities identified for the No Action alternative (that is, fuel characterization procurement for Fast Flux Test Facility fuel), the following general activities wet and dry storage methods for defense production N-Reactor and Single-Pass Reactor storage methods for other fuels (Shippingport Core II, Fast Flux Test Facility, miscellaneous extensive research and development on defense

Figure 3-2. Spent nuclear fuel distribution, location, and inventory for the Decentralization alternative. possibly a stabilization facility. In response to public comment, this alternative process defense production SNF at an overseas facility. A discussion of this option is in Appendix A, Attachment B.

The Hanford Site would not transport SNF to or receive SNF from offsite locations. If an option to process defense production SNF at an overseas facility is selected. Local transportation support safety requirements, improved SNF management, and research and development

Combinations of wet and dry storage would be considered. Either a new wet storage casks or vault-type dry storage would be needed to replace existing facilities. Dry storage of defense production SNF would require a new stabilization facility. Because of substantial differences between defense production fuels and the nondefense fuels, it is possible that new facilities would be built. Additional National Environmental Policy Act documentation is available before selecting this option.

3.1.2.2 Idaho National Engineering Laboratory.

Under the Decentralization alternative, the Idaho National Engineering Laboratory would accept limited shipments of SNF for storage from some domestic research reactors and some foreign research reactors. Some on-site activities would be conducted. DOE would manage the existing SNF at the Idaho National Engineering Laboratory, the naval SNF at the Naval Reactors Facility and the SNF in underwater pools, to accept and store SNF until ultimate disposition.

DOE would use the characterization and canning equipment described for the No Action alternative to stabilize SNF removed from the CPP-603 Underwater Fuel Storage Facility for interim storage. DOE would transfer the SNF in the CPP-603 Underwater Fuel Storage Facility to the Fuel Storage Facility 2000. DOE would continue to use the Underground Storage Facility and the Irradiated Fuel Storage Facility for existing SNF inventory and transfers of other SNF based on safety analyses. DOE would increase fuel storage capacity at the Idaho National Engineering Laboratory, as required by the EIS.

The Idaho National Engineering Laboratory would conduct various research and development activities, including laboratory and pilot-plant testing, continued repository performance criteria development, and the characterization of SNF.

The Idaho National Engineering Laboratory would examine different amounts of SNF depending on the option selected for the Navy Nuclear Propulsion Program (see Section 3.1.2.1 of the EIS). If an option to process defense production SNF at an overseas facility is selected, the Expanded Core Facility would ultimately be shut down. As an alternative, each of the options for naval fuel would require a transition period. SNF would be transported in shipping containers to the Expanded Core Facility for processing at the Idaho Chemical Processing Plant for storage.

3.1.2.3 Savannah River Site.

The near-term fuel transfer and consolidation activities at the Savannah River Site for the Decentralization alternative would be similar to those for the No Action alternative, except that the site would receive limited SNF shipments from other local research reactors. This SNF would consist primarily of aluminum-clad fuel elements and zircaloy fuel elements.

Fuel would continue to be stored in the Receiving Basin for Offsite Fuels and Spent Nuclear Fuel until it is either canned, placed in wet or dry storage, or is processed. The alternative represented for evaluation in the EIS consists of processing existing Savannah River Site fuel using existing chemical separations facilities (that is, F- and H-Canyons) and storing the fuel in stainless-steel-clad and zirconium-clad fuel as well as future receipts of aluminum-clad fuel.

analyzed because DOE has data from past processing that can be used for analyses. technology are representative of other processing technology options that may be cc Other processing options, such as processing all SNF or processing coupled with vit feasible and would be analyzed as part of the site-specific National Environmental needed to implement any option for this alternative.

The Decentralization alternative would require a new fuel characterization fac canning facility, and a new wet or dry storage facility. The Savannah River Site w storage and processing options because (as in the No Action alternative) interim we elements without canning could cause corrosion and cladding failures. The Savannah initiate projects to design characterization, canning, and dry storage facilities f Ongoing SNF research would continue at the site.

3.1.2.4 Oak Ridge Reservation.

Under the Decentralization alternative, the Oak Ridge National Laboratory would generate and store SNF from reactor research activities. No SNF w the Oak Ridge Reservation except for small amounts associated with research and dev example, from Sandia National Laboratories). No SNF would be transported offsite. stabilized, as necessary, to provide safe storage. Research and development activi Reservation would continue as planned. Because the interim storage capacity for SN Reservation is limited, new interim storage capacity would be added. The amount of would not increase substantially.

3.1.2.5 Nevada Test Site.

Under the Decentralization alternative, the Nevada Test Site would not generate or store any SNF and would not receive any SNF. Therefore, this alternati Nevada Test Site.

3.1.2.6 Naval Nuclear Propulsion Program.

The Decentralization alternative at the naval sites is similar to the No Action alternative because naval reactors would continue to be planned, and the fuel would generally be stored at or near the defueling site. No prepare the naval SNF for storage because of its corrosion resistance, high integri transition period would be required while the necessary interim storage capabilitie developed at the naval sites. During this period, naval SNF would continue to be t Core Facility for examination and subsequent interim storage at the Idaho National. The principal difference from the No Action alternative is that the options for int selected from shipping containers, dry storage casks, and wet storage in water pool difference is that examination of naval fuel would be possible.

Under this alternative, the Navy has three options, which vary by the amount c tion that could be performed on the naval SNF:

Option A, No Examination-Interim storage of naval SNF at the naval site of any detailed examination, except during the 3-year transition period when continue to be transported to the Expended Core Facility at the Idaho Nat Laboratory for detailed examination and preparation for storage at the Ic Processing Plant.

Option B, Limited Examination-Transport approximately 10 percent of the na Puget Sound Naval Shipyard where the existing water pool, designed to sup refuelings, would be modified to enable limited examination of certain hi of this water pool for examination would preclude the performance of airc work at the shipyard.

Option C, Full Examination-Transport naval SNF to the Expended Core Facili examination and then return the fuel to the naval or DOE facility near th storage.

For Option A, the Expanded Core Facility at the Idaho National Engineering Lab shut down after the transition period. For Option B, the water pool facility at the Shipyard would be modified to support SNF examinations and, upon completion, the Ex would be shut down. It would not be possible to perform aircraft carrier refueling Shipyard if this option were selected. Under Options A and B, examinations of SNF terminated or severely decreased. Under Option C, the Expanded Core Facility would and planned Expanded Core Facility improvements, including construction of the dry completed.

3.1.2.7 Other Generator/Storage Locations.

The Decentralization alternative for other generators and storage locations is similar to the No Action alternative because of would be allowed in limited amounts for continued operation. Thus, both DOE and nc reactors would be allowed to transport SNF offsite, as necessary. Additional SNF i domestic research reactors would not be required. For this alternative, SNF curren Valley Demonstration Project, Babcock & Wilcox Research Center, and the Fort St. Vr remain at these sites. As identified in the No Action alternative, loss of access Engineering Laboratory for storage of its SNF has already resulted in the construct storage at Fort St. Vrain. Therefore, implementation of the Decentralization alter additional impact on the management of SNF at Fort St. Vrain.

3.1.3 1992/1993 Planning Basis

1992/1993 Planning Basis Alternative

Transport to and store newly generated SNF at the Idaho National Engineering Laboratory or Savannah River Site. Consolidate some existing fuels at the Idaho National Engineering Laboratory or the Savannah River Site.

Fuel would be transported as follows:

- TRIGA fuel from the Hanford Site to the Idaho National Engineering Laboratory; Hanford Site receives limited fuel for research of storage and dispositioning technologies
- Naval fuel to the Idaho National Engineering Laboratory for examination and storage
- West Valley Demonstration Project and Fort St. Vrain fuel to the Idaho National Engineering Laboratory
- Oak Ridge Reservation fuel to the Savannah River Site
- Domestic research fuel, and foreign research reactor fuel as may yet be determined, divided between the Savannah River Site and the Idaho National Engineering Laboratory.

Facilities upgrades and replacements that were planned would proceed, including increased storage capacity.

Research and development for SNF management would be undertaken, including stabilization technology.

SNF processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

The 1992/1993

Planning Basis alternative represents DOE's 1992/1993 plans for management of its SNF. Under this alternative, existing SNF located at major DOE sites would remain at those sites. This results in less

intersite transportation of SNF compared with the other alternatives, except for the No Action alternative.

Table 3-3 summarizes the basic actions at each site under this alternative.

Under this alternative, DOE would transport and store newly generated SNF at the Idaho National Engineering Laboratory or Savannah River Site. Some existing SNF currently at other sites would be consolidated at the Idaho National

Engineering Laboratory or the Savannah River Site. Specifically, the Idaho National would receive TRIGA fuel from the Hanford Site, SNF from naval sites, some test reagents from the West Valley Demonstration Project and Fort St. Vrain, and some SNF from various foreign research reactors. The Savannah River Site would also receive some test reagents from university and perhaps from foreign research reactors. DOE sites would generate and construct new facilities for the management of SNF.

Continued SNF transportation, receipt, processing, and storage are assumed for construction and operation of any new facilities required to accommodate current and interim storage requirements would be implemented. Figure 3-3 identifies the movement through 2035 under this alternative. Activities related to SNF processing would include development and pilot programs to support future decisions on the ultimate disposition. Figure 3-3. Spent nuclear fuel distribution, location, and inventory for the 1992/

Naval SNF would continue to be transported to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination. After examination, the SNF would be transferred to the Chemical Processing Plant for interim storage, pending ultimate disposition.

3.1.3.1 Hanford Site.

The activities at the Hanford Site for the 1992/1993 Planning Basis alternative are the same as those identified for the Decentralization alternative, with elements currently stored in the 308 Building and the 200 Area low-level burial ground being moved to the Idaho National Engineering Laboratory. No new SNF would be transported to the Hanford Site for limited quantities of materials for research in support of interim storage technology development. Thus, the overall inventory at the Hanford Site would decrease slightly.

3.1.3.2 Idaho National Engineering Laboratory.

Under the 1992/1993 Planning Basis alternative, DOE would continue the maintenance and operation of existing SNF-related facilities similar to the No Action alternative; however, some consolidation of Idaho National Engineering Laboratory facilities could occur. Newly generated SNF would, with minor exceptions, be transported to the Idaho National Engineering Laboratory or the Savannah River Site.

DOE would complete a new characterization and canning facility with appropriate conditioning, and packaging equipment to stabilize any new receipts of SNF and to provide for underwater storage for dry storage. DOE would upgrade or increase dry fuel storage capacity at the Idaho National Engineering Laboratory, as required.

SNF research and development, with the construction of a Technology Development Facility, would continue as planned. The Electrometallurgical Process Demonstration Project would continue at the Idaho National Laboratory-West Fuel Cycle Facility. The Dry Fuels Storage Facility would be used to demonstrate technology for the dry storage of selected DOE highly enriched uranium fuels.

Naval SNF would continue to be transported to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination. After examination, the SNF would be transferred to the Chemical Processing Plant for interim storage, pending ultimate disposition.

3.1.3.3 Savannah River Site.

The implementation of the 1992/1993 Planning Basis alternative at the Savannah River Site would involve the same actions and options as the Decent except that DOE would transfer about half of the newly generated domestic and foreign research reactor SNF to the Savannah River Site.

The stabilization activities and options would be the same as those for the Decent alternative. The Savannah River Site would place the nonaluminum fuels and offsite receipts in interim storage and either process the aluminum-clad fuels currently at place them in interim storage. The storage options and new facility requirements would be those for the Decentralization alternative. The Savannah River Site would undertake research and development programs as those described for the Decentralization alternative activities would continue. The Savannah River Site would also conduct research and determine the best technology for ultimate disposition of the aluminum-clad fuels.

3.1.3.4 Oak Ridge Reservation.

Under the 1992/1993 Planning Basis alternative, the Oak Ridge Reservation would transport excess SNF to other DOE locations as necessary to operations of Oak Ridge reactors. The option for acquiring dry storage facilities High Flux Isotope Reactor operation during the transition period. The amount of SNF Ridge Reservation would not increase. Research and development activities would not storage capacity would not increase.

3.1.3.5 Nevada Test Site.

Under the 1992/1993 Planning Basis alternative, the Nevada Test Site would not generate or store any SNF and would not receive any SNF. Therefore, this alternative is not applicable to the Nevada Test Site.

3.1.3.6 Naval Nuclear Propulsion Program.

Under this alternative, naval reactors would continue to be defueled and refueled as planned. Upon removal from the ship, the SNF to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination, the fuel would be transported to the Idaho Chemical Processing Plant for pending ultimate disposition. No action to prepare the SNF for storage would be necessary corrosion resistance, high integrity, and strength. Planned improvements for the E including construction of the dry cell facility, would be completed.

3.1.3.7 Other Generator/Storage Locations.

Under this alternative, SNF would continue to be transported to designated DOE sites. At Brookhaven National Laboratory, implementation could require a transition period of several years and construction of temporary SNF acquisition of dry storage containers. DOE assumes that no additional SNF interim be constructed at the other generator/storage sites. For this alternative, SNF currently Valley Demonstration Project, Babcock & Wilcox Research Center, and the Fort St. Vrain be transported to the Idaho National Engineering Laboratory.

3.1.4 Regionalization

The Regionalization alternative comprises Regionalization 4A, which would assist

projected SNF among DOE sites based primarily on fuel type, and Regionalization 4B, fuels geographically. This subsection briefly defines each one, provides a boxed s implications of both on each site.

Table 3-4 summarizes actions at the sites being considered for the Regionalization alternative.

Regionalization 4A Preferred Alternative

Distribute existing and projected SNF among DOE sites based primarily on fuel type.

Naval fuel would be transported to, examined, and stored at the Idaho National Engineering Laboratory.

Aluminum-clad fuel would be transported to the Savannah River Site; TRIGA and nonaluminum fuel would be transported to the Idaho National Engineering Laboratory; defense production fuel would be retained at the Hanford Site.

SNF processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

Facilities required to support SNF management would be upgraded or built as necessary.

Research and development for SNF management would be undertaken, including stabilization technology.

Regionalization 4A is the management of SNF based on the specific fuel type. The DOE has identified Regionalization 4A as its preferred alternative (see Section 3.0). All SNF would be transported to and stored at either the Idaho National Engineering Laboratory or the Savannah River Site, depending upon the fuel type, with the exception of defense production fuel that would be retained at the Hanford Site. Regionalization 4A is similar to the 1992/1993 Planning Basis alternative but involves more intersite transportation of SNF to the sites, depending on the existing capabilities of the sites to manage respect to cladding material, physical and chemical composition, fuel condition, and handle the increased quantity. Actions for this alternative would assign all but c either the Idaho National Engineering Laboratory or the Savannah River Site, depend

Figure 3-4 shows the movement of SNF from 1995 through 2035 under Regionalization 4A. Upgrades, replacements, and additions would be undertaken to the extent required by Activities related to the management of SNF, including research and development activities, would be included.

Figure 3-4. Spent nuclear fuel distribution, location, and inventory for Regionalization 4B

Distribute existing and projected SNF between an Eastern Regional Site (either Oak Ridge Reservation or Savannah River Site) and a Western Regional Site (either Hanford Site, Idaho National Engineering Laboratory, or Nevada Test Site).

The Eastern Regional Site would receive fuel from east of the Mississippi River and the Western Regional Site would receive fuel from west of the Mississippi River.

Naval fuel would be transported to, examined, and stored at either the Western Regional Site or the Eastern Regional Site.

SNF processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or

transport.

Facilities required to support SNF management would be upgraded or built as necessary.

Research and development would be undertaken for SNF management, including stabilization technology.

Regionalization 4B is the management of SNF based on geography. In general, SNF from eastern locations (east of the Mississippi River) would be consolidated at the Eastern Regional Site (either the Oak Ridge Reservation or the Savannah River Site); SNF from western locations (west of the Mississippi River) would be consolidated at the Western Regional Site (either the Hanford Site, the Idaho National Engineering Laboratory, or the Nevada Test Site). All naval SNF would be transported to, examined, and stored at either the Eastern or the Western Regional Site. Regionalization 4B has 10 options, based on the combination of site and Western Regional Site and the placement of the expended core facility at either Western Regional Site. There are three potential Western and two potential Eastern be paired, with either supporting the expended core facility. Neither of the two p include the Idaho National Engineering Laboratory as the Western Regional Site would another expended core facility at the Eastern Site because of the estimated \$1 billion expended core facility. Figure 3-5 shows the movement of SNF from 1995 through 2030. Regionalization 4B with the Idaho National Engineering Laboratory as the Western Regional Site as the Eastern Regional Site. Facility upgrades, replacements, undertaken to the extent required by Regionalization 4B. Activities related to the including research and development, would be included.

3.1.4.1 Hanford Site.

Regionalization 4A-Under Regionalization 4A, activities at the Hanford Site intermediate to those of the Decentralization and the 1992/1993 Planning Basis alternative continue to store its defense production fuel. The Hanford Site would not receive would transport commercial remnants and stainless steel and nondefense production from the Idaho National Engineering Laboratory. Facility upgrades, Figure 3-5. Spent nuclear fuel distribution, location, and inventory for Regionalization 4A and 1992/1993 Planning Basis alternatives. Minor facility additions required to accommodate other onsite SNF for transport offsite would also occur.

Regionalization 4B-If the Hanford Site were selected as the Western Regional Site implementation of Regionalization 4B, DOE SNF located or generated in the western United States possibly naval SNF nationwide would be sent to the Hanford Site. This would require upgrades, increases, and replacements of storage capacity identified for the existing Decentralization alternative, as well as additional capacity to accommodate DOE SNF from the existing or new facilities. A new stabilization facility may be required to accommodate off SNF.

New facilities would also be required to receive, handle, and store offsite fuel. A facility for research and development and pilot programs would be required to support an expended core facility would be built on the Hanford Site, if the naval SNF were to be managed there.

Implementation of Regionalization 4B at a site other than the Hanford Site would require a site to consolidate and prepare onsite SNF for transport to the Western Regional Site. If a potential chemical reactivity of the defense production fuel at Hanford, it would require offsite transport, which would require a new facility similar to the one described in the Decentralization alternative. Additional casks and associated handling equipment compatible with the

the regional site may also be required. After the SNF is transported, related facilities would be closed.

3.1.4.2 Idaho National Engineering Laboratory.

Regionalization 4A-Under Regionalization A, stainless-steel- and zircaloy and naval SNF would be transported to the Idaho National Engineering Laboratory. The Idaho National Engineering Laboratory would transport aluminum-clad fuel to the Savannah River Site. Capacity would be increased and facility upgrades similar to those described for the Decentralization alternative would be undertaken, with replacements and additions as appropriate.

Regionalization 4B-If the Idaho National Engineering Laboratory were selected as the Western Regional Site for implementation of Regionalization 4B, SNF from western locations would be transported to the Idaho National Engineering Laboratory. The western facilities would stabilize, and can the SNF in containers compatible with dry storage at the Idaho National Engineering Laboratory. Naval SNF removed from naval reactor to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination, the SNF would be transferred to the Idaho Chemical Processing Plant for examination.

DOE would complete an expanded Dry Fuels Storage Facility, which would include characterization and canning facility similar to the one described for the 1992/1993 alternative. In addition, the same new facility projects described for the 1992/1993 alternative would be initiated.

DOE would conduct SNF research and development. Similar to the 1992/1993 Plan alternative, the Electrometallurgical Process Demonstration Project would continue at the Idaho National Engineering Laboratory-West.

If implementation of Regionalization 4B were to occur at a different site, DOE would complete characterization and canning facility at the Idaho Chemical Processing Plant to assess different types of Idaho National Engineering Laboratory SNF before placement in various and storage containers before transport to the selected Western Regional Site.

Similar to the No Action alternative, DOE would complete the transfer of the Dry Fuels Storage Facility pool inventory to existing dry storage facilities by the year 2000. DOE would then close all SNF-related facilities at the Idaho National Engineering Laboratory, except for operating reactor support facilities, such as the Argonne National Laboratory-West Hot Fuel Examination Facility and Fuel Examination Facility.

The SNF-related research and development activities would be phased out, although the Electrometallurgical Process Demonstration Project would continue at Argonne National Laboratory (but would only test processes for SNF currently on the site). Similar to the No Action alternative, the transfer of naval SNF to the Idaho National Engineering Laboratory would cease, and the Expanded Core Facility would be phased out.

3.1.4.3 Savannah River Site.

Regionalization 4A-Under Regionalization 4A, DOE would transport aluminum-clad fuels to the Savannah River Site. The same actions and options as the Decentralization alternative would be required. The Savannah River Site would transport nonaluminum-clad fuels to the Idaho National Engineering Laboratory.

The stabilization activities and options would be similar to those described for the Decentralization alternative. The principal differences are that, under this alternative, the Savannah River Site would store more aluminum-clad fuel and would not manage nonaluminum-clad fuels. The amount of fuel processed would remain the same. The storage options and new facility requirements would be those described for the Decentralization alternative, except that storage space for zirconium-alloy-clad fuels would not be necessary. The Savannah River Site would continue programs of research and development programs as those described for the 1992/1993 Planning alternative. A principal difference would be that nonaluminum-clad fuels would not be included under this alternative.

Regionalization 4B-If the Savannah River Site were selected as the Eastern Regional Site for implementation of Regionalization 4B, eastern locations would transport aluminum-clad fuels to the site. In addition, naval SNF might be transported to the Eastern Regional Site if the Eastern Regional Site were selected for naval fuels. The stabilization activities would be similar to those for the Decentralization alternative. The Savannah River Site would store nonaluminum-clad fuels and either store or process the aluminum-clad fuels. The storage requirements would also be the same as those for the Decentralization alternative. DOE would undertake the same types of research and development programs as those described for the Decentralization alternative.

Decentralization alternative. Current ongoing activities would continue. The Savannah River Site would conduct research and pilot-scale studies to determine the best technology for ultimate aluminum-clad fuels.

If the Savannah River Site were not selected as the Eastern Regional Site, DOE would transport SNF to the Oak Ridge Reservation. Some fuel would have to be stabilized before transport.

3.1.4.4 Oak Ridge Reservation.

Regionalization 4A-Under Regionalization 4A, the Oak Ridge Reservation would receive SNF and would transport its aluminum-clad SNF to the Savannah River Site. SNF currently stored at other DOE facilities would be transported to the Idaho National Engineering Laboratory.

Regionalization 4B-If the Oak Ridge Reservation were selected as the Eastern Regional Site for implementation of Regionalization 4B, the eastern locations would transport SNF to the Savannah River Site. In addition, naval SNF might be transported to the Oak Ridge Reservation if the Eastern Regional Site were selected for naval fuel. SNF currently stored at other DOE facilities would arrive at the Oak Ridge Reservation fully stabilized. New non-DOE domestic, foreign research reactor SNF would arrive in a condition necessary for safe transportation but uncanned. This fuel would be stabilized, prepared, and canned at the Oak Ridge Reservation to assure safe interim storage. Development activities at the Oak Ridge Reservation would increase from current levels. A SNF management complex would be built, including (a) a SNF receiving and canning facility, (b) a technology development facility, (c) an interim dry storage area, and (d) an expanded core facility at the Idaho National Engineering Laboratory.

The SNF receiving and canning facility would receive SNF cask shipments from other DOE facilities and transport the SNF for dry storage. A pool storage area would be included in this facility for interim storage. The technology development facility would be used to investigate the application of various storage technologies and pilot-scale technology development for disposition of the various SNF. The interim dry storage area would consist of passive storage modules designed to safely store SNF. Naval SNF would be examined at the new expanded core facility at Oak Ridge before interim storage.

A small quantity of Molten Salt SNF is stored in tanks at the Oak Ridge Reservation. A technology to stabilize this SNF for transport does not exist. Under this alternative, SNF currently stored at the Savannah River Site, this Molten Salt SNF would be transported to the Oak Ridge Reservation until it could be stabilized for safe transport.

If the Oak Ridge Reservation were not selected as the Eastern Regional Site, SNF currently stored at the Savannah River Site would be transported to the Savannah River Site. Some SNF might be transported until a stabilization process is developed because of the current inability to stabilize SNF for transport. The option for acquiring dry storage facilities would support continued Savannah River Reactor operation during the transition period.

3.1.4.5 Nevada Test Site.

Regionalization 4A would not affect the Nevada Test Site because fuel currently stored at the Nevada Test Site is not currently stored onsite and fuel would not be transported to the site.

If the Nevada Test Site were selected as the Western Regional Site for implementation of Regionalization 4B, SNF from western locations would be transported to the Nevada Test Site. In addition, naval SNF might be transported to the Nevada Test Site if the Western Regional Site were selected for naval fuel. SNF currently stored at other DOE facilities would arrive at the Nevada Test Site. New non-DOE domestic, foreign research reactor, and naval SNF would arrive in a state not suitable for safe transportation but uncanned. This fuel would be stabilized, prepared, and canned to ensure safe interim storage. A new SNF management complex would be built including a SNF receiving and canning facility, (b) a technology development facility, (c) an interim dry storage area, and (d) an expanded core facility similar to the one at the Idaho National Engineering Laboratory (if the Nevada Test Site were selected for receipt of naval fuel).

The SNF receiving and canning facility would receive SNF cask shipments from other DOE facilities and transport the SNF for dry storage. A pool storage area would be included in this facility for interim storage before dry storage. The technology development facility would be used to investigate the application of various storage technologies and pilot-scale technology development for disposal of the various SNF. The interim dry storage area would consist of passive storage modules designed to safely store SNF for several years. Naval fuel would be examined at the new expanded core facility at the Nevada Test Site (if Nevada Test Site were selected for receipt of naval fuel).

If the Nevada Test Site were not selected as the Western Regional Site, then SNF currently stored at the Savannah River Site would not be applicable to the Nevada Test Site because it does not generate or store SNF.

3.1.4.6 Naval Nuclear Propulsion Program.

Regionalization 4A-Under Regionalization 4A, the management of naval SNF the same as for the 1992/1993 Planning Basis alternative. Naval SNF removed from n continue to be transported to the Expanded Core Facility at the Idaho National Engi examination. Following examination, the SNF would be transferred to the Idaho Chem for interim storage. Planned improvements for the Expanded Core Facility, includin Cell Facility, would be completed.

Regionalization 4B-Under Regionalization 4B, naval reactors would continu defueled and refueled, and the SNF would be sent to either the Western or the Easte examination and storage.

If the Idaho National Engineering Laboratory were selected as the Western Regi SNF would continue to be transported to the Expanded Core Facility for examination. SNF would be transferred to the Idaho Chemical Processing Plant for storage. If an storage, naval SNF would continue to be transported to the Expanded Core Facility a Engineering Laboratory for examination until construction of a new nuclear fuel exa modification of an existing facility to perform the examinations at the selected si provide capabilities equivalent to the Expanded Core Facility at the Idaho National

3.1.4.7 Other Generator/Storage Locations.

Under Regionalization 4A, the activities at the other generator and storage locations are the same as indicated for the 1992 alternative. The exact destination of SNF transported would vary depending on the Regionalization 4A and on the generation/storage location under Regionalization 4B.

3.1.5 Centralization

Centralization Alternative

Manage all existing and projected SNF inventories at one site until ultimate disposition.

Existing SNF would be transported to the centralized site.

Naval fuel would be transported to, examined, and stored at the centralized site.

Projected SNF receipts would be transported to the centralized site.

SNF processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

Facility upgrade/replacement and new storage capacity would be provided at the centralized site; stabilization facilities would be provided at the transporting sites.

Research and development would be undertaken for SNF management, including stabilization technology.

Under the Centralization alternative, the SNF that DOE is obligated to manage would be transported to a single location for management. Potential sites include the Hanford Site, Idaho National Engineering Laboratory, Savannah River Site, Oak Ridge Reservation, and Nevada Test Site. Table 3-5 summarizes the basic

actions at each site under this alternative. Consequently, this alternative has five options (Options A through E)-centralization at each of the five potential sites. For the five sites designated under the Centralization alternative, the following discussion comprises two parts. The implications for the site if it were selected as the receiving site (that is, the part presents the implications to the site if it were not selected as the centraliz managed SNF would be transported to the centralized site.

Regardless of the option selected, new facilities would be built at the select increased inventories. Some SNF would require stabilization, such as canning, before facilities at the transporting sites would then be closed. Activities related to research and development and pilot programs, would also be centralized. Figure 3-6 fuel from 1995 through 2035 under this alternative.

For consolidation at sites other than the Idaho National Engineering Laboratory facility with capabilities comparable to the one in Idaho would be constructed, and closed. Naval SNF would continue to be transported to the Expanded Core Facility at Engineering Laboratory during a transition period, pending construction of storage at the central site.

3.1.5.1 Hanford Site.

Under the Centralization alternative, Option A, DOE-controlled and naval reactor SNF would be transported to the Hanford Site. This would require the completion of Figure 3-6. Spent nuclear fuel distribution, location, and inventory for the Centralization and Decentralization alternatives, as well as of the additional capacity within those facilities to accommodate the SNF from the other sites and possibly a stabilization facility.

New facilities would also be required to receive, handle, and store offsite fuel for research and development and pilot programs would be required to support an expanded core facility would also be built at the Hanford Site.

If the Hanford Site were not selected for storage, Hanford would have to consolidate onsite SNF for transport to the central site. Some of the SNF would require stabilization and transport, which would require a new facility similar to the one described in the I Additional casks and associated handling equipment compatible with the receiving facility site might also be required. After transport of the SNF, related facilities at the

3.1.5.2 Idaho National Engineering Laboratory.

If Option B were selected under the Centralization alternative, the Hanford Site, the Savannah River Site, and other DOE facilities would characterize, stabilize, and can the SNF in containers compatible with dry storage at the Idaho Chemical Processing Plant. Naval SNF removed from naval reactors would be transported to the facility at the Idaho National Engineering Laboratory.

Projects and activities for storage of SNF would be similar to those described in the I Planning Basis alternative, except that accelerated schedules for the Increased Rack Capacity projects would be necessary to accommodate the increased fuel addition, the schedule for the Dry Fuel Storage Facility project would have to be expanded.

DOE would conduct maximum SNF research and development. Similar to the Region alternative, the Electrometallurgical Process Demonstration Project would continue at the Idaho National Engineering Laboratory-West.

If the Idaho National Engineering Laboratory were not selected as the storage facility, a characterization facility would be constructed at the Idaho Chemical Processing Plant. Naval SNF in various shipping casks and drums would be transported to the selected DOE facility.

Like the No Action alternative, the CPP-603 Underwater Fuel Storage Facility project would be transferred to existing dry storage facilities until it is transported offsite. A new facility would not be built. SNF-related facilities at the Idaho National Engineering Laboratory would remain except for facilities directly supporting operating reactors, such as the Advanced

Argonne National Laboratory-West Fuel Cycle Facility.

SNF-related research and development activities would be phased out, although Electrometallurgical Process Demonstration Project would continue at the Argonne Na West Fuel Cycle Facility (but would process only SNF currently on the site). Similar alternative, naval SNF would not be transported to the Idaho National Engineering I Expanded Core Facility would be shut down.

3.1.5.3 Savannah River Site.

If Option C were selected under the Centralization alternative, the Savannah River Site would receive all DOE and naval SNF. Major new facilities, including a facility for naval fuels, would have to be constructed. Near-term actions and options those described for the Decentralization alternative.

The activities and options for management of the aluminum-clad fuel would be as described for the Decentralization alternative. Fuels received from other sites would

The Receiving Basin for Offsite Fuels and reactor disassembly basins would be term storage requirements for the current inventory of Savannah River Site SNF in terms described for the Decentralization alternative. The Savannah River Site would build storage facilities for the SNF received. In addition, SNF receiving, characterization would be necessary, and an expanded core facility would be built onsite for examination

Projects would be initiated to design characterization, canning, and storage facilities that the Savannah River Site would manage. Additional research would be conducted requirements for the ultimate disposition of the SNF.

If the Savannah River Site were not selected as the centralized storage site, onsite SNF to the central site after stabilizing any fuel that is not safe for transport would be necessary because the Savannah River Site would maintain the SNF in the expanded described for the Decentralization alternative) until moving it to the characterization. The Savannah River Site would construct new characterization and canning facilities transport. In addition, research would be conducted on stabilization and transport is heavily corroded.

3.1.5.4 Oak Ridge Reservation.

If Option D were selected under the Centralization alternative, the Oak Ridge Reservation would receive DOE SNF stabilized and canned to the extent transportation. The SNF might need to be uncanned, stabilized, prepared, and recanned Reservation, however, to ensure safe interim storage. New non-DOE domestic, foreign naval SNF would arrive in a form suitable for safe transportation. If necessary, it prepared, and canned at the Oak Ridge Reservation to ensure safe interim storage. development activities would increase from current levels. A new SNF management cell including (a) an SNF receiving and canning facility, (b) a technology development facility storage area, and (d) an expanded core facility similar to the one currently at the Laboratory.

The SNF receiving and canning facility would receive SNF cask shipments from the the SNF for dry storage. A pool storage area would be included in this facility for placed into dry storage, as necessary. The applicability of dry storage technology development for ultimate disposition of the various types of SNF would be investigated development facility. The interim dry storage area would consist of passive storage safely store the SNF. Naval SNF would be examined at the expanded core facility by

A small quantity of Molten Salt SNF is stored in tanks at the Oak Ridge Reservation technology to stabilize this SNF for transport does not exist. Under this alternative Reservation were to transport SNF to the Savannah River Site, this Molten Salt SNF stored at the Oak Ridge Reservation until it could be stabilized for safe transport

If the Oak Ridge Reservation were not selected as the centralization site, the Oak Ridge Reservation would be transported to the centralization site. The option facilities would support continued High Flux Isotope Reactor operation during the transport

3.1.5.5 Nevada Test Site.

If Option E were selected under the Centralization alternative, the Nevada Test Site would receive DOE SNF stabilized and canned to the extent necessary for transportation. (However, the SNF might need to be uncanned, stabilized, prepared, and canned at the Nevada Test Site to ensure safe interim storage.) New non-DOE domestic, foreign reprocessed SNF would arrive in a state necessary for safe transportation but uncanned, stabilized, prepared, and canned at the Nevada Test Site to ensure safe interim storage. A management complex would be built, including (a) an SNF receiving and canning facility, (b) a development facility, (c) an interim dry storage area, and (d) an expended core facility currently at the Idaho National Engineering Laboratory.

The SNF receiving and canning facility would receive SNF cask shipments from the Nevada Test Site for dry storage. A pool storage area would be included in this facility for SNF placed into dry storage, as necessary. The applicability of dry storage technology for development for disposal of the various types of SNF would be investigated in the test facility. The interim dry storage area would consist of passive storage modules designed for SNF for 40 years. Naval SNF would be examined at the expended core facility before

If the Nevada Test Site were not selected as the centralization site, then this alternative would not be applicable to the Nevada Test Site because it neither generates nor stores SNF.

3.1.5.6 Naval Nuclear Propulsion Program.

Under the Centralization alternative, naval SNF would be transported to the selected site for examination and storage. If a site at the Idaho National Engineering Laboratory were selected, then a transition period would be required, and SNF would be transported to the Expended Core Facility at the Idaho National Engineering Laboratory. No actions would be required to construct the expended core facility at the central site would be constructed. No actions would be required to store naval SNF for storage because of its corrosion resistance, high integrity, and strength.

3.1.5.7 Other Generator/Storage Locations.

Under the Centralization alternative, SNF would be transferred from the other generator and storage locations to the central storage site. Although the shipment destination may vary, the impacts from SNF operations at these locations would be similar to those identified in the 1992/1993 Planning Basis alternative.

3.2 Alternatives Eliminated from Detailed Analysis

In the process of evaluating management alternatives available to the DOE, several concepts and technologies have been considered for incorporation into the program described in Section 3.1. The following section describes the concepts and technologies carried forward and identifies why they have been eliminated from detailed analysis.

3.2.1 Examine or Store Spent Nuclear Fuel in Foreign Facilities

The design and operating characteristics of the fuel for naval reactors and spent nuclear fuel are classified. As such, they are not releasable to foreign interests without the procedure prescribed in the Atomic Energy Act and strict U.S. Nuclear Regulatory Commission requirements. Some of these classified design details and characteristics are obvious from the fuel, and others could be learned from detailed examination or analyses. The Weapons Nonproliferation Policy is summarized in the White House Fact Sheet on Nonproliferation Export Control Policy, dated September 27, 1993 (White House 1993). Under its nonproliferation policy, the United States seeks to reduce or eliminate, where possible, the accumulation and transport of highly enriched uranium or plutonium. These factors, along with others such as the cost of foreign transport and storage, make this alternative impractical. Based on these factors, this alternative was eliminated from detailed analysis.

3.2.2 Leave Naval Spent Nuclear Fuel in Nuclear-Powered Ships

It is physically possible to retain SNF in the reactors in nuclear-powered vessels and shipyards until a decision on the ultimate disposition of the SNF is determined and could then be removed from the ships.

Implementing this alternative would require extensive modifications to facilities including increasing the number of piers and the availability of waterfront utility moorings. Other shipyard facilities also might have to be modified or replaced in order to accommodate the number of ships involved during the 40-year period. The construction of piers and other new facilities has impacts on the waterfronts and harbors and could affect the local ecology. Shipyards are overloaded with the requirement to moor vessels retaining their SNF onboard and shipyards would be unable to continue to work on the operational fleet.

In addition, the costs and impacts on national security resulting from such an alternative would be large; it would affect the ability of the U.S. Navy to carry out its mission. The costs of providing waterfront services, and utilities would be large, both for ships that are to be decommissioned that would normally be refueled and returned to duty. (Failure to remove the SNF from ships still needed for service would result in these ships being unavailable once their useful life reaches the end of useful life.)

3.2.3 Alternate Sites for the Management of Spent Nuclear Fuel

An alternative SNF site selection process was undertaken to identify alternative DOE sites—Hanford Site, Idaho National Engineering Laboratory, and Savannah River Site. The DOE sites were evaluated, site selection screening process, and results are presented in the Decision Process Report (DOE-ID 1994). This study concluded that the uncertainties of Defense sites together with their lack of SNF facilities and expertise made these sites less attractive as site alternatives. The alternative SNF site selection process included the addition of the Nevada Test Site and Oak Ridge Reservation as potential regionalized sites for SNF management. The Oak Ridge Reservation represented a reasonable alternative site for regionalization of Eastern-based SNF and the Nevada Test Site represented a reasonable alternative site to the Idaho National Engineering Laboratory or Hanford Site for Western-based SNF. These two sites also represented options for centralization of SNF management activities. However, the DOE did not consider the Nevada Test Site to be a preferred site for SNF because of the State of Nevada's current role as the host site for the Yucca Characterization Project and the Nevada Test Site's lack of SNF management facilities and infrastructure. For purposes of conducting a thorough National Environmental Policy Act review, the Nevada Test Site provides a contrast to other potential sites because it represents SNF infrastructure. Non-DOE sites were eliminated from further analysis.

3.2.4 Chemical Separation/Processing of Spent Nuclear Fuel

Three potential technical management options were evaluated for chemical separation of DOE SNF. However, DOE will not select SNF technical management options on the basis of this EIS. These technology-based decisions are most appropriately made after detailed site-specific or site-specific basis. The three options include (a) chemical separation facilities at the Hanford Site, Idaho National Engineering Laboratory, and Savannah River Site; (b) chemical separation/processing in foreign commercial facilities; and, (c) chemical separation/processing in commercial facilities.

Chemical separation/processing at DOE sites was evaluated under certain alternative management options as a SNF stabilization technology. This activity is discussed in detail in the EIS. However, the evaluation was limited to certain alternatives and certain fuel types and capabilities. Future technology-based SNF management decisions will be made in future National Environmental Policy Act reviews were completed.

Several foreign commercial facilities exist that have the capability to process SNF. An analysis of processing DOE SNF at those facilities would have to consider nonproliferation policy (with regard to highly enriched uranium and plutonium), nat

(with regard to the classified nature of naval fuel), and other technical considerations transportation of wet fuel, processing capability in foreign facilities, possible for certain fuel types addressed in this EIS for which management by processing in a facility considered appropriate. In such instances, final decisions on technology-based options on further analysis in other site-specific or fuel type-specific National Environmental tiered from this EIS. For example, in a separate EIS on a Proposed Nuclear Weapons Concerning Foreign Research Reactor Spent Nuclear Fuel, DOE addresses foreign processing research reactor SNF included in this EIS as a potential management alternative.

In response to public comment, Appendix A, Volume 1 of this EIS includes an alternative transporting N-Reactor and Single-Pass Reactor SNF currently stored at the Hanford for processing. The impacts identified by this analysis are considered to be representative of transporting and handling any specific DOE SNF that might be considered for foreign processing. Reactor SNF is low-enriched SNF and is a large fraction (in MTHM) of the currently stored SNF. In addition, the analysis included transportation routes that maximize foreign and domestic processing. A summary of these transportation impacts is included in Appendix I, Volume 1 of this EIS. Domestic commercial facilities are not available for SNF processing for intercontinental transport were eliminated from further consideration.

3.2.5 Preparations for Disposal

DOE has not yet decided whether the ultimate disposition for DOE SNF is disposal, removal/recycle of the fissile material (primarily uranium). Disposal of SNF would be subject to (a) the repository waste acceptance criteria, and (b) completion of the characterization of SNF that would allow a determination of the specific technology needed for SNF processing (e.g., canning, etc.) for each fuel type. Because of the large number of uncertainties at this time, preparation for disposal was eliminated from further evaluation in this EIS.

3.3 Comparison of Alternatives

As discussed in Chapter 5 and the site-specific appendices, the environmental impacts of the alternatives therefore, differences among the five SNF management alternatives addressed in Section 3.3. The comparison of alternatives in this section concentrates on (a) the areas in which there is considerable interest, and (b) programmatic factors important to DOE decisionmaking that were selected for comparison:

- Number of SNF shipments among sites
- Public health effects
- SNF-related employment
- Generation of radioactive waste
- Impact on DOE or Navy missions
- Cost of implementation.

The alternatives that would cause the smallest impacts in these areas maximize the use of staff, and infrastructure.

3.3.1 Number of Shipments

Figure 3-7 shows the number of shipments that would occur under each alternative. Figure 3-7 also quantifies shipments of test specimens under each alternative. Shipments of test specimens are included here because of their contribution to cumulative impacts of SNF. Details concerning naval test specimens and methodologies for calculating impacts can be found in Appendix D. The No Action alternative would involve a limited number of shipments (200) and test specimen shipments (320). The Decentralization alternative, the Basis alternative, and Regionalization 4A alternative mostly involve shipments to and from reactor and storage sites and from the naval sites to DOE sites. These shipments are

approximately 2,300 shipments under Decentralization Options A or B to approximately Regionalization 4A alternative. Decentralization Option C and the 1992/1993 Plan have approximately 3,200 and 3,700 shipments, respectively, over the 40-year period. Regionalization 4B alternative and the Centralization options, SNF is transported to these alternatives and options, the number of shipments range from approximately 5, Regionalization 4B alternative (Idaho National Engineering Laboratory and Savannah about 9,200 under the Centralization Option E (centralization at the Nevada Test Site shipments is

Figure 3-7. Number of spent nuclear fuel and test specimen shipments between the y summarized in Table 3-6. A more detailed discussion can be found in Appendices D a public health effects from such shipments are discussed in the next section.

3.3.2 Public Health Effects

This section discusses the public health effects from radiation exposure and the DOE's SNF Management Program (see Section 5.1.1.4 for basic information regarding a These effects are estimated to be small, as shown by Figures 3-8, 3-9, and 3-10. The radiation exposure are (a) normal site operations, (b) transportation, and (c) accidents the estimated number of latent cancer fatalities from the operation of the entire INEL system over a 40-year period would range from approximately zero to about two latent

3.3.2.1 Normal Operations.

In general, the greatest radiation exposure from normal SNF site activities and incident-free transportation results when large quantities of SNF are such as under the Regionalization 4B alternative or Centralization alternative. Under transportation, as noted in Table 3-7, the estimated total fatalities are less than the highest estimates associated with the Centralization options. This reflects the shipments associated with these options.

In summary, estimated radiation impacts on public health are small for all alternatives (many different siting options), and it would, therefore, not be possible to materially through a site selection process.

3.3.2.2 Accidents.

Transportation accidents pose the lowest risk of cancer fatalities (although the consequences of some accidents can be high). The accident risks are presented in Table 3-8. The results indicated that the risks associated with traffic fatalities associated with cancer caused by radiation exposure. Both normal site operations and transportation have greater risk than that expected from transportation accidents with consequences of potential accidents are considered. The latent cancer fatalities associated with accidents is small across alternatives. The transportation accident with the largest to 55 latent cancer fatalities; the probability of occurrence is 1.1×10^{-7} per year (1 in 10 million years) (see Appendix I).

In summary, for radiation-induced latent cancer fatalities to the public over management under all of the alternatives evaluated, the most likely outcome is as follows:

- Essentially zero latent cancer fatalities from normal facility operations
 - Essentially zero latent cancer fatalities from transportation accidents
- Table 3-6. Number of offsite spent nuclear fuel and test specimen shipments
Maximum number

Alternative	Spent fuel shipments
No Action	200
Decentralization Option A	2,000
Option B	2,000
Option C	2,900

1992/1993 Planning Basis	2,900
Regionalization 4A	3,700
Regionalization 4B	
Hanford Site/Savannah River Site	4,800
Idaho National Engineering Laboratory/Savannah River Site	4,600
Nevada Test Site/Savannah River Site	6,600
Hanford Site/Oak Ridge Reservation	5,600
Idaho National Engineering Laboratory/Oak Ridge Reservation	5,400
Nevada Test Site/Oak Ridge Reservation	
	7,300
Centralization	
Hanford Site	5,700
Idaho National Engineering Laboratory	5,500
Savannah River Site	6,600
Oak Ridge Reservation	7,300
Nevada Test Site	7,400

- a. Assuming naval SNF shipments by rail and DOE SNF by truck.
- b. Test specimens by truck.

Figure 3-8. Maximum estimated number of latent cancer fatalities per year in the c transportation.

Figure 3-9. Estimate of risk of latent cancer fatalities in general population frc

Figure 3-10. Estimate of average annual riskb from transportation accidents for sr

Table 3-7. Comparison of incident-free transportation total fatalities for alterna

	Minimum(a,b) total fatalities	Maximum(b,c) total fatalities
No Action	0.0089	0.0089
Decentralization	0.12 to 0.15	0.35 to 0.3
1992/1993 Planning Basis	0.14	0.45
Regionalization 4A (fuel type)	0.17	0.61
Regionalization 4B (geography)		
Idaho National Engineering Labor- atory and Savannah River Site	0.15 to 0.17	0.51 to 0.5
Idaho National Engineering Labor- atory Ridge Reservation	0.14 to 0.15	0.53 to 0.5
Hanford Site and Savannah River Site	0.17	0.55 to 0.5
Hanford Site and Oak Ridge Reserva- tion	0.15	0.57
Nevada Test Site and Savannah River Site	0.19	0.88
Nevada Test Site and Oak Ridge Reser- vation	0.17	0.90
Centralization		
Hanford Site	0.23	1.3
Idaho National Engineering Laboratory	0.21	1.1
Savannah River Site	0.26	1.7
Oak Ridge Reservation	0.21	1.6
Nevada Test Site	0.26	1.6

- a. The minimum total fatalities are associated with transport of DOE fuel by rail;

are by both truck (onsite) and rail (offsite).

b. Total fatalities are for the 40-year period 1995 through 2035 and were the sum number of radiation-related latent cancer fatalities for workers and the general public and the estimated number of nonradiological fatalities from vehicle emissions.

c. The maximum total fatalities are associated with transport of DOE fuel by truck shipments are by both truck (onsite) and rail (offsite).

Table 3-8. Comparison of estimated transportation accident risks for alternatives

Alternative	Truck accident risks(a)		Rail accidents
	Latent cancer fatalities	Traffic fatalities	Latent cancer fatalities
No Action	4.1 X 10 ⁻⁶	0.047	4.1 X 10 ⁻⁶
Decentralization(b)	0.00085 to 0.00090	0.20 to 1.01	0.00029 to 0.00034
1992/1993 Planning Basis	0.0010	0.70	0.00035
Regionalization 4A (fuel type)	0.0011	0.77	0.00037
Regionalization 4B (geography)			
Idaho National Engineering Laboratory and Savannah River Site	0.00090	0.72	0.00034
Idaho National Engineering Laboratory and Oak Ridge Reservation	0.00095	0.73	0.00024
Hanford Site and Savannah River Site	0.0013	0.84	0.00075
Hanford Site and Oak Ridge Reservation	0.0013	0.81	0.00050
Nevada Test Site and Savannah River Site	0.0012	0.99	0.00045
Nevada Test Site and Oak Ridge Reservation	0.0012	1.00	0.00035
Centralization			
Hanford Site	0.0050	1.10	0.0013
Idaho National Engineering Laboratory	0.0048	1.00	0.0013
Savannah River Site	0.0020	1.44	0.00080
Oak Ridge Reservation	0.0017	1.35	0.00055
Nevada Test Site	0.0050	1.33	0.0014

a. Assumes SNF shipments are 100 percent by truck or 100 percent by rail, except for onsite and rail (offsite).

b. Range of values in each column for the Decentralization alternative reflects the range of SNF.

Up to about one latent cancer fatality from most incident-free transportation alternatives and up to about two latent cancer fatalities under the Centralization options

Up to about two fatalities from nonradiological traffic accidents.

A more detailed discussion of accidents is found in Chapter 5, Volume 1 of this report.

3.3.3 Employment Related to Spent Nuclear Fuel Management at DOE and Naval Sites

Under various alternatives, the total labor force involved in SNF management could increase by more than 2,100 jobs averaged over the period 1995 to 2005, as a baseline. This labor force is the sum of permanent employment in operating or main shorter term construction jobs. Figures 3-11 and 3-12 characterize the range of SNF management alternatives. The number of jobs related to SNF management is small compared with the total (2 to 4.5 percent) at the sites that would be involved in SNF management. SNF management alternatives account for less than 4.5 percent of total employment at the sites and less than 8 percent at any one site.

It is important to note that the relocation of large amounts of SNF under the Centralization alternative and the Centralization options would eventually result in closure of SNF major DOE sites and, therefore, long-term job loss at the closed facilities. However, closed facilities would be accompanied by job gains at the sites receiving the fuel from 1995 to 2005 several management actions already initiated at various sites to reconfigure for existing SNF will be completed, and much of the SNF would need to be transported. In the near term, the combination of building facilities at some sites and transporting SNF to other sites complicates estimating the near-term SNF employment situation.

Under the No Action alternative, employment would not increase substantially as a result of the closure of the Expanded Core Facility at the Idaho National Engineering Laboratory. The maximum number of jobs involved in SNF management following closure. The maximum number of jobs indicated in Figure 3-11 assumes processing for stabilization and reports the maximum number of jobs at each site.

For any of the alternatives, no more than an average additional 2,100 jobs over the period 1995 to 2005 would be required for implementation. Some of the larger SNF employment requirements (those involving the Hanford Site) would be caused by the development and operation of facilities needed to stabilize stored SNF. If processing were not undertaken, less employment would be required at those sites. In addition, the relocation of the Expanded Core Facility to sites other than the Idaho National Engineering Laboratory would result in an increase of

Figure 3-11. Change in the number of jobs averaged over the years 1995 to 2005 for spent nuclear fuel management alternatives.
Figure 3-12. Change in site employment between the years 1995 and 2005 for spent nuclear fuel management alternatives.

about 500 jobs per year in the support of naval SNF examinations at those sites and corresponding loss of approximately 500 jobs at the Idaho National Engineering Laboratory. Regionalization with the Nevada Test Site as the Western Regional Site and the Oak Ridge Eastern Regional Site would result in the highest employment peak. The peak, estimated at 4,600 jobs in the year 2000, includes employment at sites preparing SNF for transport.

A more detailed discussion of socioeconomic impacts can be found in Chapter 5, Socioeconomic Impacts, of this EIS.

3.3.4 Generation of Radioactive Wastes

When SNF is stored onsite, very little high-level, transuranic, or mixed waste (see Figure 3-13). These small quantities of radioactive wastes would usually be generated during the period 1995 to 2005. As a result, under the No Action alternative fewer than 20 cubic meters per year of high-level waste and transuranic wastes would be generated from SNF management nationwide because SNF would be stabilized. Under the other alternatives, where stabilization activities are assumed, between 20 and 190 cubic meters (26 and 250 cubic yards) of high-level waste and between 20 and 120 cubic meters (26 and 120 cubic yards) of transuranic waste would be generated each year. Lower generation rates would occur in the Decentralization alternative, where SNF is transported among major DOE sites (and stabilization for transport would not be necessary). Under the other alternatives, greater amounts of SNF would be transported among sites; therefore, more SNF would be stabilized before transport and more waste would be generated. The difference in the maximum volume of waste generated results principally from the contribution attributed to onsite stabilization.

Low-level waste is also generated as a result of SNF management. Figure 3-14 shows the estimated annual volume for each of the alternatives. As previously noted for high-level waste, the higher values are principally the result of processing for stabilization.

A more detailed discussion of radioactive waste generation under each alternative can be found in Chapter 5, Volume 1 of this EIS.

3.3.5 Impacts on DOE and Navy Missions

The concerns for the missions of DOE and the Navy relate to storing SNF safely preparing SNF for ultimate disposal, and examining naval SNF.

3.3.5.1 Impacts on DOE.

The DOE mission regarding the safe storage of SNF is impacted in the No Action alternative. Under this alternative, DOE will initially suffer from a loss of storage capacity. Figure 3-13. Average volume of high-level, transuranic, and mixed waste generated and Figure 3-14. Average volume of low-level wastes generated per year over the years in storage capacity. In addition, DOE may be impacted by needing to make more frequent repairs (potentially losing the use of a facility because it is beyond repair). There is no flexibility for repairs under the No Action alternative.

Additionally, by limiting research and development to activities already approved, DOE's ability to safely store SNF would be impacted by being unable to conduct new research and development. The No Action alternative would not permit development of processing and other technologies underway as of June 1995.

Under the No Action alternative, DOE would not satisfy its obligations associated with university reactors, other research reactors, and special-case commercial SNF. Also, under this alternative, DOE might not be able to fulfill agreements with states or other Federal agencies regarding SNF, except those specific actions already in progress, unless the agreements are carried out on the terms of these agreements would expose DOE to adverse legal actions. In addition, DOE would not proceed, as it has proposed, to establish a new policy for management of foreign reprocessed uranium contained in United States origin uranium (see Section 1.2.4). These mission impacts contrast the No Action alternative but the No Action alternative.

The DOE recognizes a need, which is not yet well defined, to prepare SNF for ultimate disposition. At this point, the processing and other technology required for ultimate disposition is not available. Under the No Action alternative, no new facilities or new research and development would be undertaken. The No Action alternative would not permit development of processing and other technologies that have been begun as of June 1995. Although the acceptance criteria for DOE-managed SNF have not yet been defined and repository disposal may be required, alternative approaches for ultimate disposition must be developed. By not allowing development of these alternatives, DOE would be unable to meet one of the major goals of the SNF Management Program. For the No Action alternative, no facilities could be built for SNF that are acceptable for disposition. In addition, with facilities storing SNF throughout the country, other processing facilities might be required than are currently planned. Building multiple locations would impede efficient disposition of SNF produced at small reactors. The No Action alternatives would allow research and development to proceed as deemed appropriate.

3.3.5.2 Impacts on the Navy.

The Navy would incur large storage costs under the No Action and Decentralization alternatives. In addition, the Navy mission would be hindered if SNF could not be stored at an expended core facility were not possible. Full examination would not be possible under alternative and Decentralization Options A and B. The examinations are a critical part of the Navy's Nuclear Propulsion Program's ongoing advanced fuel research and development program. The examinations provide engineering data on nuclear reactor environments, material behavior, and design performance. These data support

- The design of new reactors having extended lifetimes

- Continued safety of naval reactors

- Improvements in nuclear fuel performance and ship operational performance

- The operation of existing naval reactors by providing confirmation of their safety and allowing maximum depletion of their fuel.

- The verification of engineering methods and models to design naval nuclear reactors

Although it is difficult to quantify the benefits of an outstanding safety record, the benefits are significant.

operational characteristics, increased core life yields an economic advantage—a reactor cores that must be procured and in the number of refuelings that must be processed less SNF being generated. Another advantage is the increased online availability with life-of-ship fuel, which would reduce the number of ships required. About \$5 life-of-ship fuels are developed, based on an assumed force structure of fewer than ships by 2005. Additional details can be found in Appendix D, Volume 1 of this EIS

3.3.6 Cost of Implementation

The DOE prepared and issued in March 1995 a cost evaluation report (DOE 1995b) insight for short- and long-term planning for DOE complex-wide SNF management. This report is used to provide costs relevant to this EIS. This section provides potential costs management of DOE SNF for the 40-year period evaluated in this EIS.

3.3.6.1 Results.

Table 3-9 provides a range of costs for interim storage. Because of the very broad scope associated with complex-wide SNF management and the uncertain nature of future "estimate" costs cannot be developed at this time. The degree to which existing facilities alternative can vary. To account for this, each alternative was analyzed for two possible spread of cost for each alternative. The upper and lower cost ranges were Upper Cost Range - Assumed construction of new facilities, except for a limited adequate for 40 years.

Table 3-9. Cost results for storage only (billions of dollars).

Alternatives

No Action (1)
 Decentralization-no examination (2A)
 Decentralization-limited examination (2B)
 Decentralization-full examination (2C)
 1992/1993 Planning Basis (3)
 Regionalization by fuel type (4A)
 Regionalization by geography (4B)a
 Centralization at Hanford (5A)
 Centralization at Idaho National Engineering Laboratory (5B)
 Centralization at Savannah River Site (5C)
 Centralization at Oak Ridge Reservation (5D)
 Centralization at Nevada Test Site (5E)

a. All options were considered, however, only Idaho National Engineering Laboratory Site costs are shown.

Lower Cost Range - Assumed existing facilities used at the Idaho National Engineering Laboratory and the Savannah River Site but no existing facilities used at Hanford. Facilities limited to Phase III vulnerability costs (DOE 1994c).

3.3.6.2 Discussion and Conclusions.

Table 3-9 shows that Alternatives 1, 2A, 2B, 3, or 4A are roughly equivalent. This is because most of the SNF would be located at the same site (Idaho National Engineering Laboratory, and Savannah River Site) in each alternative. Alternatives 2B and 2C are more expensive than Alternative 3 because all SNF would be moved to two sites (Idaho National Engineering Laboratory and Savannah River Site), which have existing infrastructures, and economies of scale (

dictate that two sites would be less costly than three. The table also shows that it would be least expensive to centralize SNF management at a site with existing SNF infrastructure (that is, Alternatives 5A, 5B, or 5C). Transportation costs, which are included in total costs, would not be an overriding consideration in the selection of locations.

In the lower cost range, if existing facilities can continue to be used, it would be possible to manage fuel under alternatives that maximize the use of sites with existing capabilities (2A, 2B, 4A, or 4B). The centralization alternatives, which would require the construction of new facilities, could cost up to \$6.7 billion more than the least costly alternative (2B) based on the lower cost range results, however, the reader should recognize that the use of existing facilities, combined with a commitment to upgrade facilities [over existing vulnerabilities (DOE 1994c)] may significantly change the cost comparisons. In this case, the costs tend to increase toward the upper cost range.

Additional details can be found in DOE (1995b). This report is available in the rooms listed in the EIS, or upon request from the Office of Communications, DOE Idaho at the address listed in the front of the EIS.

3.3.7 U.S. Nuclear Regulatory Commission Licensing Standards

DOE is proceeding with actions to implement safe, efficient, and cost-effective SNF management before final disposition. The need for interim storage has led DOE to evaluate alternative management strategies to provide an optimum solution to storage challenges. Storage technologies under evaluation for DOE SNF have been licensed and regulated by the Nuclear Regulatory Commission. In addition, DOE SNF could eventually come under the jurisdiction of the Nuclear Regulatory Commission if it is to be disposed of in a geologic repository. DOE is considering having any new interim storage facilities reviewed to determine whether they meet Nuclear Regulatory Commission licensing standards. This approach, if implemented, would provide a basis for the development of the technical and administrative protocols between the Nuclear Regulatory Commission and DOE in the event that some type of U.S. Nuclear Regulatory Commission regulatory oversight occurs in the future.





4. AFFECTED ENVIRONMENT

This chapter contains overviews of the potentially affected environments at a and potential sites under consideration for management of SNF within the various al the EIS. Because of the large amount of information necessary to adequately charac environments at these sites, the space available in this chapter limits the present relevant key site characterization information. Consequently, the detailed descrip environments are presented under separate cover as self-contained appendices to Vol allows the reader to compare the relative similarities and differences among the si thousands of pages of text. These separate site-specific appendices also contain t environmental impacts associated with each alternative that are rolled up and summa

The site-specific appendices under separate cover are organized as follows:

Appendix	Focus of appendix
A	Hanford Site
B	Idaho National Engineering Laboratory
C	Savannah River Site
D	Naval Nuclear Propulsion Program
E	Other Generator/Storage Locations
F	Nevada Test Site and Oak Ridge Reservation

This chapter focuses on details about resources most likely to be affected by under the various alternatives. Consequently, not every category of information ac appendices is rolled up for presentation here.

4.1 Hanford Site

This section summarizes the environmental characterization information on the Richland, Washington. This information has been used in evaluating environmental i from implementing the various alternatives for management of SNF at the Hanford Sit information characterizing the affected environment of the Hanford Site is presente separate cover.

The Hanford Site covers about 1,450 square kilometers (560 square miles) of t of the State of Washington (see Figure 4-1). It is located in parts of Benton, Gra The nearest city is Richland, Washington, which borders the Hanford Site on its sou 380,000 people live within an 80-kilometer (50-mile) radius of the Hanford Site.

The population within 80 kilometers (50 miles) of the Hanford Site has been c purposes of identifying whether any disproportionately high and adverse impacts exi income communities. The population surrounding the Hanford Site is shown to be 20 18 percent low-income, based on U.S. Bureau of Census information and the definitic presented in Appendix L.

Approximately 6 percent of the Hanford Site is occupied by operational facili management and SNF processing activities and waste storage occur near the center of Eight retired plutonium production reactors and the N Reactor are located on the sc River, and the nuclear research and development laboratories are located in the sou Hanford Site near the city of Richland. The majority of Hanford's SNF is stored in 100-KE. The Fast Flux Test Facility is located in the east-central area of the Han area is undeveloped land that provides for buffer zones for the operating areas. I Superfund site, listed on the National Priority List.

The land adjacent to the Hanford Site is either urbanized or agricultural. A irrigated and dry-land farming and grazing.

In 1992, the Hanford Site employed 16,100 people, accounting for almost 25 pe nonagricultural employment in Benton and Franklin Counties. Other major employers Nuclear Power Corporation, Sandvik Special Metals, Iowa Beef Processors, Boise Casc Northern Railroad.

As of 1992, 248 prehistoric archaeological sites were recorded by the Hanford Laboratory of the Pacific Northwest Laboratory. Of the 48 sites on the National Re

two are single sites and the remainder are in seven archaeological districts. Arch remains of numerous pithouse villages, campsites, cemeteries along the river banks, hunting camps, game drive complexes, quarries in mountains and rock bluffs, hunting stabilized dunes, and small temporary camps near perennial sources of water away from the river. Americans have inhabited the land around the Hanford Site since prehistoric times. Chamnapum bands of the Yakama tribe were the area's primary inhabitants, being joined by Walla Walla people, and Umatilla people for fishing the Hanford Reach of the Columbia River. Some native people retain traditional secular and religious ties to the region. Some native plants are used in religious ceremonies performed by members of the Washane or Seven Drums bands found on the Hanford Site.

Figure 4-1. Hanford Site location and site map. The Hanford Site is on a low-lying plain about 105 meters (345 feet) in the southeast part to about 245 meters (804 feet) in the northwest. The Hanford Site is bounded to the east by the Columbia River and the White Bluffs Formation, to the southeast by the city of Richland, to the west by the Rattlesnake River and the Saddle Mountain.

The principal geologic features beneath the Hanford Site, listed from the oldest to the youngest include the Columbia River Basalt Group (basaltic lava flows), the Ringold Formation (coarse sandy gravel to compacted silt and clay), and a series of deposits called the Hanford Formation (other than gravel, there are no geologic resources of economic value on the Hanford Site).

The area of the Hanford Site is historically of low-to-moderate seismicity. The Hanford Site is in a Uniform Building Code Seismic Risk Zone 2B. (Zone 0 represents the area subject to the greatest seismic risk.) The largest seismic shock near the Hanford Site was approximately 4.5 to 5.0 on the Richter scale and Modified Mercalli Intensity of V; it occurred about 35 kilometers (22 miles) north of the Hanford Site in 1918. A Modified Mercalli Intensity of VI occurred in 1973. Many lower intensity earthquakes have occurred in the Columbia Plateau as part of "earthquake swarms," which are clusters of several small earthquakes occurring over a short time.

The Hanford Site is located approximately 160 kilometers (100 miles) to the east of the Cascade Range, which includes several volcanic vents. The great distance eliminates the possibility of these volcanoes reaching the Hanford Site. The foreseeable volcanic effects at the Hanford Site are windborne volcanic ash.

The general climate of the Hanford Site is hot and dry in summer and cool in winter. Annual precipitation is 16 centimeters (6.3 inches), most of which falls during the winter. Thunderstorms occur 11 days per year, mostly during the summer. Tornadoes are extremely rare within 160 kilometers (100 miles) of the Hanford Site about once in 3 years. Air quality in the region is well within the State of Washington and U.S. Environmental Protection Agency criteria pollutants, except that short-term particulate concentrations occasionally exceed the standards (PM-10 is particulate matter defined as suspended particulates with an aerodynamic diameter of 10 micrometers.) The Class I Area (areas where degradation of air quality is to be avoided) near the Hanford Site is at Goat Rocks Wilderness Area, 145 kilometers (90 miles) away.

Two rivers pass through or near the Hanford Site. The Columbia River passes through the western part of the Hanford Site and forms part of the eastern boundary. The average daily discharge is 120,000 cubic meters per second (120,100 cubic feet per second). The Yakima River, with an average discharge of 3,673 cubic meters per second (3,673 cubic feet per second), is located near the southern part of the Hanford Site. Wastewaters are discharged to several ponds on the Hanford Site and the Columbia River. To these surface waters, there are two intermittent creeks that form the remainder of the Hanford Site. The flood areas of these rivers and streams include some areas where flooding is well-controlled by upstream dams on the Columbia River. Minor flooding occurs from other watercourses. While specific information on the 100-year floodplains is not available, the projected extent of the maximum probable flood, which is greater than the area affected by a 100-year flood, would not impact proposed SNF facilities. More details on floodplains induced by dam failures, are given in Section 4 of Appendix A of Volume 1.

The water quality of the Columbia River is high, with minor increases in concentrations near the Hanford Site discharges. Radiological monitoring shows low levels of radionuclides in the Columbia River water. Tritium, iodine-129, and uranium are found in somewhat higher concentrations near the Hanford Site than upstream, but are well below concentration guidelines established by the Environmental Protection Agency drinking water standards. Nonradiological water quality measured during 1989 were similar to those reported in previous years and were within the Environmental Protection Agency Water Quality Standards.

Part of the water supply at the Hanford Site and for the nearby Tri-Cities is derived from the Columbia River. In 1991, the combined water use for Richland, Pasco, and Kennewick was 4.3 billion gallons (107 cubic meters). Richland and Kennewick derive a portion of their water used from nearby wells and rely on groundwater as a sole source of water from November through March each year.

references and more detailed information on groundwater are in Appendix A of Volume

In 1993, several radionuclides and nonradioactive chemicals were present in water located beneath the Hanford Site in some locations at levels exceeding U.S. Environmental drinking water standards and/or DOE Derived Concentration Guides. These constituents are as follows: radiological constituents—tritium, strontium-90, cobalt-60, antimony-125, cesium-137, uranium, and plutonium; and nonradiological constituent—nitrate, carbon tetrachloride, and chloroform. Groundwater at the Hanford Site is not used for human consumption or food production with the exception of water at the Fast Flux Test Facility visitor center. Above-background levels of tritium were detected in this well; however, these levels are well below U.S. Environmental Protection water standards.

DOE asserts a federally reserved water withdrawal right with respect to the Columbia River. Current withdrawals from the Columbia River occur under this assertion. Of the water surface waters in the vicinity of the Hanford Site, 13 percent is used for industrial purposes and 41 percent of the water targeted for industrial use.

The Hanford Site is a shrub-steppe environment dominated by cheatgrass and sagebrush. It includes 10 different types of plant communities. This plant environment supports a variety of animals and reptiles, 39 species of mammals, and numerous bird and insect species. Deer and coyotes are the major mammalian predators. Wetlands of varying size along the Columbia River and support extensive stands of willows, grasses, aquatic plants, and other plants. In the Reach of the Columbia River, 44 species of fish have been identified. The Hanford Site is a spawning area and a migration route to and from various salmon and trout species as well as a migration route to and from various areas. Four threatened or endangered plants classified by the State of Washington as well as seven species of threatened or endangered birds or mammals and one insect species and three of the bird species are federally listed.

No federally listed threatened or endangered species have been observed at the Hanford Site. However, two Federal and/or state candidate species, the loggerhead shrike (Federal candidate) and sage sparrow (state candidate), were observed during a survey of the proposed SNF site. This habitat at the proposed site is considered priority habitat by the State of Washington. Other species observed include shrikes, sage sparrows, burrowing owls (state candidate), pygmy rabbits (Federal candidate), sage thrashers (state candidate), western sage grouse (Federal and state candidate), and sagebrush voles (state monitored). Although burrowing owls were not observed at the Hanford Site, burrows used by burrowing owls and owl pellets were observed during the survey. No other species were found at the proposed site. The closest known ferruginous hawk (Federal candidate) nest is approximately 8.9 kilometers (5.5 miles) northwest of the Hanford Site and should be considered as comprising a portion of the foraging range of this species.

The Tri-Cities (Richland, Kennewick, and Pasco) serve as a regional transport corridor through air, land, and river connections. The Tri-Cities area has four major highways: U.S. Route 240, and Interstate 82. State Route 240 traverses the Hanford Site from south to north. Burlington Northern and Union Pacific railroads connect the area to more than 35 states. Major roads exist at the ports of Benton, Kennewick, and Pasco. The Tri-Cities Airport, located near Pasco, provides passenger and freight services.

For the years 1991 to 1993, the potential collective dose to the population within the Hanford Site (miles) from all Hanford Site effluents was calculated to be 0.9, 0.8, and 0.4 person-rem in 1991, 1992, and 1993, respectively. In 1993, the dose to the maximally exposed offsite individual was calculated to be 0.04 person-rem per year from all exposure pathways. For perspective, collective dose to the same population from background radiation was calculated to be about 100,000 person-rem from an average of 300 millirem per year.

In 1993, about 14,500 individuals were monitored at the Hanford Site. Of these, about 1,500 were classified as radiation workers with a collective dose of 200 person-rem and an equivalent of 0.02 rem (20 millirem) per individual with measurable doses. A subset of about 1,000 workers associated with SNF storage at 100 K Basins averaged doses of 0.4 rem (400 millirem) per year. These averages are well below the 10 CFR Part 835 radiation dose limit of 5 rem (5,000 millirem) per year, and the DOE Administration Control Level of 2 rem (2,000 millirem) per year for occupational exposure.

Electricity in the region is provided by several different entities, but it is primarily generated by the Bonneville Power Administration. About 74 percent of the region's installed generating capacity is hydroelectric. Power for the Hanford Site is purchased wholesale from the Bonneville Power Administration amounting to greater than 550 megawatts in 1988. Because of the reliance on hydroelectric power, capacity is variable, averaging 16,400 megawatts of capacity.

Major incorporated areas in Benton and Franklin Counties are served by municipal wastewater treatment systems. The unincorporated areas are served by onsite septic systems.

High-level radioactive waste has been accumulating at the Hanford Site since 1944. High-level waste in single-shell tanks—no new waste has been added to these tanks since 1980. Much of the liquid high-level waste in single-shell tanks has been transferred to newer double-shell tanks for safer storage.

disposed of onsite before 1970 in unlined trenches. Since 1970, transuranic waste abovegrade storage facilities. As of 1991, there were about 120,000 cubic meters (transuranic waste buried or in retrievable storage. Mixed low-level waste totaling (21,902 cubic yards) was buried at the Hanford Site from 1987 to 1991. Another 4,2 cubic yards) of mixed waste has accumulated in storage. In 1992, 56,245 kilograms mixed low-level waste was generated. From 1944 to 1991, approximately 558,916 cubic yards) of low-level waste was buried at the Hanford Site. In 1991, 5,300 cubic yards) of low-level waste was generated at the Hanford Site. In 1992, 619,268 kilopounds) of hazardous waste was generated. Mixed wastes are 99 percent tank wastes resulting from 108 different waste streams. Hazardous wastes generated in 1995 from total 2.2 cubic meters (2.9 cubic yards). In 1992, industrial solid waste totaled cubic yards) and asbestos totaled 1,017 cubic meters (1,330 cubic yards). A total chemicals are reported at the Hanford Site at over 783 locations, and they are four hazardous materials. In 1992, the Emergency Planning and Community Right-to-Know Act threshold was exceeded for 53 hazardous chemicals.

4.2 Idaho National Engineering Laboratory

This section summarizes environmental characterization information on the Idaho Engineering Laboratory. This information has been used to evaluate impacts at the Engineering Laboratory under various alternatives for management of SNF. More detailed information characterizing this Idaho National Engineering Laboratory is presented in separate cover.

The Idaho National Engineering Laboratory is located on approximately 2,300 square miles (890 square miles) of land in southeastern Idaho and contains nine major facilities located primarily within Butte County, but portions of the Idaho National Engineering Laboratory are located in Bingham, Jefferson, Bonneville, and Clark Counties. The Idaho National Engineering Laboratory is roughly equidistant from Salt Lake City, Utah, and Boise, Idaho. Cities near the Engineering Laboratory include Idaho Falls to the east, Blackfoot to the southeast, Arco to the southwest, and Arco to the southwest. Yellowstone National Park is 149 kilometers

Categories of land use at the Idaho National Engineering Laboratory include grazing, general open space, and infrastructure, such as roads. About 2 percent of the Engineering Laboratory area [4600 hectares (11,400 acres)] is used for facilities. A National Engineering Laboratory is a Superfund site, listed on the National Priorities List.

The region of influence for the Idaho National Engineering Laboratory is a subregion comprising Bingham, Butte, Bonneville, Clark, Jefferson, Bannock, and Madison counties. The region had a 1990 population of 219,713. Historically, the regional economy has been based on farming and ranching. Mining is also an important component of the regional economy.

The population within an 80-kilometer (50-mile) circle centered at Argonne National West on the Idaho National Engineering Laboratory has been characterized for the purpose of determining whether any disproportionately high and adverse impacts exist to minority and low-income populations surrounding the Idaho National Engineering Laboratory. It is shown to be 7 percent low-income, based on U.S. Bureau of Census information and the definitions in Appendix L.

During fiscal year 1990, the Idaho National Engineering Laboratory directly employed approximately 11,100 personnel, accounting for almost 12 percent of the total regional employment. Approximately 38,000 persons, or 17 percent of the total regional population, were employed associated with the operation of the Idaho National Engineering Laboratory. Direct Idaho National Engineering Laboratory employment was approximately 11,600 jobs at the Idaho National Engineering Laboratory is projected to decrease to approximately 7,250 in fiscal year 2004.

More than 1,500 prehistoric and historic archaeological resources have been identified in the Idaho National Engineering Laboratory area, but only 4 percent of the Idaho National Engineering Laboratory sites are listed on the National Register of Historic Places. Laboratory and historic sites and isolates. Although not formally evaluated, these sites are eligible for nomination to the National Register of Historic Places; the isolates have been evaluated and meet eligibility requirements. The Experimental Breeder Reactor-I is listed on the National Register of Historic Places, and other structures could potentially be listed. The Shoshone-Bannock region's primary Native American residents. Because they believe the land is sacred to them, the Shoshone-Bannock peoples, include all forms of traditional lifeways and usage at the Idaho National Engineering Laboratory reserve is potentially culturally important to them. This includes not only prehistoric archaeological sites, which are important in rel

context, but also features of the natural landscape, air, plant, water, or animal special significance. DOE has committed to additional interaction and exchange of Shoshone-Bannock Tribes at the Fort Hall Reservation.

The northwestern edge of the Eastern Snake River Plain, where the Idaho National Laboratory is located, is bordered on the north and west by the Bitterroot, Lemhi, and Teton ranges. A number of inactive volcanic buttes also form part of the Idaho National landscape.

The Eastern Snake River Plain forms a broad, northeast-trending, crescent-shaped relief comprised primarily of basaltic lava flows. These flows at the surface range from 2,100 years. The surface of the Eastern Snake River Plain is comprised primarily of thin, discontinuous, interbedded deposits of wind-blown loess and sand, waterborne floodplain alluvial sediments, and rhyolitic domes formed 1,200,000 to 300,000 years ago.

The Eastern Snake River Plain is on an area of low seismicity that is adjacent to the active Intermountain Seismic Belt and Centennial Tectonic Belt and lies in Uniform Risk Zones 2B and 3. The largest recorded earthquake in the Centennial Tectonic Belt occurred on August 17, 1959, near Hebgen Lake, Montana, with an epicenter 145 kilometers northeast of the Idaho National Engineering Laboratory. In addition to these earthquakes, 29 earthquakes greater than magnitude 5.5 have occurred within 322 kilometers (200 miles) of the Idaho National Engineering Laboratory since 1884. The Idaho National Engineering Laboratory is an active but long-time dormant volcanic area. The conditional probability of a basaltic eruption in the south-central area of the Idaho National Engineering Laboratory is one incident in 100 years. The probability of volcanic impact on Idaho National Engineering Laboratory facilities is estimated to be less than one incident in every million years or longer.

Within Idaho National Engineering Laboratory boundaries, the geologic resources are sand, gravel, and pumice. Several quarries or pits maintain supply material for construction projects.

The general climate of the Idaho National Engineering Laboratory is characterized by seasonal temperatures that range from -7.3C (18.8F) in winter to 18.2C (64.8F) in summer. The annual average temperature is about 5.6C (42F). Annual precipitation is light, averaging 8.71 inches. Snowfall averages 701 millimeters (27.6 inches) per year.

Although the Idaho National Engineering Laboratory is in a belt of prevailing winds that are normally channeled by the adjacent mountain ranges into southwest wind. The wind speed measured at the 6.1-meter (20-foot) level at the Central Facilities Area weather station is 7.5 meters per second (17 miles per hour). Monthly average values range from 2.3 meters per second (5.1 miles per hour) in December to 4.2 meters per second (9.3 miles per hour) in April and May. The highest nearground windspeed measured at the Idaho National Engineering Laboratory is 22.8 meters per second (51 miles per hour).

Severe weather, other than thunderstorms, is uncommon. Five funnel clouds (touching the ground) and no tornadoes have been reported between 1950 and 1988.

Neither the Idaho National Engineering Laboratory nor the surrounding county are in a nonattainment area (40 CFR Part 81.313) with respect to any of the National Ambient Air Quality Standards (40 CFR Part 50). The Idaho National Engineering Laboratory is located in a Class II significant deterioration (40 CFR Part 52.21) Class I ambient air quality area in the vicinity of the Idaho National Engineering Laboratory: Craters of the Moon Wilderness, 53 kilometers (33 miles) west-southwest from the center of the Idaho National Engineering Laboratory; Yellowstone National Park, Idaho-Wyoming, 143 kilometers (89 miles) east-northeast of the Idaho National Engineering Laboratory; and Grand Teton National Park, Wyoming, approximately 145 kilometers (90 miles) east from the center of the Idaho National Engineering Laboratory.

The types and amounts of nonradiological emissions from Idaho National Engineering Laboratory facilities and activities are similar to those of other industrial complexes of similar size. Concentrations of criteria and hazardous/toxic air pollutants are within applicable standards. Radioactive emissions occur from Idaho National Engineering Laboratory facilities; the maximum dose to the maximally exposed offsite individual is 0.00005 rem (0.05 millirem).

Essentially no surface water bodies drain the Idaho National Engineering Laboratory. Streams arise in the mountains and much of their water is diverted for irrigation. Some streams onsite. Water that does reach the Idaho National Engineering Laboratory through the Test Reactor Area/Idaho Chemical Processing Plant area before going below the Test Area is diverted by an onsite dam during heavy flows onto the southern part of the Idaho National Engineering Laboratory. The remainder of the water infiltrates near Test Area North. All river flows are intermittent. No surface water runs off of the Idaho National Engineering Laboratory.

The Idaho National Engineering Laboratory does not withdraw or use surface wa

nor does it discharge effluents to natural surface water. However, the three surface waters of the Idaho National Engineering Laboratory (Big and Little Lost Rivers and Birch Creek) are designated for agricultural water supply, cold-water biota, salmonid spawning, and contact recreation. In addition, waters in the Big Lost River and Birch Creek have domestic water supply and are special resource waters.

Depths to the water table at the Idaho National Engineering Laboratory range from 100 to 274 meters (300 to 900 feet) in the north to 274 meters (900 feet) in the south. Flows in the largely unconfined aquifer are generally to the southwest. Groundwater flows at speeds ranging from 1 to 20 feet per day. The water quality of the aquifer is generally good, and it meets the U.S. Environmental Protection Agency's maximum contaminant levels for drinking water. As of 1992, concentrations of iodine-129, cobalt-60, strontium-90, and cesium-137 are below the U.S. Environmental Protection Agency's maximum contaminant levels for drinking water. However, concentrations of these radionuclides in groundwater are generally above the established limits for gross alpha particle activity or the proposed adjustment for radioactive decay. Individual maximum contaminant levels have not been established for plutonium-239, plutonium-240, and americium-241. However, these radionuclides have not exceeded the established limits for gross alpha particle activity or the proposed adjustment for radioactive decay. This decrease is attributed to improved waste management practices, reduced discharge rates, and natural radioactive decay. Individual maximum contaminant levels have not been established for plutonium-239, plutonium-240, and americium-241. However, these radionuclides have not exceeded the established limits for gross alpha particle activity or the proposed adjustment for radioactive decay. Extremely low concentrations of iodine-129 have migrated offsite, but both concentrations are well below the current U.S. Environmental Protection Agency's maximum contaminant levels for drinking water.

Of the nonradioactive metals, only total chromium has exceeded maximum contaminant levels established by the Safe Drinking Water Act. Nitrates have exceeded the maximum contaminant level established by the Safe Drinking Water Act in the past near the Idaho Chemical Processing Plant but have been below the maximum contaminant level since 1988. Carbon tetrachloride, chloroform, 1,1-dichloroethylene, cis-1,2-dichloroethylene, tetrachloroethylene, trichloroethylene, and vinyl chloride have exceeded maximum contaminant levels at various times over the last 5 years.

Groundwater use on the Snake River Plain includes irrigation, food processing, domestic, rural, public, and livestock supply. Water use for the upper Snake River Plain Aquifer was 16.4 million cubic meters (4.3 million gallons) per year. The aquifer is the source of all water used at the Idaho National Engineering Laboratory. Site activities withdraw an average of 7.4 million cubic meters (1.9 million gallons) per year with a substantial portion discharged to the surface or subsurface and eventually recharged. Withdrawal represents approximately 0.4 percent of the water consumed from the East Snake River Aquifer, or 53 percent of the maximum yield of a single typical irrigation well.

Total consumption of water at the Idaho National Engineering Laboratory averages 23.8 million cubic meters per second (8.8 cubic feet per second). DOE holds a Federal Reserved Water Right at the Idaho National Engineering Laboratory, which permits a groundwater pumping capacity of 2.0 million cubic meters per second (80 cubic feet per second), though this capacity is not utilized. The DOE permit dates back to the establishment of the Idaho National Engineering Laboratory.

Localized flooding can occur at the Idaho National Engineering Laboratory when frozen and melting snow combines with heavy spring rains. Test Area North was flooded in 1969, extensive flooding caused by snowmelt occurred in the lower Birch Creek Valley shown that both the 25- and 100-year, 24-hour rainfall/snowmelt storm event could occur at the Radioactive Waste Management Complex. The drainage system, including dikes and other features designed to mitigate potential surface water flooding, have been upgraded. The probable maximum flood in the vicinity of Mackay Dam, 75 kilometers (45 miles) north of the Idaho National Engineering Laboratory, coupled with a dam failure, probably exceeds the area inundated by 100- and 500-year floods of the Big Lost River at the Idaho National Engineering Laboratory. Analyses indicate that the shallow depths and low flow velocities resulting from the probable maximum flood and dam failure would not have a significant impact on Idaho National Engineering Laboratory facilities.

Onsite vegetation is predominantly shrub-steppe. Communities range from shrub-steppe vegetation at lower altitudes, through sagebrush and grass dominated communities, to coniferous forest along the foothills of nearby mountains and buttes. Big sagebrush and rabbitbrush are the dominant shrub species. Indian ricegrass, wheatgrasses, squirreltail, and cheatgrass are the dominant grass species. Forbs include phlox, mustards, and Russian thistle.

About 270 vertebrate species have been observed onsite. These include 46 mammal species, 2 reptile, 2 amphibian, and 9 fish species. Major fur-bearing species include coyote, mink, and fisher. Important big-game species include the pronghorn, mule deer, and elk. Two federal candidate animal species potentially occur on the Idaho National Engineering Laboratory. The golden eagle is a winter resident and is locally common in the far north end and the western edge of the Idaho National Engineering Laboratory. Peregrine falcons are infrequently observed in the winter. The bald eagle does not nest onsite, and neither is commonly observed near facilities. The candidate species include white-faced ibis, northern goshawk, ferruginous hawk, burrowing owl, Townsend's big

rabbit, long-eared myotis, small-footed myotis, and Idaho pointheaded grasshopper (Idaho National Engineering Laboratory).

No Federal- or state-listed plant species occur at the Idaho National Enginee eight plant species identified by the U.S. Bureau of Land Management, the U.S. Fore Native Plant Society as sensitive, rare, or unique are known to occur there. These located near any facilities and are uncommon on the Idaho National Engineering Labc require unique microhabitats.

Two interstate highways serve the general region: Interstate 15, a north-sou several cities along the Snake River, approximately 40 kilometers (25 miles) east c Engineering Laboratory, and Interstate 86, an east-west route that intersects Inter (40 miles) south of the Idaho National Engineering Laboratory. U.S. Highways 20 an access routes to the southern portion of the Idaho National Engineering Laboratory. access to the northern portion of the Idaho National Engineering Laboratory from th and 33 from the north, and State Route 22 from the west. These roads are complemen (controlled access) system of about 140 kilometers (87 miles) of roads.

The Union Pacific Railroad provides rail service to the Idaho National Engine Idaho Falls receives railroad freight service from Butte, Montana, to the north, an Salt Lake City, Utah, to the south. The Union Pacific's Blackfoot-to-Arco route, w portion of the Idaho National Engineering Laboratory, provides rail service to the Laboratory. This branch connects with a DOE spur line that links with developed ar SNF has been transported to the Idaho National Engineering Laboratory over these ra shipments arrive by truck.

Several airlines provide Idaho Falls with aircraft passenger and cargo servic

Recorded doses from 1987 to 1991 were used as a baseline for comparison with operations for the next 40 years. The average annual occupational dose to individu was 0.156 rem (156 millirem), giving an average collective dose of about 300 person

Industrial health and safety statistics from 1987 to 1991 are used as a basel alternatives. There were 1,337 total recordable injury and illness cases at the IC Laboratory from 1987 to 1991, for an average of 8,385 employees working a total of fatality occurred at the Idaho National Engineering Laboratory between 1987 and 199 was struck and killed by a forklift.

The water supply for the Idaho National Engineering Laboratory is provided by wells, with pumps and storage tanks. The average combined pumpage from the Idaho N Laboratory wells from 1987 through 1991 was 7.4 billion liters per year (1.9 billic calculated based on the cumulative volumes of water withdrawn from the wells.

Average annual wastewater discharge volume at the Idaho National Engineering through 1991 was 537 million liters (142 million gallons).

The rated capacity of the Idaho National Engineering Laboratory electric powe line is 124 megavolt-amperes. The peak demand on the system from 1990 through 199 megavolt-amperes, and the average usage was approximately 200,000 megawatt-hours pe

No high-level liquid waste resulting from reprocessing activities has been ge National Engineering Laboratory since 1992; however, certain other processes genera handled as high-level waste. These sources are estimated to generate 750 cubic met through 1992, an average of approximately 48.5 cubic meters of mixed low-level wast annually. From 1989 through 1992, an average of approximately 46.5 cubic meters of generated annually.

Burial of transuranic waste ended in 1970; since then all transuranic waste h retrievable storage. Receipt of offsite transuranic waste ended in 1988 (with minc After 1988, only minor amounts of transuranic waste have been generated onsite and storage. About 127,000 cubic meters (166,000 cubic yards) are retrievably stored c National Engineering Laboratory. The average annual volume of hazardous waste tran 1988 through 1991 was approximately 180 cubic meters. The average annual volume of commercial solid waste disposed of at the Central Facilities Area landfill from 198 approximately 52,000 cubic meters (68,000 cubic yards).

4.3 Savannah River Site

This section presents summary environmental characterization information on t Site. This information has been used to evaluate impacts at the site under various management of SNF. More detailed information characterizing the Savannah River Sit Appendix C, under separate cover.

The Atomic Energy Commission established the Savannah River Site in 1950 as t

Project to produce nuclear materials for the national defense. The number of Savannah River Site reactors grew to include five nuclear production reactors (now inactive), two chemical separations target fabrication facility (inactive), and support facilities.

The Savannah River Site occupies an area of approximately 800 square kilometers (310 square miles) in western South Carolina, in a generally rural area about 40 kilometers (25 miles) southwest of Augusta, Georgia (see Figure 4-3). The Savannah River Site, which is bordered by the Savannah River to the southwest, includes portions of three South Carolina counties: Aiken, Barnwell, and

approximately 73,500 hectares (181,500 acres) of the Savannah River Site is under forest cover. Approximately 73,500 hectares (181,500 acres) of the Savannah River Site is under forest cover. Approximately 73,500 hectares (181,500 acres) of the Savannah River Site is under forest cover. The Savannah River Site is managed in cooperation with the U.S. Forest Service) manages the forested areas, many of which are pine plantations. The Savannah River Site has a cooperative agreement with DOE. Facilities that previously produced defense nuclear materials occupy approximately 5 percent of the total Savannah River Site land area. The remaining land area consists of ponds, and reservoirs.

Approximately 90 percent of the Savannah River Site work force lives in six counties in South Carolina (Aiken, Allendale, Bamberg, and Barnwell counties in South Carolina and Columbia counties in Georgia). In 1990, employment at the Savannah River Site represented approximately 10 percent of the employment in the six-county region. Employment at the Savannah River Site grew to 23,351 in Fiscal Year 1992, with a payroll of \$1.2 billion. The total number of jobs at the Savannah River Site is projected to decrease to approximately 15,000 by the year 1995.

Between 1980 and 1990, the population in the six-county region of influence increased from 376,058 to 425,607. More than 88 percent of the 1990 population lived in Aiken (66,031), and Richmond (189,719) counties. According to census data, the estimated persons per household in the six-county region was 2.72, and the median age of the population was 30 years.

The population within 80 kilometers (50 miles) of the Savannah River Site has been identified for the purposes of identifying whether any disproportionately high and adverse impacts exist on low-income communities. The population surrounding the Savannah River Site is predominantly white and 17 percent low-income based on U.S. Bureau of Census information, and the approach presented in Appendix L.

As of the end of Fiscal Year 1992, archaeological surveys have covered about 100 square kilometers of the Savannah River Site and recorded 858 archaeological sites. Of these 858 sites, more than 500 have been evaluated, and 53 have been determined to be eligible for the National Register of Historic Places.

Three Native American groups—the Yuchi Tribal Organization, the National Council of American Indians, and the Indian Peoples Muscogee Tribal Town Confederacy—have expressed concern over sites and items on the Savannah River Site. Figure 4-3. Savannah River Site location and site map. These organizations have expressed concern about major planned actions on the Savannah River Site and asks the Savannah River Site documents prepared in accordance with the National Environmental Policy Act of 1969.

The Savannah River Site has gently rolling terrain and is heavily wooded. Facilities are located about the Savannah River Site, but major production facilities (for example, reactors) are confined to its interior. As a result, the Savannah River Site facilities are located outside of the Savannah River Site.

The Savannah River Site lies in the Coastal Plain physiographic province of South Carolina, approximately 32 kilometers (20 miles) southeast of the Fall Line, which separates the Coastal Plain province from the Piedmont province. Onsite elevations range from 27 to 128 meters above mean sea level.

The Coastal Plain sediments underlying the Savannah River Site consist of sand and silt; however, occasional beds of clean sand, gravel, clay, and carbonate do occur. The sediments are dense crystalline igneous and metamorphic rock or younger consolidated igneous and metamorphic rock of the Triassic Period. A regional aquitard, the Appleton Confining System, hydrologically separates the Triassic and older igneous and metamorphic rocks from the overlying Coastal Plain sediments.

The area of the Savannah River Site is historically of low-to-moderate seismicity. The Savannah River Site is in a Uniform Building Code Seismic Risk Zone 2A. The Pen Branch Fault, which spans the central portion of the Savannah River Site, is considered to be a Cretaceous/Tertiary (140 million to 1.6 million years) reactivation of a northern extension of the Triassic age Dunbarton basin. There is no evidence to indicate that the Pen Branch Fault is defined by the U.S. Nuclear Regulatory Commission. Surface mapping, subsurface borehole investigations have not identified any faulting of the sedimentary strata at the Savannah River Site that have an effect on facilities.

The closest offsite fault system of significance is the Augusta Fault Zone, a 40 kilometers (25 miles) from the Savannah River Site. In this fault zone, the Belton Fault is the most recent movement, but it is not considered capable of generating major earthquake. There is conclusive evidence of recent displacement along any fault within 320 kilometers (200 miles) of the Savannah River Site.

Savannah River Site, with the possible exception of the buried faults in the epicenter of the Charleston, South Carolina, earthquake, approximately 145 kilometers (90 miles) away.

Two major earthquakes have occurred within 320 kilometers (200 miles) of the Savannah River Site: (a) the Charleston earthquake of 1886, which had an estimated Richter scale magnitude of 7.0, and (b) the Union County, South Carolina, earthquake of 1913, with an estimated Richter scale magnitude of 6.5. The 1913 earthquake occurred about 160 kilometers (100 miles) from the Savannah River Site. In June 1913, there was a local Richter scale magnitude of 2.6 and a focal depth of 1.0 kilometer (0.6 miles) at the Savannah River Site. An earthquake with a local Richter scale magnitude of 2.0 occurred on August 5, 1988, but was not felt by onsite workers.

The Savannah River Site is in a temperate region with mild winters and long hot summers. Average monthly temperatures range from 7.2C (45F) in January to 27.2C (81F) in July. Annual precipitation at the Savannah River Site is approximately 122 centimeters (48 inches).

Prevailing winds are from the northeast and southwest, with an annual average wind speed of 3.8 meters per second (8.5 miles per hour). Windspeeds are typically highest in winter.

On average, thunderstorms occur 56 days per year. The estimated probability of a major hurricane striking the Savannah River Site is 7.0 x 10⁻⁵ per year. Nine tornadoes have been confirmed at the Savannah River Site since 1953. Hurricane-strength winds have been recorded once at the Savannah River Site, Hurricane Gracie in 1959.

Air quality at the Savannah River Site is generally good, meeting National Ambient Air Quality Standards for criteria pollutants. The nearest Class I Area, the Congaree National Park, is 80 kilometers (50 miles) from the Savannah River Site. Tritium is the only radionuclide of Site origin that is routinely detected in offsite air samples in concentrations above background levels.

Five streams drain the Savannah River Site: Upper Three Runs Creek, Fourmile Branch, Steel Creek, and Lower Three Runs Creek. These streams originate on the Aiken Plateau and descend 15 to 60 meters (50 to 200 feet) before discharging to the Savannah River.

Surface-water quality in the Savannah River downstream of the Savannah River Site is generally good. In 1992, the South Carolina Department of Health and Environmental Control classified the river and its tributary streams as "freshwaters" from "Class I" to "Class III" water quality standards. Two elements-iron and manganese (both naturally occurring in local waters)-have historically exceeded maximum concentration limits.

Two distinct hydrogeologic systems underlie the Savannah River Site: (a) the Coastal Plain province, where a wedge of unconsolidated sediments of Late Cretaceous and Tertiary age underlies the major aquifer systems of the area, and (b) the Piedmont Province, where groundwater is contained in mudstones and sandstones within Paleozoic metamorphic and igneous basement rock. The thickness of the aquifer systems ranges from approximately 40 meters (130 feet) in the northernmost portion of the Savannah River Site to the surface in areas where the wetlands or streams.

The sediments of the southeastern Coastal Plain hydrogeologic province are grouped into three aquifer systems divided by two major confining systems, all underlain by the Applegate Formation. These aquifer systems are known regionally as the Floridan, the Dublin, and the Middle Atlantic aquifers. Associated with these three aquifer systems are the Steed Pond, Crouch Branch, and McQueen Branch Aquifers.

The Crouch Branch and McQueen Branch hydrostratigraphic units are the most important in the vicinity of the Savannah River Site. The McQueen Branch Aquifer, in particular, is the primary aquifer and serves as the main production aquifer for the Savannah River Site. The groundwater in the Crouch Branch and McQueen Branch Aquifers is suitable for most domestic and industrial purposes.

Industrial solvents, metals, tritium, or other constituents used or generated at the Savannah River Site have contaminated the groundwater over 5 to 10 percent of the Site. Contaminated groundwater underlies only a few facilities, and the contaminants detected reflect the material used at these facilities. Contamination of groundwater in an aquifer supplying drinking water has occurred in a relatively small area in the northwest portion of the Savannah River Site: two wells in the Aquifer System (formerly known as the Tuscaloosa Formation) contain low concentrations of trichloroethylene and tetrachloroethylene.

The aquifers underlying the Savannah River Site sustain single-well yields of up to 100,000 liters per day (2.7 million gallons per day). The Savannah River Site withdraws approximately 100,000 liters per year (3.7 billion gallons per year) of groundwater for domestic and industrial purposes. The Savannah River Site draws approximately 75.7 billion liters per year (20 billion gallons per year) of groundwater from the Savannah River. Water rights are not at issue at the Savannah River Site.

The Savannah River Site lies in the Upper Coastal Plain physiographic province. The Savannah River Site is near the transition area between the oak-hickory-pine forest and the longleaf-pine forest, and the consequence, species typical of both associations are present.

Plant communities adapted to dry conditions occur on more northern, upland areas of the Savannah River Site. (This area is sometimes referred to as the Aiken Plateau.) The most common plant communities on the northern half of the Savannah River Site are longleaf pine plantations and loblolly

sandhills. Wetter areas along streams support different groups of plant species, including bottomland hardwood forest communities. Other aquatic habitats, such as ponds, marshes, and Carolina bays, add considerable botanical diversity to the Savannah River Site.

Four federally listed endangered animal species occur on the Savannah River Site: the red-cockaded woodpecker, the southern bald eagle, and the shortnose sturgeon. The U.S. Fish and Wildlife Service lists the American alligator, as "threatened due to similarity of appearance" (to the crocodile). Researchers have found one federally listed endangered plant species, the Savannah River Site.

In 1992, the Savannah River Site hunters (chosen by lottery from a large pool) harvested 1,519 deer and 168 feral hogs. The purpose of these hunts is to keep deer populations in check and to reduce the number of animal-vehicle accidents on the Savannah River Site. Each animal killed during the hunts for radioactivity. A measurement of cesium-137 in a Savannah River Site deer was 22.4 picocuries per gram. For hogs, the maximum value was 22.9 picocuries per gram; and for hogs, the maximum value was 22.9 picocuries per gram. The estimated maximum dose received by a Savannah River Site hunter (49 millirem) per year. This estimate assumed a hunter whose entire meat consumption of the Savannah River Site deer.

The major sources of noise at the Savannah River Site are equipment and machinery, cooling towers, transformers, engines, pumps, boilers, steam vents, and piping systems in operational areas. Studies indicate that, because of the remote locations of the Savannah River Site operational areas, existing onsite noise sources do not adversely affect individual noise limits established by the Occupational Safety and Health Administration.

Interstate 20 is the primary east-west corridor in the general area of the Savannah River Site. Highways 1 and 25 are the principal north-south routes. Direct access to the Savannah River Site is provided by South Carolina Highways 125 and 19; South Carolina Highway 19 through traffic. South Carolina Highways 39 and 64 also provide access to the Savannah River Site. The CSX railroad line also serves the Savannah River Site.

Atmospheric releases of radioactive material to the environment from Savannah River Site operations from 1990 to 1992 resulted in an average dose of approximately 0.00002 rem per year to individuals living within an 80-kilometer (50-mile) radius of the Savannah River Site. The dose equivalent due to atmospheric releases from the 1992 Savannah River Site operations of 620,100 occupying the 80-kilometer (50-mile) radius was 6.4 person-rem. Atmospheric releases accounted for more than 90 percent of the estimated offsite population dose.

Similarly, liquid releases of tritium account for more than 99 percent of the total dose discharged to the Savannah River from the Savannah River Site activities. The calculated dose to the maximum exposed individual resulting from liquid releases from 1990 to 1992 (0.21 millirem). This resulted in average doses of 0.00004 and 0.00005 rem (0.04 a year) to consumers of drinking water from the downstream Beaufort-Jasper (South Carolina) and Wentworth (Georgia) water treatment plants, respectively.

The Savannah River Site purchases power from South Carolina Electric and Gas Company. Three purchased power-line interconnects to the Savannah River Site transmission grid. Average power consumption for the Savannah River Site was approximately 659,000 megawatt hours per year. The average load was 75 megavolt-amperes, and the peak demand was about 130 megavolt-amperes.

Average annual wastewater discharge volume at the Savannah River Site is about 528,400 gallons per day, which is about 50 percent of capacity. Eighteen plants currently process all Savannah River Site sanitary waste. A new centralized sanitary waste facility, scheduled for completion in mid-1995, will replace 14 of these plants.

The Savannah River Site had 127.9 million liters (33.8 million gallons) of radioactive waste onsite at the end of 1991, in 50 underground tanks, which is more than 90 percent of capacity. By 1993, the Savannah River Site had 9,900 cubic meters (350,000 cubic feet) of transuranic waste storage. The current volume of mixed low-level waste at the Savannah River Site is 60,000 cubic feet. Low-level waste is packaged for disposal onsite in carbon steel trenches. Hazardous wastes in storage at the Savannah River Site total some 1.6 million pounds, with a volume of 2,430 cubic meters (86,000 cubic feet).

4.4 Nevada Test Site

This section presents summary environmental characterization information on the Nevada Test Site. This information has been used to evaluate impacts at the Nevada Test Site under various management scenarios. More detailed information characterizing the Nevada Test Site is provided in Appendix F, under separate cover.

The Nevada Test Site is located in southwestern Nevada in southern Nye County. The site is bordered on three sides by the Nellis Air Force Base Bombing and Gunnery Range. The Nellis Range serves as a buffer zone between Nevada Test Site test areas and the Nevada Test Site. The Nevada Test Site comprises about 3,500 square kilometers (1,350 square miles), the largest contiguous, unpopulated land areas in the United States. The Nevada Test Site is used for underground weapons testing and as a nonnuclear test area. Congress has mandated that the Government pursue the development of mined geologic repositories for the permanent high-level waste and has directed DOE to study the Yucca Mountain, Nevada, site repository.

The majority of the land near the Nevada Test Site is managed by the U.S. Bureau of Land Management and used for livestock grazing. The area is surrounded by recreational activities such as hunting, fishing, and camping.

The economy of the two-county area near the Nevada Test Site is dominated by contractor personnel at the Nevada Test Site, with a direct link to Clark County and most of the employees reside. Most of the offsite supporting contractors and the indirect economic activity connected to the Nevada Test Site are also located in Clark County. The population of the Las Vegas Metropolitan Statistical area was 735,000, with a 4.7 percent increase since 1980. In contrast, Nye County is sparsely populated, with employment provided by some mining and Government-sector jobs. As of January 1994, the work force totaled 1,000 jobs.

The population within 80 kilometers (50 miles) of the Nevada Test Site has been the subject of studies to identify whether any disproportionately high and adverse impacts exist on low-income communities. The population surrounding the Nevada Test Site is shown to be 12 percent minority and 12 percent low-income, based on U.S. Bureau of Census information and the approach presented in Appendix L.

On the Nevada Test Site, numerous prehistoric sites and prehistoric/historic sites are located and recommended as eligible for the National Register of Historic Places. However, the sites are located in the vicinity of the proposed SNF management facility. Historic activities include the Emigrant Trail, mining camps, and later the settlements of Bullfrog-Goldfield, Las Vegas, and Southern Nevada, including parts of what is now the Nevada Test Site, was inhabited by the Southern Paiute and Shoshone Tribes. Areas in the northern portion of the Nevada Test Site, including Pahute and Rainier Mesas, contain sites of cultural affiliation to these peoples. American resources are located within the areas proposed for SNF facilities. Some vertebrate fossils also occur in the area, notably at Tule Springs.

The Nevada Test Site is in a visual setting of low-lying valleys and flats in the Mojave Desert and Great Basin. Because the public can be concerned about changes in the area's landscape and views are not regionally unique, the Nevada Test Site has a low to moderate visual sensitivity.

The Nevada Test Site is located in the southern part of the Great Basin section of the Basin and Range Physiographic Province. Local geology is characterized by mountains of Precambrian sedimentary rocks and Tertiary volcanic tuffs and lavas separated by alluvial, Tertiary sedimentary rocks. Sedimentary rocks are complex, folded, and faulted carbonates in the upper and lower sections and sandstone in the middle section. Volcanic rocks are predominantly Tertiary tuffs with scattered granitic plutons. Potential geologic resources within the Nevada Test Site include gold, tungsten, molybdenum, zeolites, barite, and fluorite.

The area of the Nevada Test Site is historically of low-to-moderate seismicity. The Nevada Test Site is in Uniform Building Code Seismic Risk Zones 2B and 3. Seismicity in the Nevada Test Site area generally occurs as thrust faults, normal faults, and strike-slip displacements are thought to have occurred as a consequence of underground nuclear testing. Seismic activity before 1978 within 10 kilometers (6 miles) of Yucca Mountain shows two had magnitudes 3.6 and 3.4 on the Richter scale, and five had magnitudes that were determined because of instrument problems. Two historical earthquakes with a magnitude of 5.0 (scale) have been reported 110 kilometers (68 miles) southwest of Yucca Mountain and 100 kilometers (62 miles) to the northeast. Most earthquakes in the area are less than 10 kilometers from the site. Historic seismic events and the length of active faults can be used to infer a maximum magnitude of earthquakes in the Yucca Mountain region. Recurrence intervals for earthquakes with magnitudes greater than 7 are 25,000 years, greater than 6 are 2,500 years, and greater than 5 are 250 years.

The climate in the Nevada Test Site region is characterized by high solar radiation, low precipitation, low humidity, and large diurnal temperature ranges. At Area 6, the maximum temperatures are -6.1 to 10.6C (21 to 51F) in January and 14 to 36C (57 to 97F) in July. Average precipitation at Area 6 is 15 centimeters (6 inches).

DOE maintains an extensive network of air sampling stations for radiological particulates, reactive gases, tritium, and noble gases. Nonradiological air pollutants are also monitored. Federal standards. In recent years, the majority of radioactive effluents at the Nevada Test Site have been within Federal standards.

from underground nuclear tests. In addition, some of the radioactivity detected by attributed to resuspension of radioactive particulate matter remaining from the atm from 1951 to 1962. Monitoring of airborne particulates, noble gases, and tritiated Test Site in 1992 indicated onsite concentrations that were generally not statistic background concentrations. External gamma exposure monitoring has indicated that t has been consistent from year to year. Although airborne releases of radioactivity during the years that atmospheric testing was performed, in recent years, no Nevada radioactivity has been detected offsite at any air sampling station.

Surface drainage in the Nevada Test Site area is ephemeral, and almost no str collected. Perennial surface waters occur as springs and in short reaches of the A evaporation is 152 to 170 centimeters per year (60 to 67 inches per year). Run-off infrequent storm events, which may cause local flooding, especially in Fortymile Ca River, and Jackass Flats drainage. There is the potential for a 100-year magnitude radioactive contaminants released as a result of historic underground nuclear testi the Nevada Test Site.

Six major aquifers occur in the area of the Nevada Test Site, including some The hydrogeology is characterized by great depths to the groundwater table of 200 t 1,640 feet) and slow velocity in the saturated and unsaturated zones. Flow velocit from 1.8 to 183 meters (6 to 600 feet) per year. Regional groundwater flow is frc toward the regional discharge area near Ash Meadows in the Amargosa Desert. Modeli Radioactive Waste Management Site at Area 5 indicate that the travel time from the water table is on the order of thousands of years.

Water in southern Nevada (excluding the Las Vegas area) is used chiefly for i extent for livestock, municipal needs, and domestic supplies. Almost all water sup groundwater aquifers, although some springs supply water to Death Valley and other Nevada Test Site. The Nevada Test Site obtains its water supply from the aquifers Test Site in the Ash Meadows Subbasin and Alkali Flat-Furnace Creek Ranch Subbasin. water use is discussed in detail in Appendix F of Volume 1.

Groundwater meets U.S. Environmental Protection Agency secondary standards fc and anions and the primary standards for deleterious constituents. Contamination k below the water table as well as in the unsaturated zone above it as a result of un The extent of this contamination is currently being studied.

The Nevada Test Site lies in a transition area between the Mojave Desert and supporting flora and fauna from both areas. Less than 1 percent of the area has be vegetation occurs in nine plant communities identified as creosote bush; blackbrush hopsage-desert thorn; sagebrush; saltbush; mountains, hills, and mesas; and two dis communities. Introduced weedy species, such as cheatgrass and Russian thistle, are areas.

Approximately 273 vertebrate wildlife species have been observed onsite, incl of reptiles, 190 species of birds, and 50 species of mammals. Common species inclu raptors, and wild horses. A number of game and fur-bearing species are found on th hunting and trapping are not permitted.

National Wetland Inventory maps of the Nevada Test Site have not been prepare been delineated onsite. Available information indicates that wetlands on the Nevac distribution and extent. Small riverine and palustrine wetlands may occur adjacent springs, playas, and reservoirs on the Nevada Test Site. There are no perennial st Site, and permanent surface water sources are limited to a few small springs and re support fish populations onsite, while reservoirs support introduced bluegill, gold

Twenty-five federally and state-listed threatened, endangered, and other spec been identified on and in the vicinity of the Nevada Test Site, including 9 birds, and 11 plant species. Federally endangered species include the American peregrine Devil's Hole pupfish. The federally threatened species is the desert tortoise.

The major noise sources at the Nevada Test Site occur primarily in developed include various facilities; equipment and machines (for example, engines, pumps, bc systems, construction equipment, and vehicles); aircraft operations; and testing. boundary away from most facilities, noise levels are barely distinguishable from ba Some wildlife disturbances may occur as a result of these activities.

Vehicular access to the Nevada Test Site is provided by U.S. Route 95 from th access via State Route 375 from the northeast. No major improvements are schedule providing immediate access to the Nevada Test Site.

The major railroad in the area is the Union Pacific, which runs through Las V approximately 80 kilometers (50 miles) east of the Nevada Test Site. A 15-kilomete Area 25, but it does not connect with the Union Pacific line.

Background radiation exposure and releases of radionuclides to the environmen

Site operations provide the sources of radiation exposure to people in the Nevada Test Site. The estimated dose-equivalent during 1992 for the population within 80 kilometers (50 miles) of the Nevada Test Site was 5.2×10^{-3} person-rem. The average dose was 1.1×10^{-5} rem (1.110-2 millirem) at the Nevada Test Site boundary. This dose is well below the National Emission Standards for Air Pollutants standard of 0.01 rem (10 millirem) per year and is a very small percentage of the total dose.

From 1988 to 1993, water use at the Nevada Test Site varied from a high of 13 (2,125 gallons per minute) in 1989 to a low of 60 liters per second (949 gallons per second). Significant changes in consumption are not anticipated.

From 1989 to 1993, Nevada Test Site electrical consumption ranged from 144,521 to 183,188 megawatt hours, with peak demands varying from 30.9 to 38.4 megavolt-ampere. Future consumption is projected to be 176,440 megawatt hours, with a peak demand of 39.5 megavolt-ampere.

Nevada Test Site manages the following categories of waste: low-level waste, hazardous waste, radioactive mixed waste, and nonhazardous waste. The Nevada Test Site manages high-level waste or SNF. Waste management activities include onsite treatment, onsite disposal, and preparation for appropriate offsite disposal. In addition, the Nevada Test Site manages an onsite inventory of hazardous materials, including some managed in underground storage tanks.

Total nonradioactive waste generated at the Nevada Test Site in 1992 included 90,000 kilograms (100 tons) of Resource Conservation and Recovery Act hazardous waste and 218,000 kilograms (240 tons) of hazardous non-Resource Conservation and Recovery Act waste.

4.5 Oak Ridge Reservation

This section presents summary environmental characterization information on the Oak Ridge Reservation. This information has been used to evaluate impacts at the Oak Ridge Reservation alternatives for management of SNF. More detailed information characterizing the Oak Ridge Reservation is presented in Appendix F, under separate cover.

The Oak Ridge Reservation is located on approximately 34,667 acres (140 square miles) of federally owned land. The reservation comprises forested lands, public lands, buffer zones, and operations areas: Y-12 Plant, Oak Ridge National Laboratories, and the K-25 Site (Gaseous Diffusion Plant) (see Figure 4-5). The Oak Ridge Reservation is located within the city limits of Oak Ridge, Tennessee. Bordering land uses are predominantly rural, including farms, forest, and pasture.

Most of the industrial and commercial development, by energy-related companies, in the Oak Ridge Reservation, has occurred in the City of Oak Ridge in Anderson and Roane counties, where most of the offsite contractors, labor, and capital are located. The population of the Oak Ridge Reservation in 1990 was approximately 17,080 people, and it is projected to decrease to 16,980 by the year 1999.

The population within 80 kilometers (50 miles) of the Oak Ridge Reservation has been used for the purposes of identifying whether any disproportionately high and adverse impacts exist on low-income communities. The population surrounding the Oak Ridge Reservation is 50 percent minority and 16 percent low-income, based on U.S. Bureau of Census information and an approach presented in Appendix L.

There are no identified archaeological sites or historic structures on the proposed site or management facilities on the Oak Ridge Reservation. Invertebrate fossils remain from the Cambrian to early Mississippian aged formations underlying the Oak Ridge Reservation (see Figure 4-5). Oak Ridge Reservation location and site map, early 1700s, the Overhill community were forcibly moved to Oklahoma in 1838. While the Cherokee may retain cultural affiliations with their ancestral home, there are no known Native American resources on the proposed site or management facilities on the Oak Ridge Reservation.

Visual resources are characterized by a series of low ridges and valleys trending generally north-southwest. Deciduous and coniferous forest covers about 80 percent of the Oak Ridge Reservation. DOE facilities are brightly lit at night, making them highly visible.

The area of the Oak Ridge Reservation is historically of low-to-moderate seismicity. The Oak Ridge Reservation is in a Uniform Building Code Seismic Risk Zone 2A. The Oak Ridge Reservation lies entirely within the western portion of the Valley and Ridge Province of the Cumberland Plateau. This province is characterized by numerous linear ridges and valleys. From 1811 to 1975, five major earthquakes occurred in the Oak Ridge Reservation area, but none has been of an intensity that caused severe damage. There has been no volcanic activity in the area for more than one million years.

The climate of the region is characterized by moderate to high precipitation, high humidity, low winds, and low diurnal temperature ranges. At Oak Ridge, mean annual precipitation is 48 inches, mean annual maximum temperature is 68 degrees Fahrenheit, and mean annual minimum temperature is 42 degrees Fahrenheit.

inches (137 centimeters) from 1961 to 1990. Mean daily temperatures range from 2.6 to 24.8C (76.7F) in July. Daytime winds are usually southwesterly, while nighttime northeasterly. In Tennessee, tornadoes are infrequent. The western half of the state has as many tornadoes as the eastern half where the Oak Ridge Reservation is located. The Oak Ridge Reservation experienced a tornado from a severe thunderstorm on February 21, 1993.

A network of air monitoring stations at the Oak Ridge Reservation measures selenium, uranium particulates, heavy metals, and several materials released by a Toxic Substance incinerator. The total dose of 0.0033 rem (3.3 millirem) per year to the maximally exposed person within the 0.01 rem (10 millirem) per year National Emission Standards for Hazardous Air Pollutants standard. The estimated collective committed effective dose equivalent to the average person within 80 kilometers (50 miles) of the Oak Ridge Reservation was approximately 0.02 percent of the 280,000 person-rem that the surrounding population receives from all sources of natural radiation. The Oak Ridge Reservation meets the standards for all criteria pollutants.

The surface drainage of the Oak Ridge Reservation includes numerous creeks (Sycamore, Poplar, and Bear Creeks) and the Clinch River, which subsequently flow to the Tennessee River. The Clinch River Dam, immediately south of the Oak Ridge Reservation, controls the flow of the Clinch River. Average discharge from the dam was 150 cubic meters (5,300 cubic feet) per second from 1963 to 1979. The Clinch River supplies water for the Oak Ridge Reservation and for industrial uses.

Geologic units of the Oak Ridge Reservation comprise two hydrologic groups: (a) the Knox Group and Maynardville Limestone, and (b) the Oak Ridge Reservation which includes other geologic units of the area including sandstones, siltstones, and shales. The Knox Group has solution conduits that store and transmit relatively large volumes of water, which are controlled by fractures and transmit limited amounts of water. The aquifer is the Clinch River. The Oak Ridge Reservation has a stream flow on the Oak Ridge Reservation. However, some flowpaths of the Knox Aquifer extend outside the Oak Ridge Reservation boundary. Because of the abundance of surface water, groundwater wells are not common. Groundwater quality is good above 300 meters (1,000 feet), but high total dissolved solids at depth.

Groundwater contamination has occurred in the general area of past-practice waste storage tanks, spill sites, and contaminated inactive facilities. Principal contaminants are organics, nitrates, heavy metals, and radioactivity. Exact rates and extent of the contamination have not been quantified. However, data indicate that most contamination remains relatively close to the source. An example of the maximum extent of groundwater contamination, nitrate has been detected at a distance of 900 meters (550 feet) southwest of the source. Nitrate is relatively mobile in groundwater. At Oak Ridge National Laboratory, several groups have been identified and are being monitored for groundwater contamination. At each waste area group will direct further groundwater studies. At the K-25 Site, commonly detected groundwater contaminants. Elevated levels of gross alpha and gross beta activity have been detected in a number of wells. Uranium and technetium-99, respectively, appear to be associated with the elevated gross alpha and gross beta levels. The metals chromium, lead, and mercury are detected in a number of wells at concentrations exceeding drinking water standards. Fluoride and polychlorinated biphenyls have also been detected in some wells.

The offsite residential drinking water quality monitoring program has detected organics in some offsite monitoring wells; however, concentrations have been below drinking water standards. Fluoride has been detected at concentrations exceeding drinking water standards in one well. The high fluoride concentration and accompanying pH are most likely from natural sources in the substrate.

The Clinch River supplies most of the water to the Oak Ridge Reservation, the surrounding communities, and other cities along the river. Major surface water uses include withdrawals for municipal, commercial and recreational navigation, and other recreational water activities. The abundance of surface water, most community and Oak Ridge Reservation water supplies are from surface water rather than groundwater. One supply well exists on the reservation for use as a laboratory. Groundwater is used for some domestic, municipal, farm, and industrial purposes. A typical well in the aquitard yields under 0.25 gallons per minute (0.001 m³/min). In many places wells are incapable of producing enough water to support a typical household.

The Oak Ridge Reservation area was cleared by logging and agricultural practices. The area is currently dominated by pine and pine hardwood, and oak hickory, as well as north-south hemlock-white pine-hardwood forest types.

Approximately 267 different vertebrate wildlife species have been recorded on the reservation, including 169 mammals, 169 birds, 33 reptiles, and 26 amphibians. Local habitats include wetlands, pine plantations in addition to forest. Undeveloped areas on the Oak Ridge Reservation support several fur-bearing populations.

Wetlands have been identified on the Oak Ridge Reservation, based primarily on

Wetland Inventory maps. Wetlands on the Oak Ridge Reservation include emergent, sedge forested wetland. These wetlands are located in embayments of the Melton Hill and border the reservation; along all major streams, including East Fork Poplar Creek, tributaries; in old farm ponds; and around groundwater seeps. Commercial fishing on the Oak Ridge Reservation for catfish and carp. Sport fishing for bass, catfish, and other species is popular.

Forty-seven species of federally and state-listed threatened, endangered, and sensitive species have been identified on and in the vicinity of the Oak Ridge Reservation, including 1 amphibians, 4 reptiles, 2 fish, 14 birds, and 5 mammals. Virginia spirea is a federally listed species; bald eagle, peregrine falcon, gray bat, and Indiana bat are federally endangered species. The state-listed Tennessee dace has been recorded in Bear Creek and tributaries of Bear Creek.

The major noise sources within the Oak Ridge Reservation occur primarily in certain areas and include facilities and equipment and machines, such as transformers, engines, and vehicles. Outside the operations area major sources of noise are vehicles and railroads. Within the Oak Ridge Reservation boundary, away from most of these activities, noise from these sources is distinguishable from background noise levels. Some disturbances of wildlife may occur on the Oak Ridge Reservation as a result of operations and construction activities.

Bear Creek Valley Road provides vehicular access to the Oak Ridge Reservation. State Routes 58, 62, 95, and 162 pass through the Oak Ridge Reservation and are open to traffic. Construction and modification are planned for segments of Bear Creek Valley Road, State Routes 58, 62, and 95 in the near future. Interstate 40 is within 8 kilometers of the Oak Ridge Reservation. Railroad service on the Oak Ridge Reservation is provided by CSX Transportation and Southern Railway. Knoxville is the closest major airport, 64 kilometers (40 miles) from the Oak Ridge Reservation.

Low-level, hazardous, and mixed wastes are generated and managed at the Y-12 Plant and the Oak Ridge National Laboratory. Nonhazardous wastes are generated at all three sites. Waste management at the Y-12 Plant and the Oak Ridge National Laboratory includes treatment, onsite waste disposal, preparation for proper offsite waste disposal, and disposal of liquid and solid hazardous wastes are disposed of offsite. Some low-level radioactive wastes are disposed of onsite.

4.6 Naval Sites

This section presents summary environmental characterization information on sites that have been evaluated under various alternatives for management or examination of naval facilities. More information has been used to evaluate impacts at the sites under various alternatives. More detailed information characterizing these sites is presented in Appendix D, under the heading "Naval Shipyard Radiation Work." The average annual radiation exposure for each naval shipyard radiation worker is presented in Appendix D, under the heading "Naval Shipyard Radiation Work."

The average annual radiation exposure for each naval shipyard radiation worker is presented in Appendix D, under the heading "Naval Shipyard Radiation Work." The average lifetime accumulated exposure for shipyard workers is presented in Appendix D, under the heading "Naval Shipyard Radiation Work."

4.6.1 Puget Sound Naval Shipyard

The Puget Sound Naval Shipyard is located in Bremerton, Washington, 23 kilometers west of Seattle and 32 kilometers (20 miles) northwest of Tacoma (Figure 4-6). The population within 80 kilometers (50 miles) of the shipyard is about 3 million people.

The population within 80 kilometers (50 miles) of the Puget Sound Naval Shipyard is characterized for the purposes of identifying whether any disproportionately high and adverse impacts exist on minority and low-income communities. The population surrounding the Puget Sound Naval Shipyard is shown to be 13 percent minority and 8 percent low-income, based on U.S. Bureau of Economic Analysis definitions and approach presented in Appendix L.

Puget Sound Naval Shipyard is on 132 hectares (327 acres) of highly developed waterfront dry dock area is the high-security portion of the shipyard where most production takes place. This area includes production shops, administration, and some public works shops. The upland area of the shipyard provides services to military personnel, including housing, recreation, counseling, dental care, and other support services. The inland area of the shipyard includes several piers for homeported ships and support facilities, plant, warehouses, a steel yard, public works shops, and parking.

There are about 10,200 civilians working at the shipyard. With other Government

area, the Federal payroll in Kitsap County, where the shipyard is located, provides total employment.

There are no prehistoric archaeological sites identified at the shipyard. Th Registered Historical Districts and one National Historic Landmark within the bound Until the mid-1880s, Kitsap County was inhabited by several Native American tribes group who lived on the shores of Puget Sound. For about
Figure 4-6. Puget Sound Naval Shipyard location and vicinity map. 100 years, the pr are no Native American properties or ceremonial sites in the shipyard areas where s conducted.

The natural topography of the shipyard has been altered significantly from it Portions of the upland areas of the complex were cut to fill marshes and create lev material was predominantly a silty, gravelly sand with occasional pockets of silts areas of natural soils vary from dense glacial deposits to soft bay mud and peat. hardpacked, clay soil with low permeability.

The site lies within Uniform Building Code Seismic Risk Zone 3. There have b 200 earthquakes in the area since 1840, most of which caused little or no damage. most recent earthquakes of high magnitude were near Olympia [64 kilometers (40 mile 1949 (7.1 on the Richter scale) and near Seattle in 1965 (6.5 on the Richter scale) area could experience an earthquake of intensity 7.5 on the Richter scale. There b faulting in conjunction with earthquakes in the shipyard region. Potential hazards minimal and limited to windborne volcanic ash.

The potential hazard from tsunamis and seiches is minimal because the system that surround Puget Sound provides a natural barrier, effectively damping the propa generated tsunamis.

The general area around Bremerton is damp, cool, and cloudy much of the year. at the Seattle-Tacoma Airport is 4 meters per second (9 miles per hour), with preva southwest.

The Code of Federal Regulations (40 CFR Part 81) states that the Air Quality this site is better than national standards for total suspended particulate matter has no specific classification for ozone, carbon monoxide, and nitrogen dioxide. T Olympic National Park, approximately 24 kilometers (15 miles) from the site.

Puget Sound Naval Shipyard has no important surface freshwaters. Groundwater within 30 meters (100 feet) of the ground surface in sand and gravel layers. The c near Bremerton is good. Groundwater is used for approximately 35 percent of the pu Current shipyard use is about 2.6 billion liters (676 million gallons) annually.

Vegetation and wildlife on the Puget Sound Naval Shipyard are limited to unde comprise approximately 19 hectares (46 acres) of the entire Bremerton Naval Complex have been previously disturbed and are currently landscaped with native and ornamen sensitive, threatened, or endangered aquatic or terrestrial species have been obser

Land access to the Seattle/Tacoma area is over two interstate highways: Inte Interstate 5. The major thoroughfare in south Kitsap County is State Route 16, whi Bremerton to Tacoma where it connects with Interstate 5. Bremerton's primary acces Routes 3, 303, and 304.

The Burlington Northern Railroad provides scheduled and on-demand freight ser central Kitsap County. A Navy-owned spur line from Shelton, Washington, provides a the shipyard. SNF originating at Bremerton and Pearl Harbor has historically been Bremerton to the Expanded Core Facility at the Idaho National Engineering Laborator shipments of SNF have been sent from Bremerton to the Idaho National Engineering La originating from Puget Sound Naval Shipyard and 20 transported by ship from Hawaii Naval Shipyard, where the containers were transferred to railcars for the journey t Engineering Laboratory.

The annual airborne emissions from the site do not result in any measurable r general public. Emissions of radionuclides from the site result in a calculated ef than 0.0001 rem (0.1 millirem) per year to any member of the general public.

In addition, normal activities associated with current naval nuclear operatic in the intentional discharge of any radioactive liquid effluent. Environmental mon by the site and independent U.S. Environmental Protection Agency monitoring of ship that the operations at the site have had no adverse impacts on public health or saf of these monitoring programs is found in Section 4.1.1 of Appendix D of Volume 1 of

4.6.2 Norfolk Naval Shipyard

of these monitoring programs is found in Section 4.1.2 of Appendix D of Volume 1 of

4.6.3 Portsmouth Naval Shipyard

Portsmouth Naval Shipyard is located in York County, in the southeast corner Seavey Island, near the mouth of the Piscataqua River (see Figure 4-9). Seavey Isl hectares (278 acres). To the north lies the low-density residential community of K shipyard, across the river, is the city of Portsmouth (population 22,300) and the t Hampshire. The population within an 80-kilometer (50-mile) radius of the site is a The shipyard is the region's largest employer, with 5,000 employees.

Figure 4-9. Portsmouth Naval Shipyard location and vicinity map. The populati characterized for the purposes of identifying whether any disproportionately high a minority and low-income communities. The population surrounding the Portsmouth Nav to be 5 percent minority and 7 percent low-income, based on U.S. Bureau of Census i definitions and approach presented in Appendix L.

On November 17, 1977, the National Park Service, U.S. Department of the Inter Portsmouth Naval Shipyard Historic District on the National Register of Historic Pl includes 54 acres of land and 59 buildings and structures. There are no known cult of the site where naval SNF would be stored.

Seavey Island is a rock knob, a prominent bedrock outcrop. The bedrock is a lime-silicate material consisting of chalky sandstone formed under heat and pressur sandstone shale. There are no economic geologic resources at the site.

The shipyard is in Uniform Building Code Seismic Risk Zone 2A. Numerous smal in rock units across the region, but only the Rye-Kittery contact is important enou map.

The typical weather is caused by various incursions of cold, dry arctic air; Gulf States; and cool, damp air from the Atlantic Ocean. Dominance of these system basis, creating highly variable weather conditions. Precipitation is evenly distri annual total of 108 centimeters (42.6 inches). Local fog is observed 15 percent of enough to restrict visibility to 2 kilometers (1.2 miles) or less about 35 percent

Winds average 3.9 meters per second (8.8 miles per hour), but speeds greater second (40 miles per hour) can occur any time of year. Severe weather from tornadc

The Code of Federal Regulations (40 CFR Part 81) states that the Air Quality this site is in moderate nonattainment for ozone and is better than national standa particulate matter and sulfur dioxide. The area has no specific classification for nitrogen dioxide. The nearest Class I Area to the site is the Presidential Range-I which is approximately 120 kilometers (75 miles) from the shipyard.

The Piscataqua River, formed by the confluence of the Cocheco River and the S flows southeasterly for 21 kilometers (13 miles) until it enters the ocean at Ports kilometers (13 miles) of the river is tidal. The river is one of the fastest flowi commercial port in the northeastern United States. The Piscataqua River is designa water quality.

The limited amount of vegetation and the industrial nature of the shipyard li suitable habitat for most terrestrial species. There is one small freshwater wetla No threatened or endangered species have been identified at the site.

Vehicles can reach the Kittery-Portsmouth area by means of Interstate 95 and shipyard is accessible by two federally owned bridges that cross to the residential Walker Avenue is the primary access route to Bridge 1, and Whipple Road provides di

There is daily freight rail service to the Shipyard by the Boston and Maine R connects Portsmouth with Manchester, New Hampshire; Portland, Maine; and Boston, Ma

Naval SNF has been removed from Navy nuclear ships at the shipyard and transg National Engineering Laboratory since 1959. There have been 43 shipments made, all

The annual airborne emissions from the site do not result in any measurable r general public. Emissions of radionuclides from the site result in a calculated ef than 0.0001 rem (0.1 millirem) per year to any member of the general public.

In addition, normal activities associated with current naval nuclear operatic in the intentional discharge of any radioactive liquid effluent. Environmental mon by the site and independent U.S. Environmental Protection Agency monitoring of ship that the operations at the site have had no adverse impacts on public health or saf of these monitoring programs is found in Section 4.1.3 of Appendix D of Volume 1 of

4.6.4 Pearl Harbor Naval Shipyard

The Pearl Harbor Naval Shipyard is located in the Southeast Loch of Pearl Harbor (see Figure 4-10). The population of the island of Oahu was approximately 820,000.

The population within 80 kilometers (50 miles) of the Pearl Harbor Naval Shipyard is characterized for the purposes of identifying whether any disproportionately high a minority and low-income communities. The population surrounding the Pearl Harbor Naval Shipyard is shown to be 68 percent minority and 7 percent low-income, based on U.S. Bureau of Census definitions and approach presented in Appendix L.

Figure 4-10. Pearl Harbor Naval Shipyard location and vicinity map. The shipyard employs Defense civilian employees, it accounts for 10,900 local jobs.

Pearl Harbor has been the site of several important historical events, and it is a National Historic Landmark in the Pacific Theater Defense during World War II. Naval Base Pearl Harbor was designated a National Historic Landmark in 1964; in 1974, it was listed on the National Register of Historic Sites. There are no archaeological sites located within the boundary of the shipyard. There are no National Historic Landmark sites in the shipyard areas where naval SNF activities would be conducted.

Pearl Harbor estuary lies on the coastal sedimentary plain of southern Oahu. The estuary was formed by freshwater flows that entered the harbor from the north and retarded coral growth. The west side of the harbor is primarily composed of volcanic ash. The east side of the harbor is mainly compacted volcanic ash. Hard, dense volcanic rock material to the north. Much of the land area in Pearl Harbor is filled with volcanic spoils. There are no geologic resources of economic value at the shipyard.

The Pearl Harbor Naval Shipyard is located in Uniform Building Code Seismic Risk Category II for the island of Hawaii, the islands are not a highly seismic area. Even on Hawaii, volcanic activity and do little or no damage, although a few have been damaged. Hawaiian Islands were formed by volcanic eruptions; however, the only active volcano on Hawaii. There are no volcanic hazards on the Island of Oahu.

Past tsunami inundation levels have been about 1 meter (3 feet) above mean sea level. For the 10-, 100-, and 500-year event are 0.2, 0.6, and 1.2 meters (0.7, 2.0, and 3.9 feet), respectively, for adjacent coastal areas. Maximum reasonably foreseeable tsunami rise would be approximately 4.3 meters (14.1 feet) above mean sea level.

The predominant winds are from the northeast, particularly from February to April. The predominant winds are from the southwest, south to southwest winds and mild offshore breezes can be expected up to 22 meters per second (49 miles per hour) occasionally strike from the north and reach gale velocities. Southerly winds are usually accompanied by wet tropical air showers. Destructive hurricanes with high tidal surges have hit the Hawaiian Islands in 1992 and 1994 (both times centered on Kauai), in 1982 and 1992.

The Code of Federal Regulations (40 CFR Part 81) states that the Air Quality Index at this site is better than national standards for total suspended particulate matter. There is no specific classification for ozone, carbon monoxide, and nitrogen dioxide. The site is located near Haleakala National Park, on the Island of Maui, which is 188 kilometers (117 miles) from Pearl Harbor.

Eight streams discharge into Pearl Harbor. Some flooding occurs along the main stream. Aiea Stream is not a problem at the naval complex, affecting only a narrow strip along Aiea Stream. Pearl Harbor receives most of its water from the Koolau Aquifer and a small portion from the Waialae Aquifer which are located in south central Oahu.

No federally or state-listed threatened or endangered species or critical habitat are within the confines of the shipyard. Because the area has been greatly disturbed and is completely eliminated, there is little remaining terrestrial habitat of any consequence and indigenous waterfowl occasionally frequent the shoreline areas of the shipyard.

There are several wetland areas within the Pearl Harbor area, including the Pearl Harbor Wildlife Refuge, which provides habitat for the endangered Hawaiian Coot and Hawaiian Noddy.

The traffic into and out of the base is a combination of commuting traffic, and service traffic. Kamehameha Highway is the primary access route to the base from Pearl Harbor.

Both Kamehameha Highway and Interstate Highway H-1 provide access to the Base from Honolulu.

Naval SNF has been removed from Navy nuclear-powered ships and transported to the Core Facility at the Idaho National Engineering Laboratory. Naval SNF shipments to the Idaho National Engineering Laboratory were initiated in 1962. Since then, 20 shipments have been taken by ship to the Puget Sound Naval Shipyard, where the containers were then transported to the Idaho National Engineering Laboratory by rail.

The annual airborne emissions from the site do not result in any measurable risk to the public.

general public. Emissions of radionuclides from the site result in a calculated effective dose of less than 0.0001 rem (0.1 millirem) per year to any member of the general public.

In addition, normal activities associated with current naval nuclear operations in the intentional discharge of any radioactive liquid effluent. Environmental monitoring by the site and independent U.S. Environmental Protection Agency monitoring of ship prototype plant that is being permanently shut down and one prototype that has been All operating facilities are located in a secure area near the center of the 1,578-acre reservation.

4.6.5 Kesselring Site

The Kenneth A. Kesselring Site is located about 24 kilometers (15 miles) north of Schenectady, New York, and 13 kilometers (8 miles) west of Saratoga Springs (see Figure 4-11) three operating naval nuclear propulsion prototype plants and support facilities. One prototype plant that is being permanently shut down and one prototype that has been All operating facilities are located in a secure area near the center of the 1,578-acre reservation.

In 1993, the site employed about 1,450 civilian workers. About 1.15 million people live within an 80-kilometer (50-mile radius) of the site according to the 1990 Census, but most of the land adjacent to the site is either wooded or used for agriculture. The nearest cities mentioned are Gloversville, Amsterdam, and Albany.

The population within 80 kilometers (50 miles) of the Kesselring Site has been used for purposes of identifying whether any disproportionately high and adverse impacts exist in low-income communities. The population surrounding the Kesselring Site is shown to be 9 percent low-income, based on U.S. Bureau of Census information and the definition presented in Appendix L.

The Kesselring Site reservation was used primarily for agricultural purposes since Government acquisition in 1948. There are no known archaeological, architectural, or American Indian sites in the secure area where SNF storage would take place.

The site lies on primarily unconsolidated material, primarily of glacial origin. Where it exists, the overburden can be up to several hundred feet thick. The overburden consists of basic kinds of depositional units: glacier debris, lake, and ice-contact/outwash. The overburden glaciers overlies much of the bedrock and form the elliptical hills throughout most of the site. Glacier deposits are a dense and poorly sorted mixture of clay, silt, sand, gravel, and stratified lake clay and silt deposits are mapped over the southeastern quadrant of the site. Ice-contact/outwash deposits mostly consist of stratified sands and gravels.

The general area of the site is in Uniform Building Code Seismic Risk Zone 2, of damage caused by earthquakes. There is a Zone 1 (minor damage) area to the south of the site and a Zone 3 (major damage) area to the north of the site. The maximum intensity earthquake within 161 kilometers of the site had a Modified Mercalli Intensity Scale value of VII. The most recent earthquake occurred at Lake George, New York, on April 30, 1931. Because the site is located in the vicinity of this quake, an earthquake of similar intensity could occur at the site. The general climate is

Figure 4-11. Kesselring Site location and vicinity map. The general climate is from the west or northwest during the winter, but come from the south in the warmer months. Wind velocities are moderate and generally average less than 4.5 meters per second (10 miles per hour). Destructive winds [greater than 36 meters per second (80 miles per hour)] occur infrequently and are rare.

The Code of Federal Regulations (40 CFR Part 81) states that the Air Quality Criteria for suspended particulate matter and sulfur dioxide. The area has no specific classification and nitrogen dioxide. The nearest Class I Area is at Lye Brook Wilderness, Seward, New York, 74 kilometers (46 miles) from the site.

The Kesselring Site is located in a predominately rural area. There are 13 wetlands on the Site; current operations do not impact these wetlands. Federally or state-listed threatened species located in the Saratoga County area include the bald eagle, the sharp-shinned hawk, the blue falcon, and the red-shouldered hawk. There are, however, no records of any of these species in the vicinity of the site. They are used primarily for

Only secondary roads follow the boundary of the site. They are used primarily for employees and as delivery routes for small products and produce. State Route 29 runs north-south, State Route 147 runs 6 kilometers (4 miles) to the west, and State Route 148 runs 6 kilometers (4 miles) to the south. State Route 50, 10 kilometers (6 miles) east, running from Saratoga Springs to the south. State Route 50, 10 kilometers (6 miles) east, running from Saratoga Springs carries the only appreciable amount of truck and bus traffic. The majority of through traffic is on Interstate 87 or parallel route U.S. Highway 9, 16 kilometers (10 miles) to the east.

Two lines of the Delaware and Hudson Railroad cross the region within 16 kilometers of the site. The main north-south line runs through Ballston Spa, just over 8 kilometers and a trunkline runs just over 8 kilometers (5 miles) to the northeast into the center of the region. Spent Nuclear Fuel (SNF) from the Kesselring Site has been sent to the Expanded Core Facility at the Idaho National Engineering Laboratory since 1961. Shipping containers are transported by truck to the site where the containers were loaded onto rail cars. Since 1961, 20 shipments of SNF have been sent to the Expanded Core Facility from the Kesselring Site.

The annual airborne emissions from the site do not result in measurable radiation to the general public. Emissions of radionuclides from the site result in a calculated effective dose of less than 0.0001 rem (0.1 millirem) per year to any member of the general public.

In addition, normal activities associated with current naval nuclear operations in the intentional discharge of any radioactive liquid effluent. Environmental monitoring by the site have shown that the operations at the site have had no adverse impacts.

4.7 Other Generator/Storage Locations

In addition to the five major sites, DOE is responsible for the management of several other DOE sites and other locations. These sites include DOE reactors at the Savannah River Site, Idaho National Engineering Laboratory, the Savannah River Site, and the Oak Ridge Reservation, and domestic research reactors; and three locations where specific types of spent nuclear fuel for which DOE is responsible are stored. This section summarizes environmental characterization information for these sites that might be affected by programmatic management. More detailed information characterizing the sites is presented in Appendix A.

The facilities and installations included in this category preclude the definition of environments in a consistent and uniform manner without describing each site. The existing facility documents varies widely depending on the nature of the installation, describing the environment by the overseeing or regulatory agencies. For example, parameters required to be described by the U.S. Nuclear Regulatory Commission for research reactors or material processing and storage facilities are fewer in number and less detailed than those required for larger reactor installations at DOE facilities. Thus, the ability to describe parameters in a consistent manner based on existing documentation is limited, and the parameters for the major DOE sites are not discussed at all or are discussed only briefly. The parameters for these other generator/ storage locations. Because alternatives evaluated will not include these sites, the sites are not described in detail. See Appendix E, Chapter 4 for more information.

4.7.1 DOE Test and Experimental Reactors

In addition to facilities at the Hanford Site, Idaho National Engineering Laboratory, Savannah River Site, and Oak Ridge Reservation, experimental reactors are located at, and small quantities of spent nuclear fuel are stored at, the following four DOE sites: Brookhaven National Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, and Argonne National Laboratory-East.

4.7.1.1 Brookhaven National Laboratory.

Brookhaven National Laboratory is located on a 2,131-hectare (5,265-acre) site on Long Island, New York, approximately 97 kilometers from New York City, in a primarily suburban area. About 410,000 people reside in Brookhaven, and 8,000 people live within 0.8 kilometers (0.5 mile) of the Laboratory, and 8,000 people live within 0.8 kilometers (0.5 mile) of the Laboratory.

In terms of meteorology, the laboratory can be characterized, like most Eastern well-ventilated sites. The annual precipitation during 1991 was 45.3 inches (115 centimeters) below the 40-year annual precipitation average of 48.4 inches (123 centimeters) in Suffolk County, in which the site is located, is classified as being in nonattainment for the criteria pollutant ozone. The county is in attainment of standards for carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead.

No active earthquake-producing faults are known in the Long Island area. The Brookhaven National Laboratory is located in the Building Code Seismic Risk Zone 2A (moderate seismic hazard) area.

Groundwater flow under the Laboratory site is complex, moving in different directions (sections of the site, but generally with a velocity estimated to range from 30 to 48 inches per day), flowing either toward the Peconic River or in deeper layers rec The Nassau/Suffolk Aquifer System underlying the Brookhaven National Laboratory has sole source aquifer by the U.S. Environmental Protection Agency.

The releases of radioactive gaseous and liquid effluents from Brookhaven National Laboratory from 1988 to 1992 have resulted in calculated average doses to hypothetical maximally exposed individuals of 0.000113 and 0.000722 rem (0.113 and 0.722 millirem) per year, respectively.

4.7.1.2 Los Alamos National Laboratory.

Los Alamos occupies an area of about 11,000 hectares (28,000 acres) located primarily in Los Alamos county in northern New Mexico (24 miles) northwest of Santa Fe. The resident population of Los Alamos county in 1990 was 3,900. Los Alamos National Laboratory employees reside in the adjacent Rio Arriba and Sandoval counties.

The climate at Los Alamos National Laboratory is characterized as semi-arid with an annual rainfall of about 21 centimeters (8.1 inches). Severe weather affecting facilities is extremely rare. Los Alamos National Laboratory is located in the New Mexico Intra-Regional Air Quality Control Region. Areas in Los Alamos National Laboratory and its surrounding counties are in attainment with respect to the National Ambient Air Quality Standards.

The Los Alamos National Laboratory is located on the Pajarito Plateau, which is a series of canyons separated by long narrow mesas. It lies within Seismic Zone 2B, and seismicity is high. There are three identified active faults in the area. Studies suggest seismic events with a magnitude of 5.0 or greater have been produced in the last 500,000 years.

Surface water at Los Alamos consists of intermittent streams; several canyons contain industrial or sanitary effluents that rarely extend aboveground beyond Los Alamos National Laboratory boundaries. The depth to the main groundwater aquifer, which supplies nearly all water to Los Alamos National Laboratory, ranges from about 366 meters (1,200 feet) in the west to about 152 meters (500 feet) in the east part of the site, and groundwater discharges to springs along the Rio Grande.

The releases of radioactive effluents from Los Alamos National Laboratory over the period 1991 to 1992 have resulted in a calculated average dose to the hypothetical maximally exposed individual of 0.004 rem (4 millirem) per year.

4.7.1.3 Sandia National Laboratories.

The Sandia National Laboratories reactor and SNF operations are located on about 3,360 hectares (8,300 acres) of Kirtland Air Force Base, approximately 10 kilometers (6.5 miles) southeast of downtown Albuquerque, New Mexico. The population of Albuquerque was about 385,000 in 1990.

The climate at Sandia National Laboratories is characteristic of a semi-arid region with an annual rainfall of about 21 centimeters (8.1 inches). Severe weather affecting facilities is extremely rare. The Sandia National Laboratories is within the Albuquerque-Mid Rio Grande Intra-Regional Air Quality Control Region, portions of which are designated as nonattainment areas by the Environmental Protection Agency for Colorado.

The Sandia National Laboratories is located on the Albuquerque East Mesa in a region of high seismic activity but of low magnitude and intensity. More than 1,000 earthquakes occurred during the last 127 years, but only 3 have caused damage in Albuquerque.

The Rio Grande is the main surface drainage route for the area, with an average discharge of 37.3 cubic meters per second (37.3 cubic yards per second). No perennial streams flow through the Sandia National Laboratories area, and flooding is not a high probability at Kirtland Air Force Base. Groundwater is distinguished by a fault complex underlying the area; depths range from 115 to 152 meters (380 to 500 feet) on the east side of the complex and from 115 to 152 meters (380 to 500 feet) on the west side of the complex. Groundwater flow west of the complex is generally toward the north and northwest, and east of the fault complex is typically west toward the fault system.

4.7.1.4 Argonne National Laboratory-East.

Argonne National Laboratory-East occupies about a 688-hectare (1,700-acre) site located in DuPage County, Illinois, within the

area. The site is surrounded by a 826-hectare (2,040-acre) green belt forest preserve in Cook County. The 1990 population of the Chicago metropolitan area was about 6.6 million people.

The climate in the Argonne National Laboratory-East area is characterized as average annual precipitation of 80 centimeters (31.5 inches). The area experiences annually, occasionally accompanied by hail, damaging winds, or tornadoes. The most recent tornado strike at Argonne National Laboratory-East is about one every 1,200 years, with minor damage.

The Argonne National Laboratory-East site is located above about a 30-meter-thick glacial till deposit on top of dolomite bedrock. The site is in Uniform Building Class C. Several areas of seismic activity are present at moderate distances from the site, but by these seismic sources are expected to be minimal at the site.

The Argonne National Laboratory-East site contains a number of small ponds that enter the Des Plaines River about 2.0 kilometers (1.25 miles) southeast of the site. The water is extracted from two underlying aquifers. No aquifers in the region are considered by the U.S. Environmental Protection Agency.

4.7.2 Domestic Research and Test Reactors

Appendix E also identifies 55 non-DOE facilities representing domestic, licensed spent nuclear fuel (SNF). They include training, research, and test reactors at universities, commercial, and several Government installations. These facilities have been licensed by the U.S. Nuclear Regulatory Commission for reactor operation and the storage of the SNF they generate. Although these facilities, past practices and long-term plans and agreements have always called for the SNF to be transported to DOE facilities. In the past, this SNF was generally processed at the Hanford Site, or Idaho National Engineering Laboratory for recovery of the highly enriched fuel. Under all but the No Action and Decentralization alternatives, these fuels will be stored at a DOE site for storage until ultimate disposition.

These 55 U.S. Nuclear Regulatory Commission licensed facilities, 40 of which are at universities, are located in 28 states. They are located in a wide variety of areas, from rural to industrial research parks and urban university campuses, which does not permit an unaffected environment for these facilities. Information on the environments of three U.S. Nuclear Regulatory Commission-licensed research reactors [the National Institute of Standards and Technology (former National Bureau of Standards), the Massachusetts Institute of Technology, and the University of Missouri reactors] is summarized in the following sections.

4.7.2.1 National Institute of Standards and Technology.

The National Institute of Standards and Technology reactor is located on the Institute's 233-hectare (576-acre) Gaithersburg, Maryland, about 20 miles northwest of downtown Washington, D.C. The Gaithersburg, a Washington suburban area, was about 39,500. The nearest site boundary is about 0.25 kilometer (0.25 mile) southwest of the reactor.

The climate of the area is moderate, with infrequent occurrences of severe weather. The number of winter storms and hurricanes have affected the general area, the site is in the recurrence interval for a tornado at the site is about one in 2,000 years. Air quality is determined by the presence of 12-lane Interstate Highway 270, used by commuters to Washington, D.C., area and suburban residential areas.

There are no known major faults in the site vicinity, although the site region is in Seismic Zone 1. The maximum ground acceleration for the site area was estimated to be 0.15 g.

There are no discharges from the National Institute of Standards and Technology reactor to streams or groundwater; liquid wastes are processed before discharge to the local streams. The reactor has averaged 2.7 curies of tritium and 1.9 millicuries of other beta-gamma emitters. In 1992. Over the same period, the site released airborne emissions containing an average of 41 and 353 curies of tritium per year, well below the license limits for the reactor. Collective doses are not reported, and because site meteorological data are not monthly, they are not reliably estimated.

4.7.2.2 Massachusetts Institute of Technology.

The Massachusetts Institute of Technology reactor, housed in a gas-tight building with 0.6-meter (2-foot) concrete shielding, (1-acre) site in a heavily industrialized section of Cambridge, Massachusetts, a few miles from the Massachusetts Institute of Technology campus and about 1.6 kilometers (1 mile) from Charles River. The population of Cambridge was about 95,800 in 1990.

The meteorological conditions vary from highly stable with light winds to unstable conditions with strong winds. Severe weather conditions are uncommon, and flooding is expected even under record rainfall conditions. Air quality is typical of an urban area.

The Cambridge area has been relatively free of earthquakes over the past 150 years. The region last experienced an earthquake in 1755, which destroyed some buildings. The reactor is conservatively designed to withstand projected seismic activity.

There are no discharges from the Massachusetts Institute of Technology reactor to streams or groundwater; liquid wastes are processed before discharge to the local sanitary sewer. The reactor released an average of 0.074 curies of tritium and 9.5 millicuries of other beta-gamma emitters per year from 1966 to 1992. Over the same period, the reactor released airborne effluents containing an average of 0.0001 curies of argon-41, well below the license limits for the reactor. However, individual or collective doses are not reported, and because site meteorological data are not monitored, doses cannot be reliably estimated, particularly given the highly urbanized vicinity.

4.7.2.3 University of Missouri.

The Columbia Research Reactor is sited within a 34-hectare (85-acre) Research Park about 1.6 kilometers (1 mile) southwest of the main campus of the University of Missouri, located south of the main business district of Columbia, Missouri. The population of Columbia was about 69,000 in 1990. Agriculture is the predominant regional activity, although there are some small industrial activities in the area.

The climate of the region is continental, and high windspeeds are not uncommon. Hourly (94 mile per hour) winds have a recurrence interval of once in 100 years, but are not common. Air quality is representative of the nonurban midwest. Surface drainage is eventually to the Missouri River.

Columbia is located in the stable area of Missouri and, despite the proximity to the Mississippi River, the probability of seismic damage in the area is low as reflected by its location in the stable area.

There are no discharges from the University of Missouri/Columbia Research Reactor to streams or groundwater; liquid waste is processed before discharge to the local sanitary sewer. The reactor released an average of 0.21 curies of tritium and 25.6 millicuries of other beta-gamma emitters per year from 1966 to 1992. Over the same period, the reactor released airborne effluents containing an average of 0.0001 curies of argon-41 and about 7 curies of tritium, well below the license limits for the reactor. However, individual or collective doses are not reported, and because site meteorological data are not monitored, doses cannot be reliably estimated.

4.7.3 Spent Nuclear Fuel from Special Nuclear Power Plants

Three facilities house SNF from power reactors for which DOE has assumed responsibility. At the facilities discussed previously, no additional SNF is either being generated at the facilities or stored at storage facilities. These facilities include the West Valley Demonstration Project at the former Fort St. Vrain Nuclear Power Plant in Colorado; and the Babcock & Wilcox Lynchburg, Virginia. Their environmental characterizations are summarized in the figures presented in more detail in Appendix E.

4.7.3.1 West Valley Demonstration Project.

The West Valley Demonstration Project occupies an 88-hectare (220-acre) site formerly housing the first United States commercial nuclear fuel processing plant, within a larger 1,341-hectare (3,345-acre) site known as the West Valley Service Center. The Center is located in Cattaraugus County, a rural area of western New York, about 50 kilometers (31 miles) south of Buffalo, New York, and 40 kilometers (25 miles) east of Buffalo.

A 60-meter (200-foot) onsite meteorological tower is operated by DOE at the West Valley Service Center.

Demonstration Project. A review of the West Valley Demonstration Project tower's 1 the prevailing wind was from the south-southeast with a mean wind speed of 2.4 meters per hour). The precipitation for 1992 was 18 centimeters (7.1 inches) above the average (40.9 inches). The onsite 1992 wind data and National Weather Service data at the Buffalo airport did not compare well, thereby indicating that the Buffalo airport predicting conditions at the West Valley Demonstration Project.

The West Valley Demonstration Project is located within the Cattaraugus High transitional zone between the Appalachian Plateau Province and the Great Lakes Plain. Any consequence is recognized within the site. The Clarendon-Linden structure is a tectonic- (fault-) producing feature known to exist in the region. It is approximately 10 miles from the site. The site has experienced a moderate amount of relatively minor seismic activity. Historical times, ground motion at the site probably has not exceeded a Modified Mercalli intensity of VI or VII. It is estimated that the maximum earthquake on the structure would produce an earthquake of Modified Mercalli Intensity of VI or VII with a peak ground acceleration of approximately 0.12g at the site.

The West Valley Demonstration Project is located in the Cattaraugus Creek drainage part of the Great Lakes - St. Lawrence watershed. All surface drainage from the West Valley Demonstration Project is to Buttermilk Creek, which flows into Cattaraugus Creek and ultimately into the uppermost water-bearing unit underlying the West Valley Demonstration Project is a part of the Cattaraugus Creek Aquifer System, which has been designated a sole source aquifer by the Environmental Protection Agency. This unit is included in the sole source designation because of its similarity and proximity to the producing Cattaraugus Creek Aquifer.

4.7.3.2 Fort St.

Vrain. The Fort St. Vrain site is located in Weld County in northeastern Colorado, approximately 5.6 kilometers (3.5 miles) northwest of the town of Platteville, 1.6 kilometers (1 mile) west of the South Platte River, and 56 kilometers (35 miles) north of Denver. The site consists of 1,132 hectares (2,798 acres). Based on the 1980 census, the population within a 1-mile radius of the site was estimated to be 3,148, with 1,662 residing in the town of Fort St. Vrain (1982). Most of the land in the immediate area of the site is disturbed, agricultural, and forested.

The general climate around the Fort St. Vrain site is generally mild. In this area, precipitation averages 25 to 38 centimeters (10 to 15 inches) a year, mostly from the spring and summer. Northeastern Colorado has moderate thunderstorm activity. The region experiences an average of 10 to 15 tornadoes per year per 25,900 square kilometers (10,000 square miles), with peak activity during the month of June. A study of tornadoes in the area concluded that 161-kilometer-per-hour winds should constitute maximum wind forces to be expected at Fort St. Vrain.

The Fort St. Vrain site is located on the east flank of the Colorado Front Range anticlinal arch. Numerous faults and smaller folds are superimposed on the arch and are of the Front Range. The Fort St. Vrain site has not experienced any observed earth movement. Examination of the area produced no evidence of recent movement along any of the known faults. The area of recent activity is about 40 kilometers (25 miles) south of the site. The site is located on a 1.

The nearest major surface water features to the Fort St. Vrain site are the St. Vrain River, 0.8 kilometer (0.5 mile) east of the site, and the St. Vrain Creek, about 1.2 kilometers (0.75 mile) east of the site. Local surface water diversions from these rivers, which feed irrigation ditches, are somewhat closer, about 0.5 kilometer (0.33 mile) east and west of the site and about 0.5 kilometers (0.33 miles) to the north of the site, and an irrigation ditch is located 0.16 kilometer (0.1 mile) north of the site.

4.7.3.3 Babcock & Wilcox Research Center, Lynchburg.

The Babcock & Wilcox Research Center occupies a 1.6-hectare (4-acre) fenced area within Babcock & Wilcox (925-acre) Mount Athos site. The research center is in Campbell County, Virginia, approximately 6.5 kilometers (4 miles) east of the city of Lynchburg. The research center is centrally located within the area of Amherst, Appomattox, Bedford, and Giles Counties. The combined population of these counties is about 180,000.

The climate of the Lynchburg area is influenced by cold and dry polar continental air masses in winter and warm and humid gulf maritime air masses in the summer. Rainfall amounts range from 102.4 centimeters (40.3 inches) in any given year. Severe weather is limited by the low probability of tornadoes. The mean number of thunderstorms occurring at Lynchburg is about 10 per year.

22 per year. The probability of a tornado actually striking the site is 3.0 10⁻⁴ interval of 3,333 years.

The land at the Babcock & Wilcox Research Center is characterized by scattered dimensions lying eastward from the main chain of the Blue Ridge Mountains. The site is part of the central Virginia cluster region, which is classified as Seismic Zone 2. 121 earthquakes with epicenters in Virginia have occurred during the last 236 years. 121 earthquakes with epicenters in Virginia have occurred during the last 236 years. Earthquakes are not expected to cause serious damage to the Lynchburg facilities and hazardous materials.

The James River is formed about 154 kilometers (96 miles) upstream of the site from the Jackson and Cowpasture Rivers. The James River flows generally south-southeast to the Atlantic Ocean through the Hampton Roads and Chesapeake Bay. The average flow rate of the James River at the plant is estimated to be about 110 cubic meters per second (534 feet above mean sea level at Lynchburg). The largest recent flood occurred in November 1985 and had a peak flow rate of 1,100 cubic meters per second (440 and 460 feet above mean sea level, which is 3 meters (10 feet) below surface average flow rate). Because of the relative impermeability of the silt and clay top surface soils nor river flood water has a major effect on the groundwater supply or

References Chapter 4
NNPP (Naval Nuclear Propulsion Program), 1993, Environmental Monitoring and Disposal of Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report No. 1, Washington, D.C., February.

USBC (U.S. Bureau of the Census), 1982, 1980 Census of Population and Housing, Washington, D.C.

USBC (U.S. Bureau of the Census), 1992, 1990 Census of Population and Housing, Washington, D.C.





5. ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental consequences of implementing alternatives described in Chapter 3. To focus on the most significant issues in the Program, this chapter summarizes and simplifies the more detailed site-specific analyses and consequences presented under separate cover as self-contained appendices to Volume 1. This chapter provides a collection of summary information across DOE sites, SNF interim storage areas without recounting the detail of the separate appendices.

The Centralization alternative generally produces the greatest impacts, with impacts associated with the 1992/1993 Planning Basis and Regionalization alternative. The Regionalization alternative may appear to have the least impact in some of the categories analyzed, it also produces larger impacts in others, such as estimated radiation doses. In addition, the increased exposure of workers to radiation and the increased risks of material to the environment with the continuing degradation of certain types of DOE facilities are impacts that cannot be completely analyzed.

This chapter is organized into eight sections. The disciplines (topical areas) and potential impacts, are of general public interest, or may help to discriminate among alternatives discussed in Section 5.1. In general, the consequences presented in Section 5.1 re impacts, electricity use, waste generation, and radiological and transportation impacts were studied that showed small impacts or clearly did not discriminate among sites discussed in Section 5.2. Sections 5.3 through 5.8 address cumulative impacts, unanticipated environmental effects, the relationship between short-term use and long-term production, irretrievable commitments of resources, potential mitigation measures, and environmental impacts respectively.

The period covered in this EIS is the 40 years from 1995 to 2035. Detailed analyses were performed for the time period from 1995 to 2005. Normal operation impacts at the INEL Engineering Laboratory are then projected for the remaining 30 years covered by this EIS. The specific detail presented in Sections 5.1 and 5.2 is commensurate with the size of the number and types of sites where SNF would be stored. Therefore, the analyses of the sites are more detailed than the analyses for the other generator/storage locations. Inventories under the No Action and Decentralization alternatives. There are five sites that may be responsible for managing the great majority of SNF: Hanford Site, Idaho National Laboratory, Savannah River Site, Oak Ridge Reservation, and Nevada Test Site. The Nevada Test Site to be a preferred site for the management of SNF because of its current role as the host site for the Yucca Mountain Site Characterization Project and lack of SNF management facilities and high-level waste infrastructure. Minor sites include government reactor sites and the three facilities that store small quantities of SNF: West Valley Demonstration Project, Babcock & Wilcox Research Center, and Fort St. Vrain.

For more detailed information on analyses of environmental impacts, and for analyses supporting the consequences reported here, refer to the appropriate site-specific appendices, under separate cover, are organized as follows:

Appendix	Focus of Appendix
A	Hanford Site
B	Idaho National Engineering Laboratory
C	Savannah River Site
D	Naval Nuclear Propulsion Program
E	Other Generator/Storage Locations
F	Nevada Test Site and Oak Ridge Reservation

Appendix K presents site-specific data compiled from Appendices A through F to develop the discussion of environmental consequences. The summary tables in Appendix L provide a comparison of quantitative impacts (for example, increases or decreases in direct emissions) among sites.

Appendix L presents an evaluation of environmental justice considerations at sites considered in this EIS. Environmental justice considerations and exposure pathways were

80-kilometer (50-mile) radius surrounding each of 10 potential sites of proposed activity. A 40-kilometer (25-mile) radius is in keeping with analysis conducted under the National Act regarding proposed DOE activities to identify environmental impacts from proposed activity. A 40-kilometer (25-mile) radius represents the limit in which any impacts are considered significant. Minority and low-income communities surrounding each alternative site were identified using the use of a Geographical Information System, based on 1990 U.S. Census data. Data were provided for each site under consideration in Appendix L.

5.1 Environmental Consequences of Key Discriminator Disciplines

This section presents the environmental consequences of the alternatives, focusing on discriminator disciplines—those that may differentiate among sites, have the potential for significant impact, or are of general public interest. This section is organized in two parts: providing perspective for each discipline and a presentation of consequences by alternative site.

5.1.1 Background

The following discussion provides background and perspective for the environmental consequences presented in Section 5.1.

5.1.1.1 Socioeconomics.

Socioeconomic impacts are defined in terms of direct and secondary effects. Direct effects include changes in site employment and expenditures resulting from construction and operation. Secondary effects include changes that result from regional nonpayroll expenditures, and payroll spending by site employees. For the major DOE sites, projections (regardless of SNF management decisions) indicate that jobs will be lost in the long term for all sites. Potential SNF management impacts onsite and regionally are shown in light of this trend.

For the sites considered, only minor increases in site employment over the design life would result from SNF management; therefore, secondary effects were considered as a result of job loss, without substantial impacts on associated regions. At the Idaho National Laboratory, the potential for appreciable job losses exists under certain alternatives that could contribute to an overall regional decline. The reductions are not anticipated to be significant because they would occur over several years. For the naval sites, the number of staff at SNF management facilities would be approximately less than 1 percent of site employment, or 1/25 of 1 percent of regional employment, so secondary impacts were also considered minimal. For other generator/storage locations, job creation was expected to be minimal even if an alternative where long-term management of SNF would be required should operating reactors be shut down. The number of staff involved for long-term SNF management would be small relative to existing staffing levels at these reactors.

With employment as an indicator, small changes in population are anticipated, resulting in demand on regional supporting infrastructures. The number of direct jobs under each alternative as a result of SNF management activities was estimated for each alternative. Employment graphs shown on Figures 5-1 through 5-9 (presented and discussed fully in Appendix A) represent the 10-year average of the incremental change in direct employment resulting from SNF management. Secondary effects, such as the need for additional housing and improved infrastructure, are discussed if an impact is indicated. Details on the socioeconomic impact analysis, including the projections from which comparisons were made, are provided in Appendices A through F. The increases and decreases that are presented in the text are 10-year averages rather than annual increase or decrease in any single year as presented in Appendix A through F. Please refer to Appendix A for actual annual employment values.

5.1.1.2 Utilities (Electricity).

New facilities (or the restarting of idle facilities) would result in

increased demands on water, power, and sewage. Water and sewage requirements are discussed in Section 5.2.9. However, power consumption under some of the alternatives may exceed existing capacity at certain sites and this is discussed in more detail in the requirements by site and by alternative vary significantly depending on whether a site is a SNF. For example, at the Hanford Site, the annual increase in power use from SNF processing could vary from 0 megawatt-hours per year under the No Action alternative when storage of about 130,000 megawatt-hours per year under the Centralization alternative when K, Volume 1). In addition, the operation of an expended core facility consumes approximately megawatt-hours per year of electricity. Therefore, the power requirements would be alternatives where both processing and operating an expended core facility occur. Site of electricity use in Figures 5-1 through 5-9 show the maximum and minimum incremental consumption that would result from implementing the alternative. Current capacities, utilities and energy from which comparisons are made are discussed in Appendices A

5.1.1.3 Materials and Waste Management.

There are few impacts on materials and waste management activities except when SNF is processed. Stabilization of SNF, depending on the method used, may yield high-level, transuranic, low-level, mixed, and hazardous wastes. The wastes are further treated to make them safe for transport, storage, or disposal. The capacity for storing of high-level and transuranic wastes is generally limited. Low-level waste is stored onsite at the major DOE facilities. Hazardous wastes are normally treated in some of the approved disposal facilities onsite or offsite. A few categories of mixed waste are in storage awaiting development of treatment capabilities. The graphs of waste management through 5-9 illustrate the estimated annual average of low-level waste and high-level waste that each alternative would generate between 1995 and 2005. Site-specific details of waste management and the current status of waste management activities at the sites are in Appendices A through F.

5.1.1.4 Occupational and Public Health and Safety.

Radiation Effects-Radiation exposure and its consequences are topics of general concern to the public near nuclear facilities. Therefore, this EIS places more emphasis on radiation exposure than on other topics, even though the effects of radiation exposure under the circumstances evaluated in this EIS are small. This subsection explains basic concepts of radiation effects to provide the background for later discussions of impacts.

The effects on people of radiation that is emitted during disintegration (decay) of a substance depends on the kind of radiation (alpha and beta particles, and gamma rays) and the amount of radiation energy absorbed by the body. The total energy absorbed per unit mass is referred to as absorbed dose. The absorbed dose, when multiplied by certain quality factors to take into account different sensitivities of various tissues, is referred to as effective dose. The context is clear, simply dose. The common unit of effective dose equivalent is the millirem (1,000 millirem).

An individual may be exposed to ionizing radiation externally, from a radioactive source, and/or internally, from ingesting or inhaling radioactive material. The external dose is the internal dose. An external dose is delivered only during the actual time of exposure to the radiation source. An internal dose, however, continues to be delivered as long as the radionuclide remains in the body, although both radioactive decay and elimination of the radionuclide through metabolic processes decrease the dose rate with the passage of time. The dose rate is calculated over 50 years following the initial exposure.

The maximum annual allowable radiation dose to an individual of the public from nuclear facilities is 0.1 rem (100 millirem) per year (DOE Order 5400.5) (DOE 1993). Facilities covered by this EIS operate well below this limit (see Chapter 4). It is estimated that an individual in the United States receives a dose of about 0.3 rem (300 millirem) per year from natural sources of radiation. For perspective, a modern chest x-ray results in an approximate dose of 0.083 rem (83 millirem) while a diagnostic hip x-ray results in an approximate dose of 0.083 rem (83 millirem). A single acute (short-term) dose of approximately 600 rem (600,000 millirem) before the probability of near-term death (NAS/NRC 1990).

Radiation can also cause a variety of ill-health effects in people. The most serious effect to depict the consequences of environmental and occupational radiation exposure is latent cancer fatalities. This effect is referred to as latent cancer fatalities because

years to develop and for death to occur.

The collective (or population) dose to an exposed population is calculated by doses received by each member of the exposed population. This total dose received population is measured in person-rem. For example, if 1,000 people each received a (1 millirem), the collective dose is 1,000 persons 0.001 rem (1 millirem) = 1 person-rem. The same collective dose (1 person-rem) results from 500 people each of whom received a (2 millirem) (500 persons 0.002 rem = 1 person-rem).

The factor that this EIS uses to relate a dose to its effect is 0.0004 latent rem for workers and 0.0005 latent cancer fatalities per person-rem for individuals population. The latter factor is slightly higher because of the presence of individuals that may be more sensitive to radiation than workers (for example, infants).

These concepts may be applied to estimate the effects of exposing a population. For example, in a population of 100,000 people exposed only to background radiation [0.001 rem per year], 15 latent cancer fatalities per year would be inferred to be caused by the population (100,000 persons 0.3 rem (300 millirem) per year 0.0005 latent cancer fatalities per person-rem = 15 latent cancer fatalities per year).

Sometimes, calculations of the number of latent cancer fatalities associated do not yield whole numbers, and, especially in environmental applications, may yield fractional numbers. For example, if a population of 100,000 were exposed as above, but to a total dose of 0.001 rem (1 millirem), the collective dose would be 100 person-rem, and the corresponding number of latent cancer fatalities would be 0.05 [100,000 persons 0.001 rem (1 millirem) = 100 person-rem; 100 person-rem 0.0005 latent cancer fatalities/person-rem = 0.05 latent fatal cancers].

How should one interpret a noninteger number of latent cancer fatalities, such as 0.05? One should interpret the result as a statistical estimate. That is, 0.05 is the average number of latent cancer fatalities expected if the same exposure situation were applied to many different groups of 100 groups, nobody (0 people) would incur a latent cancer fatality from the 0.001 rem (1 millirem) member would have received. In a small fraction of the groups, 1 latent fatal cancer would occur. In a few groups, 2 or more latent fatal cancers would occur. The average number of latent fatal cancers would be 0.05 latent fatal cancers (just as the average of 0, 0, 0, and 1 is 0.25). The likely outcome is 0 latent cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on individuals. Consider the effects, for example, of exposure to background radiation over a lifetime. The "number of latent cancer fatalities" corresponding to a single individual's exposure over a lifetime (300 millirem) per year is the following:

1 person 0.3 rem (300 millirem)/year 72 years 0.0005 latent cancer fatalities/person-rem = 0.011 latent cancer fatalities.

Again, this should be interpreted in a statistical sense; that is, the estimated effect of exposure on the exposed individual would produce a 1.1-percent chance that the individual would incur a latent fatal cancer caused by the exposure. Said another way, about 1.1 percent of the population estimated to die of cancers induced by the radiation background.

The dose-to-risk conversion factors presented above and used in this EIS to convert exposures to latent cancer fatalities are based on the "1990 Recommendations of the Commission on Radiation Protection" (ICRP 1991). These conversion factors are consistent with those used by the U.S. Nuclear Regulatory Commission in its rulemaking "Standards for Protection of the Public from Ionizing Radiation" (NRC 1991). In developing these conversion factors, the International Commission on Radiological Protection reviewed many studies, including Health Effects of Exposure to Low Levels of Ionizing Radiation and Sources, Effects and Risks of Ionizing Radiation. These conversion factors represent estimates for relating a dose to its effect; most other conversion factors fall within the range of estimates associated with the conversion factors that are discussed in NAS/NRC (1990). The conversion factors for doses to an individual less than 20 rem (20,000 millirem) and the dose rate (10,000 millirem) per hour. At doses greater than 20 rem (20,000 millirem), the conversion factors for relating radiation doses to latent cancer fatalities are doubled. At much higher doses, the primary concern is the risk of acute radiation syndrome. Unusual accident situations involving high radiation doses to individuals are considered special cases.

In addition to latent cancer fatalities, other health effects could result from occupational exposures to radiation. These effects include nonfatal cancers among workers and genetic effects in subsequent generations. Table 5-1 shows the dose-to-effect conversion factors, as well as for latent cancer fatalities. For clarity and to allow ready comparison with other sources, such as those from chemical carcinogens, this EIS presents estimates of health effects only in terms of latent cancer fatalities. The nonfatal cancers and genetic effect consequences of radiation exposure. Estimates of the total detriment (fatal cancer and genetic effects) due to radiation exposure may be obtained from the estimates of latent cancer fatalities presented in this EIS by multiplying by 1.4 for workers and by 1.46 for the general

Table 5-1. Risk of latent cancer fatalities and other health effects from exposure

Population(c)	Latent cancer			Total detriment
	fatality	Nonfatal cancer	Genetic effects	
Workers	0.0004	0.00008	0.00008	0.00056
General public	0.0005	0.0001	0.00013	0.00073

a. When applied to an individual, units are lifetime probability of latent cancer (millirem) of radiation dose. When applied to a population of individuals, units are cancers per person-rem of radiation dose. Genetic effects as used here apply to populations of individuals.

b. Source: ICRP (1991).

c. The difference between the worker risk and the general public risk is attributable to the general population includes more individuals in sensitive age groups (that is, less than 65 years of age).

During SNF handling and transportation, the principal radiation hazard is the radiation emitted from the SNF. In comparison, the hazard from release of radioactive fission products (particulates) from within the solid SNF is small. Without adequate shielding, the surface of the SNF are often high enough to induce a prompt fatality. Fortunately, the radiation is attenuated or stopped with the insertion of shielding materials such as lead, steel and concrete. Because radiation intensity decreases with distance, maintaining a distance of several meters also offers adequate protection from the radiation from unshielded SNF. For transport, adequate shielding on shipping casks to reduce radiation levels at 2 meters to 0.01 rem (10 millirem) per hour or less. At 100 meters (328 feet), the radiation level is reduced by a factor of about 2,500, which would not be detectable.

During SNF interim storage, trace quantities of radioactive isotopes (principally fission products) may also be released to the environment from severe accidents. Releases would result in small doses to the workers in the immediate vicinity of the storage area. Atmospheric dispersion and groundwater pathways, would ultimately result in very small doses to the nearby general population.

Accidents involving SNF can also result in radiation releases and exposures. Only a very small fraction of the radioactive material within the SNF is released. This is because the SNF is in solid form and the radioactive elements are intermingled within the solid SNF. Significant quantities of radioactive elements can be released only when the accident generates enough energy to break apart particles of SNF to be released to the atmosphere. For most accidents, the energy released is not enough to cause much damage to the SNF and a small fraction of the radioactive material is released.

One type of accident, an accidental nuclear criticality (uncontrolled chain reaction), can result in large quantities of direct radiation, as well as fission products and heat. Within a few meters, doses from direct radiation can be fatal. Further away, doses are principally from fission product gases and particulates. This type of accident is well understood and has been experienced in the handling of solid materials such as SNF.

Risk-Another concept important to the presentation of results in this EIS is risk. Risk is most important when presenting accident analysis results. The chance of an accident occurring during the conduct of an operation is called the probability of occurrence. The probability of occurrence has a probability of 1 (as in 100 percent certainty). The probability of occurrence is less than one because accidents, by definition, are not certain to occur. If an accident occurs every 5 years, the frequency (and probability) of occurrence is 0.2 per year (1 occurrence every 5 years).

Once the frequency (occurrences per year) and the consequences (for radiation exposure) of an accident are known, the risk can be determined. The risk per year is the product of the annual frequency of occurrence and the number of latent cancer fatalities. This annual risk expresses the expected number of latent cancer fatalities per year, taking account of both the annual chance that an accident might occur and the consequences if it does occur.

For example, if the frequency of an accident were 0.2 occurrences per year and the number of latent cancer fatalities resulting from the accident were 0.05, the risk would be 0.01 latent cancer fatalities per year (0.2 occurrences per year x 0.05 latent cancer fatalities per occurrence = 0.01 latent cancer fatalities per year). Another way to express this risk (0.01 latent cancer fatalities per year) is to say that if the accident continued for 100 years, one latent cancer fatality would be expected to occur during that period. This is equivalent to 1 chance in 100 that a single

be caused by the accident source for each year of operation.

A frame of reference for the risks from accidents associated with SNF management alternatives can

be developed in the same way. For an average resident in the vicinity of the Idaho Laboratory, the risk of a latent cancer fatality caused by the water draining from after a large earthquake would be approximately 1.7×10^{-7} per year (see Chapter 5 risk can be compared with the lifetime risks of death from other accidental causes example, the risk of dying from a motor vehicle accident is about 1 in 80. Similar average American from fires is approximately 1 in 500, and for death from accidents about 1 in 1,000 (NNPP 1993). These comparisons are not meant to imply that risks fatality caused by DOE operations are trivial, only to show how they compare with c risks. Radiological risks to the general public from DOE operations are considered opposed to voluntary risks such as operating a motor vehicle.

Radiological Accidents-Activities associated with transporting, receiving processing, and storing SNF involve substantial quantities of radioactive materials toxic chemicals. Either routine SNF operations or accidents involving either radionuclides can result in exposure to workers or members of the public, or contamination of the environment.

A number of existing accident analyses were evaluated to find a small group with consequences or risks. These accidents included events such as small fires; severe designed to withstand; and beyond-design-basis events, which a facility is not designed to withstand; and beyond-design-basis events, which a facility is not designed to withstand; accidents included those initiated by internal events, such as operational errors; external phenomena, such as floods, tornados, and earthquakes; and those initiated external events, such as aircraft crashes and nearby explosions or toxic material releases. The accidents evaluated included those with an estimated probability ranging from 1 chance in 1,000,000 per year.

Appendices A through F summarize the possible accidents involving SNF operations at each site and evaluate the potential consequences of the accidents that present the highest estimated frequency of occurrence multiplied by consequences, to the workers and the public. The accidents with the highest consequences, though frequently not the highest risk associated with the accidents with the lowest probabilities.

The accidents selected, the amount of radioactive and toxic materials released, the conditions, and the estimated probabilities were based on existing safety analyses operations at each site, or for comparable operations at other sites. The accident with the 40 to 50 years of operational experience with SNF at the sites.

Accident consequences were analyzed utilizing radioactive and toxic material releases from each accident. The downwind concentrations of materials released in accidents were analyzed to determine the range of potential receptor locations and potential doses to individuals or people. Doses were evaluated for (a) an individual 100 meters (328 feet) downwind of the release location, (b) a hypothetical resident at the site boundary nearest to the release location, (called the maximally exposed offsite individual), and (c) the general population within 5 miles) of the release location. The potential impacts to workers in the immediate vicinity were analyzed qualitatively.

Dispersion in air from the release site was estimated with both typical (50th percentile) meteorological conditions. The unlikely weather conditions represent result in high air concentrations of the material released, elevating the exposure concentrations and human exposures are lower than these values 95 percent of the time calculated using the GENII computer code (Napier et al. 1988) for all sites except which the site-specific AXAIR89Q code was used (including 95 percent meteorological conditions the modeling for the Savannah River Site was performed using a different code, that and shown to be consistent with the GENII code and conservative in its model result nonradioactive materials was modeled using EPICode (Homann 1988).

Nonradiological Accidents-Accidents with nonradiological effects include hazards from construction and normal operation. Accidents that may affect occupational health were evaluated for each of the alternatives at each of the potentially affected sites. The maximum reasonably foreseeable accidents include chemical spills, fires, and worker accidents estimated to exceed the most widely accepted accident exposure (toxicology the Emergency Response Planning Guideline-3 and the Threshold Limit Value of the American Society of Governmental Industrial Hygienists, are summarized in Section 5.1, Volume 1. Exposure concentrations would result in an unacceptable likelihood that the worker or public would develop life-threatening or very serious toxicological effects. The analysis methods and descriptions are discussed in Appendices A through F.

Industrial accidents that do not involve the release of chemicals could occur during proposed storage and generation locations during the transition/construction phase

rates. Construction accidents would primarily occur during the construction period (approximately 8 years under the Centralization alternative). Construction fatalities (approximately one per year at the centralized site for the Centralization alternative) transported to the centralized facility, normal operations would not be expected to have a fatal accident frequency is estimated to be less than one accident per year. The same for the centralized facilities would be expected to have less than one fatal accident per year during the interim management period.

5.1.1.5 Transportation.

In this EIS, one of the ways that may be used to discriminate between alternatives is through the transportation impacts associated with each alternative. The No Action alternative, would involve limited transportation of SNF and have few impacts, while other alternatives, such as the Centralization options, would involve extensive transportation and have greater transportation impacts.

SNF is transported in large, heavy containers called shipping casks. Shipping casks meet stringent Federal standards and are designed and constructed to contain the radioactive material in the event of severe transportation accidents. There are also standards that describe the routine operations for shipping casks. Because of the stringent standards for SNF shipping casks, the U.S. Nuclear Regulatory Commission has estimated that shipping casks will withstand 99.4 percent of truck accidents sustaining damage sufficient to breach the shipping cask. Only in the worst physical conditions, which are clearly of low probability, can the shipping cask be so damaged as to cause a significant release of radioactivity to the environment.

Transportation impacts may be divided into two parts: (1) the impacts due to routine transportation and (2) the impacts due to transportation accidents. For incident-free transportation, impacts may be further divided into two parts: (1) nonradiological impacts. The nonradiological impacts are composed of the vehicular impacts such as vehicular emissions and traffic accidents, and are not related to the radioactive shipments.

In contrast to the nonradiological impacts, the radiological impacts are due to the presence of SNF shipments. In the case of incident-free transportation, the radiological impacts are the radiation field that surrounds the SNF shipping cask. These impacts are estimated for the general population along the transportation route. In the case of transportation accidents, impacts would result from the radioactivity released from the SNF shipping cask during the accident. Impacts are also estimated for the general population along the transportation route.

This EIS evaluated a full range of transportation accidents, up to and including the most severe, low probability, estimated to be on the order of one in 1 million years. In addition, impacts from severe transportation accidents were evaluated. The probability of these severe accidents is on the order of one in 10 million years.

For both incident-free transportation and transportation accidents, methodology used by the U.S. Nuclear Regulatory Commission was used to estimate impacts. These impacts were estimated in terms of the estimated number of radiation-related cancer fatalities and the estimated number of fatalities from vehicular emissions and traffic accidents associated with each alternative. Appendices C, D, F, and I contain more details on the methodology, data, and assumptions used in the estimates.

5.1.1.6 Uncertainties and Conservatism.

The calculations in this EIS have generally been performed in such a way that the estimates of risk provided are unlikely to be exceeded under routine operations or in the event of an accident. For routine operations, the results of the calculations provide realistic estimates of source terms, which when combined with conservative estimates of radiation, produce estimates of risk that are very unlikely to be exceeded. The calculations have been calculated using the same source terms and other factors, so this EIS provides a means of comparing potential impacts on human health and the environment.

The analyses of hypothetical accidents are based on the calculations that in the event of sequences of events and models of effects that have not occurred. The models have been developed to provide estimates of the probabilities, source terms, pathways for dispersion and exposure, and impacts on human health and the environment that are as realistic as possible. In many cases, the probability of an accident is postulated to be very low and little experience is available; thus, the consequences of an accident required the use of models or values for input that produce estimates of consequences.

higher than would actually occur because of the desire to provide results that will All the alternatives have been evaluated using the same methods and data, all comparison of all the alternatives on the same basis. It should be observed that, conservative analytical methods, the risks associated with implementing any of the

5.1.2 No Action Alternative

Under the No Action alternative, minimal actions would be taken for safe and SNF. SNF would not be transported to or from DOE facilities after a transition per or replacements and onsite fuel movements at DOE sites would be limited. Existing development activities at DOE sites would continue, but no new projects would be in would be stored at naval sites at or near the point of refueling or defueling withc National Engineering Laboratory. SNF from smaller DOE sites and university and oth reactors would be stored at those reactors, and the special-case commercial fuels w current location. No foreign research reactor fuels would be accepted.

If this alternative were implemented, the Expanded Core Facility at the Idaho Laboratory would be shut down, the naval sites would store SNF in transport casks a smaller DOE and university and other Government reactor sites would store the SNF t After a period of time, some smaller reactors would shut down to avoid the expense facilities, and the spent fuel would be stored in the reactor vessel.

In reviewing the impacts of the No Action alternative, it should be recognize summarized in Figure 5-1 only approximately represent the consequences of this alte consequences fall within four categories that may apply to one or more sites: incr higher radiation exposures because of degrading fuels, increasing the potential for because of the location of SNF in or near major population centers, causing a poten because research reactors would be shut down, and postponing the generation of wast research and converting SNF to a form acceptable for disposition. These issues are following paragraphs.

Because there would be minimal actions taken to stabilize fuel under the No A frequency of an SNF-related radiation accident could increase as the stored fuels c lack of structural integrity of the fuel in some instances could result in an incre accidents. In addition, releases from stored fuels could increase, increasing popu of cladding failures increase. While the DOE is committed under the No Action alte and secure management of SNF, future deterioration of fuels and facilities may incr current risk estimates.

Under this alternative, DOE-managed SNF would be stored in over 50 locations many of which are in areas of relatively high population density. While the risk c for this alternative as with other alternatives, and the worst consequence accident with one of the major DOE sites, the potential consequence of accidents could be gr proximity of a larger population at many of the potential storage sites.

Figure 5-1. Summary of impacts for the No Action alternative. (The maximum incre

The employment associated with SNF management at other generator/storage loca higher under this alternative than others because economies of scale would not be a facilities being distributed among more than 50 sites. At the same time, however, employment would decrease because of SNF management-related concerns. Several hund operations and research jobs could be lost if research reactors were forced to clos store SNF onsite. This job loss is not represented in the SNF management employmen presented in Section 5.1.2.1.

Under the No Action alternative, no new research would be initiated on approp converting fuels to an acceptable form for ultimate disposition and no new faciliti next 40 years for that purpose. Because this research was not initiated, potential impacts associated with research activities were not assessed under the No Action a adverse environmental impacts makes the No Action alternative appear to be more env acceptable than the other alternatives, when in fact the adverse impacts cannot be projects are planned.

The sites that would be affected by the No Action alternative are the Hanford Engineering Laboratory, Savannah River Site, naval sites, and other generator/stora environmental consequences at these sites are described below.

5.1.2.1 Socioeconomics.

As shown in Figure 5-1, the graph of the maximum incremental change in employment from SNF management activities for the major DOE sites, except Engineering Laboratory, indicates there would be little socioeconomic impact associated with the No Action alternative between 1995 and 2005. Implementation of the No Action alternative would result in the shutdown of the Expanded Core Facility at the Idaho National Engineering Laboratory of approximately 500 permanent jobs from a region with a relatively low population. The shutdown of the Expanded Core Facility would initially result in an increase in direct employment jobs over 3 years to handle the transport of containers, but then the 500-person work force would be replaced by a caretaker work force of 10 (see Appendix D, Volume 1). This results in the loss of approximately 240 jobs over the 10-year period or 3 percent of the Idaho National Engineering Laboratory work force, as shown in Figure 5-1. At the Hanford and Savannah River Sites, there would be a change of less than a 1 percent increase in direct employment, respectively, from the No Action alternative. The peak employment would be 50 additional workers at the Savannah River Site, which is approximately 0.3 percent of the 1995 baseline.

Naval sites would require very few additional workers to secure the naval SNF and monitor its condition. The incremental labor required for SNF management at the naval sites would be drawn from the existing work force and would be insignificant with respect to current employment at those sites. At the university and other Government reactors, there would be a need for maintenance personnel for reactors that would be shut down. While this would not be an increase in employment at those sites because the staff required to run the reactors would not be involved directly in SNF management, there would be a decrease in employment of less than 0.1 percent of the total workforce. Under the No Action alternative, there would be no socioeconomic effect on a nationwide scale.

5.1.2.2 Utilities (Electricity).

Figure 5-1 illustrates the maximum incremental power use with the No Action alternative in terms of percentage increase or decrease over baseline electric power usage, and the proposed actions under the No Action alternative. At the Idaho National Engineering Laboratory, the shutdown of the Expanded Core Facility would result in a 5 percent reduction in electric power consumption below existing levels at other generator/storage locations, there would be no discernable increase in power use.

5.1.2.3 Materials and Waste Management.

Figure 5-1 illustrates the annual average volume of high-level, transuranic, and mixed wastes and low-level waste that would be generated under the No Action alternative. Day-to-day SNF storage activities would annually generate approximately 20 cubic meters per year (660 cubic yards) of transuranic wastes and approximately 400 cubic meters per year (520 cubic yards) of low-level waste at the Savannah River Site. These volumes would be generated by activities related to SNF, including the onsite consolidation of existing fuels and refurbishment of existing fuel elements. No high-level waste would be generated at any of the sites under the No Action alternative. All levels of all wastes would be generated by the Hanford Site and the Idaho National Engineering Laboratory.

At the naval sites, implementation of the No Action alternative would result in limited amounts of solid municipal wastes and low-level radioactive waste. Wastes from the storage of naval SNF would be controlled and managed in accordance with existing site programs. These small amounts of waste are shown as zero in Figure 5-1.

5.1.2.4 Radiological Impacts.

For the No Action alternative, the radiological impacts from normal operations and accident risks are expected to be small at each of the major sites. Radiological impacts from normal operations and accidents are shown below.

Radiological Impacts From Normal Operations--The airborne releases from

SNF interim storage pools at the Hanford Site, Idaho National Engineering Laboratory Site were estimated to result in low-level exposures to the population in the vicinity of the pools. For naval sites, there are no releases; direct radiation is the only mechanism of exposure associated with the technologies that would be used under this alternative. The estimated annual latent cancer fatalities to the general population are illustrated in Figure 5-1.

Radiological Impacts From Accidents-

Hanford Site. Under the No Action alternative, a wide range of accident scenarios were considered, including accidents initiated by operational events, external hazards and natural phenomena such as earthquakes. The highest risk SNF-related accidents identified in Appendix A are a liquid metal (sodium) fire in the Fast Flux Test Facility fuel storage building (highest to worker) and a spent fuel cask drop at the 105-K Basin (highest to worker). Other induced accidents were also identified in buildings containing SNF (324 Building and 325 Building). Releases from these buildings were associated with materials other than SNF and the general population. Aircraft-crash initiated accidents were not considered to be reasonably foreseeable due to their very low frequency.

For both of the SNF-related accidents identified, the probabilities of occurrence are less than one chance in 10,000 per year of operation. The estimated population dose under conservative meteorology and assuming no protective action, for the Fast Flux Test Facility accident corresponds to an estimated 37 latent cancer fatalities in the general population (50 miles). The estimated risk per year, taking into account the probability of occurrence, is less than 3.7 10^{-3} potential latent cancer fatalities in the general population.

The potential dose to the maximally exposed offsite individual corresponds to a probability of a latent cancer fatality of 2.5 10^{-4} for the Fast Flux Test Facility accident. Offsite actions would likely reduce the actual exposures to any offsite individuals.

An onsite worker at the maximum exposure location downwind of the spent fuel storage building is estimated to receive doses that correspond to an estimated probability of a latent cancer fatality of 1.4 10^{-7} per year. The estimated risk for a worker is 1.4 10^{-7} latent cancer fatalities per year.

Workers (up to 12) in the immediate vicinity of the cask drop accident could receive an order of 70 to 140 rem (70,000 to 140,000 millirem). Acute doses of this magnitude are in the range of doses that might produce symptoms of acute radiation syndrome in human workers could be near the cask when it drops and receive direct radiation and inhalation products.

Potential secondary impacts identified for the Fast Flux Test Facility liquid sodium accident (Appendix A) include temporary closure of the Hanford Reach of the Columbia River, temporary restriction of water use locally, possible loss of crops, environmental contamination of the facility and near offsite environs, potential restriction on land use for agriculture, fishing access, and cleanup costs. The secondary impacts associated with the K Basin accident are somewhat lower but similar in nature.

Idaho National Engineering Laboratory. Under the No Action alternative, a wide range of accident scenarios were also considered, including accidents initiated by operational events, external hazards such as aircraft crashes, and natural phenomena such as earthquakes. A number of accident scenarios are identified in Section 5.15 of Appendix B.

The highest risk to the general population is associated with the melting of fuel assemblies as a result of a major earthquake and hot cell breach at the Hot Fuel Examination Facility. The estimated probability of this accident is about 1 chance in 100,000 per year of operation. The consequences are estimated to be approximately 7 latent cancer fatalities, with an estimated cancer fatality of 7.0 10^{-5} latent cancer fatalities per year.

The highest risk to workers is an inadvertent nuclear criticality in the Idaho Chemical Processing Plant CPP-603 Underwater Fuel Storage Facility, which has an estimated probability of occurrence of 1.0 10^{-5} per year of operation. The estimated probability of a latent cancer fatality in a 100 meters (about 330 feet) downwind of the accident would be 3.9 10^{-5} . The estimated risk to workers is 4.0 10^{-8} latent cancer fatalities per year.

If workers were in the immediate vicinity, doses under some circumstances could be high but are not likely to be fatal immediately. In the criticality accident, the criticality would be shielded by approximately 6.1 meters (20 feet) of water. Shielding by the water would be sufficient to protect nearby workers. Expulsion of a cone of water above the criticality might lead to high doses to any workers who were directly above the location of the criticality.

Fuel-handling accidents have the highest estimated frequency of occurrence at the Idaho Chemical Processing Plant but because of their lower consequences, fuel-handling accidents do not represent the highest risk under the No Action alternative. The frequency of fuel-handling accidents is directly related to the amount of fuel handled and the annual number of SNF shipments projected under the alternative.

Potential secondary impacts identified (Table 5.15-8 of Appendix B) for the criticality accident at the Idaho Chemical Processing Plant are limited adverse effects to vegetation or wildlife.

contamination requiring cleanup around the accident site. More extensive contamination expected should a cell breach occur at the Hot Fuels Examination Facility. Additional identified include the potential for a 1-year restriction in agricultural use of up to 100 acres at the Idaho National Engineering Laboratory site, the potential interdiction of affected nearby lands, and the potential for temporary restricted access to affected public lands.

The Expanded Core Facility at the Idaho National Engineering Laboratory would require a transition period of approximately 3 years. Potential accidents during this period are listed in Attachment F of Appendix D under the subheading of the Decentralization alternative at the Savannah River Site. Under the No Action alternative, a wide range of

accident initiators were considered for the existing SNF wet storage activities, in addition to operational events, external hazards such as aircraft crashes, and natural phenomena. Five types of SNF-related accidents are identified in Section 5.15 and Attachment A. These include (a) a fuel assembly breach because of dropping, objects falling onto the assembly cutting into the fuel part of an assembly, (b) an inadvertent nuclear criticality excursion in an adjacent facility, and (c) a fire and explosion in an adjacent facility, and (d) spills of contaminated storage containers to the ground outside of the facility. The initiators for these accidents are considered to be reasonably foreseeable because of their very low frequency.

The highest risk accident, both to the general population and workers, was identified as a fuel assembly breach accident with an estimated frequency of 0.16 per year. The estimated risk to the general population corresponds to 8.5 10^{-3} latent cancer fatalities in the general population (50 miles). The estimated risk, taking into account the probability of occurrence, is 1.6 10^{-7} latent cancer fatalities per year. The estimated dose to the maximally exposed off-site population is estimated to be 4.8 10^{-6} latent cancer fatalities per year.

A co-located worker downwind of the accident is estimated to receive a dose that corresponds to an estimated probability of 4.8 10^{-6} latent cancer fatalities. The estimated risk for cancer fatalities per year.

Based on past experience at the Savannah River Site (two fuel cutting/breach accidents occurred in the Receiving Basin for Offsite Fuels), no fatalities nor high exposure were expected for this type of accident. This type of accident would likely occur with a depth of 6 meters (1 to 20 feet) of water and result in small amounts of fuel and fission products being released into the pool water. The shielding effects of the pool water would attenuate most of the radioactive noble gases released would rise to the surface of the water and enter the room atmosphere. Upon releases into the room's atmosphere, the radiation exposure to workers in the area. Timely evacuation would likely prevent sound requiring evacuation of nearby workers. Timely evacuation would likely prevent exposure.

Potential secondary impacts identified for the SNF-related accidents (Table 5-1) include land contamination around the site of the accident, with minor contamination outside the facility area. This would not likely require cleanup of more than 4 hectares (10 acres) of land.

Under the No Action alternative, newly generated SNF would be stored at the Idaho National Engineering Laboratory. The naval sites are generally located in densely populated areas. As a result, the risk of an accident involving naval SNF at a naval site would be higher than the same accident at the Idaho National Engineering Laboratory.

After a limited transition period, naval SNF would be stored dry in shipping containers at Pearl Harbor, Norfolk, and Portsmouth Naval Shipyards and the Kesselring Site. The range of potential accidents (see Attachment F of Appendix D) indicated the limiting scenario with the potential to release radioactive material from the storage containers into the dry storage area. This accident is the highest risk accident for the general population among all of the sites.

The highest risk to the general population occurs at Pearl Harbor. The probability of a crash at the Pearl Harbor facility is estimated to be 1 chance in 100,000 per year. The probability of population consequences, using very conservative meteorology, is estimated to be 26 in the general population within 80 kilometers (50 miles) of the site. The estimated risk, taking into account the probability of occurrence of this accident, is 9.5 10^{-3} latent cancer fatalities per year. The probability of a latent cancer fatality in the maximally exposed population is estimated to be 9.5 10^{-3} .

The highest risk to workers occurs at Norfolk. The probability of an airplane crash is estimated to be 1 chance in 1,000,000 per year of operation. An onsite worker approximately 330 feet downwind of the accident is estimated to receive a dose that corresponds to a latent cancer fatality of 7.4 10^{-2} . The estimated risk for a worker is 7.4 10^{-2} latent cancer fatalities per year.

It is not likely that any fatalities would occur in workers in the vicinity of the accident.

near the containers for only brief periods when a container is being placed in the two or three nearby workers might receive significant radiation exposure from inhaled radioactivity if the container seal were breached. The low probability of the air with the probability that workers would be close enough to be affected, coupled with wind would be blowing in the direction of the workers, makes it very unlikely that substantial radiation exposure.

Secondary impacts are principally land contamination around the site of the a temporary contamination of naval vessels at the shipyard. A total of approximately might require cleanup. The contamination could extend about 0.6 kilometers (0.4 mi site boundary).

Other Generator/Storage Locations. Accident analyses were evaluated for facilities. These accidents included (a) handling accidents that resulted in fuel cladding breaches that could release portions of the more volatile fission products iodine, (b) accidental nuclear criticalities, (c) building collapse due to natural such as major earthquakes or aircraft crashes, and (d) release of contaminated storage analysis of these accidents indicated that they were similar in kind and consequence major DOE sites and, therefore, these problems are not presented for each of the 57 locations. For the No Action alternative, no accidents related to SNF management at Nevada Test Site because no SNF is currently managed at the site. Two accidents were Action alternative at the Oak Ridge Reservation. The first involved a dropped dam High Flux Isotope Reactor fuel pool. This accident resulted in an estimated 9.2 1 to the worker and 1.7 latent cancer fatalities to the general population with a risk and to the general population of 1.7×10^{-4} . A beyond design basis accident at the could result from a roof collapse triggered by a tornado. This accident could result latent cancer fatalities to the worker and 2.3 latent cancer fatalities to the general worker of 3.8×10^{-9} and to the general population of 4.4×10^{-6} .

5.1.2.5 Nonradiological Impacts.

A series of the maximum reasonably foreseeable accidents was evaluated at each of the SNF management sites that would potentially release hazardous chemicals to the workplace or the environment. The specific accident was defined based on the characteristics of the specific facility, potentially affected public local residents (at the site boundary).

The maximum reasonably foreseeable chemical accident at SNF management facility Hanford Site could result in the release of polychlorinated biphenyls and sulfuric acid KW Basins. Should these releases occur, workers and the general public travelling could be subjected to chemical concentrations that might cause fatalities or serious general public at the reservation boundary would be subjected to approximately 20 percent guideline value.

A maximum reasonably foreseeable chemical accident at the Idaho Chemical Processing be expected to release chlorine and nitric acid. Should such an event occur, workers chemical concentrations that might cause fatalities or serious health effects. The boundary would be subjected to approximately 7 percent or less of the guideline value Planning Guideline-3). The expected concentration on public access adjacent to the approximately 30 percent of the guideline value. Because these accidents would occur alternatives evaluated and do not discriminate among alternatives, they are not discussed.

The release of nitrogen dioxide vapor from the interaction of target cleaning nitrite at the Receiving Basin for Offsite Fuel is the maximum reasonably foreseeable at the Savannah River Site. Should this accident occur, the estimated concentration would be 1 percent of the concentration that would be expected to cause fatalities or serious worker and 0.1 percent for the maximally impacted offsite individual.

A diesel spill and fire was identified as the maximum reasonably foreseeable at naval sites. Such an accident would be expected to produce toxic gas concentrations should it occur, would be expected to cause fatalities or serious health effects from dioxide, oxides of nitrogen, and nitric acid) that are produced during the fire. The nearest public access point at each of the five naval sites would be affected. The expected to adversely affect the public immediately outside the facility boundary at a Shipyard site.

5.1.2.6 Transportation.

Shipments-Under the No Action alternative, the only offsite transportat involves shipments of naval SNF from the Newport News Shipyard to the Norfolk Naval shipments of irradiated test specimens from the Expanded Core Facility at the Idaho Laboratory to offsite locations. Onsite transportation of SNF would occur at the National Engineering Laboratory, and Savannah River Site.

Incident-Free Transportation-For the No Action alternative, the incident transportation of SNF was estimated to result in a total of 0.0089 fatalities over through 2035. These fatalities were the sum of the estimated number of radiation-r fatalities and the estimated number of nonradiological fatalities from vehicular en number of radiation-related latent cancer fatalities for transportation workers was number of radiation-related cancer fatalities for the general population was 0.0003 number of nonradiological fatalities from vehicular emissions was 0.0059.

Onsite shipments of SNF were estimated to result in 0.0022 fatalities. Offsi were estimated to result in 0.0067 fatalities. These fatalities represent the sum radiation-related latent cancer fatalities and the estimated number of nonradiologi emissions.

Transportation Accidents-The cumulative transportation accident risks c 40-year operational period were estimated to be 4.1×10^{-6} latent cancer fatalities. If an accident occurred, it would be unlikely to result in the release of any radic reasonably foreseeable accident has a chance of occurrence between 1×10^{-6} and 1×10^{-5} . If an accident occurred in an urban or suburban population zone, the likelihood of a single latent exposed population was estimated to be about 1 in 100. In a rural population zone, latent cancer fatality was estimated to be about 1 in 500.

Onsite transportation of SNF would occur under the No Action alternative at t National Engineering Laboratory, and Savannah River Site. The maximum reasonably f for this alternative would occur at the Idaho National Engineering Laboratory, with risk of about 7.5×10^{-7} for a rural population zone and about 1.1×10^{-5} for a subur the extremely unlikely event that this accident occurred under stable (worst-case) result in 6 latent cancer fatalities in a rural population, such as around the Idah Laboratory, within 80 kilometers (50 miles) of the accident, or 85 latent cancer fa population zone. For comparison, the rural population zone would be expected to ex fatalities and the suburban population zone would experience 42,000 cancer fataliti

5.1.3 Decentralization Alternative

Under the Decentralization alternative, SNF currently stored or generated at at those sites, and SNF generated by university, other Government reactors, and for would be transported to either the Idaho National Engineering Laboratory or the Sav Special-case commercial SNF would be transported to the Idaho National Engineering facilities would be upgraded or replaced at DOE sites to improve the safe and secur Existing research and development of technologies improving the safe and secure stc sites would continue, and new projects would commence. The Navy would store SNF at refueling or defueling (Option A), transport about 10 percent of its SNF to the Pug for limited examinations and storage with the remainder stored at or near the point (Option B), or transport all naval SNF to the Expanded Core Facility at the Idaho N Laboratory for examination and then transport it back to naval sites for storage (C

The implications of this alternative would be the closure of the Expanded Cor National Engineering Laboratory under Options A and B and the modification of an ex Sound Naval Shipyard to provide limited examination under Option B. Major DOE site storage facilities to replace existing facilities or to accept newly generated SNF fuels at the major DOE sites might be stabilized to improve safe storage.

The sites affected by the Decentralization alternative include the Hanford Si Engineering Laboratory, Savannah River Site, and naval sites. The environmental cc sites are described below.

5.1.3.1 Socioeconomics.

For the Decentralization A and B options, one socioeconomic consequence would be similar to that described for the No Action alternative-closing Facility would result in the loss of an average of approximately 240 direct jobs at the National Engineering Laboratory (Figure 5-2), with an ultimate loss of about 500 jobs decrease in employment at the Idaho National Engineering Laboratory of approximately 100 jobs. Under Decentralization C option, the Expanded Core Facility would continue to operate at the National Engineering Laboratory with no socioeconomic consequences. At the Hanford and Savannah River sites, this alternative would result in significant new construction, employing an additional 200 workers at the Hanford Site and 200 to 220 workers at the Savannah River Site over a 10-year period. The higher value reflects an increase in employment of approximately 3 percent at the Hanford Site and approximately 1 percent at the Savannah River Site. The peak in employment would be an additional 1,100 workers at the Hanford Site, approximately 6 percent of the 1995 baseline.

Figure 5-2. Summary of impacts for the Decentralization alternative. (The maximum value is shown.)

Increases in construction activity over the short-term at the Hanford Site could increase the local market and put additional demands on school capacity. Operations after the construction phase would have very small consequences through the overall project timeframe. No secondary effects are expected at the Savannah River Site.

At the naval sites, the Decentralization alternative would require construction of fuel storage areas and to staff these areas, but it is expected that this would be a very small increase in the sites or the local area, and there would not be a significant socioeconomic impact on the communities. Nevertheless, staff required would be approximately a 1 percent increase over existing naval site staffing.

5.1.3.2 Utilities (Electricity).

Figure 5-2 illustrates the minimum and maximum incremental change in power use with respect to existing site usage from implementing the Decentralization alternative. As previously discussed in Section 5.1.1.2, the variation in power use by site shows whether processing occurs or not. As an example, if the Hanford Site were to choose a processing option, the power required for the storage option would be less than 1 percent increase in power use; however, if a processing option were selected, then power use could increase to 10 percent of existing site use (see Appendix K). At each of the sites, the increase in electric power use would be accommodated with the existing site electric power infrastructure. At Hanford, if a processing option were selected, an extension of existing utilities in the 200 Area to the project area would be required. At the Savannah River Site, the maximum potential electricity usage shown at the Savannah River Site would be associated with a processing option that requires the operation of the F- and H-Canyons. These have adequate onsite and offsite utilities for their operation. At the Idaho National Engineering Laboratory, the principal differences among options are due to the operation or shutdown of the Expanded Core Facility as was discussed in Section 5.1.2.2.

5.1.3.3 Materials and Waste Management.

The minimum and maximum volumes of high-level, transuranic, mixed, and low-level wastes that would be generated by SNF management over the next 10 years relative to the baseline are shown in Figure 5-2. The combined volume of transuranic, and mixed waste generated annually, if processing options were implemented, would range from approximately 18 to 44 cubic meters per year at the Savannah River Site and 18 to 44 cubic meters per year at the Hanford Site, respectively. In contrast, if wet storage options for N-Reactor fuel were selected, high-level, transuranic, or mixed waste would be expected to be generated. Figure 5-2 shows the volume of low-level waste that would be generated from implementation of the Decentralization alternative. It should be noted that the volume of low-level waste would increase if a processing option were selected at either the Hanford Site or the Savannah River Site. Additional volumes of low-level waste would be generated at the Savannah River Site from the limited receipt of SNF shipments from the Savannah River Site. Low-level waste would only be generated at the National Engineering Laboratory under the Decentralization alternative, where the Expanded Core Facility would continue to operate. Operation of an Expanded Core Facility could result in the generation of approximately 430 cubic meters (526 cubic yards) of low-level waste (Appendix D).

At the naval sites, the implementation of the Decentralization alternative would result in a 1 percent increase in the volume of low-level waste generated.

impact as that described in Section 5.1.2.3 for the No Action alternative because i the naval sites under both alternatives.

5.1.3.4 Radiological Impacts.

Radiological exposures to both workers and the public from normal operations for the Decentralization alternative were estimated to be small, alternative, with the principal differences associated with possible implementation at the Hanford and Savannah River Sites because of higher radionuclide releases to increases the offsite population doses and potential for latent cancer fatalities. estimated latent cancer fatalities associated with SNF operations at the major site cancer fatalities from 40 years of SNF operation would be less than one for each si

Hanford Site-The Decentralization alternative considers several options of new facilities at the Hanford Site, including a new wet storage facility for N-R storage facility for fuels currently stored at other onsite locations. A second of Decentralization alternative at the Hanford Site is processing of the N-Reactor SNF

Under this alternative, one of the highest risk SNF-related accidents identif alternative remains-the spent fuel cask drop at a wet storage facility. Because of storage facility, the offsite consequences and risks associated with this accident 25 percent of those described under the No Action alternative. The other highest r fire in the Fast Flux Test Facility fuel storage area, is no longer applicable beca SNF would be moved to a new dry storage facility.

Potential accidents at the proposed new facilities include a severe cask impa new dry storage facility and a uranium metal fire at a new facility for processing Appendix A indicates that the cask impact and fire accident scenario presents the h both the onsite workers and the general public of the accident scenarios identified Hanford.

For the severe cask impact accident, the estimated probability is 6 in 1,000, operation. The estimated population dose, using very conservative meteorology, cor cancer fatalities in the general population within 80 kilometers (50 miles). The e taking into account the chance of occurrence of this accident, would be 4.9 10⁻⁴ 1 year in the general population. The potential dose to the maximally exposed offsit protective action, corresponds to an estimated probability of a latent cancer fatal

An onsite individual approximately 100 meters (about 330 feet) downwind of th remains within the plume while the fire burns could receive a dose of 120 rem (120, doses of this magnitude are in the lower end of the range of doses that might produ radiation syndrome in humans. Because a fire is also involved, the close-in dose i meteorological conditions at the time, the amount of plume rise that is generated k exact location of the accident relative to buildings, etc. An individual 100 meter is estimated to receive a dose that is sufficient to cause immediate health impacts lethal. This dose corresponds to an estimated worker probability of a latent cance estimated risk for a worker is 5.6 10⁻⁷ latent cancer fatalities per year.

Workers in the immediate vicinity of this accident could receive very high dc unless they immediately evacuated the area of the accident. There are likely to be associated with this accident: immediately following the accident and while the fi may not be able to avoid the immediate radiological impacts but could likely evacua most of the fire-related radiological releases unless incapacitated by the accident

Potential secondary impacts identified for the severe cask impact with fire a Appendix A) include possible restriction of use of the Hanford Reach of the Columbi potential loss of crops, moderate environmental contamination in the vicinity of th environs, temporary restriction on land use for agriculture, possible short-term re and cleanup costs.

Idaho National Engineering Laboratory-Under the Decentralization altern the Idaho National Engineering Laboratory the highest consequence and highest risk are associated with SNF storage and are the same as described under the No Action a Decentralization alternative, there are more SNF shipments, and consequently more h compared to the No Action alternative. As a result, the potential frequency of fue be about 20 percent higher than under the No Action alternative, but because of low handling accidents would not represent the highest risk accidents under the Decentr DOE-ID 1994).

Savannah River Site-The Decentralization alternative considers several SNF management at the Savannah River Site, including wet storage (Option 2b), new f

storage (Option 2a), and processing the SNF followed by dry storage (Option 2c), wh under the No Action alternative.

The highest risk accident for both the general population and workers, howeve assembly breach accident that was discussed under the No Action alternative.

The accident frequency is expected to be about 0.35 fuel assembly breaches pe with implementation of this alternative. The risks to the general public, the maxi individual, and co-located workers were estimated to be 3 10⁻³, 3.5 10⁻⁷, and 1.7 fatalities per year of operation, respectively.

Naval Facilities-The accident risks for the three subalternatives were naval facilities under the Decentralization alternative: (a) decentralization with and the Kesselring Site without examination of the SNF, (b) decentralization with 1 Puget Sound Naval Shipyard, and (c) decentralization with performance assessment ex Expanded Core Facility at the Idaho National Engineering Laboratory followed by stc Attachment F of Appendix D presents a full discussion of the accident risks at each

The accident risks associated with this alternative would be the same as with alternative, with the highest risk accident being an aircraft crash into a dry stor consequences and risks of this maximum risk accident would be the same as those des Action alternative.

Other Generator/Storage Locations-For the Decentralization alternatives accident risks at the Oak Ridge Reservation and other SNF interim storage sites tha SNF elsewhere would be expected to be similar to and bounded by the accident risks alternative.

5.1.3.5 Nonradiological Accidents.

The maximum reasonably foreseeable chemical accident at the Idaho National Engineering Laboratory, Savannah River Site, naval sites, and locations would be similar to those described under the No Action alternative. An facility on the Hanford Site could release sulfuric acid vapor and subject workers chemical concentrations that are associated with fatalities or serious health effec

5.1.3.6 Transportation.

Shipments-Under the Decentralization alternative, university, foreign, research reactors would transport SNF to the Idaho National Engineering Laboratory Site. In addition, naval SNF shipments would be equal to or greater than those unc alternative, depending on the choice of subalternative with respect to fuel examina shipments at major DOE sites would occur to relocate SNF from one facility to anoth storage.

Incident-Free Transportation-For the Decentralization alternative, the transportation of SNF was estimated to result in total fatalities that ranged from year period 1995 through 2035. These fatalities represent the sum of the estimated radiation-related latent cancer fatalities and the estimated number of nonradiologi emissions.

The reason for a range of fatalities was because of three factors: (a) diffe for naval SNF (see Appendix D), (b) the option of using truck or rail transport for I), and (c) different SNF management options at the Savannah River Site (see Append would be made using a combination of truck and rail; DOE shipments were assumed to percent truck or 100 percent rail.

The estimated number of radiation-related latent cancer fatalities for transp from 0.026 to 0.090, the estimated number of radiation-related latent cancer fatali population ranged from 0.041 to 0.24, and the estimated number of nonradiological f emissions ranged from 0.047 to 0.050 for this alternative.

Onsite shipments of SNF were estimated to result in 0.0025 to 0.0036 fataliti of SNF were estimated to result in 0.12 to 0.37 fatalities. These fatalities also estimated number of radiation-related latent cancer fatalities and the estimated nu fatalities from vehicular emissions.

Transportation Accidents-The cumulative transportation accident risks c year operational period were estimated to be in the range of 0.00085 to 0.0009 late 0.20 to 1.01 traffic fatalities, if all SNF were transported by truck. If all SNF corresponding risks were estimated to be in the range of 0.00029 to 0.00034 latent

to 1.07 traffic fatalities. The range of fatality estimates reflects the different naval SNF (see Appendix D).

The maximum reasonably foreseeable offsite transportation accident under the alternative involves transport of naval SNF by rail in a suburban area. The consequences were estimated to be 1.7 latent cancer fatalities. The probability of occurrence is slightly greater than 1.0×10^{-7} per year. This probability accounts for the accident number of miles traveled, the percentage of the total distance that occurs in a suburban meteorological conditions, and the severity of the accident. Based on DOE guidance with a probability of occurrence less than 1.0×10^{-7} per year are not reasonably foreseeable evaluated in this EIS. Consistent with this guidance, an accident of similar severity in a suburban area, but occurring in an urban area, would not be reasonably foreseeable. The number of miles traveled in an urban area would be only a few percent of the total transportation probability of occurrence of less than 1.0×10^{-7} per year. Thus, the maximum reasonably foreseeable transportation accident in an urban area would be less severe than postulated to occur. It is estimated to result in 0.065 latent cancer fatalities. (A more complete discussion is presented in Section A.5.2 of Volume 1, Appendix D, Part B, Attachment A.)

Onsite transportation of SNF would occur under the Decentralization alternative at the Idaho National Engineering Laboratory, and Savannah River Site. The maximum reasonably foreseeable accident for this alternative occurs at the Idaho National Engineering Laboratory, and would be the same as those described under the No Action alternative.

5.1.4 1992/1993 Planning Basis Alternative

Under the 1992/1993 Planning Basis alternative, SNF currently stored at major DOE sites remain at those sites, and newly generated SNF from DOE, universities, and other Government facilities would be transported to the Idaho National Engineering Laboratory or the Savannah River Site. Commercial SNF and naval SNF would be transported to the Idaho National Engineering Laboratory for storage. Existing research and development of technologies improving the safe and efficient storage of SNF at DOE sites would continue, and new projects would commence. Examination of naval fuel cycle activities conducted at the Expanded Core Facility at the Idaho National Engineering Laboratory would continue.

The implications of this alternative for major DOE sites would be similar to the Decentralization alternative. New storage facilities would be built at the major DOE sites or to accept newly generated SNF from other sites. Degraded fuels at the Hanford Site might be stabilized to improve safe storage.

The sites that would be affected by the 1992/1993 Planning Basis alternative are the Idaho National Engineering Laboratory, and Savannah River Site. The environmental impacts at these sites are described below.

5.1.4.1 Socioeconomics.

Implementation of the 1992/1993 Planning Basis alternative would not have a significant socioeconomic impact at any of the major DOE or naval sites. Impacts at the Hanford and Savannah River Sites would be similar to those described in the Decentralization alternative in Section 5.1.3.1 and shown on Figure 5-2. Proposed new construction activities at the Idaho National Engineering Laboratory would result in the addition of approximately 1,100 workers over 10 years, less than a 2 percent increase above baseline site employment at Hanford would be the same as that described for the Decentralization alternative. At the Savannah River Site, an increase of approximately 6 percent above baseline. Secondary socioeconomic impacts at the Hanford Site would be similar to those described in the Decentralization alternative.

There would be no socioeconomic impact at the naval sites because current practices would be altered. Storage facilities would not need to be constructed at the individual naval sites. SNF would be generated at naval sites.

5.1.4.2 Utilities (Electricity).

The minimum and maximum change in power use from implementing the 1992/1993 Planning Basis alternative with respect to the site base load would be similar to those described in Section 5.1.3. The impact on power consumption at the sites would be the same as that described in the Decentralization alternative.

Decentralization alternative in Section 5.1.3.2 (compare with Figure 5-2) except at Figure 5-3. Summary of impacts for the 1992/1993 Planning Basis alternative. (The National Engineering Laboratory. The variation in power use over site baseline use and Hanford Sites reflects whether a storage or processing option is selected for S increase in power use at the Idaho National Engineering Laboratory would be because Electrometallurgical Process Demonstration Project. If processing options were implemented at the Site, an extension of existing utilities to the project area would be necessary.

5.1.4.3 Materials and Waste Management.

Figure 5-3 illustrates the combined average annual volumes of high-level, transuranic, and mixed wastes and of low-level wastes over the next 10 years as a result of SNF management activities with the implementation of the 1992/1993 Planning Basis alternative. The volume of low-level waste and the combined volume of transuranic, and mixed waste would be similar to the volumes generated under the Decentralization alternative for the Hanford and Savannah River Sites (see Figures 5-2 and 5-3). The maximum values shown for these sites reflect whether a storage option or a processing option is implemented, respectively.

At the Idaho National Engineering Laboratory, implementation of the 1992/1993 alternative would result in the generation of high-level, transuranic, and mixed waste to be generated by the Electrometallurgical Process Demonstration Project. The volume of waste generated at the Idaho National Engineering Laboratory would be from the construction, storage and characterization facilities at the site. Adequate storage capacity existed until 2005, when additional capacity would be expected to be required for managing waste (Appendix B).

5.1.4.4 Radiological Impacts.

Radiological exposures to both workers and the public from normal SNF management operations and onsite accidents for the 1992/1993 Planning Basis alternative would be essentially the same as estimated for the Decentralization option. Figure 5-4 shows estimated latent cancer fatalities associated with SNF operations at the major site.

SNF Facility Accidents-

Hanford Site. The implementation of the 1992/1993 Planning Basis alternative at the Hanford Site would not result in accident risks significantly different from those estimated for the Decentralization alternative (Section 5.15 of Appendix A).

Idaho National Engineering Laboratory. Under the 1992/1993 Planning Basis alternative at the Idaho National Engineering Laboratory, the consequences and risk with SNF storage would be the same as described under the No Action alternative (Section 5.1.4.3). The consequences of fuel-handling accidents would be the same as described under the Decentralization alternative, but increased SNF shipments, and consequently more handling of SNF, increased the frequency of fuel-handling accidents about three times higher than for the No Action alternative (Slaughterbeck et al. 1995). Because of the increased frequency of fuel-handling accidents, the risk from fuel-handling accidents may exceed the risk from SNF storage accidents.

Savannah River Site. The implementation of the 1992/1993 Planning Basis alternative at the Savannah River Site would not result in accident consequence estimates that differ from those identified under the Decentralization alternative (Section 5.1.4.3 of Appendix C). Because of increases in amount of SNF handled, the accident frequency would increase.

The accident frequency for the highest risk accident, the fuel assembly breach, would be about 0.40 fuel assembly breaches per year of operation with implementation of the alternative. This results in estimated risk to the general public, maximally exposed offsite individuals, of 3.4×10^{-3} , 4.0×10^{-7} , and 1.9×10^{-6} latent cancer fatalities per year of operation, respectively.

Naval Facilities. With implementation of the 1992/1993 Planning Basis alternative at the naval facilities, all storage and examination activities occur at the Idaho National Engineering Laboratory. The maximum risk accident at this facility was not the maximum risk accident at the Idaho National Engineering Laboratory, so it is not discussed further in this volume. See Attachment 1 for details.

Other Generator/Storage Locations. For the 1992/1993 Planning Basis alternative, accident risks at the Oak Ridge Reservation and other SNF interim storage sites that are not SNF elsewhere would be similar to the accident risks under the No Action alternative.

5.1.4.5 Nonradiological Accidents.

The maximum reasonably foreseeable chemical accident at the Idaho National Engineering Laboratory, Savannah River Site, and other general facilities would be similar to those described under the No Action alternative. The Hanford Site would be similar to those in the Decentralization alternative.

Two independent accidents were evaluated to describe the maximum reasonably foreseeable chemical hazards during the operation of the Expanded Core Facility at the Idaho National Engineering Laboratory. Such a release could subject workers to chemical concentrations that could cause serious health effects but would not subject the public to such concentrations.

5.1.4.6 Transportation.

Shipments-Under the 1992/1993 Planning Basis alternative, university, federal, and non-DOE research reactors would transport SNF to the Idaho National Engineering Laboratory, Savannah River Site. Commercial SNF stored at the West Valley Demonstration Project and SNF stored at the Fort St. Vrain site would be transported to the Idaho National Engineering Laboratory and the Savannah River Site. Naval SNF would be transported from the Naval Expanded Core Facility and irradiated test specimens would be transported between the Naval Facility and offsite locations. Onsite transportation would relocate SNF from one location to another for stabilization or storage.

Incident-Free Transportation-For the 1992/1993 Planning Basis alternative, the number of incident-free transportation of SNF was estimated to result in total fatalities that would be over the 40-year period 1995 through 2035. These fatalities were the sum of the estimated radiation-related latent cancer fatalities and the estimated number of nonradiological fatalities from emissions.

The reason for a range of fatalities was due to two factors: (a) the option to transport for DOE SNF (see Appendix I) and (b) different SNF management options at the Savannah River Site (see Appendix C). Navy shipments would be made using a combination of truck and rail. It was assumed to be made using 100 percent truck or 100 percent rail.

The estimated number of radiation-related latent cancer fatalities for transport ranged from 0.029 to 0.11, the estimated number of radiation-related latent cancer fatalities for the population ranged from 0.044 to 0.30, and the estimated number of nonradiological fatalities from emissions ranged from 0.045 to 0.071.

Onsite shipments of SNF were estimated to result in 0.0028 to 0.0036 fatality per shipment. SNF were estimated to result in 0.14 to 0.45 fatality per shipment. These fatalities were also the sum of the estimated radiation-related latent cancer fatalities and the estimated number of nonradiological fatalities from vehicular emissions.

Transportation Accidents-The cumulative transportation accident risks for 10 years of year operational period were estimated to be 0.0010 latent cancer fatality and 0.70 traffic fatalities were transported by truck. If all SNF were transported by rail, the corresponding risks would be 0.00035 latent cancer fatality and 0.73 traffic fatality.

The maximum reasonably foreseeable offsite transportation accident involves a special-case commercial SNF in a suburban population zone under neutral (average) weather conditions. The accident has a probability of occurrence of about 2.0×10^{-7} per year and would result in about 100,000 cancer fatalities in the exposed population. For comparison, the same population would experience about 100,000 cancer fatalities from other causes. The probability of traffic fatalities in an urban population zone would be less than 1×10^{-7} per year. In a rural population zone, the consequences would be estimated to be about 0.2 latent cancer fatalities.

Onsite transportation of SNF would occur under the 1992/1993 Planning Basis alternative at the Hanford Site, the Idaho National Engineering Laboratory, and the Savannah River Site. The maximum reasonably foreseeable accident for this alternative occurs at the Idaho National Engineering Laboratory. The potential impacts would be the same as those described under the No Action alternative.

5.1.5 Regionalization Alternative

There are two alternatives under Regionalization: Regionalization 4A would result in

the expended core facility or a 7- and 13-percent increase with an expended core facility (Figure 5-6). The peak annual employment from implementation of Regionalization 4B would be an additional 1,100 workers at the Nevada Test Site. The secondary impacts of increased employment at the Oak Ridge Reservation or the Nevada Test Site could result in an increased housing demand at the Nevada Test Site, overall socioeconomic impacts could be absorbed within the project area. Local economy, infrastructure, public service, and real estate development. At the increased employment could result in increases in capital expenditures to meet the housing, transportation, and educational facilities.

Figure 5-5. Summary of impacts for Regionalization 4B (by geography) if the site were not selected as the regional center. Input data are summarized in Appendix K.)

Figure 5-6. Summary of impacts for Regionalization 4B (by geography) if sites were not selected as the regional center. Input data are summarized in Appendix K.)

Figure 5-7. Summary of impacts for Regionalization 4B (by geography) if sites were not selected as the regional center. Input data are summarized in Appendix K.)

For the naval sites, implementing Regionalization 4B would have no socioeconomic

5.1.5.2 Utilities (Electricity).

As shown in Figure 5-4, implementing Regionalization 4A would have a similar impact on power consumption as the 1992/1993 Planning Basis alternative (Figures 5-3 and 5-4). There would be no effect on power consumption at the Oak Ridge Reservation or naval sites from the implementation of Regionalization 4A.

Figures 5-5, 5-6, and 5-7 illustrate the minimum and maximum change from baseline power consumption from implementing Regionalization 4B with and without an expended core facility and selected as the regional site. Regionalization at the Hanford Site or the Nevada Test Site would increase power consumption at these sites.

Figure 5-5 illustrates the impact on power consumption if a site were not selected as the regional center. The increase in electricity consumption at the Hanford Site and the Savannah River Site would be required to prepare or process the SNF for transport as required. The decrease in electricity consumption at the Idaho National Engineering Laboratory would be from shutdown of the Expended Core Facility.

Figure 5-6 shows the minimum and maximum percent change, without an expended core facility, over baseline site power consumption if a site were selected as a regional center. At the Savannah River Site, the power consumption increases slightly with the transport of SNF. Regionalization at the Oak Ridge Reservation would result in a small (less than 3 percent) increase in power demand. The site electricity supply at each of these sites would be more than adequate. Regionalization at the Nevada Test Site would increase power consumption about 13 percent. This increase in power consumption may require additional transmission lines or another substation at the site (see Appendix K).

Regionalization 4B with an expended core facility onsite is illustrated in Figure 5-7. Power requirements at each of the major DOE sites would increase with the addition of an expended core facility. An examination of naval SNF. Power consumption at the Nevada Test Site would increase about 13 percent above baseline and about 40 percent at Hanford if the processing facility were selected. The storage only options (figure minimum) at the Hanford site would result in a decrease in electricity consumption. The Nevada Test Site would require additional transmission lines and another substation to handle additional loads. The increased load could be handled at the Nevada Test Site, and relatively minor increases could occur at the Idaho National Engineering Laboratory.

5.1.5.3 Materials and Waste Management.

Figures 5-4 through 5-7 illustrate the effects of implementing the different Regionalization alternatives: Regionalization 4A, Regionalization 4B without an expended core facility located at the selected site, and Regionalization 4B with an expended core facility located at the selected site. The annual generation rate of waste from SNF management activities at a nonselected site would decrease over time, but at the selected sites the annual generation rate of waste from SNF management activities would increase with implementation of the Regionalization alternative. The construction of a new facility at any site would also increase the annual volume of low-level waste generated.

The annual waste volumes generated from SNF management activities associated with Regionalization 4A are illustrated in Figure 5-4. The effects of Regionalization 4B are described for the 1992/1993 Planning Basis alternative in Section 5.1.4.3 (see Figure 5-4).

Figure 5-5 illustrates the effect of not being selected as a regional center.

Decentralization and 1992/1993 Planning Basis alternatives, the annual generation of transuranic, mixed, and low-level wastes would ultimately decrease as the affected inventory would be transported offsite. However, characterization and stabilization transport would generate transient increases in waste volumes.

The effect of being selected as a regional center without a replacement expense is illustrated in Figure 5-6. Implementation of this Regionalization 4B alternative at the Hanford Site and Savannah River Site as the 1992/1993 Planning Basis alternative at the Reservation and Nevada Test Site would generate waste from SNF management activities at either of these two sites would be expected to generate 21 cubic meters (21 cubic yards) of transuranic waste and approximately 200 cubic meters of low-level waste annually from operating an SNF management complex.

Figure 5-7 illustrates the effect on annual waste volume generation of being a regional center with the addition of an expanded core facility to examine naval SNF. The addition of a core facility would have no effect on the annual volume of high-level, transuranic, but would increase the volume of low-level waste that would have to be managed at a regional center.

The effects from implementing either of the Regionalization alternatives at a regional center are the same as that described for the 1992/1993 Planning Basis alternatives in Section 5.1.5.4.

5.1.5.4 Radiological Impacts.

Radiological exposures to both workers and the public for Regionalization 4A would be similar to the 1992/1993 Planning Basis alternative. These are not discussed further in this section. Figure 5-4 illustrates the potential latent cancer risk within 80 kilometers (50 miles) from SNF operations at the major sites for Regionalization 4A.

Radiological exposures to both workers and the public for Regionalization 4B would be similar to the 1992/1993 Planning Basis alternative if the Savannah River Site, Idaho National or Hanford Site were selected as regional sites. Figures 5-5, 5-6, and 5-7 illustrate the potential latent cancer risk to the population within 80 kilometers (50 miles) from SNF operations if SNF is transported offsite, or if the site is selected as the regional site without a core facility, respectively.

For any of the Regionalization alternatives, the maximum estimated latent cancer risk to the general population from normal operations are estimated to be 7.6×10^{-3} per year.

SNF Facility Accidents-

Hanford Site. Accident risks under Regionalization 4A are the same as under the Decentralization alternative. The selection of the Hanford Site as the regional site would result in accident risks significantly different from those identified for the Decentralization alternative (Appendix A), although higher activity under this alternative would increase the number of accidents. The probability of the cask impact and fire accident scenario was estimated to be 5 in 1,000,000 if the Hanford Site were selected as a regional site.

Selecting a different site as the regional site would reduce the estimated accident risks identified for the Decentralization alternative because the existing wet storage facility and the amount of SNF handled at the dry storage facility would change slightly. The probability of the dry storage cask impact and fire was estimated to be 5 in 1,000,000 such that the highest risk accident, would be 4.1×10^{-4} latent cancer fatalities in the general population.

Idaho National Engineering Laboratory. While the consequences of potential storage and handling accidents would be similar for all alternatives, the estimated number of accidents depends on the amount of SNF handled under the alternatives. For alternatives where SNF is transported to another site, SNF storage and handling risks would be reduced. For SNF generated at the Idaho National Engineering Laboratory research reactors, under the No Action alternative (Section 5.15, Appendix B). The consequences of fuel-handling accidents would be the same as described under the No Action alternative, but increased transportation would result in a frequency of fuel-handling accidents about five times higher than the No Action alternative (Slaughterbeck et al. 1995). Because of the increased frequency of fuel-handling accidents, the risk to the public from fuel-handling accidents may exceed the risk from SNF storage accidents.

If the Idaho National Engineering Laboratory were selected as a regional site for Regionalization 4B, the highest consequences to the offsite population result from accidents involving SNF storage and handling. The consequences of fuel-handling accidents would be the same as described under the No Action alternative (Section 5.15 of Appendix B). With the resumption of processing at the Idaho Chemical Processing Plant, the highest consequence and risk to workers would be an inadvertent release during processing that has an estimated probability of 1 chance in 1,000 per year of operation.

probability of a latent cancer fatality in a worker approximately 100 meters (330 feet) from the accident would be 3.6×10^{-3} , corresponding to an estimated risk to a worker of 3.6 fatalities per year of operation. The consequences of fuel-handling accidents would be higher under the No Action alternative, but increased transporting and handling of SNF resulting from fuel-handling accidents about 20 times higher than for the No Action alternative (Slaughterbeck et al. 1995). Because of the increased frequency of fuel-handling accidents, risk to the public from fuel-handling accidents may exceed the risk from SNF storage and processing accidents.

If the Idaho National Engineering Laboratory were not selected as a regional alternative, the consequences and risks of accidents associated with SNF storage and processing would be the same as described under the No Action alternative (Section 5.15 of Appendix B). The consequences of fuel-handling accidents would be the same as described under the No Action alternative, but increased transporting and handling of SNF would result in a frequency of fuel-handling accidents higher than for the No Action alternative (Slaughterbeck et al. 1995). Because of the increased frequency of fuel-handling accidents, risk to the public from fuel-handling accidents may exceed the risk from storage accidents.

Savannah River Site. Accident risks under Regionalization 4A would be the same as those for the 1992/1993 Planning Basis alternative. The accident frequency for a fuel assembly breach, would be expected to be about 0.44 fuel assembly breaches per year of operation with implementation of this alternative. The estimated risk of latent cancer fatalities to the general public, maximally exposed offsite individual, and co-located worker would be 3.7×10^{-6} per year of operation, respectively.

The implementation of Regionalization 4B at the Savannah River Site, including dry storage, wet storage, and processing followed by dry storage, would not result in different risks from those identified for the same options under the Decentralization alternative (Attachment A of Appendix C). Because of an increase in the amount of SNF handled, the frequency for some accidents would increase.

Under Regionalization 4B, the accident frequency for the highest risk accident, a fuel assembly breach, would be expected to be about 0.41 fuel assembly breaches per year of operation with implementation of this alternative. This results in a proportional increase in risk to workers. The estimated risk of latent cancer fatalities to the general public, maximally exposed offsite individual, and co-located worker would be 3.5×10^{-3} , 4.1×10^{-7} , and 2.0×10^{-6} per year, respectively. With regionalization elsewhere, the highest risk accident would still be a fuel assembly breach with an estimated risk approximately the same as with the No Action alternative.

Naval Facilities. The accident risks associated with the implementation of Regionalization 4B at sites other than the Idaho National Engineering Laboratory are detailed in Attachment F of Appendix D. That evaluation considered the accidents at sites as an expended core facility and wet and dry storage facilities at the Hanford Site, Sandia Ridge Reservation, and Nevada Test Site. Accidents evaluated were the same set of accidents as for the Decentralization alternative. The maximum risk accidents, for either the general public or workers, at sites where an expended core facility might be located if they are associated with the alternative are discussed under the affected sites.

Oak Ridge Reservation. The Oak Ridge Reservation would not be affected by Regionalization 4A. The implementation of Regionalization 4B at the Oak Ridge Reservation would be similar to implementation of the Centralization alternative, except that additional safety requirements would be needed. Section 5.15 (Part 3) of Appendix F indicates that the risks described for the Centralization alternative would envelop the risks for the Regionalization alternative.

A wide range of accident scenarios were considered, including accidents initiated by internal events, external hazards such as aircraft crashes, and natural phenomena such as earthquakes. The risk SNF-related accidents identified were (a) a fuel assembly breach as a result of a fuel assembly falling on the assembly, or cutting into the fuel portion of the assembly, (b) a severe impact that results in breach of a transport cask and fire, (c) an aircraft crash into a fuel assembly facility, (d) an aircraft crash into the SNF dry cell facility, (e) a wind-driven fire, and (f) an aircraft crash into a water storage pool.

The highest risk to the general population would be a fuel assembly breach, with a frequency of 0.16 per year. General population consequences were estimated to be a 2.1×10^{-2} latent cancer fatalities per year. The estimated risk to the general population from the probability of occurrence of this accident, would be 3.4×10^{-3} latent cancer fatalities per year. The estimated probability of maximum latent cancer fatalities to the maximally exposed worker would be 6.0×10^{-6} .

The dropped fuel cask accident has the maximum risk to workers with an estimated probability of 1 in 10,000 per year. A worker downwind of the accident was estimated to receive a dose that corresponds to an estimated probability of 1.9×10^{-3} latent cancer fatalities. The estimated probability of maximum latent cancer fatalities to the maximally exposed worker would be 1.9×10^{-7} latent cancer fatalities per year.

Workers in the immediate vicinity of the cask drop accident could receive very low doses which would not result in a fatality. For that accident, workers could be exposed when it drops and receive both direct radiation as well as inhale airborne fission products. Workers would be expected to quickly evacuate the area and thus reduce their potential radiation exposure.

Nevada Test Site. The implementation of Regionalization 4B at the Nevada Test Site would also be expected to be similar to implementation of the Centralization alternative. The requirements for Regionalization 4B would be less. Section 5.15 (Part 2) of Appendix F indicates that the risks described for the Centralization alternative would envelop the Regionalization 4B risks.

A wide range of accident scenarios were considered for the Centralization alternative. These scenarios apply to Regionalization 4B, including accidents initiated by operational events, such as aircraft crashes, and natural phenomena such as earthquakes. The highest risk SNF-identified for the Nevada Test Site were a fuel assembly breach (highest risk to the general population) and a dropped fuel cask (highest risk to workers).

The fuel assembly breach is the highest risk to the general population with a risk of 0.16 per year and an estimated offsite population dose corresponding to 6.6×10^{-4} rem per year. The estimated risk to the general population, taking into account the probability of an accident, would be 1.1×10^{-4} latent cancer fatalities per year. The potential dose to an individual would correspond to a probability of a latent cancer fatality of 1.9×10^{-7} .

The dropped fuel cask accident was the highest risk accident to workers with a risk of less than 1 in 10,000 per year. A worker approximately 100 meters (330 feet) downwind would have a probability of a latent cancer fatality of 1.9×10^{-3} . The estimated risk to workers is 1.9×10^{-7} latent cancer fatalities per year of operation.

Workers in the immediate vicinity of the cask drop accident could receive very low doses which would not result in a fatality. For that accident, workers could be exposed when it drops and receive both direct neutron and gamma radiation as well as inhale fission products. Workers would be expected to quickly evacuate the area and thus reduce their exposure.

Other Generator/Storage Locations. For Regionalization 4A and 4B, the risks would be expected to be similar to the accident risks under the No Action alternative.

5.1.5.5 Nonradiological Accidents.

The maximum reasonably foreseeable chemical accident at the Idaho Engineering National Laboratory, Savannah River Site, and other general sites would be similar to those described under the No Action alternative. An accident at a wet storage facility at the Hanford Site could release sulfuric acid and subject workers to health effects.

Two independent accidents have been evaluated to describe the maximum reasonably foreseeable chemical accident during the operation of the expended core facility at each of its sites. These accidents could subject workers to chemical concentrations that could cause fatalities but would not subject the public to such concentrations except at potential locations near the Hanford Site and adjacent to the Savannah River Site.

5.1.5.6 Transportation.

Regionalization 4A (by fuel type)-

Shipments. Under Regionalization 4A, the same SNF types would be transported as under the 1992/1993 Planning Basis alternative with differences occurring in the destination and mode of transport. Onsite shipments would relocate SNF for continued safe storage or shipment.

Incident-Free Transportation. For Regionalization 4A, the incident-free transportation alternative, the estimated number of radiation-related latent cancer fatalities was estimated to result in total fatalities that ranged from 0.17 to 0.61 over the period 1992 through 2035. These fatalities represent the sum of the estimated number of radiation-related fatalities and the estimated number of nonradiological fatalities from vehicular emissions.

The reason for a range of fatalities was due to two factors: (a) the option to transport DOE SNF (see Appendix I), and (b) different SNF management options at the Savannah River Site (see Appendix C). Navy shipments would be made using a combination of truck and rail. Shipments were assumed to be made using 100 percent truck or 100 percent rail.

The estimated number of radiation-related latent cancer fatalities for transport ranged from 0.031 to 0.15, the estimated number of radiation-related latent cancer fatalities to the general population ranged from 0.054 to 0.41, and the estimated number of nonradiological fatalities ranged from 0.031 to 0.15.

emissions ranged from 0.052 to 0.084.

Onsite shipments of SNF were estimated to result in 0.0025 to 0.0034 fatalities. Offsite shipments of SNF were estimated to result in 0.17 to 0.61 fatalities. These fatalities also include the estimated number of radiation-related latent cancer fatalities and the estimated number of nonradiological fatalities from vehicular emissions.

Transportation Accidents. The cumulative transportation accident risks for the operational period were estimated to be 0.0011 latent cancer fatality and 0.77 traffic fatalities for transportation by truck. If all SNF were transported by rail, the corresponding risks would be 0.00037 latent cancer fatality and 0.76 traffic fatalities.

As in the 1992/1993 Planning Basis alternative, the maximum reasonably foreseeable transportation accident involves a rail shipment of special-case commercial SNF in a zone under neutral (average) weather conditions. The accident has a probability of 10^{-7} per year, and the consequences are the same as those described under the 1992/1993 alternative.

Onsite transportation of SNF would occur under Regionalization 4A at the Hanford National Engineering Laboratory, and Savannah River Site. The maximum reasonably foreseeable for this alternative would occur at the Idaho National Engineering Laboratory, and would be the same as those described under the No Action alternative.

Regionalization 4B (by geography)-

Shipments. Under Regionalization 4B, the same SNF types would be transported as in the 1992/1993 Planning Basis alternative with differences occurring in the destination and geographical considerations. Non-naval SNF originating from western United States would be transported to the Idaho National Engineering Laboratory, Hanford Site, or the Savannah River Site or Oak Ridge Reservation. Naval SNF would not be split on destination because the Navy would operate a facility for examining naval SNF at one of the DOE sites. Shipments at major DOE sites may relocate SNF from one facility or another for containment stabilization, if applicable.

Incident-Free Transportation. For the six Regionalization 4B alternatives, the maximum reasonably foreseeable free transportation of SNF was estimated to result in total fatalities that ranged from 0.17 (Idaho National Engineering Laboratory and Oak Ridge Reservation alternative) to 0.90 (Nevada Test Site and Oak Ridge Reservation alternative). The other four alternatives would result in fatalities between 0.21 and 0.60. These fatalities were over the 40-year period 1995 through 2035 and represent the sum of the number of radiation-related latent cancer fatalities and the estimated number of nonradiological fatalities from vehicular emissions.

The reason for a range of fatalities was due to two factors: (1) the option of truck or rail transport for DOE SNF (see Appendix I), and (2) the six regionalization alternatives. For DOE shipments, the mode of transport to be made using a combination of truck or rail; DOE shipments were assumed to be made 100 percent truck or 100 percent rail.

For regionalization at the Idaho National Engineering Laboratory and Oak Ridge Reservation, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for transportation workers was 0.21, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for the general population was 0.60, and the maximum reasonably foreseeable estimated number of nonradiological fatalities from vehicular emissions was 0.059.

For regionalization at the Nevada Test Site and Oak Ridge Reservation, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for transportation workers was 0.21, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for the general population was 0.60, and the maximum reasonably foreseeable estimated number of nonradiological fatalities from vehicular emissions was 0.091.

For regionalization at the Idaho National Engineering Laboratory and Oak Ridge Reservation, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for transportation workers was 0.0025, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for the general population was 0.13, and the maximum reasonably foreseeable estimated number of nonradiological fatalities from vehicular emissions was 0.059.

For regionalization at the Nevada Test Site and Oak Ridge Reservation, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for transportation workers was 0.0023, the maximum reasonably foreseeable estimated number of radiation-related latent cancer fatalities for the general population was 0.21, and the maximum reasonably foreseeable estimated number of nonradiological fatalities from vehicular emissions was 0.091.

Transportation Accidents. Cumulative accident risks for transportation for the operational period range from 0.00090 latent cancer fatalities and 0.72 traffic fatalities for regionalization at the Idaho National Engineering Laboratory and Savannah River Site, to 0.0012 latent cancer fatalities and 0.72 traffic fatalities for regionalization at the Nevada Test Site and Oak Ridge Reservation. Cumulative transportation by rail would range from 0.00024 latent cancer fatalities and 0.72 traffic fatalities for regionalization at the Idaho National Engineering Laboratory and Oak Ridge Reservation, to 0.00037 latent cancer fatalities and 0.91 traffic fatalities for regionalization at the Nevada Test Site and Oak Ridge Reservation.

As in the 1992/1993 Planning Basis alternative, the maximum reasonably foreseeable

transportation accident would involve a rail shipment of special-case commercial SNF population zone under neutral (average) weather conditions. The accident has a probability that ranges from about 2.7×10^{-7} per year for regionalization at the Hanford Site to about 3.7×10^{-7} per year for regionalization at the Nevada Test Site and Savannah River. Consequences would be the same for each alternative and would be the same as those for the 1992/1993 Planning Basis alternative.

Onsite transportation of SNF would occur under Regionalization 4B at the Hanford National Engineering Laboratory, and Savannah River Site. The maximum reasonably foreseeable for this alternative would occur at the Idaho National Engineering Laboratory, and would be the same as those described under the No Action alternative.

5.1.6 Centralization Alternative

Under this alternative, all stored and newly generated SNF would be transported to one of five sites: the Hanford Site, Idaho National Engineering Laboratory, Savannah River Reservation, or Nevada Test Site. SNF management activities at unselected sites would be related research and development activities would be conducted at the selected site. A new facility would also be located there.

The implications of this alternative would be similar to those of Regionalization at western sites, but if an eastern site were selected, considerably greater volumes could be stored than under any other alternative because the site would receive fuels from the Hanford National Engineering Laboratory. Therefore, substantially larger storage facilities would be required for this alternative than under any other. New facilities with the largest capacity would be located at the Oak Ridge Reservation and Nevada Test Site because they do not now have the capacity to store fuels and do not currently store significant volumes of SNF. The potential environmental impacts at these sites are described below.

5.1.6.1 Socioeconomics.

The Centralization alternative would result in the largest socioeconomic impact in terms of the number of direct jobs created (or lost) on SNF management activities (see Figure 5-7). The change in site employment would range from about 3 percent of total site employment at the Idaho National Engineering Laboratory to about 13 percent above existing site employment at the Nevada Test Site when new facilities were constructed at the site. The intensity of this impact at the major DOE sites would depend on whether the SNF management programs used existing personnel or required workers to be hired and (b) future actions at each site competing for the available labor pool. Under the alternative where a site were selected, the peak in employment would occur at the Savannah River Site where workers would be required for the proposed SNF management activities, an increase of about 13 percent above the projected 1995 baseline. If the site were not selected, the peak would be at the Hanford Site or approximately 3 percent above the projected 1995 baseline. At either the Hanford Site, Idaho National Engineering Laboratory, or Savannah River Site, a central site under the Centralization alternative, there would ultimately be a reduction in existing employment for SNF management at these sites. This would add to the fiscal impacts of these sites. In the short term, additional jobs would be required to prepare for the closure of the Expanded Core Facility at the Idaho National Engineering Laboratory; however, would lead to a long-term loss of jobs as well, increasing the rate of job loss.

Sites selected as central sites would generally have increased employment over the long term (see Figure 5-6). This increased direct employment would also result in an indirect increase in surrounding communities. At the Oak Ridge Reservation, the associated population growth increases in capital expenditures to meet the increased demand of housing, utilities, generation, wastewater treatment, and water, transportation, and education facilities. Centralization activities could strain the housing market and add to school-capacity constraints. Centralization at the Savannah River Site or the Idaho National Engineering Laboratory could have potential impacts on the demand for community resources and services would be minimized. At the Nevada Test Site, there is a potential increase in housing demand. Overall, the impacts of centralization at the Nevada Test Site could be absorbed within the projected expansion of infrastructure, public service, and real estate development.

5.1.6.2 Utilities (Electricity).

The effect on power consumption from implementing the Centralization alternative would be generally similar to that described for Regionalization 4B. SNF is transported offsite or where the SNF is transported to the regional site except for the Savannah River Site. Power consumption minimum increase would be about 8 percent over the site baseline for the Centralization alternative. Figures 5-8 and 5-9 illustrate the Centralization impacts for the two or not selected as the central site (compare with Figures 5-5 and 5-7). The impact those described in Section 5.1. Thus, for example, electric power requirements with the Nevada Test Site would be similar to Regionalization 4B at the Nevada Test Site with the expended core facility also located at that site (Figure 5-6).

Under the Centralization alternative at Hanford, the power consumption would increase 3 percent if SNF were only stored and could rise as much as 40 percent if processing the SNF. At the Savannah River Site, much of the difference would be the result of a higher Savannah River Site with power consumption.

5.1.6.3 Materials and Waste Management.

The Centralization alternative would have similar effects at the major DOE sites to those described in Section 5.1.5.3 for the Regionalization 4B (Figures 5-5 and 5-7). If a site were not selected as the central site, the annual SNF management activities would ultimately decrease; however, transient activities at the site could be substantial. The site selected as the central site would have a larger amount of wastes generated from SNF management activities. The increase in waste would be proportional to the larger amount of SNF being managed onsite because the origin of the waste is characterized and can be managed before transport so it could be placed directly into the waste volumes would be generated from transferring fuel from water pools at some sites and canning small amounts of new fuel, and operating the expended core facility. For the effects of not being selected as well as being selected as the central site for the Centralization option if sites were not selected as the central site (see Appendix K.)

Figure 5-9. Summary of impacts for the Centralization option if sites were selected as the central site. Input data are summarized in Appendix K.)

5.1.6.4 Radiological Impacts.

For the Centralization alternative, the radiological impacts from both normal operations and accidents at both the originating site and the central site are expected to be low and similar in magnitude. Accident analysis for both existing and proposed storage facilities indicates that the probabilities of accidents with the potential for radiological impacts are extremely low.

Figure 5-7 illustrates the estimated latent cancer fatalities among the population (50 miles) from SNF operations at each of the major sites. For each major site, the potential impacts associated with site SNF operations with centralization at another site are shown. The centralization at that site.

Accident risks from SNF activities would be principally because of handling and, therefore, would be expected to be similar for each of the centralization sites. The risks would be due to activities at the existing SNF sites necessary to prepare the SNF for transport to the centralization site.

SNF Facility Accidents-

Hanford Site. The implementation of the Centralization alternative at Hanford would be expected to result in accident risks for some accidents slightly different from the Decentralization alternative (Section 5.15 of Appendix A). The amount of SNF handled at the Hanford facility would be greater, resulting in an increase in the accident probability for Hanford from approximately 8 in 1,000,000. The estimate of risk from this, the high general population, would be 6.5×10^{-4} latent cancer fatalities in the general population. The corresponding risk to an individual worker would be 7.5×10^{-7} potential latent

of operation.

Implementation of the Centralization alternative (or Regionalization 4B) else estimates of accident risks from those identified for the Decentralization alternative storage facilities would be shut down and the amount of SNF handled at the site dec accident probability for the dry storage cask impact and fire would be expected to approximately 5 in 1,000,000. This yields an estimated accident risk to the general public of approximately 4.75 10^{-7} potential latent cancer fatalities per year of operation. The corresponding highest risk accident would be 4.75 10^{-7} potential latent cancer fatalities per year of operation.

Idaho National Engineering Laboratory. The implementation of the Centralization alternative at the Idaho National Engineering Laboratory is estimated in Section 5.15 in additional accident scenarios and accident risks from those identified for the Decentralization alternative. The assumed resumption of chemical processing of SNF at the Idaho Chemical Processing Plant consequences and risks from SNF-related accidents would be the same as Regionalization 4B if the Idaho National Engineering Laboratory is selected as a regional site.

The implementation of the Centralization alternative at a site other than the Idaho National Engineering Laboratory would result in potential accident consequences and risks that are different from those identified for the same options under the Decentralization alternative. Regionalization 4B when the Idaho National Engineering Laboratory is not selected as a regional site.

Savannah River Site. The implementation of the Centralization alternative at the Savannah River Site, including the three options of dry storage, wet storage, and spent nuclear fuel storage, is assessed in Section 5.15 and Attachment A of Appendix C to result in an increase in the amount of SNF handled, however, the accident frequency for some accidents would be lower than for the Decentralization alternative.

The accident frequency for the highest risk accident, a fuel assembly breach, is estimated at about 0.84 fuel assembly breaches per year of operation with implementation of this alternative. The estimated risk of latent cancer fatalities to the general public, maximally exposed located worker would be 7.2 10^{-3} , 8.4 10^{-7} , and 4 10^{-6} per year of operation, respectively. Centralization elsewhere, the highest risk accident would still be the fuel assembly breach. The risk is approximately the same as with the No Action alternative.

Oak Ridge Reservation. The accident risks associated with implementation of the Centralization alternative at the Oak Ridge Reservation are presented in detail in Appendix F. These accident risks are summarized under Regionalization 4B.

Nevada Test Site. The accident risks associated with implementation of the Centralization alternative at the Nevada Test Site are presented in detail in Section 5.15 (Part 2). These accident risks are summarized under Regionalization 4B.

Other Generator/Storage Locations. The accident risks under the Centralization alternative would be expected to be the same as the accident risks under the No Action alternative.

5.1.6.5 Nonradiological Accidents.

Abnormal operational events could result in the release of toxic or hazardous substances from the centralized facility or from SNF management storage/generator sites prior to the shipment of SNF to the central site. The event frequency and exposure guidelines would be similar to those described under the 1992/1993 alternative.

Two independent accidents have been evaluated to describe the maximum reasonable chemical hazard during the operation of the expended core facility at each of its plants. The release could subject workers to chemical concentrations that would exceed the Emergency Planning Guideline value but would not subject the public to such concentrations except on the Oak Ridge Reservation and adjacent to the Savannah River Site.

5.1.6.6 Transportation.

Shipments-Under the Centralization alternative, all stored and newly generated SNF would be transported to one of five sites: the Hanford Site, Idaho National Engineering Laboratory, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site.

Incident-Free Transportation-For the five Centralization alternative sites, the incident-free transportation of SNF was estimated to result in total fatalities that are less than 1.7 (centralization at the Oak Ridge Reservation) to 1.7 (centralization at the Savannah River Site) fatalities were over the 40-year period 1995 through 2035 and represent the sum of radiation-related latent cancer fatalities and the estimated number of nonradiological emissions.

The range of fatalities was due to two factors: (a) the option of using truck SNF (see Appendix I) and (b) the five centralization options. Navy shipments would be a combination of truck and rail; DOE shipments were assumed to be made using 100 percent rail.

For centralization at the Oak Ridge Reservation, the estimated number of radiation-related cancer fatalities for transportation workers was 0.050, the estimated number of radiation-related cancer fatalities for the general population was 0.073, and the estimated number of nonradiation-related cancer fatalities from vehicular emissions was 0.083.

For centralization at the Savannah River Site the estimated number of radiation-related cancer fatalities for transportation workers was 0.43, the estimated number of radiation-related cancer fatalities for the general population was 1.2, and the estimated number of nonradiation-related cancer fatalities from vehicular emissions was 0.11.

For centralization at the Oak Ridge Reservation, onsite shipments of SNF were estimated to result in 0.0023 radiation-related cancer fatalities. Offsite shipments of SNF were estimated to result in 0.20 radiation-related cancer fatalities. Also the sum of the estimated number of radiation-related latent cancer fatalities and nonradiation-related cancer fatalities from vehicular emissions.

For centralization at the Savannah River Site, onsite shipments of SNF were estimated to result in 0.0035 radiation-related cancer fatalities. Offsite shipments of SNF were estimated to result in 1.7 radiation-related cancer fatalities. Also the sum of the estimated number of radiation-related latent cancer fatalities and nonradiation-related cancer fatalities from vehicular emissions.

Transportation Accidents-Cumulative accident risks for transportation accidents would range from 0.0048 radiation-related cancer fatalities and 1.0 traffic fatalities for centralization at the Oak Ridge Reservation, to 0.0020 radiation-related cancer fatalities and 1.44 traffic fatalities for centralization at the Savannah River Site. Cumulative accident risks for transportation accidents from 0.0013 radiation-related cancer fatalities and 0.95 traffic fatalities for centralization at the Nevada Test Site, to 0.0014 radiation-related cancer fatalities and 1.19 traffic fatalities for centralization at the Nevada Test Site.

For centralization at either the Hanford Site or Idaho National Engineering Laboratory, the maximum reasonably foreseeable offsite transportation accident would involve a rail shipment of special-case commercial SNF in a suburban population zone under neutral (average) weather conditions. The accident has a probability of occurrence of about 5×10^{-7} per year and the consequences are as those described under the 1992/1993 Planning Basis alternative.

For centralization at the Oak Ridge Reservation or the Nevada Test Site, the maximum reasonably foreseeable offsite transportation accident involves a rail shipment of special-case commercial SNF in a suburban population zone under neutral (average) weather conditions. The accident has a probability of occurrence of about 1×10^{-7} per year and could result in an estimated 36 latent cancer fatalities in the exposed population for Oak Ridge Reservation; for the Nevada Test Site, the accident could result in approximately 36 latent cancer fatalities. For comparison, the same population would experience about 540,000 cancer fatalities from other causes. The probability of the accident occurring under stable (worst-case) weather conditions is less than 1×10^{-7} per year for urban areas. The probability of occurrence is 5.7×10^{-7} per year if the accident occurred in a rural area. The result is an estimated 2 latent cancer fatalities.

For centralization at the Savannah River Site, the bounding offsite transportation accident would involve a rail shipment of commercial SNF in a suburban population zone under stable weather conditions. The accident has a probability of occurrence of about 1.2×10^{-7} per year and could result in an estimated 55 latent cancer fatalities in the exposed population. For comparison, the population would be expected to experience about 42,000 cancer fatalities from other causes. The probability of the accident occurring in an urban population zone is less than 1×10^{-7} per year. In a rural population zone, the consequences would be approximately 3 percent of the suburban zone consequences.

Onsite transportation of SNF would occur under the Centralization alternative at the Idaho National Engineering Laboratory, and Savannah River Site. The bounding accident occurs at the Idaho National Engineering Laboratory, and the potential impact is as those described under the No Action alternative.

Table 5-2 summarizes the comparison of incident-free transportation fatality management alternatives. Table 5-3 provides the comparison of transportation accident fatality management alternatives.

Table 5-2. Comparison of incident-free transportation total fatalities for alternative period.

	Minimum (a,b) total fatalities	Maximum (k) total fatalities
No Action	0.0089	0.0089

Decentralization	0.12 to 0.15	0.35 to 0
1992/1993 Planning Basis	0.14	0.45
Regionalization 4A (fuel type)	0.17	0.61
Regionalization 4B (geography)		
Idaho National Engineering Laboratory and Savannah Site	0.15 to 0.17	0.51 to 0
Idaho National Laboratory and Oak Ridge Reservation	0.14 to 0.15	0.53 to 0
Hanford Site and Savannah River Site	0.17	0.55 to 0
Hanford Site and Oak Ridge Reservation	0.15	0.57
Nevada Test Site and Savannah River Site	0.19	0.88
Nevada Test Site and Oak Ridge Reservation	0.17	0.90
Centralization		
Hanford Site	0.23	1.3
Idaho National Engineering Laboratory	0.21	1.1
Savannah River Site	0.26	1.7
Oak Ridge Reservation	0.21	1.6
Nevada Test Site	0.26	1.6

a. The minimum total fatalities would be associated with transport of DOE fuel by truck (onsite) and rail (offsite).

b. Total fatalities were calculated for the 40-year period 1995 through 2035 and w radiation-related latent cancer fatalities for workers and the general population a fatalities from vehicle emissions.

c. The maximum total fatalities would be associated with transport of DOE fuel by both truck (onsite) and rail (offsite).

Table 5-3. Comparison of estimated transportation accident risks for alternatives

Alternative	Truck Accident Risks(a)		Rail Accident
	Latent cancer fatalities	Traffic fatalities	Latent cancer fatalit
No Action	4.1 X 10 ⁻⁶	0.047	4.1 10 ⁻⁶
Decentralization(b)	0.00085 to 0.00090	0.20 to 1.01	0.00029 to 0.00034
1992/1993 Planning Basis	0.0010	0.70	0.00035
Regionalization 4A (fuel type)	0.0011	0.77	0.00037
Regionalization 4B (geography)			
Idaho National Engineering Laboratory and Savannah River Site	0.00090	0.72	0.00034
Idaho National Engineering Laboratory and Oak Ridge Reservation	0.00095	0.73	0.00024
Hanford Site and Savannah River Site	0.0013	0.84	0.00075
Hanford Site and Oak Ridge Reservation	0.0013	0.81	0.00050
Nevada Test Site and Savannah River Site	0.0012	0.99	0.00045
Nevada Test Site and Oak Ridge Reservation	0.0012	1.00	0.00035
Centralization			

Hanford Site	0.0050	1.10	0.0013
Idaho National Engineering Laboratory	0.0048	1.00	0.0013
Savannah River Site	0.0020	1.44	0.00080
Oak Ridge Reservation	0.0017	1.35	0.00055
Nevada Test Site	0.0050	1.33	0.0014

a. Assumes SNF shipments would be 100 percent by truck or 100 percent by rail, except by both truck (onsite) and rail (offsite).

b. Range of values in each column for the Decentralization alternative reflects the SNF.

5.2 Issues Not Discussed In Detail

This section discusses potential impacts for issues that are not discussed in detail. These issues are small and do not distinguish among alternatives, but about which the public may have an interest. The discussion for each discipline generally concentrates on sites and all the largest expected impacts, demonstrating that the environmental consequences for these issues are not of sufficient importance to be given strong consideration in the programmatic process.

5.2.1 Land Use

The proposed alternatives would not result in major impacts on land use at either the naval sites. The largest amount of land that would be disturbed at any of the 153 hectares (130 acres) at the Hanford Site. This would occur under the Centralization alternative and would take less than 0.5 percent of the land at that site. Less than 6.5 hectares would be required at the naval sites for the No Action alternative for the storage and no additional land outside of the existing sites would be required. At all SNF sites, land would be located near existing facilities or new facilities would be built on previously industrialized land. Additional land might be required for infrastructure and buffer for a SNF management facility is required. Because less than 0.5 percent of the land at the sites would be needed and the current land use at the naval sites would not change, land use is determined not to be a discriminating factor (discriminator) among sites or alternatives considered further in this volume. Detail on land use impacts is presented in Appendix F. The EIS does not explicitly consider land that is currently used for SNF management that might or might not be made available for other uses under some alternative.

5.2.2 Cultural Resources

Cultural, archaeological, historic, and architectural resources are defined as historic sites, districts, structures, and evidence of human use that are considered significant to a culture, subculture, or a community for scientific, traditional, religious, or other reasons.

Most of the major DOE sites and some of the naval sites contain areas of archaeological, or historical interest. Direct impacts to archaeological resources would result from ground disturbance activities. Indirect impacts would result from improved visitor access, land status, or other actions that would limit future scientific investigation. All sites have not been surveyed completely, the locations for the construction of proposed alternatives have generally been evaluated for their cultural importance. No known cultural resources were affected by construction under any of the proposed alternatives. Specific surveys were conducted before beginning any construction to determine the impacts to cultural resources. A Section 5.7.3, if cultural resources (for example, prehistoric or historic artifact sites) are identified during construction, earth-moving activities would stop and the State Historic Preservation Office would be contacted immediately. If Native American or Native Hawaiian resources were involved, their leaders would also be contacted. Impacts to cultural resources were determined to be an important discriminator among sites and alternatives; therefore, they are not

in this chapter. Details on cultural impacts are given in Appendices A through F.

5.2.3 Aesthetic and Scenic Resources

At all DOE sites, any proposed new SNF management facilities would be located in areas with public access. Where new facilities would be visible to the public, similar to those already visible. At naval sites, SNF storage locations would be located at existing sites. Aesthetic and scenic resources would not be significantly affected by SNF management activities and are not considered further in this chapter. Discussion of impacts on aesthetic and scenic resources is contained in Appendices A through F.

5.2.4 Geologic Resources

None of the sites has known significant geologic resources that would be affected by the alternatives. Except for the potential existence of gold, tungsten, and molybdenum at the Nevada Test Site, geologic resources at the candidate sites consist of surficial sand, gravel, and silt that have low economic value. The alternatives that involve constructing new facilities do not involve disturbing or extracting surface deposits to construct the facilities. New construction would increase the use of surface deposits (that is, sand and gravel deposits), but because of the large volume of these materials on the sites, the impact is expected to be small.

All the major DOE sites have experienced earthquakes; however, they are located in areas with low to moderate seismic potential with respect to more seismically active areas of the United States (Algermissen et al. 1982, 1990). Because any new facility would be constructed to meet current seismic design criteria for a given area, seismic concerns are not a distinguishing factor among sites. Details on site geology are provided in Appendices A through F.

5.2.5 Air Quality

SNF management activities under some alternatives would result in slightly increased emissions of pollutants to the atmosphere. At the major DOE sites, the projected emissions from SNF management activities would not contribute to nonattainment of state or Federal standards. At the naval sites, construction activities at several different sites are expected to cause short-term fugitive dust emissions, but the use of standard dust suppression techniques would minimize this problem. These particulate emissions could temporarily affect visible air quality in some areas but would not cause nonattainment of state or Federal standards. Because SNF management activities would not be expected to cause either radiological or nonradiological air quality impacts that exceed state or Federal standards at any site for any alternative considered, or to otherwise affect air quality in any other respect, air quality impacts are not discussed further in this chapter. Potential radiological impacts on health are discussed in Section 5.1. The computer program used for evaluating air quality impacts, and detailed results are discussed in Appendices A through F.

5.2.6 Water Resources

The proposed alternatives would have small impacts on water resources at each candidate site. Compared with existing activities at all proposed SNF sites, additional water consumption would be minor and would relate primarily to the increased demand of a larger workforce because SNF water pools use recycled water. The maximum increase of water usage above the baseline at any candidate site would be approximately 5 percent. There would be no net change in water employment at the Oak Ridge Reservation, and the Nevada Test Site; however, water resources at the Nevada Test Site would not be expected to be appreciably affected under any alternative. Nevertheless, at the Nevada Test Site, where available water is limited, a cumulative water supply impact is possible from groundwater withdrawal from the Frenchman Flat hydrographic area at the Nevada Test Site. The impact of groundwater withdrawal from the Frenchman Flat hydrographic area to support a proposed SNF facility on groundwater yields are unknown and require additional study. The Frenchman Flat hydrographic area is part of the Ash Meadows sub-basin whose per capita water use has greatly exceeded its annual water withdrawals. Some potential also exists for

impacts of sedimentation during construction at the Oak Ridge Reservation and the S Site.

Storing SNF in water pools creates a potential for radiological groundwater c through undetected leaks or accidents that breach containment systems. Releases to caused by accidental minor breaches of leak containment systems are very small comp accidental minor releases, which are presented in Appendices A through F under Occu Public Health and Safety. Water resources are discussed in detail in Appendices A t

5.2.7 Ecological Resources

The major DOE sites under consideration are located on large reservations tha predominantly "natural." The naval sites, on the other hand, are generally much sma significant industrial infrastructure. Similarly, the majority of the other generat are in urban or suburban settings, where natural flora and fauna are limited to spe developed a tolerance to human activities. Therefore, the largest impacts to ecolog expected to occur at the five major DOE sites where undisturbed or semi-disturbed n be converted to industrial activity. Under any of the alternatives involving the cc facilities at DOE sites, individuals or small populations of some wildlife species displaced, or destroyed.

The development of new DOE facilities would affect some natural habitats. The areas affected would be small in relation to the size of the sites and the size of habitats. The type of habitats affected would vary but would be typical of the regi the sites are located. The habitat losses would probably not affect any threatened species or critical habitats with the possible exception of the proposed facilities Site and the Hanford Site. At the Nevada Test Site, the proposed SNF facilities cov within the range of the desert tortoise, a federally listed threatened species. At construction related to SNF management could result in a habitat loss up to 28 hect Federal and state-listed candidate species (for example, loggerhead shrike, sage sp owls, pygmy rabbits). As described in Section 5.7.7, mitigation plans would be deve consultation with the appropriate agencies if any threatened or endangered species the project site. Habitat fragmentation is not expected because new facilities would adjacent to existing facilities. Because minor impacts to ecological resources woul for all alternatives involving construction, ecology was not considered a significa among sites and, therefore, is not discussed further in this chapter. Appendices A a detailed discussion of ecological impacts.

5.2.8 Noise

The construction of SNF management facilities at any of the sites would gener consistent with light industrial activity. However, at the major DOE sites, noise g does not propagate offsite at levels that would affect the general population. Nois is primarily from truck and car traffic, shiploading, and diesel-powered equipment. analyses at the naval sites indicate that noise from construction or operation of f cause the ambient noise levels to exceed U.S. Environmental Protection Agency or st Construction would occur at the naval sites under the No Action and Decentralizatic Noise impacts would be expected to be comparable at the major DOE sites for all alt for the No Action alternative, which does not involve construction of new facilitie new facilities would be located in industrialized areas, however, no impacts are ex noise impacts would be minor and do not differentiate among the sites or the altern considered further in this chapter. Details on the noise impact analyses are provic through F.

5.2.9 Utilities and Energy

New facilities (or the restarting of idle facilities) would result in increas power, and sewage. The greatest resource requirements would result from the impleme Centralization alternative. Based on available data, the increased water usage woul

than 1 percent at the Idaho National Engineering Laboratory to a maximum of less than 1 percent at the Savannah River Site. Electricity requirements are above existing site usage at the Savannah River Site. Electricity requirements are Section 5.1. The increase in sewage generation resulting from implementation of the would range from less than 1 percent at the Idaho National Engineering Laboratory to 9 percent at the Savannah River Site. A central sewage treatment system would be constructed for the SNF facilities at the Nevada Test Site under the Regionalization alternatives if the Nevada Test Site were selected as a regional or central site. The capacities at all sites could manage the estimated changes in utility usage rates if Appendices A through F provide details on utilities and energy consumption.

5.3 Cumulative Impacts

A cumulative impact on the environment results from the incremental impact of when added to other past, present, and reasonably foreseeable actions. "Other" activities projects at the potentially affected sites not related to SNF management, as well as by other Government agencies, private businesses, or individuals. This type of an activity is important because significant cumulative impacts can result from several smaller activities themselves do not have significant impacts. The programmatic cumulative impacts from implementation of the DOE SNF Management Program are discussed in Section 5.3.1. The site-specific cumulative impacts are described in Section 5.3.2.

5.3.1 Programmatic Cumulative Impacts

On a nationwide basis, the implementation of any of the SNF Management Program alternatives would not be expected to significantly contribute to cumulative impact a small change in regional employment, little use of nonrenewable resources, low radio emissions, and a low rate of radioactive waste generation. Under most alternatives, and options, the activities required for SNF management would be very small in comparison to non-SNF-related activities already underway at almost all sites where SNF would be those alternatives where there would be large changes in nonrenewable resource use sites (Regionalization by geography or Centralization), on a national scale, increased regional or central site would be compensated for by changes at nonselected sites, very small.

Reasonably foreseeable projects that could contribute to cumulative impacts are each of the DOE and naval sites in Appendices A, B, C, D, and F. For the major DOE projects are primarily associated with environmental restoration and waste management of the priorities being given to site management, and are being covered by the Waste Programmatic EIS and site-specific EISs. It is expected that SNF management activities consistently smaller impacts than the environmental restoration and waste management that the overall impact of SNF management would not contribute significantly to cumulative impact on either a regional or a nationwide basis.

The transport of DOE and naval SNF over highways and railways is only one of a radiological dose to the general public. The potential transport of commercial wastes to the Waste Isolation Pilot Plant in New Mexico, and the expected transport used in medicine and other activities all would contribute to public exposures. Available data and projected future doses are summarized in Appendix I.

During analysis, the potential for significant cumulative impacts to other resources considered; none were found. Cumulative impacts are described qualitatively because considerations do not require detailed information that depends on specific facilities. More detailed cumulative effects analysis will be performed for any actions that are the course of implementing programmatic SNF management decisions.

5.3.2 Site-Specific Cumulative Impacts

All of the sites contain facilities unrelated to SNF that may continue to operate during the duration of the SNF interim management program (approximately 40 years). Impacts from construction and operation of SNF facilities would be cumulative with the impacts from

planned facilities or actions such as environmental restoration and waste management unrelated to SNF. Cumulative effects involving site-specific projects that are planned simultaneously with SNF management activities at the major DOE sites are discussed in Appendices A through F. Not all planned facilities were factored into the assessment of cumulative impacts. Pending funding approval or resolution of DOE policy issues.

The following sections discuss cumulative impacts to those environmental resources in Appendices A through F. During analysis, the potential for significant cumulative impacts to environmental resources (that is, geologic resources, aesthetic and scenic resources) was evaluated; none were found.

5.3.2.1 Land Use.

Implementation of any of the SNF alternatives at the major DOE sites would have a minimal cumulative impact with respect to either the available land on which the continued mission of the sites. The largest proportion of any site that would be required for sitewide activities is less than 1 percent of the total site area.

5.3.2.2 Socioeconomics.

Depending on the economic status and outlook for an area, SNF management activities coupled with other actions have the potential to strain or overburden the resources of certain areas, particularly if either the Regionalization or Centralization alternatives are selected with an expanded core facility located at the site. For example, these alternatives could contribute to housing shortages, the need for additional schools, and increased utilities and transportation.

Each site is anticipating an overall decline in site employment over the next few years; therefore, the existing work force could be reassigned to SNF management activities. It was assumed that the construction activities associated with the proposed SNF management alternatives would require the in-migration of construction workers. Although these activities are short-term with a duration of a few years, when addressed cumulatively with other reasonably foreseeable activities, there could be a socioeconomic impact in the communities surrounding the Hanford Site, Nevada Test Site, and Oak Ridge Reservation. For example, at the Hanford Site cumulative employment, housing requirements, and needs for schools would increase by 1 percent over those based on present Hanford employment for SNF management activities.

Impacts to socioeconomic resources associated with the implementation of proposed actions at the Idaho National Engineering Laboratory, Savannah River Site, naval shipyard sites, and nuclear power generator sites are not expected to be sufficient to have a cumulative effect on the infrastructure within each site's region of influence.

5.3.2.3 Air Quality.

The available data in Appendices A through F indicate that the cumulative air emissions from the Savannah River Site, Idaho National Engineering Laboratory, and naval sites, including those from the proposed SNF management alternatives, would not exceed the limits for nonradioactive air pollutants and would not threaten to exceed the limit for radioactive pollutants or the 40 CFR Part 61 limit of 0.01 rem (10 millirem) per year for radioactive pollutants.

5.3.2.4 Water Resources.

Based on data available in Appendices A through F, the implementation of any of the SNF alternatives at the major DOE sites would result in minimal cumulative impacts to water resources under normal operations. The proposed SNF management alternatives are designed to generate no liquid releases of wastewater to surface or water resources containing radiological constituents or hazardous chemicals. Facilities would be constructed using state-of-the-art technologies, including secondary treatment and leak detection and water balance monitoring equipment. Liquid effluent discharges would be controlled to meet applicable standards.

activities will be monitored for the presence of radioactive and chemical constituents suitable for land disposal as required under Federal and State regulations.

Water usage from SNF activities would also have a small cumulative effect on quantities of water available at the major DOE sites. The maximum increase over bas would be approximately 5 percent for any of the proposed locations.

5.3.2.5 Biotic Resources.

Construction of the proposed SNF facilities in addition to other planned activities could disturb as much as 9 hectares (24 acres) of terrestrial habitat at the Idaho Site and as much as 13 hectares (31 acres) of previously disturbed land at the Savannah Engineering Laboratory. No impacts to biotic resources would be expected at the Nevada Test Site or Oak Ridge Reservation. However, construction activities at the Nevada Test Site could result in habitat loss for either Federal and state candidate species or threatened species. For example, at the Hanford Site the cumulative impact from planned activities including construction related to SNF management could result in habitat loss for Federal candidate species (for example, loggerhead shrike, sage sparrows, burrowing owls, and pronghorn). At the Nevada Test Site, the proposed SNF facilities would be constructed within the habitat of the desert tortoise, a federally listed threatened species. Therefore, the proposed SNF activities in addition to other planned actions could result in a small cumulative impact on the desert tortoise.

5.3.2.6 Occupational and Public Health.

The sources of radiation exposure to individuals consist of natural background radiation from cosmic, terrestrial, and manmade sources; medical radiation; and radiation from manmade sources, including consumer products, nuclear facilities, and weapons test fallout. At the Savannah River Site, natural background radiation contributes about 82 percent of the dose received by a member of the population within 80 kilometers (50 miles) of the site, medical exposure accounts for 15 percent of the annual dose, and the combined doses from weapons test fallout, consumer products, and air travel account for approximately 3 percent. DOE nuclear facilities at the Savannah River Site account for less than 0.1 percent of the total radiation exposure.

The radiological impacts from SNF management operations are exposures to both the general public from normal operations and the risk of additional radiation exposure from accidents. The major concerns with these exposures are whether the doses are sufficient to cause immediate harm and how much they will increase the probabilities, among the exposed population, of latent cancer fatalities, nonfatal cancers, and genetic effects. Of further concern are management-related exposures in addition to those exposures and risks affecting workers and members of the general public from other sources. The cumulative impact of both SNF-related increment and other possible sources is also a concern.

Cumulative Impacts to the General Public-The principal regulatory limit affecting emissions from DOE and naval sites is the Clean Air Act standard (40 CFR 61.110 Subpart H for DOE; Subpart I for the Navy) for airborne radionuclide emissions from DOE sites. This rule limits airborne emissions to those amounts that would not cause any member of the general public to receive in any year an effective dose equivalent of more than 0.01 rem (10 millirem). Implementation of any of the alternatives at any of the sites is not expected to result in releases exceeding this limit. The naval sites have demonstrated to the U.S. Environmental Protection Agency that, at 0.0001 rem (0.1 millirem) per year, they are at 1 percent of the limit. SNF management facilities is not expected to change that conclusion. Data available for DOE sites (see Appendices A through F) indicate that over the 40-year planning period, radioactive emissions from the existing, the potential SNF management activities, and foreseeable future site activities at any of the sites would not be expected to result in a latent cancer fatality among the general population surrounding the site, except for the Savannah River Reservation. With centralization at the Oak Ridge Reservation, operation of the proposed SNF management facilities over their expected 40-year lifetimes is estimated to result in a cumulative dose of approximately 2,500 person-rem. This equates to approximately two latent cancer fatalities over the period.

Cumulative Impacts on the Site Work Force - The cumulative impact of the proposed SNF management activities on the site work force is a function of the selection of either of the alternatives coupled with the existing and reasonably foreseeable future activities and the potential to increase the radiological exposure to workers at the sites through planned activities.

the SNF. For both the transporting and receiving sites, the routine exposure to the expected to increase because much of the dose to the workers is associated with SNF operations.

Because occupational worker exposures are easily monitored and controlled to of 10 or more below the current standards, the overall average exposure per worker remain approximately constant at each of the SNF transporting and receiving sites w alternatives. However, with options that involve more SNF activities, the number of workers is expected to increase, thus increasing the collective radiation dose to t As reported in Appendices A through F and summarized in Appendix K, the increases i dose to the work force varies from site to site and with the alternatives. At the C Reservation, for example, the increases due to SNF-related actions range to 3,200 p the 40-year planning period. The maximum SNF-related increase is equivalent to appr additional latent cancer fatality among the workforce.

5.3.2.7 Transportation.

Radiological Impacts - Table 5-4 summarizes the existing and reasonable foreseeable actions assessed to determine the cumulative impact for transportation alternatives. The cumulative radiological impacts of incident-free transportation c in terms of radiation-related latent cancer fatalities. These results are summarize more details are contained in Appendix I. Over the 93-year period from 1943 through number of radiation-related latent cancer fatalities was estimated to be 290, or ap latent cancer fatalities per year. General transport of radioactive material account 90 percent of these radiation-related latent cancer fatalities. The radiation-relat fatalities would be indistinguishable from other cancer fatalities and would be 0.0 total number of cancer fatalities that would be expected to occur. The radiation-re fatalities associated with the alternatives evaluated in this EIS would be 5×10^{-6} number of cancer fatalities that would be expected to occur.

Traffic Accident Impacts - Fatalities involving the transport of radic materials for 1971 through 1993 were surveyed based on data in the Radioactive Mate Report database. This database contains information on radioactive materials transp

Table 5-4. Other activities included for assessment of cumulative impacts for trans

Activity	Description
Existing activities:	
Historical shipments	Historical shipments of SNF, Hanford Site, Idaho National Engineering Laboratory, Savannah River Site, Oak Ridge Reservation and Nevada Test Site
General transportation	Nationwide transport of radioactive materials for medical, industrial, fuel cycle, and other purposes
Reasonably foreseeable activities:	
Geologic repository	Shipments of commercial SNF and defense high-level waste to the geologic repository at Yucca Mountain, Nevada
Waste Isolation Pilot Plant	Shipments of transuranic waste to the Waste Isolation Pilot Plant at Carlsbad, New Mexico (including a 5-year Test Phase and 20-year Disposal Phase)
Submarine reactor compartments	Shipments of reactor compartments from the Shippingport Reactor to the Hanford Site
Return of isotope capsules	Shipments of cesium-137 isotope capsules from the Hanford Site
Uranium billets	Shipment of low-enriched uranium billets from the Hanford Site to the United Kingdom

Table 5-5. Summary of transportation radiological cumulative impacts.

	Occupational latent	General population latent

Category of shipment(a)	cancer fatalities	cancer fatalities
Projected SNF shipments for all alternatives		
Truck	0.00060 to 0.40	0.00017 to 1.2
Train	0.00060 to 0.060	0.00017 to 0.085
Historical SNF(b)	0.080	0.055
General transportation (1943 to 2035)(c)	120	140
Reasonably foreseeable actions(d)		
Truck	4.4	25
Train	0.33	0.85
Total cancer fatalities(c)	130	160

- a. See Table 54 and Appendix I for more details.
- b. Shipments to Hanford Site, Idaho National Engineering Laboratory, Savannah Rive Ridge Reservation, and Nevada Test Site. Includes transport of naval SNF to the IC Engineering Laboratory.
- c. Shipments are a combination of truck and train.
- d. Shipments to the geologic repository, the Waste Isolation Pilot Plant, and ship submarine reactor compartments, isotope capsules, and uranium billets
- e. Numbers may not sum due to rounding.

and accidents from the U.S. Department of Transportation, U.S. Nuclear Regulatory C DOE, state radiation control offices, and media coverage. From 1971 through 1993, 2 accidents involving 36 fatalities have occurred. These fatalities resulted from tra were not associated with the radioactive nature of the cargo. No radiological fatal transportation accidents have ever occurred in the United States. During the same t 1,000,000 persons were killed in traffic accidents in the United States.

For the alternatives evaluated in this EIS, about one traffic accident fatali occur. During the 40-year time period from 1995 through 2035 evaluated in this EIS, 1,600,000 persons would be killed in traffic accidents in the United States.

5.3.2.8 Energy/Utilities.

Under certain SNF management alternatives, energy or utility requirements for SNF management in combination with other present for future projec or exceed the existing capacity at a site. The existing energy and capacity would b SNF management alternatives at all sites with the possible exception of the Hanford Nevada Test Site.

If all SNF were transported to the Hanford Site under the Centralization alte existing utilities, including water mains, power lines, sewage facilities, and tele need to be extended to the project area. If the Centralization alternative was impl to other power-intensive activities (for example, operating a vitrification plant), might be inadequate based on current consumption.

If the Centralization alternative were implemented at the Nevada Test Site, a transmission lines might need to be constructed. In addition, a sewage treatment fa management facility would have to be constructed at the Nevada Test Site if SNF man activities were implemented under the Regionalization and Centralization alternativ at the Nevada Test Site have been developed from local groundwater sources within t Sub-basin. Existing withdrawals of groundwater from this sub-basin may have already localized perennial yield (Appendix F). SNF management facilities at this site may for additional water.

5.3.2.9 Waste Generation.

Waste volumes generated from SNF management activities depend on the alternative chosen. In general, the Regionalization and Centralizatic the Idaho National Engineering Laboratory, and the alternatives at the Savannah Riv processing, would result in the largest cumulative impact on waste generation. Unde the total increase in waste generation could be four times the current facility bas construction of additional facilities.

To evaluate the adequacy of existing storage capacity, waste volumes generate

management alternatives were compared with current generation rates at the major DC Navy sites, the rate of low-level waste generation would be small and not stress mixed, transuranic, or high-level waste would be generated from SNF activities at t (Appendix D).

At the major DOE sites, increased low-level waste generated from SNF manageme would range from about 1 percent above baseline generation rates at the Oak Ridge R approximately four times above baseline at the Savannah River Site for centralizati options, respectively. Adequate storage capacity exists at all sites except at the Engineering Laboratory, where beyond the year 2005 low-level waste storage capacity strained (Appendix B).

The increased volume of transuranic waste that could be generated from SNF ma activities could exceed 100 percent above baseline at the Idaho National Engineerin Savannah River Site, Oak Ridge Reservation, and Nevada Test Site based on centraliz processing options. This percentage is high at both Nevada Test Site and the Oak Ri because neither of these sites is currently generating transuranic waste and becaus projected that future transuranic waste volumes will only be produced by SNF manage However, adequate storage capacity exists at both sites.

The volume of high-level waste generated from SNF management activities has k to range from approximately 21 percent to greater than 100 percent above current si generation rates at the Idaho National Engineering Laboratory and the Savannah Rive respectively. Again, the percentage is high at the Savannah River Site because esse high-level waste is currently being generated onsite, but with processing approxima per year of high-level waste could be generated. Adequate storage capacity exists a high-level waste would be generated at either the Nevada Test Site or the Oak Ridge

5.4 Adverse Effects That Cannot Be Avoided

Adverse impacts would result, no matter the alternative, from radiation expos with maintaining facilities that are at or near the end of their design life, until construction of new facilities. However, these exposures would be kept within appli requirements and other applicable guidelines and would be controlled to levels that reasonably achievable. Implementation of any alternative except the No Action alter increase the volume of radioactive waste, in particular, low-level waste generated sites. Under the action-based alternatives, where SNF is transported to other sites small increased potential for exposure to the general population when the SNF is in

Under the No Action alternative, there would be several adverse effects that avoided. These include the continuation of the environmentally degraded state of th DOE sites because existing facilities would deteriorate further. Naval and research would be stored near population centers, potentially increasing the consequences of or management accident. This alternative also presents a greater personnel requirem SNF interim storage facilities. (Under other alternatives, the apparently higher pe would be for additional management activities that would not be done under the No A alternative - they are not just related to storage facilities.) In addition, the sh reactors that could not store SNF onsite would result in the loss of several hundre and research positions.

Under Regionalization 4B and Centralization alternatives, one or more major I would transport all its SNF to another major DOE site, the facilities at the transp shut down, and facilities at the receiving site(s) would be built. This would cause many jobs associated with SNF management and duplicate some existing facilities. Wh facilities are generally required at each DOE site under many alternatives, there a that can be used for storage at major sites that would be shut down prior to the en design life.

The construction and operation of any of the facilities under consideration f would result in some adverse impacts to the environment. Although location-dependen project design and other measures (for example, sound engineering practices during would eliminate, avoid, or minimize these impacts. In general, most of the adverse of short duration and would result from the construction of proposed facilities. Fc atmospheric emissions, fugitive dust, sediment runoff, and solid waste would be exp during construction. Section 5.7 discusses potential mitigation measures that could or minimize impacts to the environment. See Appendices A through F for site-specifi adverse effects that cannot be avoided.

5.5 Relationship Between Short-Term Use of the Environment

and the Maintenance and Enhancement of Long-Term Productivity
 The implementation of any of the SNF management alternatives would cause some impacts to the environment and permanently commit certain resources. This section discusses the relationship between short-term influences from the implementation of an SNF management alternative and the associated long-term effects.

The proposed alternatives for SNF management would require the short-term use of resources; for example, energy, materials of construction, and labor to achieve the goal of securing SNF to minimize the risk to workers, to the public, and to the environment if no action were taken, degradation of the fuel and SNF facilities would occur with releases to the environment. Releases to the environment could contaminate land near storage, thereby reducing the potential future use. By consolidating and containing SNF at specific locations, the potential for impacting the environment would be reduced at those locations. After the implementation of a comprehensive SNF management strategy, the land currently used for SNF management could be released to allow other productive use, such as research or technology development.

The premature shutdown of research reactors due to a lack of sufficient SNF inventory space under the No Action alternative could have an impact upon the national and regional communities in which they are located. Most of these reactors are the only regional radiopharmaceuticals and often they are important centers of medical and biological research. Sites where these reactors are located, many of them universities, are unique training sites for students in many fields of research and development: materials science, environmental physics, biology, and electronics.

In the medical arena, research reactors have proven to be vital to cancer therapy, medical imaging, studies of the biological effects of radiation, and other important medical research. Demand for medically important radioisotopes would not decrease merely because the reactors are shut off. The continued demand for radioisotopes would be met by placing orders with remote reactors, which may be farther away from the place where they are needed. Many medically important isotopes (for example, iodine-131) have such short half-lives that the shipping time must include enough to allow for radioactive decay during shipment. Therefore, shutdown would result in the need to produce and transport larger quantities of radiopharmaceuticals.

Shutdown of research reactors could produce an impact on commercial enterprises engaged in the doping of silicon crystals through neutron irradiation. The doped silicon is widely used in electronic components such as the computers used in automobile engines.

Graduates trained at these facilities contribute to a wide variety of nuclear research. Government agencies involved with (a) monitoring nuclear technology, for example, and (b) hardware for inspections, and (c) monitoring.

Development of new SNF interim management facilities would commit lands to that use from the time of construction through cessation of operations. At that time, these lands could be converted to other uses or decontaminated, decommissioned, and the site restored to original use. Existing SNF management facilities could also be converted to other uses or their decommissioning.

See Appendices A through F for site-specific discussions on the relationship between short-term use of the environment and the maintenance and enhancement of long-term

5.6 Irreversible and Irretrievable Commitment of Resources

The irreversible and irretrievable commitment of resources resulting from the operation of SNF management facilities would involve materials that could not be recycled, or resources that would be consumed or reduced to unrecoverable forms. From the construction and operation of an SNF facility at any of the locations under consideration, there would be consumption of irretrievable amounts of electrical energy, fuel, construction materials, and chemicals. Some construction materials are recyclable and, therefore, should not be considered as irretrievable commitments of resources. Furthermore, some of the human resources used for the construction and operation of the proposed SNF facility would be irretrievably lost since these resources would be unavailable for use in other work. The whole, however, SNF management is not particularly resource intensive. See Appendix

through F for site-specific discussions on irreversible and irretrievable commitments

5.7 Potential Mitigation Measures

This section summarizes measures that DOE(a) could implement to avoid or reduce the environment. Possible mitigation measures are generally the same for all alternatives summarized by resource category below. Although the environmental effects described in Sections 5.1 through 5.3 may not require mitigation, the range of potential mitigation measures described below. For all sites, impacts to land use and aesthetic and scenic resources; therefore, mitigation measures for these attributes would not be required.

5.7.1 Pollution Prevention

Implementation of the SNF management alternatives would generate waste with potential for releases to air and water. To control both the volume and toxicity of waste generated and reduce impacts on the environment, pollution prevention practices would be implemented.

DOE is responding to Executive Order 12856, Federal Compliance with Right to Information and Pollution Prevention Requirements, and associated DOE orders and guidelines by use of toxic chemicals; improving emergency planning, response, and accident notification; encouraging the development and use of clean technologies and the testing of innovative pollution prevention technologies. Pollution prevention programs have been implemented at each Program component include waste minimization, source reduction and recycling, and practices that preferentially procure products made from recycled materials. Pollution prevention programs have been implemented at the existing DOE and naval sites for nuclear waste. For example, the waste minimization program at the Savannah River Site has decreased all waste types generated by material substitutions.

Implementation of the pollution prevention plans minimizes the amount of waste generated during SNF management activities.

5.7.2 Socioeconomics

The SNF management alternatives would require additional workers for construction, stabilization, monitoring, and maintenance of SNF. This would produce a socioeconomic impact depending on the available site work force, regional labor pool, and community infrastructure. Socioeconomic impacts would be expected from implementation of the SNF management alternatives.

a. Because this is an EIS issued by the DOE, it contains language concerning compliance with applicable environmental requirements, taking appropriate mitigative measures to reduce environmental impacts, and other matters phrased in the context of DOE as the party responsible for the actions. As a cooperative agency, and because Navy sites are also evaluated in this EIS, DOE will also assure compliance with applicable environmental requirements and take other appropriate measures for its facilities in a consistent and appropriate fashion.

the mitigation measures described below could be used to further minimize the effects on the community.

Construction and operation-related impacts resulting from increased labor and material requirements could be reduced by coordinating with local communities and county planning. Effective planning would address changes in community services, housing, infrastructure and transportation. DOE would coordinate, in an appropriate manner, with the local planning agencies to address impacts on the work force and community infrastructure facilitated through the development of citizen advisory boards. The timing of certain activities have been proposed to proceed concurrently could also be adjusted to minimize socioeconomic impacts.

5.7.3 Cultural Resources

Impacts to cultural resources could occur during construction and earth-moving associated with the SNF management alternatives. Areas of proposed ground disturbance assessed for the potential to contain important archaeological and paleontological resources. DOE operations office is responsible for establishing and maintaining mitigation agreements to be taken in the event of discovery of archaeological resources or human remains during construction. These agreements will be negotiated with their potentially affected tribal and historic preservation officers. These agreements would be referenced in future site Environmental Policy Act documentation when appropriate. An example of a possible mitigation measure for archaeological resources would be avoidance or data recovery prior to construction. Other measures would be necessary to mitigate potential impacts to values of Native Hawaiian populations, including involvement in the selection of a mitigation plan for recovery, stabilization, and caring of the resources would be in construction.

For paleontological resources, assessments could include literature searches, and consultation with recognized paleontological experts in the region or limited to geologically similar disturbed areas. If significant paleontological resources were identified, a mitigation plan for recovery, stabilization, and caring of the resources would be in construction.

For example, at the Hanford Site, certain site activities would have the potential to affect prehistoric archaeological sites. In this case, the specific activity plans determine potential effects before initiation of activities. The activity will then determine if avoidance of these sites would not be possible, mitigation measures developed in conjunction with the appropriate state agencies and Native American tribes.

To avoid impacts during operation such as unauthorized artifact collection, workers would be educated through programs and briefing sessions to inform personnel of applicable regulations for site protection. These educational programs would stress the importance of resources and specifics of the laws and regulations for site protection.

5.7.4 Soils

Soils could be affected from implementation of the SNF management alternative if there are leaks or a release to soils as a result of SNF activities. DOE would appropriately address soils contaminated from SNF management activities.

5.7.5 Air Resources

Certain actions under the SNF management alternatives would impact air quality. For example, the construction of new facilities could negatively impact air quality through fugitive dusts and from pollutants from diesel- and gasoline-powered equipment. The offsite ambient levels would be small because of the large distance to the nearest sensitive receptors. The use of the mitigation measures described below would further minimize the potential impacts.

DOE would meet applicable regulations regarding the maintenance of air quality from radiological and nonradiological emission sources. DOE does not foresee impacts to air quality from SNF management that would warrant measures beyond those employed consistent with good construction, engineering, and operations, and management practices.

5.7.6 Water Resources

The implementation of some of the SNF management alternatives would require large volumes of water for the stabilization of SNF. DOE would control water consumption through appropriate application of water recycling, water conservation measures and equipment, catchment basins, and worker training programs. Constant process monitoring and maintenance design to current standards, including double-wall confinement of all vessels and piping included in design and operating standards by DOE to limit potential operational releases to a processing or storage facility to essentially zero.

5.7.7 Ecological Resources

Implementation of the SNF management alternatives could impact terrestrial wetlands, aquatic resources, and threatened and endangered species either directly through activities that disturb habitat or indirectly through construction activities that result in runoff into wetlands or aquatic environments.

To avoid potential impacts to endangered, candidate, or state-identified sensitive species, preconstruction surveys would be completed to determine the presence of these species in their habitat. If protected species or primary habitat for these species are located near the project, DOE would evaluate the project design and other program activities to avoid or minimize impacts. DOE would consult with the U.S. Fish and Wildlife Service to develop the most appropriate action-specific mitigation measures.

Wetland habitat would be delineated in accordance with applicable U.S. Army Corps of Engineers procedures and wetlands located near proposed activities would be avoided where avoidance was not possible, specific mitigation measures would be developed in consultation with the U.S. Army Corps of Engineers. For example, mitigation could include construction of acreage equivalent to the acreage of disturbed wetland habitat or enhancement of existing habitat at another location onsite.

5.7.8 Noise

Construction and operation from SNF management would result in the generation of noise consistent with light industrial activity. DOE does not foresee noise impacts from the project that would warrant mitigation measures beyond those employed consistent with good engineering, operational, and management practices.

Noise impacts to the public and other noise-sensitive receptors could be reduced by establishing noise buffer areas between sources and receptors, constructing noise walls and other structures, and limiting the emissions to daytime periods.

5.7.9 Traffic and Transportation

The number of workers in SNF management activities under some of the alternatives would add to the current work force and to additional commuting traffic. At sites with increased traffic concerns, roads could be widened with the addition of lanes or implementation of traffic management. DOE would also consider using high-occupancy vehicles (such as vans or shuttles) for worker transport. DOE would also consider implementing car-pooling or ride-sharing programs, or staggering schedules to reduce traffic congestion. See Section 5.7.12 for discussion of transportation mitigation.

5.7.10 Occupational and Public Health and Safety

Implementation of the SNF management alternatives would increase the potential for radiation exposure either through direct exposure or through air emissions. Although these exposures are discussed in Section 5.2, the as low as reasonably achievable principle would be used to minimize radiation exposure of workers and the public. Pollution prevention practices would be implemented to avoid or reduce production of potentially harmful substances. Waste minimization practices would be used to reduce the toxicity and volume of secondary wastes to be managed. DOE would update their current worker training, emergency planning, emergency preparedness, and emergency response programs as needed to address new SNF management actions for the protection of both workers and the public.

5.7.11 Site Utilities and Support Services

The SNF management alternatives would put increased demands on utilities at the site.

Under certain alternatives, additional transmission lines or substations may need to be constructed, and, at the Nevada Test Site, a sewage treatment facility for the SNF facility would need to be constructed. However, DOE would reduce the need for certain (such as water and electricity) through the implementation of resource conservation prevention, and energy efficiency measures.

5.7.12 Accidents

The potential exists for an accident associated with either the handling or transport of SNF with the consequence being a significant release of radioactive or other hazardous materials into the environment. Although the probability is very small, as discussed in Section 5.7.11, all locations considered for SNF management have emergency action plans and equipment to respond to accidents and other emergencies to limit the magnitude of potential impacts from such accidents. Plans include training of workers, local emergency response agencies (such as fire departments, police, and the public; communication systems and protocols; readiness drills; and mutual aid agreements). Plans would be updated to cover any new SNF facilities and activities. DOE would coordinate activities with state and local agencies to establish and implement an appropriate training program for potential accidents.

5.8 Environmental Justice

In February 1994, Executive Order 12898, titled Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (FR 1994), was released. This order directs Federal agencies to incorporate environmental justice into their missions. As such, Federal agencies are specifically directed to identify and address disproportionately high and adverse human health or environmental effects of their policies, programs, and activities on minority populations and low-income populations. Appendix C provides an assessment of the areas surrounding the 10 sites under consideration for SNF under all programmatic alternatives considered in this volume. Because DOE is in the process of developing guidance, the approach used in this analysis might depart somewhat from guidance eventually issued.

The overall review indicated that the potential impacts calculated for each of the alternative sites considered for the management of all or some portion of SNF (naval SNF only) present no significant risk and do not constitute a reasonably foreseeable impact to the surrounding population. This includes both the impacts of facility operation and transport of SNF, and the risk of reasonably foreseeable accident scenarios postulated, which are small. Therefore, the impacts of the programmatic management of DOE SNF under the alternatives evaluated in this EIS do not constitute a disproportionately high and adverse impact on any particular segment of the population, minorities or low-income communities included in the analysis.

Characterization of the numbers and location of minority and low-income populations is dependent on how these populations are defined and what assumptions are used in conducting the analysis. As discussed in Appendix L, at the time this EIS and the Draft Environmental Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Reactor Spent Nuclear Fuel (Draft FRR SNF EIS) were prepared, the Federal Interagency Group on environmental justice had not issued final guidance on the definitions of minority and low-income populations, or the approach to be used in analyzing environmental justice impacts. The Executive Order (FR 1994). Final internal DOE guidance on environmental justice impacts has been adopted. As a result, both the definitions and assumptions used by and within DOE in conducting environmental justice analyses can vary and the resulting demographic results can vary on a case-by-case basis. For example, this EIS and the Draft FRR SNF EIS present demographic characterizations derived from the same United States Census Bureau database, but they used different definitions and assumptions. Several of the same candidate interim SNF sites were evaluated in both documents. As discussed in Appendix L, variations in definitions and assumptions led to differences in the characterization of minority and low-income populations surrounding these potential interim SNF management sites. Nevertheless, although the characterizations differ, the impacts resulting from the proposed action under all alternatives do not present a significant risk to the population as a whole. Therefore, no disproportionately high and adverse effects would be expected for any particular segment of the population, including minority and low-income populations, regardless of which set of definitions and assumptions were used.





6. LIST OF PREPARERS

This EIS was prepared under the supervision of the DOE Idaho Operations Office organizations and individuals who contributed to the preparation of this document accompanied by each person's project role and level of experience and training. This section summarizes, for each contributor, the chapters of the EIS for which inputs

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7. CONSULTATIONS, LAWS, AND REQUIREMENTS

7.1 Laws and Requirements

This section identifies and summarizes the major laws, regulations, executive orders that may apply to the programmatic alternatives for SNF.

Section 7.1.1 discusses the major Federal statutes that impose environmental compliance requirements upon DOE. In addition, there may be other Federal, state, applicable to the SNF Management Program because Federal law delegates enforcement authority to state or local agencies. These state- and local-specific requirements specific appendices. Section 7.1.2 addresses environmentally-related presidential issues of national policy and set guidelines under which Federal agencies, including implements its responsibilities for protection of public health, safety, and the en departmental orders that are mandatory for operating contractors of DOE facilities. those DOE orders related to environmental, health, and safety protection. Hazardou materials transportation regulations are summarized in Section 7.1.4.

7.1.1 Federal Environmental Statutes and Regulations

National Environmental Policy Act of 1969, as amended (42 USC -4321 et seq.) National Environmental Policy Act establishes a national policy promoting awareness consequences of the activity of humans on the environment and promoting considerati impacts during the planning and decisionmaking stages of a project. The National E requires all agencies of the Federal Government to prepare a detailed statement on of proposed major Federal actions that may significantly affect the quality of the

This EIS has been prepared in response to these National Environmental Policy policies. It discusses reasonable alternatives and their potential environmental c SNF activities at various locations in the country and has been prepared in accorda Environmental Quality Regulations for implementing the procedural provisions of the Environmental Policy Act Implementing Procedures (40 CFR Parts 1500 through 1508) a Environmental Policy Act Implementing Procedures (10 CFR Part 1021).

Atomic Energy Act of 1954, as amended (42 USC -2011 et seq.). The Atomic Ene Act of 1954 authorizes DOE to establish standards to protect health or minimize dan with respect to activities under its jurisdiction. Through a series of DOE orders, extensive system of standards and requirements to ensure safe operation of its faci

The Atomic Energy Act and the Reorganization Plan No. 3 of 1970 [5 USC (app. other related statutes gave the U.S. Environmental Protection Agency responsibility developing generally applicable environmental standards for protection of the gener radioactive material. The U.S. Environmental Protection Agency has promulgated sev this authority, among which are the Environmental Radiation Protection Standards fc Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes, at 4

Nuclear Waste Policy Act of 1982, as amended, (42 USC -10101-10270). The Act authorizes the Federal agencies to develop a geologic repository for the permanent level radioactive waste. The Act specifies the process for selecting a repository operating, closing, and decommissioning the repository. The Act also establishes p these activities.

Clean Air Act, as amended (42 USC -7401 et seq.). The Clean Air Act, as amen intended to "protect and enhance the quality of the Nation's air resources so as to and welfare and the productive capacity of its population." Section 118 of the Cle requires that each Federal agency, such as DOE, with jurisdiction over any property result in the discharge of air pollutants, comply with "all Federal, state, interst with regard to the control and abatement of air pollution.

The Act requires the U.S. Environmental Protection Agency to establish Nation Quality Standards as necessary to protect public health, with an adequate margin of

or anticipated adverse effects of a regulated pollutant (42 USC -7409). The Act also sets national standards of performance for new or modified stationary sources of atmospheric pollutants (42 USC -7411) and requires specific emission increases to be evaluated so as to prevent deterioration in air quality (42 USC -7470). Hazardous air pollutants, including radionuclides, are regulated separately (42 USC -7412). Air emissions are regulated by the U.S. Environmental Protection Agency under 40 CFR Parts 50 through 99. In particular, radionuclide emissions and hazardous air pollutants are regulated under the National Emission Standard for Hazardous Air Pollutants Program (see 40 CFR Part 63).

The Safe Drinking Water Act, as amended [42 USC -300 (F) et seq.]. The primary purpose of the Safe Drinking Water Act, as amended, is to protect the quality of the public water supplies. The implementing regulations, administered by the U.S. Environmental Protection Agency unless delegated to the states, establish standards applicable to public water systems. The maximum contaminant levels, including those for radioactivity, in public water systems are defined as public water systems that serve at least 15 service connections used regularly by at least 25 year-round residents. Safe Drinking Water Act requirements are promulgated by the U.S. Environmental Protection Agency in 40 CFR Parts 100 through 140. For radionuclides, the regulations in effect now specify that the average annual concentration of radionuclides from manmade radionuclides in drinking water shall not produce an equivalent total body or any internal organ greater than 0.004 rem (4 millirem). The maximum contaminant level for gross alpha particle activity is 15 picocuries per liter. The U.S. Environmental Protection Agency proposed revisions to limits on regulating radionuclides July 18, 1991, has not been finalized. For purposes of analysis, however, the more conservative standards programs established by the Safe Drinking Water Act include the Sole Source Aquifer Protection Program, and the Underground Injection Control Program.

The Clean Water Act, as amended (33 USC -1251 et seq.). The Clean Water Act, which amended the Federal Water Pollution Control Act, was enacted to "restore and maintain the physical and biological integrity of the Nation's water." The Clean Water Act prohibits the discharge of "toxic pollutants in toxic amounts" to navigable waters of the United States. Section 402(p) of the Clean Water Act, as amended, requires all branches of the Federal Government engaged in any activity that results in a discharge or runoff of pollutants to surface waters to comply with Federal, state, and local requirements.

In addition to setting water quality standards for the Nation's waterways, the Clean Water Act supplies guidelines and limitations for effluent discharges from point-source dischargers. The U.S. Environmental Protection Agency has the authority to implement the National Pollution Discharge Elimination System permitting program. The National Pollution Discharge Elimination System is administered by the Water Management Division of the U.S. Environmental Protection Agency. Regulations are in 40 CFR Part 122 et seq. Idaho has not applied for National Pollution Discharge Elimination System authority from the U.S. Environmental Protection Agency. Thus, all National Pollution Discharge Elimination System permits required for the Idaho National Engineering Laboratory are issued through the U.S. Environmental Protection Agency Region 10 (40 CFR Part 122 et seq.).

Sections 401 and 405 of the Water Quality Act of 1987 added Section 402(p) to the Clean Water Act. Section 402(p) requires that the Environmental Protection Agency establish regulations for stormwater discharges associated with industrial activity. Stormwater discharge from industrial activity are permitted through the National Pollution Discharge Elimination System. Permit requirements are published at 40 CFR Part 122.

The Resource Conservation and Recovery Act, as amended (42 USC -6901 et seq.). The Resource Conservation and Recovery Act regulates the treatment, storage, or disposal of hazardous and nonhazardous waste under the Resource Conservation and Recovery Act and the Hazardous Waste Amendments of 1984. Pursuant to Section 3006 of the Act, any state that seeks to enforce a hazardous waste program pursuant to the Resource Conservation and Recovery Act must obtain U.S. Environmental Protection Agency authorization of its program. The U.S. Environmental Protection Agency regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 280. These regulations define hazardous wastes and specify hazardous waste management, handling, treatment, storage, and disposal requirements.

The regulations imposed on a generator or a treatment, storage, and/or disposal unit are based on the type and quantity of material or waste generated, treated, stored, or disposed of, and the method of treatment, storage, and/or disposal also impacts the extent and complexity of the program (see Section 7.2.5).

The Comprehensive Environmental Response, Compensation, and Liability Act, as amended (42 USC -9601 et seq.). The Comprehensive Environmental Response, Compensation, and Liability Act, as amended, provides a statutory framework for the cleanup of waste sites. The Superfund Amendments and Reauthorization Act provides an emergency response program in the event of a release (or threat of a release) of a hazardous substance into the environment. Using the Hazard Ranking System, Federal and private sites are ranked

the National Priorities List. The Comprehensive Environmental Response, Compensation and Liability Act, as amended, requires such Federal facilities having such sites to undertake investigations and monitoring as necessary. The Act also includes requirements for reporting releases of certain hazardous substances in excess of specified amounts to state and Federal agencies.

Emergency Planning and Community Right-to-Know Act of 1986 (42 USC -11001 et seq.) (also known as "SARA Title III"). Under Subtitle A of this Act, Federal facilities owned by DOE, provide various information (such as inventories of specific chemical releases that occur from these sites) to the State Emergency Response Commission and Emergency Planning Committee to ensure that emergency plans are sufficient to respond to releases of hazardous substances. Implementation of the provisions of this Act began and inventory and annual emissions reporting began in 1988 based on 1987 activities also requires compliance with Title III as matter of Agency policy. The requirements promulgated by the U.S. Environmental Protection Agency in 40 CFR Parts 350 through

Toxic Substances Control Act (15 USC -2601 et seq.). The Toxic Substances Control Act provides the U.S. Environmental Protection Agency with the authority to regulate new substances, both new and old, entering the environment, and regulates them where necessary complements and expands existing toxic substance laws such as -112 of the Clean Air Act and Clean Water Act. The Toxic Substances Control Act came about because there were no regulations for the potential environmental or health effects of the thousands of new substances each year before they were introduced into the public or commerce. The Act regulates the treatment, storage, and disposal of certain toxic substances, specifically biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, and PCBs. The asbestos regulations under the Toxic Substances Control Act were ultimately overruled by regulations pertaining to asbestos removal, storage, and disposal are promulgated under the Emission Standard for Hazardous Air Pollutants Program (40 CFR Part 61, Subpart M) for chlorofluorocarbons, Title VI of the Clean Air Act Amendments of 1990 requires a reduction in chlorofluorocarbons beginning 1991, and prohibits production beginning 2000.

Pollution Prevention Act of 1990 (42 USC -13101 et seq.). The Pollution Prevention Act of 1990 establishes a national policy for waste management and pollution control through source reduction, followed sequentially by environmentally safe recycling, treatment, and reuse. Releases to the environment should only occur as a last resort. In response to public participation in the Superfund Amendments and Reauthorization Act Section 313, U.S. Environmental Protection Agency 33/50 Pollution Prevention Program. The goal, for facilities already in compliance, is to achieve a 33 percent reduction in the release of 17 priority pollutants by 1993 baseline. On August 3, 1993, Executive Order 12856 was issued, expanding the program to require that DOE must reduce its total releases of all toxic chemicals by 50 percent by December 1993. DOE is also requiring each DOE site to establish site-specific goals to reduce general releases.

Federal Facility Compliance Act. The Federal Facility Compliance Act, enacted in 1992, waives sovereign immunity for fines and penalties for Resource Conservation and Recovery Act violations at Federal facilities. However, a provision postpones fines and penalties for Resource Conservation and Recovery Act waste storage prohibition violations at DOE sites and requires DOE to prepare plans for the required treatment capacity for mixed waste stored or generated at each facility. The plans must be approved by the host state or the U.S. Environmental Protection Agency, after consultation with the host state and a consent order must be issued by the regulator requiring compliance with the Resource Conservation and Recovery Act. The Compliance Act further provides that the DOE will not be subject to fines and penalties for Resource Conservation and Recovery Act waste storage prohibition violations for mixed waste as long as it is in compliance with a plan and consent order and meets all other applicable regulations.

National Historic Preservation Act, as amended (16 USC -470 et seq.). The National Historic Preservation Act, as amended, provides that sites with significant national historic interest be listed in the National Register of Historic Places. There are no permits or certifications required for DOE activities. However, if a particular Federal activity may impact a historic property resource, DOE must consult with the Advisory Council on Historic Preservation and generally generate a Memorandum of Understanding with the Advisory Council on Historic Preservation stipulations that must be followed to minimize adverse impacts. Coordinations with the National Historic Preservation officer are also undertaken to ensure that potentially significant sites are identified and appropriate mitigative actions are implemented.

Archaeological Resource Protection Act, as amended (16 USC -470aa et seq.). The Archaeological Resource Protection Act requires a permit for any excavation or removal of archaeological resources from Federal lands. Excavations must be undertaken for the purpose of furthering archaeological knowledge and resources removed are to remain the property of the United States. Consent must be obtained from the Indian tribe owning lands on which a resource is located before issuance of a permit. The permit must contain terms or conditions requested by the tribe.

Native American Grave Protection and Repatriation Act of 1990 (25 USC -3001). This law directs the Secretary of Interior to guide responsibilities in repatriating human remains and collections held by museums receiving Federal funding that are culturally significant.

American tribes. Major actions to be taken under this law include (a) establishing monitoring and policy-making responsibilities, (b) developing regulations for repatriation procedures for identifying lineal descent or cultural affiliation needed for claims programs designed to meet the inventory requirements and deadlines of this law, and procedures to handle unexpected discoveries of graves or grave goods during activities on land.

American Indian Religious Freedom Act of 1978 (42 USC -1996). This act reaffirms Native American religious freedom under the First Amendment and sets United States policy to preserve the inherent and constitutional right of American Indians to believe, express, and practice traditional religions. The act requires that Federal actions avoid interfering with and traditional resources that are integral to the practice of religions.

Religious Freedom Restoration Act of 1993 (42 USC -2000bb et seq.). This Act prohibits the Government, including Federal departments, from substantially burdening a person's exercise of religion unless the Government demonstrates a compelling governmental interest and the burden is the least restrictive means of furthering that interest.

Endangered Species Act, as amended (16 USC -1531 et seq.). The Endangered Species Act, as amended, is intended to prevent the further decline of endangered and threatened species and their habitats. The Act is jointly administered by the U.S. Department of Commerce and the Interior. Section 7 of the Act requires consultation with the U.S. Fish and Wildlife Service to determine whether endangered and threatened species or their critical habitats are in the vicinity of the proposed action.

Migratory Bird Treaty Act, as amended (16 USC -703 et seq.). The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. It regulates the harvest of migratory birds, such as the mode of harvest, hunting seasons, and bag limits. The Act stipulates that no person shall, at any time, by any means, or in any manner, kill . . . any migratory bird." Although a project is required under the Act, DOE is required to consult with the U.S. Fish and Wildlife Service regarding impacts to migratory birds and to evaluate ways to avoid or minimize these impacts in accordance with the U.S. Fish and Wildlife Service Mitigation Policy.

Bald and Golden Eagle Protection Act, as amended (16 USC -668-668d). The Bald and Golden Eagle Protection Act makes it unlawful to take, pursue, molest, or disturb bald eagles, their nests, or their eggs anywhere in the United States (Section 668, 668c). The Act requires the U.S. Department of the Interior to relocate a nest that interferes with or recovery operations.

Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq. 71:8301 et seq.). The Wild and Scenic Rivers Act, as amended, protects certain selected rivers of the Nation that are outstanding scenic, recreational, geological, fish and wildlife, historical, cultural, or otherwise significant. These rivers are to be preserved in a free-flowing condition to protect water quality and for conservation purposes. The purpose of the Act is to institute a national wild and scenic rivers system, designate the initial rivers that are a part of that system, and to develop standards for the future.

Occupational Safety and Health Act of 1970, as amended (29 USC -651 et seq.). The Occupational Safety and Health Act establishes standards to enhance safe and healthful working conditions in places of employment throughout the United States. The Act is administered and enforced by the Occupational Safety and Health Administration, a U.S. Department of Labor agency. The Occupational Safety and Health Administration and the U.S. Environmental Protection Agency share jurisdiction to reduce exposures to toxic substances, the Occupational Safety and Health Administration's jurisdiction is limited to safety and health conditions that exist in the workplace. Under the Act, it is the duty of each employer to furnish all employees a place of employment free from recognized hazards likely to cause death or serious physical harm. Employees have the right to a safe and healthful workplace. Occupational Safety and Health Administration regulations (published in Title 29 of the Code of Federal Regulations) establish specific standards telling employers what must be done to create a safe working environment. DOE places emphasis on compliance with these regulations at all facilities. DOE prescribes through DOE orders the Occupational Safety and Health Act standards that are applicable to their work at Government-owned, contractor-operated facilities (DC 5483.1A). DOE keeps and makes available the various records of minor illnesses, in part to prevent deaths as required by Occupational Safety and Health Administration regulations.

Noise Control Act of 1972, as amended (42 USC -4901 et seq.). Section 4 of the Noise Control Act of 1972, as amended, directs all Federal agencies to carry out "to the maximum extent practicable" programs within their jurisdictions in a manner that furthers a national policy of providing an environment free from noise that jeopardizes health and welfare.

7.1.2 Executive Orders

Executive Order 12088 (Federal Compliance with Pollution Control Standards) (1978), as amended by Executive Order 12580 (January 23, 1987) Federal Compliance with Standards, directs Federal agencies, including DOE, to comply with applicable administrative pollution control standards established by, but not limited to, the Clean Air Act, Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act (15 and the Resource Conservation and Recovery Act.

Executive Order 11593 (National Historic Preservation) (May 13, 1971) directs agencies, including DOE, to locate, inventory, and nominate properties under their the National Register of Historic Places if those properties qualify. This process the Advisory Council on Historic Preservation the opportunity to comment on the proposed activity on any potential eligible or listed resources.

Executive Order 11514 (National Environmental Policy Act) directs Federal agencies continually monitor and control their activities to protect and enhance the quality develop procedures to ensure that fullest practicable provision of timely public in understanding of the Federal plans and programs with environmental impact to obtain parties. The DOE has issued regulations (10 CFR Part 1021) and DOE Order 5440.1E f this executive order.

Executive Order 11988 (Floodplain Management) directs Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management any action undertaken in a floodplain and that floodplain impacts be avoided to the extent practicable, any short- and long-term adverse impacts on wetlands wherever t alternative.

Executive Order 11990 (Protection of Wetlands) directs governmental agencies to the extent practicable, any short- and long-term adverse impacts on wetlands wherever t alternative.

Executive Order 12344 (Naval Nuclear Propulsion Program) [enacted as permanent Public Law 98-525 (42 USC -7158)] prescribes the authority and responsibility of the Propulsion Program, a joint Navy/DOE organization, for matters pertaining to Naval. These responsibilities include all environmental and occupational safety and health.

Executive Order 12580 (Superfund Implementation) delegates to the heads of executive departments and agencies the responsibility for undertaking remedial actions for releases that are not on the National Priority List and removal actions other than release is from any facility under the jurisdiction or control of executive department.

Executive Order 12856 (Right to Know Laws and Pollution Prevention Requirements) directs all Federal agencies to reduce and report toxic chemicals entering any waste emergency planning, response, and accident notification; and encourage clean technology innovative prevention technologies. The executive order also provides that Federal purposes of the Emergency Planning and Community Right-to-Know Act (SARA Title III) agencies to meet the requirements of the Act.

Executive Order 12898 (Environmental Justice) This order directs Federal agencies environmental justice by identifying and addressing, as appropriate, disproportionate human health or environmental effects of its programs, policies, and activities on low-income populations in the United States and its territories and possessions. The Interagency Working Group on Environmental Justice and directs each Federal agency within prescribed time limits to identify and address environmental justice concerns each Federal agency to collect, maintain, and analyze information on the race, national and other readily accessible and appropriate information for areas surrounding facilities have a substantial environmental, human health, or economic effect on the surrounding such facilities or sites become the subject of a substantial Federal environmental action and to make such information publicly available.

Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions) declares that Federal agencies are required to prepare environmental analyses for "significantly affecting the environment of the global commons outside the jurisdiction ocean or Antarctica)." According to the Executive Order, major Federal actions significantly environment of foreign countries may also require environmental analyses under certain procedural requirements imposed by the Executive Order are analogous to those under Environmental Policy Act.

7.1.3 Department of Energy Regulations and Orders

Through the authority of the Atomic Energy Act, DOE is responsible for establishing a comprehensive health, safety, and environmental program for its facilities. The regulations through which DOE manages its facilities are the promulgation of regulations and the orders.

The DOE regulations are generally found in Title 10 of the Code of Federal Regulations. These regulations address such areas as energy conservation, administrative requirements, safety, and classified information. For purposes of this EIS, relevant regulations include: Procedures for DOE Nuclear Activities; 10 CFR Part 830.120, Quality Assurance; 10 CFR Part 835, Radiation Protection of the Public and the Environment (proposed); 10 CFR Part 835, Radiation Protection; 10 CFR Part 1021, Compliance with the National Environmental Policy Act; 10 CFR Part 1022, Compliance with Floodplains/Wetlands Environmental Review Requirements.

DOE orders generally set forth policy and the programs and internal procedures that implement those policies. The major DOE orders pertaining to the eventual construction and operation of the DOE Complex are listed in Table 7-1. The following sections provide a list of selected orders:

DOE Order 5440.1E, National Environmental Policy Act Compliance Program. This order establishes the authorities and responsibilities of DOE officials and sets forth the procedures for implementing the National Environmental Policy Act. This order was issued by DOE on 11/19/92.

DOE Order 5480.1B, Environment Safety and Health Program for Department of Energy Operations. This order establishes the Environment, Safety and Health Program for DOE operations.

7.1.4 Hazardous and Radioactive Materials Transportation Regulations

Transportation of hazardous and radioactive materials, substances, and wastes is regulated by the U.S. Department of Transportation, U.S. Nuclear Regulatory Commission, and U.S. Environmental Protection Agency regulations. These regulations may be found in 49 CFR Parts 171 through 179, 49 CFR Parts 383 through 397, 10 CFR Part 71, and 40 CFR Part 262, respectively.

U.S. Department of Transportation regulations contain requirements for identifying hazardous or radioactive materials. These regulations interface with those of the U.S. Nuclear Regulatory Commission or U.S. Environmental Protection Agency regulations for identifying material, but the U.S. Department of Transportation regulations govern the hazard communication (such as labelling, vehicle placarding, and emergency response telephone number) and shipping requirements. U.S. Environmental Protection Agency waste management regulations are also applicable. See Table 7-1. DOE orders relevant to the DOE Spent Nuclear Fuel Management Program.

DOE Order	Subject
1300.2A	Department of Energy Technical Standards Program (5-19-92)
1360.2B	Unclassified Computer Security Program (5-18-92)
1540.2	Hazardous Material Packaging for Transport-Administrative Procedures (9-30-86; Chg. 1, 12-19-88)
3790.1B	Federal Employee Occupational Safety and Health Program (1-7-93)
4330.4B	Maintenance Management Program (2-10-94)
4700.1	Project Management System (3-6-87; Chg. 1, 6-2-92)
5000.3B	Occurrence Reporting and Processing of Operations Information (1-19-93; Chg. 1, 7-2-93)
5400.1	General Environmental Protection Program (11-9-88; Chg. 1, 6-29-90)
5400.2A	Environmental Compliance Issue Coordination (1-31-89; Chg.1, 1-7-93)
5400.4	Comprehensive Environmental Response, Compensation, and Liability Act (10-6-89)
5400.5	Radiation Protection of the Public and the Environment (2-8-90; Chg. 2, 1-7-93)
5440.1E	National Environmental Policy Act Compliance Program (11-10-92)
5480.1B	Environment, Safety and Health Program for DOE Operations (9-23-86; Chg. 1, 1-7-93)
5480.3	Safety Requirements for the Packaging and Transportation of Hazardous Substances, and Hazardous Wastes (7-9-85)
5480.4	Environmental Protection, Safety, and Health Protection Standards (5-15-84; Chg. 4, 1-7-93)

5480.6	Safety of Department of Energy-Owned Nuclear Reactors (09-23-86)
5480.7A	Fire Protection (2-17-93)
5480.8A	Contractor Occupational Medical Program (6-26-92; Chg. 1, 10-19-92)
5480.9A	Construction Project Safety and Health Management (4-13-94)
5480.10	Contractor Industrial Hygiene Program (6-26-85)
5480.11	Radiation Protection for Occupational Workers (12-21-88; Chg. 3, 6-17-
5480.15	Department of Energy Laboratory Accreditation Program for Personnel Dc (12-14-87)
5480.17	DOE Site Safety Representatives (10-05-88)
5480.18B	Nuclear Facility Training Accreditation Program (08-31-94)
5480.19	Conduct of Operations Requirements for DOE Facilities (7-9-90; Chg. 1,
5480.20	Personnel Selection, Qualification, Training, and Staffing Requirement and Nonreactor Nuclear Facilities (2-20-91; Chg. 1, 6-19-91)
5480.21	Unreviewed Safety Questions (12-24-91)
5480.22	Technical Safety Requirements (2-25-92; Chg. 1, 9-15-92)
5480.23	Nuclear Safety Analysis Reports (4-30-92; Chg. 1, 3-10-94)
5480.24	Nuclear Criticality Safety (8-12-92)
5480.28	Natural Phenomena Hazards Mitigation (1-15-93)
5480.31	Startup and Restart of Nuclear Facilities (9-15-93)
5481.1B	Safety Analysis and Review System (9-23-86; Chg. 1, 5-19-87)
5482.1B	Environment, Safety, and Health Appraisal Program (9-23-86; Chg. 1, 11
5483.1A	Occupational Safety and Health Program for DOE Contractor Employees at Owned, Contractor-Operated Facilities (6-22-83)
5484.1	Environmental Protection, Safety, and Health Protection Information Re Requirements (2-21-81; Chg. 7, 10-17-90)
5500.1B	Emergency Management System (4-30-91; Chg. 1, 2-27-92)
5500.2B	Emergency Categories, Classes, and Notification and Reporting Requirem Chg. 1, 2-27-92)
5500.3A	Planning and Preparedness for Operational Emergencies (4-30-91; Chg. 1
5500.4A	Public Affairs Policy and Planning Requirements for Emergencies (6-8-9
5500.7B	Emergency Operating Records Protection Program (10-23-91)
5500.10	Emergency Readiness Assurance Program (4-30-91; Chg. 1, 2-27-92)
5630.11B	Safeguards and Security Program (8-2-94)
5630.12A	Safeguards and Security Inspection and Assessment Program (6-23-92)
5700.6C	Quality Assurance (8-21-91)
5820.2A	Radioactive Waste Management (9-26-88)
6430.1A	General Design Criteria (4-6-89)

U.S. Nuclear Regulatory Commission regulations applicable to radioactive materi are found in 10 CFR Part 71, which includes detailed packaging design requirements certification testing requirements. Complete documentation of design and safety an required testing is submitted to the U.S. Nuclear Regulatory Commission to certify certification testing involves the following components: heat, physical drop onto submersion, puncture by dropping package onto a rigid spike, and gas tightness. Sc simulate maximum reasonably foreseeable accident conditions.

U.S. Environmental Protection Agency regulations pertaining to hazardous wast found in 40 CFR Part 262. These regulations deal with the use of the U.S. Environm waste manifest, which is the shipping paper for transporting Resource Conservation hazardous waste.

7.1.5 Applicability of the Resource Conservation and Recovery Act to Spent Nuclear Fuel

Historically, DOE chemically reprocessed SNF to recover valuable products and materials, and as such, the SNF was not a solid waste under the Resource Conservati

World events have resulted in significant changes in DOE's direction and oper April 1992 DOE announced the phase-out of reprocessing for the recovery of special these changes, DOE's focus on most of its SNF has changed from reprocessing and rec storage and ultimate disposition. This in turn has created uncertainty in regard t some of DOE's SNF relative to the Resource Conservation and Recovery Act.

DOE has initiated discussion with the U.S. Environmental Protection Agency on applicability of the Resource Conservation and Recovery Act to SNF. Further discus

Environmental Protection Agency Headquarters and regional offices and state regulatory agencies will develop a path forward toward meeting any Resource Conservation and Recovery Act requirements that might apply.

7.2 Consultation

The National Environmental Policy Act requires that Federal, state, and local agencies with jurisdiction or special expertise regarding any environmental impact be consulted during the National Environmental Policy Act process. Agencies involved include those with applicable permits, licenses, and other regulatory approvals, as well as those responsible for significant resources (for example, endangered species, critical habitats, or historic properties). Copies of the Final EIS will be sent to all agencies.

Consultations with Federal and state agencies and native American tribes were held. Table 7-2 shows the dates and locations of the meetings held. Volume 2, Appendix E shows the correspondence generated as a result of these meetings.

Table 7-2. Meetings held in response to agency or nation comments on the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Restoration and Waste Management Programs Draft Environmental Impact Statement.

Agency or nation	Location	Date
Defense Nuclear Facilities Safety Board	Washington, D.C.	November 9, 1994
U.S. Environmental Protection Agency	Washington, D.C.	December 15, 1994
Center for Disease Control	Conference call	November 22, 1994
Council on Environmental Quality	Washington, D.C.	December 21, 1994
Seneca Nation of New York	New York	January 10, 1995
Shoshone-Bannock Tribes of Idaho	Fort Hall, Idaho	December 2, 21, and 29, January 10, 1995 February 13, 1995





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SUMMARY DOE/EIS-0203-F

Department of Energy Programmatic
Spent Nuclear Fuel Management
and
Idaho National Engineering Laboratory
Environmental Restoration and
Waste Management Programs
Final Environmental Impact Statement

Summary
April 1995

U.S. Department of Energy
Office of Environmental Management
Idaho Operations Office

Department of Energy
Washington, DC 20585
April 1995

Dear Citizen:

This is a summary of the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement. The Department of Energy and the Department of the Navy, as a cooperating agency, have prepared the final Environmental Impact Statement in accordance with the National Environmental Policy Act and a 1993 Federal District Court order.

Volume 1 analyzes alternatives for the management of existing and reasonably foreseeable inventories of the Department's spent nuclear fuel. Site-specific analyses, provided in appendices, support the discussion of the environmental consequences related to five alternative approaches for managing the Department's spent nuclear fuel through the year 2035. Volume 2 is a detailed analysis of environmental restoration and waste management activities at the Idaho National Engineering Laboratory. This analysis supports facility-specific decisions regarding new, continued or discontinued environmental restoration and waste management operations through the year 2005. Volume 3 is the Comment Response Document which comprises summaries of public comments received on the draft Environmental Impact Statement during a 90-day public comment period, and the responses to those comments.

A complete copy of the final Environmental Impact Statement and a list of reference documents are available in public reading rooms and information locations. Their addresses are included in this summary. For further information or to request additional copies, call or contact:

U. S. Department of Energy
Idaho Operations Office
Office of Communications
850 Energy Drive, MS 1214
Idaho Falls, ID 83402
(208) 526-0833

The Department of Energy will issue a Record of Decision no less than thirty days after the Environmental Protection Agency publishes a Notice of Availability for the final Environmental Impact Statement. The Record of Decision will be announced by June 1, 1995.

Sincerely,
(signature)

Thomas P. Grumbly
Assistant Secretary for
Environmental Management

Printed with soy ink on recycled paper

Cover Sheet

RESPONSIBLE AGENCIES: Lead Federal Agency: U.S. Department of Energy
Cooperating Federal Agency: U.S. Department of the Navy
TITLE: Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement.

CONTACT: For further information on this Environmental Impact Statement call or contact
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For general information on the U.S. Department of Energy NEPA process call 1-800-473-6842 or send a message or contact:

Carol Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington D.C. 20585
202-586-4600

ABSTRACT: This document analyzes (at a programmatic level) the potential environmental consequences over the next 40 years of alternatives related to the transportation, receipt, and management of spent nuclear fuel under the responsibility of the U.S. Department of Energy. It examines the specific consequences of the Idaho National Engineering Laboratory sitewide actions over the next 10 years for waste and spent nuclear fuel management and environmental restoration. For regionalized spent nuclear fuel management, this document analyzes alternatives of no action, regionalization, centralization and the use of the plans that existed in 1992 and 1993. For these materials. For the Idaho National Engineering Laboratory, this document analyzes alternatives of no action, ten-year plan, and minimum and maximum treatment, storage, and disposal of Energy wastes.

Summary i

Reader's Guide

The U.S. Department of Energy's (DOE's) Environmental Impact Statement (EIS) for Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs [DOE/EIS-0203-F] is divided into three volumes:

- Volume 1, DOE Programmatic Spent Nuclear Fuel Management
- Volume 2, Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs (including site-specific spent nuclear fuel management)
- Volume 3, Comment Response Document.

Volume 1 comprises five primary sections and ten key appendices. The five primary sections provide (a) an introduction and overview to DOE's spent nuclear fuel management program throughout the nation, (b) the purpose and need for action to manage spent nuclear fuel, (c) management alternatives that are under consideration, (d) the affected environment, and (e) potential environmental consequences that may be caused by the implementation of each alternative. The information contained in these sections relies, in part, upon more detailed information and analyses in the ten key appendices. These appendices describe and assess the site-specific spent nuclear fuel management programs at three primary DOE facilities and several alternative sites, the naval spent nuclear fuel management program, offsite transportation of spent nuclear fuel, environmental consequences data, and environmental justice considerations.

Two additional appendices include a glossary and a list of acronyms and abbreviations.

Volume 2 is similarly constructed. Five primary sections are presented that provide (a) the purpose and need for an integrated 10-year environmental restoration, waste management, and spent nuclear fuel management program at the Idaho National Engineering Laboratory, (b) background, (c) management alternatives under consideration, (d) the affected environment, and (e) potential environmental consequences that may be associated with the implementation of each alternative. The information presented in these sections relies, in part, upon four key appendices, which include a basic description of radioactivity and toxicology (chemical effects), agency consultation letters, detailed project summaries, and technical methodologies and key data. Two additional appendices include a glossary and a list of acronyms and abbreviations.

Volumes 1 and 2 provide an index as well as a list of references to enable the reader to further review and research selected topics. DOE has established reading rooms and information

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locations across the United States where these references may either be reviewed or obtained for review through interlibrary loan. The addresses, phone numbers, and hours of operation for these reading rooms and information locations are provided at the end of this EIS Summary. A line in the margin in Volumes 1 and 2 indicates a change since the Draft EIS.

Volume 3 comprises a primary section, called Comment Summaries and Responses, and three appendices. In the primary section individual public comments are summarized, grouped with others that are similar and organized into topical sections, called Response Sections. The appendices are designed to aid the reader in locating specific comment summaries and responses. Appendix A is an alphabetical list of commentors, showing for each the associated comment document number and response section number(s). Appendix B is a numerically ordered list of comment document numbers, showing associated commentors and response section numbers, and Appendix C provides a correlation of response section numbers to comment document numbers.

(Side_bar #: 1)

To find a response to comment(s), the reader should:

1. Turn to Appendix A in Volume 3 and find the name (or organization or Agency), and note the comment document number(s) assigned to his/her comments.
2. In the same entry, find the response section number(s) where the response to the comments are located,
3. Turn to the Table of Contents in Volume 3 under the heading Comment Summaries and Responses, where response section numbers are listed in numerical order, to find the page on which the response section number(s) that apply to the comment(s) appear.
4. Turn to the appropriate page(s) to find a response to a summary of the comment.

A copy of the actual comments (rather than the comment summaries found in Volume 3 of the EIS) can be found along with the EIS in the public reading rooms listed at the end of this summary.

Example:

1. The first alphabetical entrant, Dinah Abbott, has been assigned comment document number 615.
 2. Ms. Abbott's first entry is for response number 01.01.01.01(005); four other response numbers are applicable to her comments.
 3. That first entry is in Section 1.1.1.1, entitled "Action alternatives" under Specific Preferences for SNF Management Alternatives.
 4. Section 1.1.1.1 begins on page 1-1. The selected entry for Ms. Abbott is Response 005 in that section and is located on page 1-2.
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Introduction

National Environmental Policy Act Process

The U.S. Department of Energy (DOE) is currently evaluating its options for two separate, but related, sets of decisions. The first involves programmatic (DOE-wide) approaches to DOE's management of spent nuclear fuel. The second involves site-specific approaches regarding the future direction of environmental restoration and waste management programs (including spent nuclear fuel) at the Idaho National Engineering Laboratory. A key element of DOE's decisionmaking is a thorough understanding of the environmental impacts that may occur during the implementation of the proposed action. The National Environmental Policy Act of 1969, as amended, provides federal agency decisionmakers with a process to consider potential environmental consequences (both positive and negative) of proposed actions before agencies make decisions. In following this process, DOE has prepared this final Environmental Impact Statement (EIS) to assess various management alternatives and to provide the necessary background, data, and analyses to help decisionmakers and the public understand the potential environmental impacts of each alternative. DOE's decisions will be discussed in a Record of Decision to be issued by June 1995.

(Side_bar #: 2)

National Environmental Policy Act
National Environmental Policy Act of 1969: A law that requires Federal agencies to consider in their decisionmaking processes the potential environmental effects of proposed actions and analyses of alternatives and measures to avoid or minimize the adverse effects of a proposed action.

Alternatives: A range of reasonable options considered in selecting an approach to meeting the proposed objectives. In accordance with other applicable requirements, the No-Action alternative is also considered.

Environmental Impact Statement: A detailed environmental analysis for a proposed major Federal action that could significantly affect the quality of the human environment. A tool to assist in decision making, it describes the positive and negative environmental effects of the proposed undertaking and alternatives.

Record of Decision: A concise public record of DOE's decision, which discusses the decision, identifies the alternatives (specifying which ones were considered environmentally preferable), and indicates whether all practicable means to avoid or minimize environmental harm from the selected alternative were adopted (and if not, why not).

Summary 1

General Scope of the Environmental Impact Statement

Volume 1 of this EIS considers programmatic (DOE-wide) alternative approaches to safely, efficiently, and responsibly manage existing and projected quantities of spent nuclear fuel until the year 2035. This amount of time may be required to make and implement a decision on the ultimate disposition of spent nuclear fuel. DOE's spent nuclear fuel responsibilities include fuel generated by DOE production, research, and development reactors; naval reactors; university and foreign research reactors; domestic non-DOE reactors such as those at the National Institute of Standards and Technology and the Armed Forces Radiobiology

Research Institute; and special-case commercial reactors such as Fort St. Vrain and the Lynchburg Technology Center. Volume 1 focuses on the following:

- . Impacts to worker safety, public health, the environment, and socioeconomic factors related to transporting, receiving, stabilizing, and storing DOE and naval spent nuclear fuel, as well as special-case commercial fuels under DOE responsibility.
- . Siting locations for spent nuclear fuel management operations, which may

(Side_bar #: 3)

What Is Spent Nuclear Fuel?

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. For purposes of this EIS, spent nuclear fuel inventory also includes uranium/neptunium target material, blanket subassemblies, pieces of fuel, and debris.

Fuel in a reactor consists of fuel assemblies that come in many configurations but generally consist of the fuel matrix, cladding, and structural hardware. The matrix, which contains the fissionable material (typically uranium oxide or uranium metal), is typically plates or cylindrical pellets. The cladding (typically zirconium, aluminum, or stainless steel) surrounds the fuel, confining and protecting it. For gas-cooled reactors, this may be a ceramic coating over fuel particles. Structural parts hold fuel rods or plates in the proper configuration and direct coolant flow (typically water) over the fuel. Structural hardware is generally nickel alloys, stainless steel, zirconium, or aluminum, or for gas-cooled reactors, graphite.

The radiation of most concern from spent nuclear fuel is gamma rays. Although the radiation levels can be very high, the gamma-ray intensities are readily reduced by shielding the fuel elements with such materials as concrete, lead, steel, and water. The shielding thicknesses are dependent on the energy of the radiation source, desired protection level, and density of the shielding material. Shielding thicknesses for concrete or lead are smaller than for water.

Figure (Summary 2) What Is Spent Nuclear Fuel?

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- . include storing, stabilizing, and continuing research and development. (Stabilizing reduces fuel deterioration.)
- . Fuel stabilization activities required for safe interim storage such as canning of degraded fuels or processing, research and development of spent nuclear fuel management technologies, and pilot programs.

DOE will not analyze the ultimate disposition (final step in which material is disposed of) of spent nuclear fuel in this EIS. Decisions regarding the actual disposition of DOE's spent nuclear fuel will follow appropriate review under the National Environmental Policy Act and be subject to licensing by the Nuclear Regulatory Commission.

DOE will not select spent nuclear fuel stabilization technologies on the basis of this EIS. These technology-based decisions are more appropriately dealt with on a fuel-type basis. DOE will conduct additional National Environmental Policy Act reviews for research and development, and characterization activities that help select technologies for placing the fuel in a form suitable for ultimate disposition (this is commonly referred to as "tiering" within the National Environmental Policy Act process). For example, the Waste Management Programmatic EIS complements decisions to be made in Volume 2. Other EISs being prepared complement decisions for the disposition of other nuclear materials, and these EISs and their relationships to this EIS are discussed in Section 1.2 of Volume 1. The Draft EIS on a Proposed Nuclear Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel will be distributed for public review and comment in April 1995. Decisions derived from that policy also complement this EIS.

Except for special-case commercial fuel, management of spent nuclear fuel from commercial nuclear power plants is not the subject of this EIS. Volume 2 of this EIS addresses alternative approaches for the management of DOE's environmental restoration, waste management, and spent nuclear fuel activities over the next 10 years at the Idaho National Engineering Laboratory. This volume includes evaluations of potential environmental impacts associated with Idaho National Engineering Laboratory programs and site activities that contribute to waste streams requiring handling or disposal. Waste management activities are evaluated at both the site-wide and project-specific levels.

Summary 3

Figure (Summary 3) Waste management activities at the Idaho national Engineering Laboratory. Environmental restoration activities are addressed only at the site-wide level. Volume 2 considers site-specific activities for spent nuclear fuel management, including fuel receipt, transportation, characterization, stabilization, storage, and technology development for ultimate disposition.

Volume 2 evaluates impacts of operations or programs associated with the spent nuclear fuel, environmental restoration, and waste management programs at the Idaho National Engineering Laboratory. Other activities are discussed when they are relevant to understanding the affected environment or are expected to occur during the next 10 years, and are included as part of the cumulative effects analysis. This EIS does not evaluate the DOE-wide programmatic alternatives for waste management, which are being evaluated in a separate programmatic EIS to be issued in draft form in 1995. However, the alternatives presented in Volume 2 have been developed to be consistent with the programmatic objectives of the Waste Management Programmatic EIS (previously known as the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement), which will not be completed before the Record of Decision is signed for the EIS summarized here. Any conflicts between these Records of Decision will be evaluated and, as appropriate, additional National Environmental Policy Act reviews will be conducted.

4 Summary

Comments and Responses

During the public comment period for the Draft EIS, more than 1,430 individuals, agencies, and organizations provided DOE with comments. Comments were received from all affected DOE and shipyard communities. Most citizens and organizations expressed broad opinions, especially on siting and transportation options, and recommended new or enhanced alternatives or additional sites, or commented on the National Environmental Policy Act process. Many commentators used this opportunity to comment on legislation, policies, or federal programs not specifically related to the EIS. Some questioned or commented on the laws and regulations applicable to DOE's mission, DOE interim spent nuclear fuel management, or environmental restoration and waste management at the Idaho National Engineering

Laboratory.

Many commentators expressed strongly held opinions about the EIS, DOE, and the Navy and/or the alternatives. Some commentators expressed the opinion that DOE does not consider public comments and that some comments will be given more weight than others. Others stated that fear-driven commentators should be ignored, and decisions should be based on good science. Recurring and controversial issues raised during the public comment period included comments on DOE and Navy credibility; the apparent lack of a clear path forward with respect to ultimate disposition of spent nuclear fuel and nuclear waste; continued generation of spent nuclear fuel; cost of implementation; safety of, and risk to, the public; transportation of spent nuclear fuel and waste; impacts of accidents and perceived risk on local economies and the quality of life; other issues of local interest; and U.S. nuclear, defense, energy, and foreign policies.

Public comments were considered by the DOE and Navy and resulted in changes to the Draft EIS and in the preparation of the Comment Response Document, Volume 3, of this Final EIS. In general, public comments, coupled with consultations with commenting agencies and state and tribal governments, resulted in additional analyses, clarifying or correcting facts, or expanded discussion in certain technical areas. Where appropriate, Volume 3 provides an explanation of why certain comments did not warrant further change to the EIS.

Both volumes of the Final EIS identify DOE's preferred alternatives- Regionalization by fuel type (Alternative 4A) for managing spent nuclear fuel, and a hybrid alternative that is the Ten-Year Plan (Alternative B) enhanced to include elements of other alternatives for the Idaho National Engineering Laboratory. The DOE's preferred alternatives are consistent with the Navy's preferred alternative identified in the draft EIS- to continue to conduct refueling and defueling of nuclear-powered vessels and prototypes, and to transport spent nuclear fuel to the Idaho National Engineering Laboratory for full examination and interim storage, using the same practices as in the past. Identification of the preferred alternatives was based on consideration of environmental impacts, public issues and concerns, regulatory compliance, the DOE's and Navy's spent nuclear fuel missions, national security and defense, cost, and DOE policy.

As committed to in the Draft EIS, the evaluation and discussion of environmental justice has been expanded to both Volumes 1 and 2 of the Final EIS. This approach is consistent with draft interagency definitions at the time of its preparation and reflects public comments received regarding environmental justice. Consultation with commenting Native American

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Tribes is reflected in the environmental justice analysis, as well as in various sections of the EIS, as appropriate.

In response to concerns raised by public comments regarding the technical analysis, seismic and water resource discussions and analyses were reviewed, clarified, and enhanced for all alternative sites, and current data and analyses were added to Volumes 1 and 2, as appropriate.

In Volume 1, a discussion of potential accidents caused by a common initiator was added. The option of stabilizing some of DOE's spent nuclear fuel (specifically Hanford site production reactor fuel) by processing it at available facilities located overseas was added, thus expanding processing options discussed in the EIS. An analysis of barge transportation was added to the EIS, addressing the option of transporting production-reactor fuel to a shipping point for overseas processing and supporting the transport of Brookhaven National Laboratory spent nuclear fuel to another site, as appropriate. In addition, an analysis of shipboard fires was added, primarily in response to comments related to receiving spent nuclear fuel of U.S. origin from foreign research reactors.

In response to public comments, the results of a separate evaluation of the various alternatives' costs were summarized in the EIS. The cost evaluation was performed independently of the EIS for purposes broader than those analyzed in the EIS.

The discussion of the option of leaving Fort St. Vrain spent nuclear fuel

in Colorado has been expanded, specifically with respect to contractual commitments versus programmatic benefits. Other enhancements include clarification that potential shipment of spent nuclear fuel of U.S. origin from foreign research reactors consists of approximately 20 metric tons of heavy metal. As a result of public comments, Volume 1 was enhanced to include a description that clarifies the relationship between other DOE NEPA reviews related to spent nuclear fuel and this EIS. This description explains the interrelationship of these actions in response to comments about segmentation. In the same regard, the relationship between the EIS and Spent Fuel Vulnerability Action Plans was clarified.

With regard to naval spent nuclear fuel, enhancements to Appendix D (Naval Spent Nuclear Fuel Management) include providing additional information in the following areas: importance of naval spent nuclear fuel examination, impacts of not refueling or defueling nuclear-powered vessels, the reasons why storage and processing of naval spent nuclear fuel in foreign facilities were not evaluated in detail, environmental justice considerations, the transition period required to implement naval spent nuclear fuel alternatives, potential accident scenarios at naval shipyards, and uncertainties in calculating potential environmental impacts. In Volume 2, the air quality analysis was revised to upgrade the information on existing baseline conditions. The analysis compared impacts of each alternative with Prevention of Significant Deterioration increment limits. The Waste Experimental Reduction Facility project summary was enhanced with respect to related operation and combustion strategy. The EIS was also revised to reflect employment projections resulting from the Idaho National Engineering Laboratory contractor consolidation.

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Volume I - Spent Nuclear Fuel

Overview

The DOE Spent Nuclear Fuel Management Program is intended to (a) provide interim storage and management of fuel at specified locations until ultimate disposition, (b) stabilize the fuel as required for environmentally safe storage and protection of human health (for both workers and the public), (c) increase safe storage capacity by replacing facilities that cannot meet current standards and providing additional capacity for newly generated spent nuclear fuel, (d) conduct research and development initiatives to support safe storage and/or ultimate disposition, and (e) examine fuel generated by the Naval Nuclear Propulsion Program. DOE's spent nuclear fuel management responsibilities include fuel generated by DOE production and research and development reactors, naval reactors, university and foreign research reactors, other miscellaneous generators, and special-case commercial reactors. The primary goals of the management program are to reduce the risk of nuclear accidents during transportation and storage and to minimize the release of radionuclides to the environment where they can pose hazards to human health, plants, and animals.

History of Spent Nuclear Fuel Management

Most DOE spent nuclear fuel is currently stored at three primary locations: the Hanford Site (State of Washington), the Idaho National Engineering Laboratory (State of Idaho), and the Savannah River Site (State of South Carolina) (Figure 1). Much smaller quantities of spent nuclear fuel remain at other locations throughout the nation (see Figure 1). Historically, DOE has reprocessed spent nuclear fuel at the three primary locations to recover and recycle uranium and plutonium. Much of the spent nuclear fuel at the three primary locations resulted from production reactors at the Hanford and Savannah River Sites. These reactors

are no longer operating, but they previously produced material for DOE's defense programs and research and development programs. Smaller quantities of spent nuclear fuel at other locations have resulted from experimental reactor operations and from research conducted by approximately 55 university- and Government-owned test reactors. DOE proposes to adopt and implement a policy concerning management of spent nuclear fuel containing enriched uranium that originated in the United States and was used by foreign research reactors. DOE also would manage limited amounts of special-case commercial reactor spent nuclear fuel.

Since 1957, spent nuclear fuel from nuclear-powered naval vessels and naval reactor prototypes (operating reactors used for land-based training) has been transported from shipyards and prototype sites to the Naval Reactors Facility at the Idaho National Engineering Laboratory for testing and examination. A court order issued on June 28, 1993 prohibited the receipt of all spent nuclear fuel by Idaho; that order was amended on December 22, 1993 allowing only a limited number of shipments of spent nuclear fuel to Idaho, pending completion of this EIS and the Record of Decision.

Purpose and Need for Future Spent Nuclear Fuel Management

DOE is responsible for developing and maintaining a capability to safely manage its spent nuclear fuel. During the last four decades, DOE and its

Summary 7

Figure (Summary 8) Figure 1. Locations of current spent nuclear fuel generators and sites

predecessor agencies have transported, received, stored, and reprocessed more than 100,000 metric tons of heavy metal of spent nuclear fuel. Approximately 2,700 metric tons heavy metal of spent nuclear fuel stored at various locations in the United States and overseas have not been reprocessed. This spent nuclear fuel is in a wide range of enrichments (that is, percent uranium-235), types, and conditions. By the year 2035, this quantity may increase by approximately 100 metric tons of heavy metal. The end of the Cold War led DOE to reevaluate the scale of its weapons production, nuclear propulsion, and research missions. In April 1992, DOE began to phase out reprocessing of spent nuclear fuel for recovery and recycling of highly enriched uranium. In November 1993, DOE documented current and potential environmental, safety, and health vulnerabilities regarding DOE spent nuclear fuel storage facilities. DOE also identified storage locations of fuel with degraded cladding (metal coverings to prevent fuel corrosion) and other problems that require action to ensure continued safe storage. This situation has also been identified by the independent Defense Nuclear Facilities Safety Board in Recommendation 94-1, issued May 26, 1994. The Board concluded that imminent hazards could arise within several years unless certain problems are corrected, including those related to spent nuclear fuel storage. Thus, DOE needs to establish an integrated complex-wide program that provides safe and effective management for present and reasonably foreseeable quantities of spent nuclear fuel, pending its ultimate disposition. Relevant decisions that must be made include the selection of:

- . Locations to conduct specific spent nuclear fuel management activities after evaluating existing and potential locations
- . Appropriate capabilities, facilities, and technologies
- . Research and development activities needed to support the DOE Spent Nuclear Fuel Management Program.

In other words, this EIS will provide the environmental information to support decisions that will facilitate a transition between DOE's current management practices and ultimate disposition of spent nuclear fuel.

Technologies for Spent Nuclear Fuel Management

contain radioactive releases, or control geometry.
processing (of spent nuclear fuel)-Applying a chemical or physical process designed to alter the characteristics of the spent nuclear fuel matrix.
passivation-The process of making metals inactive or less chemically reactive. For example, the surface of steel can be passivated by chemical treatment.

the criteria. Decisions regarding the actual disposition of DOE's spent nuclear fuel would follow appropriate review under the National Environmental Policy Act, and would be subject to licensing by the U.S. Nuclear Regulatory Commission. This "path forward" would be implemented so as to minimize impacts on the first repository schedule. The current planning assumption is that any DOE material (vitrified high-level waste and/or spent nuclear fuel) qualified and selected for emplacement in the first repository would be disposed beginning in the year 2015. Disposition of the remaining DOE spent nuclear fuel and vitrified high-level waste that is not emplaced in the first repository would not be decided until the DOE recommendation on the need for a second repository (which would consider such factors as the physical and statutory limits of the first repository). The Nuclear Waste Policy Act, as amended, requires DOE to make that recommendation between January 1, 2007 and January 1, 2010.

Several technology options are available to accomplish overall spent nuclear fuel management objectives. Their selection is dependent upon fuel design and its structural integrity, fuel enrichment, and the chemical stability of the cladding including the degree of corrosion, and of the fuel matrix. These options include direct storage (limited to high-integrity fuels) or stabilization in preparation for storage. Direct storage means storing spent nuclear fuel in essentially the same physical form in which it is removed from the reactor (that is, little or limited stabilization of the fuel elements). Fuel that has high-integrity cladding, for example naval fuel, can be direct stored, indefinitely. Both wet storage in water pools and dry storage in casks and vaults provide effective cooling and shielding for the safe storage of such high-integrity spent nuclear fuel.

Some stabilization technologies provide additional containment for spent nuclear fuel with reduced integrity. These technologies include (a) direct canning, (b) passivation, and (c) coating.

Several processing technologies are available to stabilize spent nuclear fuel without separating uranium and/or plutonium from the highly radioactive constituents. These technologies involve changing the physical and chemical form to reduce fuel volume and reactivity, or make the fuel more homogeneous. They include (a) oxidation, (b) chemical dissolution, and (c) mechanical steps, such as chopping or shredding.

Some processing technologies separate uranium and/or plutonium from degraded cladding. Available technologies include (a) aqueous extraction from the chemically dissolved fuel, and (b) electrometallurgical processing with an electrical current to create chemical reactions at high temperature to extract the chemical elements.

Processing facilities and capabilities exist at various DOE sites. For some fuel, such as Hanford Site production reactor fuel, existing foreign processing capabilities could be employed. Foreign processing would be on a pay-as-you-go basis, without a substantial investment in facility upgrades and maintenance. A viable scenario would have to consider proliferation concerns, safety of overseas transport of spent nuclear fuel and returned materials, and national security.

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Alternatives

DOE must provide for safe, efficient management of its spent nuclear fuel during the next 40 years, pending ultimate disposition. The alternatives considered are: No Action, Decentralization, 1992/1993 Planning Basis, Regionalization, and Centralization. These alternatives include variations of several components: (a) number of storage locations, (b) amounts of

spent nuclear fuel shipped, (c) fuel stabilization methods (ways to reduce deterioration) required, (d) number and types of storage facilities to be constructed, and (e) scope of technology research and development efforts for management technologies.

In addition to the three DOE sites that have conducted extensive spent nuclear fuel management activities, four naval shipyards (Norfolk, Portsmouth, Pearl Harbor, and Puget Sound) and one prototype reactor site (Kesselring Site) were selected as potential storage locations for naval spent nuclear fuel. In response to public comments raised during the scoping process, DOE undertook a process for identifying possible alternative sites. The end result of the selection process was the inclusion and evaluation of two additional sites, the Oak Ridge Reservation (State of Tennessee) and the Nevada Test Site (State of Nevada). DOE did not be a preferred site for the management of spent nuclear fuel in the Draft EIS because of the State's current role as the host site for the Yucca Mountain Site Characterization Project. DOE's identification of the preferred alternatives also indicates that DOE does not consider the Nevada Test Site as a preferred site for spent nuclear fuel management in the Final EIS. Figure 2 depicts the various alternatives, options, and locations that DOE is evaluating for spent nuclear fuel management. The DOE's preferred alternative is Regionalization by fuel type (Alternative 4A). Under this alternative, spent nuclear fuel would be assigned to sites having the largest inventory of similar fuel types. The DOE's preferred alternative is consistent with the Navy's preferred alternative to continue to conduct refueling and defueling of nuclear-powered vessels and prototypes, and to transport spent nuclear fuel to the Idaho National Engineering Laboratory for full examination and interim storage, using the same practices as in the past.

 (Side_bar #: 6)

Summary of Alternatives for
 the Management of DOE
 Spent Nuclear Fuel

No Action

Take minimum actions required for safe and secure management of spent nuclear fuel at or close to the generation site or current storage location.

Decentralization

Store most spent nuclear fuel at or close to the generation site or current storage location with limited shipments to DOE facilities.

1992/1993 Planning Basis

Transport to and store newly generated spent nuclear fuel at the Idaho National Engineering Laboratory or Savannah River Site. Consolidate some existing fuels at the Idaho National Engineering Laboratory or the Savannah River Site.

Regionalization

Distribute existing and projected spent nuclear fuel among DOE sites based primarily on fuel type (Preferred Alternative) or geography.

Centralization

Manage all existing and projected spent nuclear fuel inventories from DOE and the Navy at one site until ultimate disposition.

Summary 13

Figure (Summary 14)Figure 2. Alternatives for management of DOE spent nuclear fuel. The programmatic (DOE-wide) decisions will not select all site- specific spent nuclear fuel management options. Such decisions will be made following additional site- specific National Environmental Policy Act evaluations.

No Action Alternative

In the No Action alternative, which provides a baseline for comparison, DOE would limit actions to the minimum necessary for safe and secure management of spent nuclear fuel at or near the point where it is generated or currently located (Figure 3). Under this

(Side_bar #: 7)

No Action Alternative

Take minimum actions required for safe and secure management of spent nuclear fuel at or close to the generation site or current storage location.

- . After an approximate three-year transition period, no shipment of spent nuclear fuel to or from DOE facilities would occur.
- . Stabilization activities would be limited to the minimum actions required to safely store spent nuclear fuel.
- . Naval reactor spent nuclear fuel would be stored at naval sites.
- . Facility upgrade/replacement and onsite fuel transfers would be limited to those necessary for safe interim storage.

Existing research and development activities would continue.

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Figure (Summary 15)Figure 3. Spent nuclear fuel distribution for the No Action alte
Summary 15

alternative, both small and large DOE sites, naval shipyards and prototypes, university and other non-DOE domestic research reactors, and foreign research reactors would independently manage their fuel onsite. No spent nuclear fuel would be transported between DOE sites. Naval spent nuclear fuel at the Newport News Shipyard would be transferred to Norfolk Naval Shipyard for retention. Naval reactors would be refueled and defueled as planned. Naval spent nuclear fuel would be stored in shipping containers at the naval or DOE facility where refueling and defueling are conducted. This alternative would require about a three-year transition period to obtain additional shipping containers for storage. During the transition period, fuel would be transported to the Idaho National Engineering Laboratory for examination at the Expended Core Facility. The shipping containers would be unloaded and reused for additional refueling and defuelings. However, after the transition period, the fuel removed from naval reactors would remain in storage at the naval sites and the Expended Core Facility at the Idaho National Engineering Laboratory would be shut down. Examinations of naval spent nuclear fuel would also cease. Current technology development activities related to spent nuclear fuel management would continue within DOE.

Decentralization Alternative

Under this alternative, DOE would maintain existing spent nuclear fuel in storage at current locations and store newly generated fuel at or near the site of generation (Figure 4). This

(Side_bar #: 8)

Decentralization Alternative

Store most spent nuclear fuel at or close to the generation site or current storage shipments to DOE facilities.

- . DOE spent nuclear fuel shipments would be limited to the following:
 - Spent nuclear fuel stored or generated at universities and non-DOE facilities
 - Potential foreign research reactor fuel.
- . Spent nuclear fuel processing might need to be conducted. Other forms of stabilization occur to provide for safe storage and/or transport.
- . Some facilities would be upgraded/replaced and additional storage capacity required alternative would be constructed.
- . Onsite fuel transfers would occur for improved safe storage.
- . Research and development activities would be undertaken for spent nuclear fuel management including stabilization technology.
- . Three options for naval spent nuclear fuel
 - No inspection-fuel remains close to refueling/defueling site
 - Limited inspection at Puget Sound Naval Shipyard
 - Full inspection at the Idaho National Engineering Laboratory followed by storage refueling/defueling site.

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Figure (Summary 17) Figure 4. Spent nuclear fuel distribution for the Decentralization alternative.

Summary 17

alternative differs from the No Action alternative by allowing fuel shipments from universities, non-DOE facilities, and foreign research reactors to DOE sites, which requires developing and upgrading facilities. Actions that would improve management capability, although not essential for safety, would be undertaken, and spent nuclear fuel research and development (including stabilization technology) would be performed. The Decentralization alternative at the naval sites is similar to the No Action alternative because naval reactors would continue to be defueled and refueled as planned, and the fuel would be stored close to the refueling/defueling site. Three Decentralization options are included. The options differ only with regard to the examination of the fuel: no examination, limited examination, and full examination. Each option would require a transition period of about three years to develop storage facilities. During the transition period, spent nuclear fuel would be transported in shipping containers to the Idaho National Engineering Laboratory and the containers would be unloaded and reused. The various small non-DOE, university, and foreign research reactors would only transport spent nuclear fuel in limited amounts to permit continued operations. No additional storage facilities would be constructed at these locations.

1992/1993 Planning Basis Alternative

(Side_bar #: 9)

1992/1993 Planning Basis

Transport to and store newly generated spent nuclear fuel at the Idaho National Engineering Laboratory or Savannah River Site. Consolidate some existing fuels at the Idaho National Engineering Laboratory or the Savannah River Site.

- . Fuel would be transported as follows:
 - TRIGA fuel from the Hanford Site to the Idaho National Engineering Laboratory; Hanford Site receives limited fuel for research of storage and dispositioning technologies
 - Naval fuel to the Idaho National Engineering Laboratory for examination and storage
 - West Valley Demonstration Project and Fort St. Vrain fuel to Idaho National Engineering Laboratory
 - Oak Ridge Reservation fuel to the Savannah

River Site

- Domestic research fuel, and foreign research reactor fuel as may yet be determined, divided between the Savannah River Site and the Idaho National Engineering Laboratory.
 - . Facilities upgrades and replacements that were planned would proceed, including increased storage capacity.
 - . Research and development for spent nuclear fuel management would be undertaken, including stabilization technology.
- Spent nuclear fuel processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

The 1992/1993 Planning Basis alternative represents DOE's plans (in 1992 and 1993) for management of its spent nuclear fuel. Under this alternative, DOE would transport and store newly generated spent nuclear fuel at the Idaho National Engineering Laboratory or the Savannah River Site (Figure 5). Most existing spent nuclear fuel located at major DOE sites would remain at those sites.

Some existing spent nuclear fuel at other sites would be consolidated at the Idaho National Engineering Laboratory or Savannah River Site. The Savannah River Site and Idaho National Engineering Laboratory would also receive some test reactor fuel and some fuel from university and foreign research reactors. The Hanford Site would receive only limited quantities of fuel for research on storage and dispositioning technologies. DOE sites would generally upgrade facilities and construct new facilities to manage

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 Figure (Summary 19) Figure 5. Spent nuclear fuel distribution for the 1992/1993 Plan alternative.

Summary 19

spent nuclear fuel. Activities related to spent nuclear fuel treatment would include research and development and pilot programs to support future decisions on the ultimate disposition of spent nuclear fuel. Naval reactors would continue to be refueled and defueled as planned. Naval spent nuclear fuel would be transported from naval sites to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination. Following examination, fuel would remain in storage at the Idaho National Engineering Laboratory pending ultimate disposition. Under this alternative, other generator and storage locations would continue to ship spent nuclear fuel to the Idaho National Engineering Laboratory and Savannah River Site. No additional storage facilities would be constructed at these originating locations.

Regionalization and Preferred Alternative

(Side_bar #: 10)

Regionalization

Regionalization Alternative 4A - Preferred Alternative:

Distribute existing and projected spent nuclear fuel among DOE sites primarily on the basis of fuel type.

- . Naval fuel would be transported to, examined, and stored at the Idaho National Engineering Laboratory.
- . Aluminum-clad fuel would be transported to the Savannah River Site; TRIGA and non-aluminum fuel would be transported to the Idaho National Engineering Laboratory; defense production fuel would be retained at the Hanford Site.
- . Spent nuclear fuel processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.

- . Facilities required to support spent nuclear fuel management would be upgraded or built as necessary.
- . Research and development for spent nuclear fuel management would be undertaken, including stabilization technology.

Regionalization Alternative 4B: Distribute existing and projected spent nuclear fuel between an Eastern Regional Site (either Oak Ridge Reservation or Savannah River Site) and a Western Regional Site (either Hanford Site, Idaho National Engineering Laboratory, or Nevada Test Site).

- . The Eastern Regional Site would receive fuel from east of the Mississippi River and the Western Regional Site would receive fuel from west of the Mississippi River.
- . Naval fuel would be transported to, examined, and stored at either the Western Regional Site or the Eastern Regional Site.
- . Spent nuclear fuel processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.
- . Facilities required to support spent nuclear fuel management would be upgraded or built as necessary.
- . Research and development for spent nuclear fuel management would be undertaken, including stabilization technology.

 This alternative would require a redistribution of spent nuclear fuel among DOE sites, either on the basis of fuel type (Regionalization Alternative 4A - Preferred Alternative) or on the basis of geography (Regionalization Alternative 4B). Regionalization by fuel type (Alternative 4A- Preferred Alternative) (Figure 6) would involve the use of the Idaho National Engineering Laboratory and Savannah River Site for storage of most newly generated spent nuclear fuel. Existing defense production spent nuclear fuel at the Hanford Site would remain there. Intersite transportation of fuel would depend on the site's existing capabilities to manage specific fuel types with respect to cladding material, physical and chemical composition, fuel condition, and adequate facilities to handle increased

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 Figure (Summary 21) Figure 6. Spent nuclear fuel distribution for Regionalization A1 4A.

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 quantities of fuel. Naval fuel would be transported to the Expanded Core Facility at the Idaho National Engineering Laboratory for examination. Following examination, fuel would remain in storage at the Idaho National Engineering Laboratory Facility upgrades, replacements, and additions would be undertaken to the extent required, including research and development activities.

Regionalization by geography (Alternative 4B) (Figure 7) would involve consolidation of spent nuclear fuel from the eastern United States at the Eastern Regional Site (Oak Ridge Reservation or Savannah River Site) and consolidation of fuel from the western United States at one of the Western Regional Sites (Hanford Site, Idaho National Engineering Laboratory, or Nevada Test Site). Naval spent nuclear fuel would be transported to, examined, and stored at either the Eastern or the Western Regional Site. Regionalization Alternative 4B has 10 options, based on the combination of sites selected as the Eastern and Western Regional Sites, and the placement of the Expanded Core Facility at either of the sites. There are three potential Western and two potential Eastern Regional Sites that could be paired, with either supporting the Expanded Core Facility. However, neither of the two possible combinations that include the Idaho National Engineering Laboratory as the Western Regional Site would consider moving the Expanded Core Facility to the eastern site because of the estimated \$1 billion cost of construction. Facility upgrades, replacements, and additions would be undertaken to the extent required, including research

and development.

Under this alternative, other generator and storage locations would continue to transport spent nuclear fuel to the Idaho National Engineering Laboratory and the Savannah River Site. The exact destination of fuels would vary, depending on the fuel type under Regionalization Alternative 4A and on the generator/ storage location under Regionalization Alternative 4B.

Centralization Alternative

Under the Centralization alternative, all spent nuclear fuel that DOE is obligated to manage would be transported to one DOE site (Figure 8). Candidate sites include the Hanford Site (Option A), Idaho National Engineering Laboratory (Option B), Savannah River Site (Option C), Oak Ridge Reservation (Option D), and Nevada Test Site (Option E). New facilities would be built at the Centralization site to accommodate the increased inventories. Some spent nuclear fuel would require stabilization before transport. All spent nuclear fuel facilities at the transporting sites would then be closed. Activities related to stabilization of fuel, including research and development and pilot programs, would also be centralized at this same site.

Transport of naval spent nuclear fuel to the Idaho National Engineering Laboratory would continue only until storage and examination facilities are constructed at the central site. For Centralization at sites other than the Idaho National Engineering Laboratory, a new facility with capabilities comparable to the Expanded Core Facility at the Idaho National Engineering Laboratory would be constructed.

All spent nuclear fuel from the other generator and storage sites would be transported to the selected central DOE site.

 (Side_bar #: 11)

Centralization

Manage all existing and projected spent nuclear fuel inventories at one site until ultimate disposition.

- . Existing spent nuclear fuel would be transported to the central site.
- . Naval fuel would be transported to, examined at, and stored at the central site.
- . Projected spent nuclear fuel receipts would be transported to the central site.
- . Spent nuclear fuel processing might need to be conducted. Other forms of stabilization might occur to provide for safe storage and/or transport.
- . Facility upgrade/ replacement and new storage capacity would be provided at the central site; stabilization facilities would be provided at the transporting sites.

- . Research and development would be undertaken for spent nuclear fuel management, including stabilization technology.

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Figure (Summary 23)Figure 7. Spent nuclear fuel distribution for Regionalization A1 4B.

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Figure (Summary 24)Figure 8. Spent nuclear fuel distribution for the Centralization alternative.

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Environmental Consequences

Estimates in the EIS of potential environmental consequences resulting from programmatic (DOE- wide) alternatives are based on conservative assumptions (that is, with a tendency to overestimate). Analytical approaches are designed provide estimates of the maximum reasonably foreseeable consequences.

As indicated in the EIS, the environmental consequences of the five spent nuclear fuel management alternatives would be small. For example, analyses of air quality, water quality, and land use for each alternative showed little or no impact. The details of these examinations are discussed in Chapter 5 of Volume 1 The comparison of alternatives in this Summary, therefore, concentrates on (a) the areas in which the public has expressed considerable interest and (b) programmatic factors important to DOE decisionmaking. The following factors were selected for comparison:

- . Number of shipments among sites
- . Public and worker health effects
- . Spent nuclear fuel-related employment
- . Generation of radioactive waste
- . Impact on DOE or Navy missions
- . Cost of implementation
- . Cumulative impacts.

Number of Shipments

Figure 9 shows the number of offsite shipments that would occur under each alternative. It quantifies shipments of test specimens, as well as fuel elements. Shipments of naval test specimens are included because of their contribution to cumulative impacts of naval spent nuclear fuel transportation. The No Action alternative would involve only a limited number of naval spent nuclear fuel shipments (about 200).

The Decentralization alternative, 1992/1993 Planning Basis alternative, and Regionalization Alternative 4A (Preferred Alternative) mostly involve shipments from the smaller reactor and storage sites and the naval sites to DOE sites. These shipments would range in number from approximately 2,000 shipments under Decentralization Options A or B to approximately 3,700 under Regionalization Alternative 4A (Preferred Alternative).

Decentralization Option C and the 1992/1993 Planning Basis alternative each would involve approximately 2,900 shipments over the 40-year period.

For the Centralization alternative and Regionalization Alternative 4B (by geography), spent nuclear fuel would be transported to one or two sites, respectively. For these Alternatives, the number of shipments would range from approximately 4,600 under the Regionalization Alternative 4B (with Idaho National Engineering Laboratory and Savannah River Site as the western and eastern sites respectively) to about 7,400 shipments under the Centralization Option E (Centralization at the Nevada Test Site).

Public and Worker Health Effects

Spent nuclear fuel management activities would result in radiation exposures to the workers and the public from facility operations and transportation activities. Additional radiation exposures could occur as a result of transportation or facility accidents. Any radiation exposures from spent nuclear fuel management activities would be in addition to exposures that normally occur from

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Figure (Summary 26) Figure 9. Number of spent nuclear fuel and test specimen shipments the years 1995 and 2035.

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natural sources such as cosmic radiation (involuntary exposure) and from artificial sources such as chest x-rays (voluntary exposure). The effects of radiation exposure on humans (and the environment) depend on (a) the kind of radiation received, (b) the total amount of radiation received (the rate of exposure times the length of exposure), and (c) the part(s) of the body exposed. Radiation can cause a variety of health effects in people. The most significant health effect to describe the consequences of public and worker radiation exposures is "latent cancer fatality." It is referred to as "latent" because the cancer may take many years to develop and for death to occur. Section 5.1.1 of Volume 1 of this EIS discusses the scientific basis and methods used to estimate latent cancer fatalities that could result from exposure to radiation. Other health effects that can result from radiation exposure include non-fatal cancers and genetic effects. This EIS focuses on latent cancer fatalities as the primary health risk from radiation exposure and uses the risk of latent cancer fatality as the basis for comparison of radiation-induced impacts among alternatives. As stated in this EIS, the total estimated health effects for the public (fatal cancers, non-fatal cancers, and genetic effects) may be obtained by multiplying the estimates of latent cancer fatalities by 1.46, based on risk estimates developed by the International Commission on Radiological Protection. Under all alternatives (over a 40-year period), the estimated number of latent cancer fatalities to the public from normal DOE spent nuclear fuel management activities (facility operations plus transportation) would range from approximately zero to about two latent cancer fatalities, or

(Side_bar #: 12)

Latent cancer fatalities caused per rem for an individual member of the general public:

Dose:

Radioactivity from all sources combined, including natural background radiation and medical sources, produces about a 0.3 rem dose to the average individual per year

Probability:

The probability of receiving the above dose is essentially one.

Average life span:

72 years is considered to be the average lifetime.

Latent Cancer Fatalities Caused Per Rem for an Individual Member of the General Public

0.0005 cancers are estimated to be caused by exposure to 1 rem.

Calculation:

Dose rate x life span x cancers caused per rem =
0.3 rem/year x 72 years x 0.0005 cancers per rem =
0.01 fatal cancers per individual lifetime.

Risk:

Probability x fatal latent cancers = 1 x 0.01 = 0.01
fatal cancer, which is a probability of about 1 in 100

of death from exposure to natural background radiation and medical sources over a lifetime.

 about 0.05 latent cancer fatalities per year (Figure 10). In general, the greatest radiation exposure from normal spent nuclear fuel site activities and incident-free transportation results when large quantities of spent nuclear fuel are transported among sites, such as under Regionalization Alternative 4B or the Centralization alternative. Under incident-free transportation, the estimated total latent cancer fatalities are less than two for all alternatives, with the highest estimates being those associated with the Centralization options. This reflects the higher number of shipments associated with these options. The risk of latent cancer fatalities associated with facility accidents is

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Figure (Summary 28) Figure 10. Maximum estimated latent cancer fatalities per year T general population from normal spent nuclear fuel site operations and total fatalities from incident-free transportation.

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small across all the alternatives, as shown in Figure 11. The evaluated facility accident scenario with the highest risk (breach of a fuel assembly for the Centralization alternative at the Savannah River Site) would result in an estimated risk of 0.0072 latent cancer fatality per year (one latent fatal cancer in 140 years).

The risk associated with radiation from transportation accidents poses a lower risk than facility accidents (Figure 12). The risks associated with traffic fatalities (nonradiological) are greater than the risks associated with cancer caused by radiation exposure, although both are very small (Figure 12). The evaluated transportation accident scenario with the largest consequences (spent nuclear fuel transportation accident in a suburban area) would lead to 55 latent cancer fatalities; the probability of this occurrence is about 1 in 10 million years.

In summary, for radiation-induced latent cancer fatalities to the public over 40 years of spent nuclear fuel management under all the alternatives evaluated, the most likely outcome is as follows:

- . Essentially zero latent cancer fatalities from normal facility operations and facility accidents
- . Essentially zero latent cancer fatalities from transportation accidents
- . Up to about one latent cancer fatality from most incident-free transportation under most alternatives; up to two latent cancer fatalities under the Centralization alternative.

Up to about two fatalities could result over the 40-year period from nonradiological traffic accidents. By comparison about 40,000 people are killed annually in U.S. traffic accidents.

Although the anticipated potential for radiation exposures would be small, DOE would use the "as low as reasonably achievable" principle for controlling exposures to workers and the public. For example, practices would be implemented to avoid or reduce production of potentially harmful substances and waste minimization would be practiced to reduce the toxicity and volume of secondary wastes to be managed. Furthermore, all sites would update their current worker training, emergency planning, emergency preparedness, and emergency response programs to address new spent nuclear fuel management activities.

Spent Nuclear Fuel-Related Employment

Under various alternatives, the total labor force involved in spent nuclear fuel management could decrease by 180 jobs or increase by more than 2,1 Of jobs, averaged over the period 1995 to 2005, as compared with the 1995 baseline (Figure 13). The peak employment is difficult to estimate because

it depends on implementation timing and funding profiles; however, Regionalization Alternative 4B (by geography) with the Nevada Test Site as the western site and Oak Ridge Reservation as the eastern site would result in the highest employment peak. The peak, estimated to be approximately 4,600 jobs in the year 2000, includes employment at sites preparing spent nuclear fuel for shipment to the selected sites.

Under the No Action alternative, employment would not increase substantially for any site, and the closure of the Expended Core Facility at the Idaho National Engineering Laboratory would result in a net loss of just over 500 spent nuclear fuel management-related jobs.

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Figure (Summary 30) Figure 11. Estimate of risk of latent cancer fatalities in general population from facility accidents for spent nuclear fuel management activities.

30 Summary

Figure (Summary 31) Figure 12. Estimate of average annual risk(b) from transportation for spent nuclear fuel management activities.

Summary 31

Figure (Summary 32) Figure 13. Change in the number of jobs averaged over the years 2005 for spent nuclear fuel management activities.

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Relocating large amounts of spent nuclear fuel, such as under Regionalization Alternative 4B (by geography) and the Centralization alternative, would eventually result in the closure of spent nuclear fuel management facilities at major DOE sites and, thus, long-term job loss at the closed facilities. However, some of the job losses at closed facilities would be accompanied by job gains at the sites receiving the shipped fuels. For all three Decentralization options, the 1992/1993 Planning Basis alternative and Regionalization Alternative 4A (Preferred Alternative), no more than an average additional 11,150 jobs would be required over the period 1995 to 2005 for implementation. Some of the more significant spent nuclear fuel employment requirements (particularly those involving the Hanford Site) would result from the development and operation of processing facilities needed to stabilize stored spent nuclear fuel. In addition, relocating the Expended Core Facility to sites other than the Idaho National Engineering Laboratory would result in an increase of about 500 jobs in the support of naval spent nuclear fuel examinations at those sites, and would result in a corresponding loss of approximately 500 jobs at the Idaho National Engineering Laboratory.

Thus, minor employment-related impacts are anticipated. To mitigate these impacts, DOE would coordinate its planning efforts with local communities and county planning agencies to address changes in community services, housing, infrastructure, utilities, and transportation. Such coordination with local planning agencies is intended to avoid placing undue burdens on local agency resources.

Generation of Radioactive Wastes

When spent nuclear fuel is stored onsite, very little high-level, transuranic, or mixed waste is generated (see Figure 14). These small quantities of radioactive wastes would usually be generated during stabilization activities. As a result, under the No Action alternative fewer than 20 cubic meters (26 cubic yards) per year of transuranic wastes would be generated from spent nuclear fuel management nationwide because spent nuclear fuel would not be stabilized. Under all other alternatives, where stabilization activities would occur, between 20 and 190 cubic meters (26 and 250 cubic yards) of high-level waste and between 20 and 90 cubic meters (26 and 120 cubic yards) of transuranic waste would be generated each year. The lower generation rates would occur in the Decentralization alternative, where small amounts of spent nuclear fuel would be transported among major DOE sites (and stabilization for transport would not be necessary).

For all other alternatives, greater amounts of spent nuclear fuel would be

transported among sites; therefore, more spent nuclear fuel would require stabilization before transport and more waste would be generated.

Low-level waste also is generated as a result of spent nuclear fuel management. Figure 15 indicates an estimated range of annual volumes for each of the alternatives. The higher values are principally the result of processing for stabilization.

To control the volume of waste generated and reduce impacts on the environment, pollution prevention practices would be implemented.

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Figure (Summary 34)Figure 14. Average volume of high-level, transuranic, and mixed generated per year over the years 1995 to 2005 for spent nuclear fuel management activities.

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Figure (Summary 35)Figure 15. Average volume of low-level wastes generated per year years 1995 to 2005 for spent nuclear fuel management activities.

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DOE is responding to Executive Order 12856, "Federal Compliance with Right to Know Laws and Pollution Prevention Requirements," and associated DOE orders and guidelines by reducing the use of toxic chemicals; improving emergency planning, response, and accident notification; and encouraging the development and use of clean technologies and testing of innovative pollution prevention technologies. Pollution prevention programs have already been implemented at DOE sites. Program components include waste minimization, source reduction and recycling, and procurement practices that preferentially procure products made from recycled materials.

Impact on DOE and Navy Missions

The mission concerns of DOE and the Navy relate to storing spent nuclear fuel safely, meeting obligations, preparing spent nuclear fuel for ultimate disposition, and examining naval fuel. Under the 1992/1993 Planning Basis, Regionalization, and Centralization alternatives, the missions of DOE and the Navy would be met. However, under the No Action and Decentralization alternatives, some parts of their current missions would not be achieved. DOE's mission is most severely impacted under the No Action alternative. In this alternative, only the minimal actions necessary would be undertaken to store spent nuclear fuel. This means that there would be no facility upgrades or replacements (except those needed for safe storage of spent nuclear fuel) and research and development activities would be limited to activities already approved. The consequences of pursuing this alternative could include any or all of the following:

- . Loss of margin in storage capacity
- . More frequent and possibly more costly repairs to equipment and facilities as the frequency of breakdowns increases
- . Eventual loss of the use of existing storage facilities because equipment or facilities are beyond repair or because there is no flexibility in storage capacity to permit repair work
- . Limited development of improved storage technologies and facilities, reducing DOE's ability to meet future needs and implement future decisions regarding ultimate disposition of spent nuclear fuel.

The Navy's mission would be hindered if the full examination of fuels at an Expanded Core Facility were not possible. No or limited examination would occur under the No Action alternative and Decentralization alternative (Options A, no examination, and B, limited examination). The examinations are an important aspect of the Navy's ongoing advanced fuel research and development program. The information derived from the examinations provides engineering data to support the design of new reactors, continued safety of

existing reactors, and improvements in nuclear fuel performance and reactor operation by providing confirmation of their proper design and allowing maximum use of their fuel.

The No Action alternative would also impact ongoing nuclear research and training activities at universities that have little or no storage capacity for spent nuclear fuel. Such activities would cease once storage capacity is exhausted.

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Cost of Implementation

Since publication of the draft EIS, DOE has completed an evaluation of potential costs associated with management of its spent nuclear fuel for an interim period (up to 40 years), and through ultimate disposition. For each alternative, the cost evaluation considered capital cost for upgrades to existing facilities and new facilities, operation and maintenance costs for existing and new facilities, decontamination and decommissioning costs for new facilities, and spent nuclear fuel transportation costs. Because each alternative would manage various amounts of spent nuclear fuel and the potential use of existing facilities would vary among alternatives, two cost ranges were considered—a minimum (lower) cost range that considered maximum use of existing facilities and a maximum (upper) cost range that minimized use of existing facilities in favor of additional new management facilities (Figure 16).

The cost analysis found that when use of existing facilities was maximized, it would be least costly to manage spent nuclear fuel under alternatives that involve sites with existing capabilities (e.g., Decentralization, 1992/1993 Planning Basis, and Regionalization), as opposed to the Centralization alternative that would require the construction of storage facilities (Figure 16).

When minimum use of existing facilities is considered, economies of scale would be realized as it is more cost effective to build and operate one larger facility than to build and operate several smaller facilities with the same combined capacity. Thus, for example, Regionalization 4A (by fuel type), in which all spent nuclear fuel would be transported to sites that have existing fuel management infrastructures, is less costly than the 1992/1993 Planning Basis and Decentralization alternatives (Figure 16).

Cumulative Impacts

A cumulative impact results from the incremental impact associated with implementing an alternative plus the impacts of other past, present, and reasonably foreseeable future actions. "Other" actions include DOE projects at the potentially affected sites not related to spent nuclear fuel management, as well as projects of other Government agencies, private businesses, or individuals.

On a nationwide basis, the implementation of any of the spent nuclear fuel management alternatives would not significantly contribute to cumulative impacts. Although impacts to the natural environment (for example, water, air, ecology, and land use) were analyzed, the cumulative impacts are very small, especially if impact avoidance and mitigation measures are taken. In general, the contribution to cumulative impacts from activities required for spent nuclear fuel management would be very small at sites where fuel is stored, in comparison to other ongoing and reasonably expected nonfuel-related projects. Even for those alternatives (Regionalization or Centralization) where the use of nonrenewable resources would be relatively large, increases in the impacts at the selected site(s) would be offset by changes at nonselected sites—resulting in a very small net change.

On a site-specific basis, the implementation of any of the alternatives would not significantly contribute to cumulative impacts. Generally, the contribution to cumulative impacts from spent nuclear fuel management activities at a specific site is minor, relative to other DOE and non-DOE

projects. Radiological emissions from normal operations and from transportation of

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Figure (Summary 38) Figure 16. Management costs for interim storage of spent nuclear through the year 2035.

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spent nuclear fuel would be well within regulatory requirements. The volumes of waste produced from fuel management activities would be a small addition to waste volumes generated by other ongoing and expected projects. Depending on the economic status and outlook for an area, spent nuclear fuel activities coupled with other actions could have the potential to strain or overburden the socioeconomic resources of certain areas, particularly if either the Regionalization or Centralization alternatives were implemented with the Expended Core Facility placed at the site. Although each site is anticipating an overall decline in site employment over the next few years, the in-migration of construction workers associated with proposed spent nuclear fuel management alternatives combined with other reasonably foreseeable activities could have small impacts on communities surrounding the Hanford Site, the Nevada Test Site, and the Oak Ridge Reservation. Such socioeconomic impacts would not be expected to occur at the other sites.

Environmental Justice

In February 1994, Executive Order 12898 entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low- Income Populations" was issued to federal agencies. This order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. Mitigation measures are to be identified, if necessary, and federal agencies are to increase communications with these communities, in order to promote increased awareness of Federal activities and involvement in Federal decisionmaking. In accordance with the Executive Order, an interagency Federal Working Group on Environmental Justice has been convened to provide guidance to agencies on implementation of environmental justice. Draft Guidance for Federal Agencies on Terms in Executive Order 12898 provide draft definitions of certain terms in the Executive Order. The definitions adopted for this Final EIS are consistent with the draft guidance. Disproportionately high and adverse human health effects are defined to occur when the risk or rate for a minority or low-income population from exposure to an environmental hazard significantly exceeds the risk or rate to the general population and, where available, to another appropriate comparison group. Disproportionately high and adverse environmental effects are defined to be any deleterious environmental impact affecting minority populations or low income populations that significantly exceed those on general population or other appropriate unit of geographic analysis. The programmatic management of DOE spent nuclear fuel and associated transportation was reviewed under each alternative. This review included potential impacts that would arise for each of the environmental disciplines, under normal operating conditions and under potential accident conditions, to minority and low- income communities within 50 miles (80 kilometers) of each potential site. Demographic information was gathered from the U.S. Census Bureau to identify minority populations and low-income communities in the zone of potential impact [(50 mile (80 kilometer)] surrounding each of the sites under consideration. Analysis of environmental justice concerns was based on a qualitative assessment of

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the human health and environmental impacts of each alternative. The analysis found that the impacts of the programmatic management of spent nuclear fuel under all alternatives would not constitute a disproportionately high and adverse impact on minority or low-income communities and, thus, do not present an environmental justice concern.

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Consultations and Environmental Requirements

DOE is committed to operating its spent nuclear fuel management program in compliance with all applicable environmental laws, regulations, executive orders, DOE orders, and permits and compliance agreements with regulatory agencies. The DOE regulations that implement the National Environmental Policy Act require consultation with other agencies, when appropriate, to incorporate any relevant requirements as early as possible in the process. These consultation and coordination requirements will commence and be completed as site-specific spent nuclear fuel management projects and decisions are proposed. To the extent that this EIS supports existing site-specific proposals, those consultations and coordination efforts are contained within Volume 1 Section 7.2 and Volume 2 Appendix B-3. DOE has reviewed all comments received on the draft EIS. To more fully understand, evaluate, and consider certain agency comments, consultations have taken place among agency, Idaho National Engineering Laboratory and Navy officials on the EIS.

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Relationship Between Volumes 1 and 2

DOE is currently in the process of making two important sets of decisions. The first involves programmatic (DOE-wide) decisions regarding DOE's future spent nuclear fuel management (addressed in Volume 1 of the EIS). The second involves site-specific decisions regarding the future direction of environmental restoration and waste management programs, which include spent nuclear fuel, at the Idaho National Engineering Laboratory (addressed in Volume 2 of this EIS).

DOE's programmatic decisions regarding spent nuclear fuel affect the Idaho National Engineering Laboratory-specific decisions about spent nuclear fuel. Therefore, the spent nuclear fuel

(Side_bar #: 13)

Volume 1-Programmatic Spent
Nuclear Fuel Management
Alternatives - Summary

No Action

Take minimum actions required for safe and secure management of spent nuclear fuel at, or close to, the generation site or current storage location.

Decentralization

Store most spent nuclear fuel at or close to the generation site or current storage location, with limited shipments to DOE facilities.

1992/1993 Planning Basis

Transport and store newly generated spent nuclear fuel at the Idaho National Engineering Laboratory or Savannah River Site. Consolidate some existing fuels at the Idaho National Engineering Laboratory or the Savannah River Site.

Regionalization

Distribute existing and projected spent nuclear fuel among DOE sites, based primarily on fuel type (Preferred Alternative) or on geography

Centralization

Manage all existing and projected spent

nuclear fuel inventories from DOE and the Navy at one site until ultimate disposition.

components of the Idaho National Engineering Laboratory-specific alternatives have been constructed to bear a relationship to those of Volume 1.

(Side_bar #: 14)

Volume 2-Idaho National
Engineering Laboratory Spent
Nuclear Fuel Management
Alternatives - Summary

No Action

- . Phase out inspection of naval spent nuclear fuel. Close Expended Core Facility.
- . Receive no non-naval spent nuclear fuel.
- . Phase out Idaho Chemical Processing Plant-603 storage pools.

Ten-Year Plan and Preferred

Alternative (for spent nuclear fuel)

- . Examine and store naval spent nuclear fuel.
- . Receive additional offsite spent nuclear fuel.
- . Transfer aluminum-clad spent nuclear fuel to Savannah River Site.
- . Phase out Idaho Chemical Processing Plant-603 storage pools.
- . Expand storage capacity in existing Idaho Chemical Processing Plant-666 pools.
- . Phase in dry storage.
- . Demonstrate electrometallurgical process.

Minimum Treatment, Storage, and Disposal

- . Phase out inspection of naval spent nuclear fuel. Close Expended Core Facility.
- . Transport all spent nuclear fuel to another DOE site.
- . Phase out spent nuclear fuel handling facilities.
- . Demonstrate electrometallurgical process.

Maximum Treatment, Storage, and Disposal

- . Examine and store naval spent nuclear fuel.
 - . Receive DOE-wide spent nuclear fuel.
 - . Phase out Idaho Chemical Processing Plant-603 storage pools.
 - . Expand storage capacity in existing Idaho Chemical Processing Plant-666 pools.
 - . Phase in expanded dry storage.
 - . Demonstrate electrometallurgical process.
 - . Phase in spent nuclear fuel stabilization.
-

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Volume 2 - INEL Environmental Restoration and Waste Management

Overview

The Idaho National Engineering Laboratory's mission is to develop, demonstrate, and deploy advanced engineering technologies and systems to improve national competitiveness and security, to make the production and use of energy more efficient, and to improve the quality of life and the environment. The environmental restoration program includes activities to assess and clean up inactive Idaho National Engineering Laboratory operations, including waste sites where there are known or suspected releases of harmful substances into the environment, and to safely manage contaminated surplus nuclear facilities. Waste management program activities are designed to protect Idaho National Engineering Laboratory employees, the public, and the environment in the design, construction, maintenance, and operation of treatment, storage, and disposal facilities in a cost-effective, environmentally sound, regulatory compliant, and publicly acceptable manner.

Figure (Summary 45)The Idaho National Engineering Laboratory is located in southeas

(Side_bar #: 15)

What Are Environmental Restoration and Waste Management?

Environmental Restoration: The cleanup and restoration of sites and decontamination and decommissioning of facilities contaminated with radioactive and/or hazardous substances during past production, accidental releases, or disposal activities.

Waste Management: The planning, coordination, and direction of those functions related to generation, minimization, handling, treatment, storage, transportation, disposal of waste, as well as associated surveillance and maintenance activities. Spent nuclear fuel management at the Idaho National Engineering Laboratory includes (a) accepting and examining shipments from generators or from other storage sites, (b) setting standards and approving methods for storing spent nuclear fuel and preparing (stabilizing) it for such storage, (c) constructing and operating facilities for stabilization, plus interim storage, (d) consolidating storage and r outdated storage facilities, and (e) developing criteria and technologies for ultimate disposition of spent nuclear fuel (or its components). DOE is developing spent nuclear fuel management plans for a 40-year timeframe that are anticipated to be sufficient to cover the period during which ultimate disposition will be established for DOE's spent nuclear fuel.

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Waste Management, Environmental Restoration, Spent Nuclear Fuel, and

Technology Development at the INEL

Waste Management

Waste management includes minimization, characterization, treatment, storage, and disposal of waste generated from ongoing Idaho National Engineering Laboratory activities and from the Environmental Restoration Program at nine major facility areas. The Waste Management Program ensures that current and future waste management practices minimize any additional adverse environmental impacts. This is accomplished through such practices as waste reduction and recycling and such treatment technologies as volume reduction and waste separation techniques. Table 1 summarizes the primary functions of each facility area.

Figure (Summary 47)Calcination is one form of waste management

Environmental Restoration

The Idaho National Engineering Laboratory Environmental Restoration Program addresses contamination resulting from the past 50 years of operations. The goals of the Environmental Restoration Program are to clean up past environmental contamination and to decontaminate and decommission facilities that are no longer needed (surplus). The cleanup program is conducted under a Federal Facility Agreement and Consent Order, entered into by the DOE, the U.S. Environmental Protection Agency, and the State of Idaho, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.

Since 1986, about 500 suspected release sites have been identified for investigation. Potential release sites were grouped together for efficiency into 10 areas called Waste Area Groups. Nine of the groups are roughly equivalent to the major facility areas at the Idaho National Engineering Laboratory. Waste Area Group 10 includes a site-wide area associated with the Snake River Plain Aquifer and surface and subsurface areas that are not addressed by the other nine Waste Area Groups. Of the approximately 500 sites, over 270 have been proposed or designated as requiring no further action.

Sources of contamination include spills, abandoned tanks, septic systems, percolation ponds, landfills, and injection wells. Contaminated sites range in size from large facilities such as the pits and trenches at the Radioactive Waste Management Complex to small areas where minor spills have occurred.

Environmental restoration also involves safely managing contaminated surplus nuclear facilities until they are decontaminated for reuse or are decommissioned.

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Table 1. Functions of major facility areas at the Idaho National Engineering Labora

Major facility area	Function performed
Test Area North	Handle and evaluate irradiated materials; support energy and defense programs; demonstrate dry cask stor of spent nuclear fuel; store spent nuclear fuel.
Test Reactor Area	Study effects of radiation on materials, fuels, and equipment; manage seven reactors (two operating, two i standby, three deactivated); perform chemistry and physics experiments.
Idaho Chemical Processing Plant	Receive and store spent nuclear fuel; prepare high-lev and solid waste for disposition; develop and apply tec for eventual disposition of spent nuclear fuel, dispos sodium-bearing and high-level waste, and management of radioactive and hazardous wastes.
Central Facilities Area	Provide technical and support services for the Idaho National Engineering Laboratory, including environmental monitoring and calibration laboratories, communication systems, security, fire protection, medical services, warehouse, cafeteria, vehicle and equipment pools, and bus operations; operate Hazardous Waste Storage Facility and Idaho National Engineering Laboratory Landfill Complex.
Power Burst Facility/ Auxiliary Reactor Area	Support waste management-related research (volume reduction and waste immobilization); develop decontamination, waste storage and treatment technolog
Experimental Breeder Reactor- I/ Boiling Water Reactor Experiment	National Historic Landmark
Radioactive Waste Management Complex	Store and dispose of wastes; support research and development for interim storage of transuranic waste, low-level waste disposal, buried waste remediation

Low-Level Waste: Waste that contains radioactivity and is not classified as high-level waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for development only, and not for the production of power or plutonium, may be classified provided the concentration of transuranic elements is less than 100 nanocuries per gram of waste.

Mixed Waste: Waste that contains both hazardous waste under the Resource Conservation and Recovery Act and source, special nuclear, or byproduct material subject to the Atomic Energy Act.

Special-Case Waste: Waste that is owned or generated by DOE that does not fit into management plans developed for the major radioactive waste types.

Transuranic Waste: Waste containing more than 100 nanocuries of alpha-emitting transuranic material per gram of waste, with half-lives greater than 20 years, except for (a) high-level waste that the DOE has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by Federal Regulations Part 191, and (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Title 10 Code of Federal Regulations.

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Purpose and Need for Future Environmental Restoration and Waste Management

DOE is responsible by law for spent nuclear fuel management, waste management, and environmental restoration at the Idaho National Engineering Laboratory in southeastern Idaho. Under the Atomic Energy Act of 1954, DOE is also responsible for managing certain spent nuclear fuels. DOE also is responsible for managing wastes and controlling hazardous substances in a manner that protects human health and the environment under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended; the Resource Conservation and Recovery Act of 1976; the Federal Facility Compliance Act of 1992; and other laws. DOE is committed to comply with these and all other applicable federal and state laws and regulations, DOE orders, and interagency agreements governing spent nuclear fuel, environmental restoration, and waste management.

Over the past 50 years, DOE activities have resulted in the accumulation of spent nuclear fuel; waste requiring treatment, storage, and disposal; and sites requiring cleanup. To better fulfill its responsibilities, DOE needs to develop and implement a program for spent nuclear fuel management, environmental restoration, and waste management at the Idaho National Engineering Laboratory. To establish an effective program for the foreseeable future (focused on the next 10 years), DOE needs to make site-specific decisions that would accomplish three major goals: (a) support research and development missions at the Idaho National Engineering Laboratory; (b) comply with legal requirements governing spent nuclear fuel management, environmental restoration, and waste management, and (c) manage spent nuclear fuel; treat, store, and dispose of waste; and conduct environmental restoration activities at the Idaho National Engineering Laboratory in an environmentally sound manner.

To achieve these goals, DOE needs to develop appropriate facilities and technologies for managing waste and spent nuclear fuel expected during the next 10 years; to more fully integrate all environmental restoration and waste management activities at the Idaho National Engineering Laboratory to achieve cost and operational efficiencies, including pollution prevention and waste minimization; and to responsibly manage environmental impacts from environmental restoration and waste management activities.

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What Are the INEL Decisions to Be Made Based on This EIS?

Spent Nuclear Fuel: What is the appropriate strategy of the Idaho National Engineering Laboratory to implement DOE's national spent nuclear fuel decisions regarding transportation, receipt, processing, and storage of spent nuclear fuel? What is the appropriate storage capacity for spent nuclear fuel?

Environmental Restoration and Waste Management: What is the appropriate strategy of the Idaho National Engineering Laboratory to implement DOE's national environmental restoration and waste management decisions?

What are the appropriate cleanup activities under the Comprehensive Environmental

Response, Compensation, and Liability Act of 1980, as amended, and the Federal Facility Agreement and Consent Order of 1991?

What are the necessary capabilities, facilities, research and development, and tech for treating, storing, and disposing of each waste type?

What treatment technologies should be used for sodium-bearing and high-level wastes other radioactive and mixed waste?

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Alternatives

DOE has chosen alternatives that represent a range of possible actions: No Action (A); Ten-Year Plan (B); Minimum Treatment, Storage, and Disposal (C); and Maximum Treatment, Storage, and Disposal (D). The Preferred Alternative is an enhanced Alternative B (see adjacent text box). Alternatives C and D were defined to provide the extremes of minimum and maximum impacts at the Idaho National Engineering Laboratory during the 1995 to 2005 time period. The impacts of Alternatives C and D would bound any reasonably foreseeable alternatives that would be selected as a result of this EIS.

Each alternative includes components for cleanup, decontamination and decommissioning, waste management, and spent nuclear fuel management. Infrastructure, technology development, and transportation were also considered. The alternatives, which reflect the public scoping process, take the following factors into account:

- . The sources of waste and spent nuclear fuel that (a) exist at the Idaho National Engineering Laboratory as of June 1995, (b) would be generated between 1995 and 2005, and (c) might be transported to the Idaho National Engineering Laboratory from other sites.
- . The practical waste and spent nuclear fuel management options, including characterization, storage, and disposal, or stabilization (spent nuclear fuel) and treatment (waste).
- . The locations at which the waste and spent nuclear fuel management could reasonably be undertaken, either on or off the Idaho National Engineering Laboratory site.

Given this, DOE determined the projects and actions needed to manage

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Alternatives

A (No Action)

Complete all near-term actions identified and continue operating most existing facilities. Serves as benchmark for comparing potential effects from the other three alternatives.

B (Ten-Year Plan)

Complete identified projects and initiate new projects to enhance cleanup, manage the Idaho National Engineering Laboratory waste streams and spent nuclear fuel, prepare waste for final disposal, and develop technologies for spent nuclear fuel ultimate disposition.

C (Minimum Treatment, Storage, and Disposal)
 Minimize treatment, storage, and disposal activities at the Idaho National Engineering Laboratory to the extent possible (including receipt of spent nuclear fuel). Conduct minimum cleanup and decontamination and decommissioning prescribed by regulation. Transfer spent nuclear fuel and waste from environmental restoration activities to another site.

D (Maximum Treatment, Storage, and Disposal)
 Maximize treatment, storage, and disposal functions at the Idaho National Engineering Laboratory to accommodate waste and spent nuclear fuel from DOE facilities. Conduct maximum cleanup and decontamination and decommissioning.

Preferred Alternative
 Complete activities as in Alternative B (Ten-year Plan), plus accept offsite transuranic and mixed low-level waste for treatment and return treated waste to the source generator or to approved disposal facilities. Plan for a high-level waste treatment facility that minimizes resulting high-activity waste. Transfer aluminum-clad spent nuclear fuel to Savannah River Site.

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 the waste and spent nuclear fuel associated with each alternative. This EIS provides the analysis required under the National Environmental Policy Act for certain projects that DOE proposes as part of the spent nuclear fuel, environmental restoration, and waste management program at the Idaho National Engineering Laboratory

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Projects Related to Alternatives

In addition to current operations and activities at the Idaho National Engineering Laboratory, there are 49 projects that form the basis for analysis of reasonably foreseeable future impacts in Volume 2. These 49 projects fall under the various Alternatives A, B, C, D, and the Preferred Alternative. The 49 projects include 12 whose National Environmental Policy Act documentation is already completed or was proposed to be completed before the Record of Decision. An objective of Volume 2 an 5 appendices is to provide sufficient analysis for another 12 projects (listed belc allow timely deployment if needed for the project. DOE would evaluate the remaining projects on a case-by-case basis to determine if any additional National Environmen Policy Act review or further evaluation is needed before implementing the project.

	Alternative (a)
. Expeded Core Facility Dry Cell Project	B, D, P
. Increased Rack Capacity for Building 666 at the Idaho Chemical Processing Plant	B, D, P
. Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	B, C, D(b), P

Fort St. Vrain Spent Nuclear Fuel Shipment and Storage	B, D, P
Tank Farm Heel Removal Project	B, C, D, P
High-Level Tank Farm New Tanks	C, D
Shipping/Transfer Station	C
Waste Experimental Reduction Facility Incineration	B, D, P
Nonincinerable Mixed Waste Treatment	B, D(b), P
Sodium Processing Project	B, D, P
Gravel Pit Expansions	B, D(b), P
Calcine Transfer Project	B, D, P

a. Alternative A = No Action, Alternative B = Ten-Year Plan, Alternative C = Minimum Storage, and Disposal, Alternative D = Maximum Treatment, Storage, and Disposal, Alternative P = Preferred Alternative.

b. These projects would be expanded for Alternative D (Maximum Treatment, Storage, Disposal).

Alternative A (No Action)

Under Alternative A (No Action), existing environmental restoration and waste management operations and projects would continue. Research and development and infrastructure facilities and projects that support the environmental restoration and waste management program at the Idaho National Engineering Laboratory would also continue. There would be no shipments of spent nuclear fuel to the Idaho National Engineering Laboratory, with the exception of shipments of naval fuel during an approximately three-year transition period. Existing inventories of spent nuclear fuel would remain in storage onsite. Activities and projects would include those that may be initiated after June 1995 but that were proposed to have been evaluated under the National Environmental Policy Act by that date. New activities would be limited to those required to maintain safe operation. Implementation of Alternative A (No Action) would not fully meet all negotiated agreements and commitments under the Federal Facility Agreement and Consent Order and obligations to receive spent nuclear fuel from universities and Fort St. Vrain.

Alternative A (No Action) represents a baseline against which the potential environmental impacts of the other alternatives can be compared.

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Alternative A (No Action)

Spent Nuclear Fuel: Phase out examination of naval spent nuclear fuel after an approximate three-year transition period; no other fuels would be received; phase out storage pools at Building 603 of the Idaho Chemical Processing Plant.

Environmental Restoration: Conduct no activities other than already approved projects; decontaminate and decommission Auxiliary Reactor Area (ARA)-11 and Boiling Water Reactor Experiment (BORAX)-V; clean up groundwater and vadose zone contamination; retrieve and treat Pit 9 waste.

High-Level Waste: Convert liquid to solid calcine.

Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new storage; transport transuranic waste offsite for disposal; accept offsite waste for storage on case-by-case basis.

Low-Level Waste: Treat onsite and offsite; dispose of onsite in existing facility.

Mixed Low-Level Waste: Treat onsite (nonincineration).

Greater-than-Class-C Waste: Continue management programs.

Hazardous Waste: Transport offsite for treatment, storage, and disposal.

Alternative B (Ten-Year Plan)

Under Alternative B (Ten-Year Plan), existing environmental restoration and waste management facilities and projects would continue to be managed. In addition to current facilities and projects, those proposed for 1995 through 2005 would be implemented to meet the current Idaho National Engineering Laboratory mission and to comply with negotiated agreements and

commitments.

Under this alternative, spent nuclear fuel, environmental restoration, and waste management activities would be continued and enhanced to meet expanded spent nuclear fuel and waste handling needs. These enhanced activities would be needed to comply with regulations and agreements and would result from acceptance of additional offsite materials and waste. Waste generation from onsite sources would increase because of increased decontamination and decommissioning and environmental restoration activities. Spent nuclear fuel and selected waste would be received from other DOE sites and aluminum-clad spent nuclear spent fuel would be transferred to the Savannah River Site. Onsite management would emphasize greater treatment and disposal capabilities, compared with Alternative A (No Action). Additional cleanup and decommissioning and decontamination projects would be conducted under this alternative.

Alternative C (Minimum Treatment, Storage, and Disposal)

Under Alternative C (Minimum Treatment, Storage, and Disposal), ongoing Idaho National Engineering Laboratory spent nuclear fuel and waste management activities, along with materials and waste, would be transferred to other locations to the extent possible. Possible locations include DOE facilities, other Government sites, or private sector locations. Minimal treatment, storage, and disposal activities would be located at the Idaho National Engineering Laboratory. Waste and spent nuclear fuel would not be received from offsite sources for management by the Idaho National Engineering Laboratory. Whenever feasible, wastes generated from onsite environmental
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Alternative B (Ten-Year Plan)

Spent Nuclear Fuel: Receive additional offsite spent nuclear fuel; transfer aluminum clad spent nuclear fuel to Savannah River Site; examine and store naval spent nuclear fuel; complete Expanded Core Facility Dry Cell Project and expand storage capacity pools at Building 666 of the Idaho Chemical Processing Plant; phase out pools at Building 603 of the Idaho Chemical Processing Plant; phase in new dry storage; demonstrate electrometallurgical process at Argonne National Laboratory-West.

Environmental Restoration: Conduct all planned projects in all Waste Area Groups; decontaminate and decommission Auxiliary Reactor Area (ARA)-11, Boiling Water Reactor Experiment (BORAX)-V, Engineering Test Reactor, Materials Test Reactor, Fuel Processing Complex, Fuel Receipt/Storage Facility, Headend Processing Plant, Waste Calcine Facility, and Central Liquid Waste Processing Facility; clean up groundwater contamination and vadose zone; retrieve and treat Pit 9 wastes.

High-Level Waste: Convert liquid to calcine (solid); construct a facility to immobilize both liquid and solid calcine.

Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new storage; treat offsite and onsite transuranic and alpha low-level waste; transport transuranic waste offsite for disposal; accept transuranic waste from offsite for treatment.

Low-Level Waste: Treat onsite and offsite; construct and operate additional treatment and disposal facilities onsite.

Mixed Low-Level Waste: Treat onsite by incineration and nonincineration; construct and operate facilities to treat waste by incineration and nonincineration; construct and operate disposal facility; transport waste offsite for treatment and disposal.

Greater-than-Class-C Waste: Receive sealed sources for recycle or storage; construct dedicated storage facility.

Hazardous Waste: Transport offsite for treatment, storage, and disposal.

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Alternative C (Minimum Treatment, Storage, and Disposal)

Spent Nuclear Fuel: Transport Idaho National Engineering Laboratory spent nuclear fuel from DOE site; continue to examine and store naval spent nuclear fuel during approximate

period; phase out spent nuclear fuel handling facilities; demonstrate electrometall National Laboratory-West.
Environmental Restoration: Conduct all planned projects for all Waste Area Groups; decommission Auxiliary Reactor Area (ARA)-11, and Boiling Water Reactor Experiment institutional controls to the extent possible for cleanup projects; clean up ground treat Pit 9 wastes.
High-Level Waste: Select technology and plan immobilization facility; develop treat high-activity waste; construct replacement liquid storage tanks.
Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new stora waste offsite for disposal; transport waste to offsite DOE facility for storage.
Low-Level Waste: Transport to other DOE facilities for treatment, storage, and disp
Mixed Low-Level Waste: Transport offsite for treatment, storage, and disposal.
Greater-than-Class-C Waste: Discontinue management programs.
Hazardous Waste: Transport offsite for treatment, storage, and disposal.

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restoration activities would be minimized by emphasizing institutional controls over treatment options. Only current cleanup and decommissioning and decontamination projects would be conducted under this alternative. Existing onsite spent nuclear fuel and waste management capability would be expanded to the extent needed to comply with regulations and agreements.

Alternative D (Maximum Treatment, Storage, and Disposal)

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Alternative D (Maximum Treatment, Storage, and Disposal)

Spent Nuclear Fuel: Examine and store naval spent nuclear fuel; receive DOE spent n storage capacity in pools at Building 666 of the Idaho Chemical Plant; phase in exp out storage pools at Building 603 of the Idaho Chemical Processing Plant; phase in stabilization; demonstrate electrometallurgical process.
Environmental Restoration: Conduct planned projects for all Waste Area Groups; decc decommission Auxiliary Reactor Area (ARA)-11, Boiling Water Reactor Experiment (BOR Test Reactor, Materials Test Reactor, Fuel Processing Complex, Fuel Receipt/Storage Processing Plant, Waste Calcine Facility, and Central Liquid Waste Processing Facil future land use to the extent possible for cleanup projects; clean up groundwater a and treat Pit 9 wastes.
High-Level Waste: Convert liquid to calcine; select technology and plan immobilizat treatment to minimize high-activity waste; construct replacement liquid storage tan
Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new stora transuranic waste offsite for disposal; accept offsite transuranic waste; treat off waste and alpha low-level waste; dispose of alpha low-level waste at new onsite fac
Low-Level Waste: Receive offsite waste; treat waste onsite; construct and operate a disposal facilities onsite.
Mixed Low-Level Waste: Receive offsite waste; treat waste onsite by incineration an construct facilities for onsite incineration and nonincineration treatment; constru facility; transport waste offsite for treatment and disposal.
Greater-than-Class-C Waste: Receive sealed sources for recycle or storage; construc facility.
Hazardous Waste: Transport waste offsite for treatment, storage, and disposal; poss treatment, storage, and disposal facility.

Under Alternative D (Maximum Treatment, Storage, and Disposal), spent nuclear fuel and waste would be transferred from other DOE facilities to the Idaho National Engineering Laboratory for management to the extent possible. Environmental restoration activities would emphasize residential use as the preferred end land use, which potentially would result in maximum waste generation. Implementation of this alternative would require additional projects not yet defined or the expansion of identified projects [compared with Alternative B (Ten-Year Plan)]. Acceptance of waste and spent nuclear fuel from other sites would be maximized. Wastes generated from environmental restoration and waste management activities onsite would be increased over that of the other

alternatives. Spent nuclear fuel and environmental restoration and waste management activities at the

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Idaho National Engineering Laboratory would be continued and enhanced to meet current and expanded spent nuclear fuel and waste handling needs. These enhancements would be needed to comply with regulations and agreements and to allow for acceptance of additional offsite-generated materials and waste. Onsite management would emphasize greater treatment and disposal capabilities compared with Alternative B (Ten-Year Plan). For decontamination and decommissioning projects, complete dismantlement and restoration would be emphasized where possible and, therefore, the volume of wastes generated would be significantly greater than under Alternative B (Ten-Year Plan).

Figure (Summary 58)(1) Low-level waste burial pit

Figure (Summary 58)(2) The Waste Experimental Reduction Facility

Figure (Summary 58)(3) One mode of transporting waste

Figure (Summary 58)(4) Air support weather shield at the Radioactive Waste Management Summary

Preferred Alternative

Under the Preferred Alternative, similar to the activities described under Alternative B (Ten-Year Plan), existing environmental restoration and waste management facilities and projects would continue to be operated. In addition to existing facilities and projects, projects proposed under Alternative B for 1995 through 2005 would be implemented to meet the current Idaho National Engineering Laboratory mission and to comply with negotiated agreements and commitments (see Projects Related to Alternatives on page 54).

Ongoing spent nuclear fuel management, environmental restoration, and waste management activities would be continued and enhanced to meet current and expanded spent nuclear fuel and waste handling needs. These enhanced activities would be needed to comply with regulations and agreements and would result from acceptance of additional offsite-generated materials and waste. Waste generation from onsite sources would increase (reflecting regulatory requirements and increased environmental restoration activities). Spent nuclear fuel, transuranic, and mixed low level waste would be received from other sites. INEL would receive waste depending on decisions based on Site Treatment Plans negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic Environmental Impact Statement. The transuranic waste and mixed low-level waste received from other DOE sites would be treated, and the residue returned to the original DOE site (generator) or transported to an approved offsite disposal facility, as negotiated under the Federal Facility Compliance Act with the State of Idaho and the Environmental Protection

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Preferred Alternative

Spent Nuclear Fuel: Receive additional non-aluminum-clad offsite spent nuclear fuel; transfer aluminum-clad spent nuclear fuel to Savannah River Site; examine and store naval spent nuclear fuel; complete Expended Core Facility Dry Cell Project and expand storage capacity in pools at Building 666 of the Idaho Chemical Processing Plant; phase out pools at Building 603 of the Idaho Chemical Processing Plant; phase in new dry storage; demonstrate electrometallurgical process at Argonne National Laboratory-West.

Environmental Restoration: Conduct all planned projects in all Waste Area Groups; decontaminate and decommission Auxiliary Reactor Area (ARA)-11, Boiling Water Reactor Experiment (BORAX)-V, Engineering Test Reactor, Materials Test Reactor, Fuel Processing Complex, Fuel Receipt/Storage Facility, Headend Processing Plant, Waste Calcine

Facility, and Central Liquid Waste Processing Facility; clean up groundwater contamination and vadose zone; retrieve and treat Pit 9 wastes.

High-Level Waste: Convert liquid to calcine; develop treatment that minimizes high-activity waste; plan a facility to immobilize both liquid and solid calcine.

Transuranic Waste: Retrieve/move onsite transuranic and alpha low-level waste to new storage; treat offsite and onsite transuranic and alpha low-level waste; transport transuranic waste offsite for disposal; accept transuranic waste from offsite for treatment; return treated offsite waste to the generator or an approved offsite disposal site.

Low-Level Waste: Treat onsite and offsite; construct and operate additional treatment and disposal facilities onsite.

Mixed Low-Level Waste: Treat onsite by incineration and nonincineration; construct and operate facilities to treat waste by incineration and nonincineration; construct and operate disposal facility; transport waste offsite for treatment and disposal; accept offsite mixed low-level waste for treatment; return treated offsite waste to the generator or an approved offsite disposal site.

Greater-than-Class-C Waste: Receive sealed sources for recycle or storage; construct dedicated storage facility (may or may not be located at Idaho National Engineering Laboratory).

Hazardous Waste: Transport offsite for treatment, storage, and disposal.

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Agency, and with other affected States. Ongoing remediation and decommissioning and decontamination projects would be continued and additional projects would be conducted.

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Affected Environment at the INEL

The Idaho National Engineering Laboratory is located on 890 square miles (230,000 hectares) west of the City of Idaho Falls in southeast Idaho. The site sits on the Eastern Snake River Plain and is bordered by the Bitterroot, Lemhi, and Lost River mountain ranges. Local rivers and streams drain the mountain watersheds, but most surface water is diverted for irrigation before it reaches the site boundaries. Site activities do not directly affect surface water quality outside the site because current discharges from facilities go to seepage and evaporation basins or storm water injection wells.

The Idaho National Engineering Laboratory overlies the Snake River Plain Aquifer, the largest aquifer in Idaho. Subsurface water quality near the site is affected by natural water chemistry and contaminants originating at the site. Previous waste discharges to unlined ponds and deep wells have introduced radionuclides, nonradioactive metals, inorganic salts, and organic compounds into the subsurface. Because of improved waste management practices, these discharges no longer occur and groundwater quality continues to improve. Only extremely low concentrations of radioactive iodine (iodine-i 29) and tritium have ever migrated beyond the site boundary; tritium no longer migrates offsite and iodine-i 29 concentrations are well below maximum contaminant levels (upper allowable limit in drinking water) established by the U.S. Environmental Protection Agency. Idaho National Engineering Laboratory activities result in radiological air emissions; however, these are very low (less than background radiation) and well within standards. Nonetheless, Idaho National Engineering Laboratory workers may be exposed to radiation through their work. Those who may receive more than 0.1 rem per year (DOE's administrative limit is 2.0 rem) are monitored. About 32 percent of workers monitored between 1987 and 1991

received measurable radiation doses.

The Idaho National Engineering Laboratory primarily consists of open, undeveloped land covered predominantly by sagebrush and grasslands with animal communities typical of these vegetation types. Two Federal endangered and nine candidate animal species have the potential for occurring, and nine animal species of special concern (State listing) occur at the Idaho National Engineering Laboratory. Eight plant species identified as sensitive, rare, or unique by other Federal agencies and the Idaho Native Plant Society also occur at the Idaho National Engineering Laboratory. Radionuclides have been found above background levels in individual plants and animals adjacent to facilities, but have not been observed at the population, community, or ecosystem levels. Many land areas and plants on the Idaho National Engineering Laboratory are important to the Shoshone-Bannock Tribes. Certain plants are used as medicines, food, tools, fuel and in traditional practices. Land areas of importance to the Shoshone-Bannock Tribes

Figure (Summary 61) View of the Snake River Plain.

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include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, and the Big Lost River.

The Idaho National Engineering Laboratory site has a varied inventory of cultural resources. These include fossil localities, prehistoric archaeological sites, historic sites, and facilities associated with the development of nuclear science in the United States. Similarly, because Native American people hold the land sacred, in their terms the entire Idaho National Engineering Laboratory is culturally important.

Most land within the site boundaries is used for grazing or is general open space. Only about 2 percent of the 890 square miles (230,000 hectares) is used for facilities and operations, with another 6 percent devoted to public roads and utility rights-of-way. Over 97 percent of Idaho National Engineering Laboratory employees live in the seven counties surrounding the site. The regional economy relies on farming, ranching, and mining. The Idaho National Engineering Laboratory accounts for approximately 10 percent of the total regional employment.

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Environmental Consequences

The environmental consequences of the site-specific alternatives have been assessed for the Idaho National Engineering Laboratory and the surrounding region. The environmental impact analyses are based on conservative assumptions (that is, with a tendency to overestimate). Analytical approaches were designed to provide a reasonable projection of the maximum reasonably foreseeable consequences. The potential effects of each alternative were estimated by evaluating each individual project proposed for the alternative, summing the projects' collective effects under each alternative, and including interactions among the individual projects that compose each alternative. Cumulative impacts were determined by evaluating past, present, and reasonably foreseeable future actions of DOE and non-DOE projects or activities, in combination with the alternatives. Although the impact to each environmental discipline (for example, land use or employment) is assessed in greater detail in Volume 2, this Summary focuses on potential adverse impacts that DOE has found to be of greater interest to the public, as demonstrated through the scoping process, comments on the Draft EIS, and other public involvement programs at the Idaho National Engineering Laboratory.

In addition, the impacts presented in this Summary reflect the Preferred Alternative, which is essentially the Ten-Year Plan (Alternative B) modified to include elements of other alternatives. Impacts under the Preferred Alternative would be similar to those of the Ten-Year Plan and less than those of Alternative D (Maximum Treatment, Storage, and Disposal).

Air Quality

The operation of specific projects associated with the alternatives would result in airborne emissions of radionuclides, criteria pollutants (e.g., sulfur dioxide, particulate matter), and toxic air pollutants (e.g., benzene, mercury). The effects of these emissions have been analyzed and compared with standards and criteria which are appropriate for comparison. The results indicate that, although some degradation of air quality could occur, all impacts would be below applicable standards established for public health and welfare. Measures such as administrative controls and best available control technology would be used as needed to minimize these impacts.

Atmospheric visibility has been specifically designated as an air-quality-related value under the 1977 Prevention of Significant Deterioration Amendments to the Clean Air Act. Conservative, screening-level analyses have been applied to estimate potential impacts related to visibility degradation at Craters of the Moon Wilderness Area [about 12 miles (20 kilometers) southwest of the Idaho National Engineering Laboratory]. The results indicate that for all alternatives, including the Preferred Alternative, there would be no perceptible changes in contrast, but potential impacts related to color shift could result. If the application of refined modeling confirms the findings of the screening-level analyses, measures such as the use of emissions controls or relocation of projects would be required to prevent these impacts. The visual setting, particularly in the Middle Butte area of the Idaho National Engineering Laboratory, is considered by the Shoshone-Bannock Tribes to be an important Native American resource. The Shoshone-Bannock Tribes would be consulted before any projects were developed that could have impacts

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to resources of importance to the tribes. For all alternatives, including the Preferred Alternative, radiation doses to offsite individuals and site workers would be below applicable limits. Similarly, projected ambient air levels of toxic air pollutants would be below applicable standards for all alternatives.

Concentrations of criteria pollutants from operation of existing and proposed projects at the Idaho National Engineering Laboratory were also found to be below State and National Ambient Air Quality Standards and Prevention of Significant Deterioration limits for all alternatives. Criteria pollutant levels associated with the alternatives represent only minor increases over existing baseline levels. As a result, the cumulative (alternatives plus baseline) levels would not differ much between alternatives.

Construction and remediation activities would result in short-term, elevated levels of particulate matter in localized areas. Under all alternatives, including the Preferred Alternative, construction activities would result in maximum 24-hour concentrations of particulate matter at locations along public roads that exceed the State and Federal standards. Particulate levels at the site boundary would not exceed these standards. Standard construction practices such as watering would be used to minimize dust generation during the activities.

The air quality was evaluated in light of past, present, and reasonably foreseeable future actions, including DOE projects not associated with the spent nuclear fuel, environmental restoration, and waste management programs, plus offsite projects conducted by Government agencies businesses, or individuals. This impact analysis found that the contribution to cumulative impacts from operation of projects associated with the alternatives would be low relative to other projects, and within limits prescribed by applicable standards.

Cultural Resources

Methods to identify, evaluate, and mitigate impacts to cultural resources have been established through the National Historic Preservation Act, as amended; the Archaeological Resource Protection Act; the Native American Graves Protection and Repatriation Act; and the American Indian Religious Freedom Act. Potential impacts to cultural resources were assessed by identifying project activities that could affect known or expected significant resources and determining whether a project activity would have an effect on significant resources. A project would affect a significant resource if it would alter the resource's characteristics.

Geographically, the Idaho National Engineering Laboratory site is included within a large territory once inhabited by and still of importance to the Shoshone-Bannock Tribes. However, the site lies outside the land boundaries established by the Fort Bridger Treaty and is occupied by the DOE.

Because some projects are not yet fully defined, the impacts to cultural resources cannot be completely identified. The impacts to cultural resources would depend on the (a) amount of surface disturbance [ranges from about 40 acres (16 hectares) under Alternative A (No Action) to about 1,340 acres (542 hectares) under Alternative D (Maximum Treatment, Storage, and Disposal)]; (b) degree to which these areas have been surveyed for resources and the number of potentially affected structures [6 for Alternative A (No

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Action) and 11 for Alternative C (Minimum Treatment, Storage, and Disposal) and 11 for the Preferred Alternative and 70 for Alternatives B (Ten-year Plan) and D (Maximum Treatment, Storage, and Disposal)]; and (c) number of known cultural resource sites (22 for Alternatives B and D and the Preferred Alternative). For any alternative, DOE would conduct detailed preconstruction surveys and would consult with the State Historic preservation Office and Native American Groups, before any undertaking, to determine the appropriate measures to minimize impacts to significant resources.

In general, Alternatives A and C would have a lesser effect on cultural resources than the Preferred Alternative, and Alternatives B and D.

Ecology

The Idaho National Engineering Laboratory primarily consists of open, undeveloped land covered predominantly by sagebrush and grasslands with animal communities typical of these vegetation types. Radionuclides have been found above background levels in individual plants and animals adjacent to facilities, but I effects have not been observed at the population, community, or ecosystem levels.

Under Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), limited environmental restoration activities would be undertaken, resulting in the long-term presence of radioactive and hazardous wastes in the environment. Plants and animals would continue to be exposed to these wastes. The Preferred Alternative and Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would result in a decrease in radioactive uptake over the long-term as environmental restoration activities proceed.

Implementation of any alternative would result in the loss of habitat from facility modification and construction. Alternative D would have the greatest estimated consequences, followed by Alternative B, the Preferred Alternative, Alternative C and Alternative A. Implementation of Alternative D (Maximum Treatment, Storage, and Disposal) would claim about 1,340 acres (542 hectares), of which 232 acres (94 hectares) would be revegetated, resulting in a net loss of about 1,108 acres (448 hectares). Alternative B and the Preferred Alternative would have similar impacts, with the latter claiming about 783 acres (317 hectares), of which 232 acres (94 hectares) would be revegetated, resulting in a long-term net loss of 551 acres (223 hectares). Alternative C would disturb about 355 acres (144 hectares) including 232 acres (94 hectares) that would be revegetated. Alternative A

(No Action) would have the least relative impact, disturbing only about 40 acres (16 hectares) of habitat. Estimated habitat loss from each alternative was assessed in light of other DOE and non-DOE projects. When these projects were considered together, it was estimated that Alternative A (No Action) would disturb 260 acres (105 hectares), followed by Alternatives C (Minimum Treatment, Storage, and Disposal) [576 acres (233 hectares)], B (Ten-Year Plan) [823 acres (333 hectares)], and D (Maximum Treatment, Storage, and Disposal) [1,560 acres (631 hectares)]. For the Preferred Alternative this cumulative habitat loss would be similar to Alternative B and less than Alternative D. To minimize habitat loss, DOE conducts surveys and consults with appropriate Federal and State agencies before facility construction or modification. If necessary, current project planning would be modified to minimize surface disturbances.

Groundwater Quality

Previous operations have introduced radionuclides, nonradioactive metals, inorganic salts, and organic compounds into the subsurface. Radionuclide concentrations in the Snake River Plain Aquifer beneath the site have generally decreased since the mid 1980s because of changes in disposal practices, radioactive decay, adsorption of radionuclides to rocks and minerals, and dilution by natural surface water and groundwater entering the aquifer. Extremely low concentrations of iodine-129 and tritium (both below maximum contaminant levels) have migrated outside of site boundaries. Although nonradioactive metals, inorganic salts, and organic compounds have been detected in the aquifer none have migrated beyond site boundaries. Modeling to estimate radionuclide (and other constituent) migration was performed. Tritium, iodine-129, and strontium-90 are discussed because they appear to have had the most impact on groundwater quality. Drinking water at the Idaho National Engineering Laboratory site may contain small concentrations of tritium, strontium-90, and iodine-129. Over a 50-year working period, this radioactivity could result in a maximum of about a 22-millirem dose to an individual worker. This radiation dose is well within regulatory limits and is small compared to other sources of occupational radiation exposure.

Normal Operations Impacts

Potential impacts from any alternative would occur to workers and the public from exposures to radiation during routine operations of facilities and during routine transportation of spent nuclear fuel and radioactive waste.

Facilities

Idaho National Engineering Laboratory facilities release small amounts of radionuclides to the air in levels that are within regulatory standards. Estimates of latent cancer fatalities are based on exposures to 10 years of Idaho National Engineering Laboratory operations under each alternative. The likelihood of the maximally exposed worker contracting a fatal cancer ranges from 1 in about 500,000 [Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) and Preferred Alternative] to 1 in about 770,000 [Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal)]. For the maximally exposed member of the public living offsite, the likelihood ranges from 1 in about 240,000 [Alternative D (Maximum Treatment, Storage, and Disposal)] and from 1 in about 320,000 (Alternatives B and Preferred) to 1 in about 1,000,000 (Alternatives A and C). In the nearby population, it is estimated that less than one latent cancer fatality would occur in the 10-year period for all alternatives.

Figure (Summary 66) Relationship of Snake River Plain to the INEL
66 Summary

Workers

Impacts to workers at the Idaho National Engineering Laboratory from routine occupational hazards were also assessed. It is estimated that routine exposure to radiation would result in less than one latent cancer fatality for any alternative over 10 years of Idaho National Engineering Laboratory operations in the worker population. Based on historical data, these same populations of workers would also report between 2,500 and 3,000 occupationally-related injuries and illnesses over 10 years of Idaho National Engineering Laboratory operations. Work place hazards would be reduced by the worker and safety programs and regulatory standards currently in place.

Transportation

During the incident-free transportation of waste and spent nuclear fuel, the general population living and traveling along the transport route would be exposed to radiation from the passing shipments. Transportation workers would also be exposed. The total number of fatalities for the shipments would be the sum of the estimated number of radiation-related latent cancer fatalities for transportation workers and the general population and the estimated number of nonradiological fatalities from vehicular emissions. Over the 10-year period 1995 through 2005, for all alternatives, if waste shipments were made by truck, the estimated number of total fatalities would range from 0.10 to 1.4. If waste shipments were made by rail, the estimated number of total fatalities would range from 0.02 to 0.3. Over the 40-year period 1995 through 2035, if spent nuclear fuel shipments were made by truck, the estimated number of total fatalities would range from 0.1 to 1.7. If spent nuclear fuel shipments were made by rail, the estimated number of total fatalities would range from 0.1 to 0.26.

Accidents

A potential exists for accidents at facilities associated with the treatment, storage, and disposal of radioactive and hazardous materials. Accidents can be categorized into events that are abnormal (for example, minor spills), events that a facility was designed to withstand, and events that a facility was not designed to withstand (but whose impacts may be offset or mitigated). A range of accidents was considered for all alternatives and consequences were estimated for a member of the public at the nearest site boundary, for the population within 50 miles (80 kilometers), and for the workers. In addition, accident analyses were performed for the transport of spent nuclear fuel and radioactive waste.

Facilities

The maximum reasonably foreseeable accident for facility operations is the same among all alternatives and involves spent nuclear fuel. A severe earthquake damages the Hot Fuel Examination Facility and causes spent nuclear fuel to melt, resulting in a radiological release. Although such an event is unlikely (once every 100,000 years), the maximally exposed individual at the site boundary would incur an estimated risk of increased latent cancer fatalities of one in about 40 million. In the surrounding population, this postulated accident could result in, at most, seven additional latent cancer fatalities.

Workers

The maximum reasonably foreseeable radiological accident for workers results from an earthquake

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causing the main stack at the Idaho Chemical Processing Plant to collapse. This event has a likelihood of occurring once in 3,300 years. As many as 50 workers could be subjected to potentially fatal prompt exposures. Workers that survive the initial event could see increased risk of developing a latent fatal cancer of 1 in 90. The maximum reasonably foreseeable hazardous material accident results from an accidental release of the entire inventory of chlorine gas (a hazardous material) from a facility. The event may occur once in 100,000 years and could cause fatalities to as many as 100 workers. Such a release also would be the maximum reasonably foreseeable hazardous material accident for public consequences, but no fatalities would be expected.

Transportation

During the transport of waste and spent nuclear fuel, radiological accidents and traffic accidents could occur. To determine the accident risk from transporting waste and spent nuclear fuel, a complete spectrum of accidents was evaluated.

The estimated cumulative risk of a latent cancer fatality from radiological accidents would range among all alternatives from 1 in 1,300 to 1 in 340 for the period 1995 through 2005 if waste shipments were made by truck. The estimated cumulative accident risk from traffic accidents would range from 0.30 to 3.4 fatalities for the period 1995 through 2005. The risk of latent cancer fatality as a result of radiological accidents, although small, is considered to be an involuntary risk incurred by the public.

The estimated cumulative risk of a latent cancer fatality from a radiological accidents would range from one in 17,000 to one in 2,900 for the period 1995 through 2005 if waste shipments were made by train. The estimated cumulative accident risk from traffic accidents would range from 0.003 to 0.04 fatalities for the period 1995 through 2005.

The estimated cumulative risk of a latent cancer fatality from radiological accidents would range from 1 in 240,000 to 1 in 200 for the period 1995 through 2035 if spent nuclear fuel shipments were made by truck. The estimated cumulative accident risk due to traffic accidents would range from 0.05 to 1.4 fatalities for the period 1995 through 2035.

The estimated cumulative risk of a latent cancer fatality from radiological accidents would range from 1 in 240,000 to 1 in 700 for the period 1995 through 2035 if spent nuclear fuel shipments were made by train. The estimated cumulative accident risk from traffic accidents would range from 0.05 to 1.2 fatalities for the period 1995 through 2035.

The consequences for various maximum reasonably foreseeable accidents also were evaluated for spent nuclear fuel and waste. The maximum reasonably foreseeable accident for spent nuclear fuel or waste shipments was for a rail shipping cask, containing special-case commercial spent nuclear fuel, to undergo any number of combinations of fire and impact to cause a release. This hypothetical accident, which was estimated to have a probability of occurring about once in 10 million years, was estimated to result in 55 radiation-related latent cancer fatalities.

Environmental Justice

In February 1994, Executive Order 12898 entitled, "Federal Actions to Address Environmental Justice in

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Minority Populations and Low-Income Populations" was released to Federal agencies. In accordance with the Executive Order, an interagency Federal Working Group on Environmental Justice has been convened to provide guidance to agencies on implementation of environmental justice.

For this final EIS, proposed projects, facilities, and transportation associated with the proposed alternatives were reviewed. This review included potential impacts that might occur for each of the environmental disciplines, under normal operating conditions and under potential accident conditions, to minority and low-income communities within 50 miles (80 kilometers) of an existing major facility area at the Idaho National Engineering Laboratory. In addition, exposure pathways were evaluated with respect to subsistence consumption of fish, game, and native plants. The analysis found that the impacts from proposed environmental restoration and waste management programs and managing spent nuclear fuel, under all alternatives, would not constitute a disproportionately high and adverse impact on minority or low-income communities and, thus, do not present an environmental justice concern.

a. The location of the facility was selected to include the maximum minority and low-income populations within the 80-kilometer radius. Of the 172,400 people residing in this area (based on the 1990 census), about 7 percent are classified by the US. Bureau of Census as minority and about 14 percent as low-income.

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Consultations and Environmental Requirements

DOE is committed to operating the Idaho National Engineering Laboratory in compliance with all applicable environmental laws, regulations, executive orders, DOE orders, and permits and compliance agreements with regulatory agencies. To ensure compliance with permits and other applicable legal requirements, regulatory agencies conduct inspections at the Idaho National Engineering Laboratory. In addition, DOE has a comprehensive program for conducting internal audits or inspections and self-assessments, including periodic reviews conducted by interdisciplinary teams of experts. DOE has prepared and issued a site-specific environmental compliance planning manual. This manual contains step-by-step methods to maintain compliance with the various requirements of Federal and State agencies that regulate operations at the Idaho National Engineering Laboratory. The DOE regulations that implement the National Environmental Policy Act require consultation with other agencies, when appropriate, to incorporate any relevant requirements as early as possible in the process. During preparation of the EIS, DOE initiated consultation with Federal and State agencies. The U.S. Fish and Wildlife Service and the State Historic Preservation Office have responded to DOE's request for consultation. The information provided has been considered in the analyses of the EIS. The DOE and the Navy have reviewed all comments received on the draft EIS. To more fully understand, evaluate, and consider certain agency comments, consultations have taken place among agency, Idaho National Engineering Laboratory, and Navy officials.

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Attachment - Reading Rooms and Information Locations

U.S. Department of Energy
 Reading Rooms
 Public Reading Room for U.S. Department
 of Energy Headquarters
 Room 1 E-1 90, Forrestal Building
 Freedom of Information Reading Room
 1000 Independence Avenue. SW
 Washington, DC 10585
 (202) 586-6020
 Monday-Friday 9:00 a.m. to 4:00 p.m.
 Public Reading Room for U.S.
 Department of Energy
 Oakland Operations Office

Environmental Information Center
1301 Clay Street, Room 700 N
Oakland, CA 94612
(510) 637-1762
Monday-Friday 8:30 a.m. to 5:00 p.m.
Public Reading Room for U.S.
Department of Energy
Rocky Flats Operations Office
Front Range Community College Library
3645 W. 112th Ave.
Level B, Center of the Building
Westminster, CO 80030
(303) 469-4435

Monday and Tuesday 10:30 a.m. to 6:30 p.m.,
Wednesday 10:30 a.m. to 4:00 p.m.,
Thursday 8:00 a.m. to 4:00 p.m.
Public Reading Room for U.S.
Department of Energy
Idaho Operations Office
Public Reading Room
1776 Science Center Drive
Idaho Falls, ID 83402
(208) 526-9162

Monday-Friday 8:00 a.m. to 5:00 p.m.
Public Reading Room for U.S.
Department of Energy
University of Illinois at Chicago Library
Government Documents Section
801 South Morgan Street
Chicago, IL 60607
(312) 996-2738

Monday-Thursday 8:00 a.m. to 10:00 p.m.,
Friday 8:00 a.m. to 7:00 p.m., Saturday 10:00 a.m. to
5:00 p.m., Sunday 1:00 p.m. to 9:00 p.m.
Public Reading Room for U.S.
Department of Energy
National Atomic Museum
20358 Wyoming Boulevard, SE
Albuquerque, NM 87185
(505) 845-4378

Monday-Friday 9:00 a.m. to 5:00 p.m.
Public Reading Room for U.S.
Department of Energy
Nevada Operations Office
Coordination and Information Center
3084 South Highland Drive
P.O. Box 98521
Las Vegas, NV 89106
(702) 295-0731

Monday-Friday 7:00 a.m. to 4:30 p.m.
Public Information Room for U.S.
Department of Energy
Fernald Operations Office
Public Environmental Center
JANTER Building 10845
Hamilton-Cleves Highway
Harrison, OH 445030
(513) 738-0164

Monday and Thursday 9:00 a.m. to 7:00 p.m.,
Tuesday, Wednesday, and Friday 9:00 a.m. to 4:30 p.m.
Saturday 9 a.m. to 1 p.m.
Public Reading Room for U.S.
Department of Energy
Savannah River Operations Office

Public Reading Room
Road 1A, Building 703A, D232
Aiken, SC 29802
(803) 641-3320
Monday-Thursday 8:00 a.m. to 11:00 p.m.,
Friday 8:00 a.m. to 5:00 p.m.,
Saturday 10:00 a.m. to 5:00 p.m.,
Sunday 2:00 p.m. to 11:00 p.m.

Public Reading Room for U.S.
Department of Energy
Oak Ridge Operations Office
Public Reading Room
55 Jefferson Avenue
Oak Ridge, TN 37831
(615) 576-1216
Monday-Friday 8:00 a.m. to 11:30 a.m. and
12:30 p.m. to 5:00 p.m.

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Public Reading Room for U.S.
Department of Energy
Richland Operations Office
Washington State University Tri-Cities
100 Sprout Road, Room 130 West
Richland, WA 99352
(509) 376-8583

Monday-Friday 8:00 a.m. to 12:00 noon and
1:00 p.m. to 4:30 p.m.

Navy Information Locations
Norfolk Naval Shipyard
Chesapeake Central Library
298 Cedar Rd.
Chesapeake, VA 23320-5512
(804) 436-8300

Monday-Thursday 9:00 a.m to 9:00 p.m.,
Friday and Saturday 9:00 a.m to 5:00 p.m.,
Sunday 1:00 pm to 5:00 p.m.

Newport News Public Library
Grissom Branch
366 Deshazor Dr.
Newport News, VA 23602
(804) 886-7896

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 1:00p.m. to 5:00p.m.

Kiln Library
301 East City Hall Ave.
Norfolk, VA 23510
(804) 441-2429

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 5:30 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.

Hampton Public Library
4207 Victoria Boulevard
Hampton, VA 23669
(804) 727-1154

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00p.m. to 5:00p.m.

Portsmouth Public Library
Main Branch
601 Court St.
Portsmouth, VA 23704
(804) 393-8501

Monday.Thursday 9:00 a.m to 9:00 p.m,

Friday and Saturday 9:00 a.m to 5:00 p.m.

Virginia Beach Central Library
4100 Virginia Beach Blvd.
Virginia Beach, VA 23452
(804) 431-3001

Monday-Thursday 10:00 a.m..to 9:00 p.m.,
Friday and Saturday 10:00 a.m. to 5:00 p.m..
Sunday 1:00p.m. to 5:00p.m.

Puget Sound Naval Shipyard
Kitsap Regional Library
1301 Sylvan Way
Bremerton,WA 98310
(206) 377-7601

Monday-Thursday 9:30 a.m. to 9:00 p.m.,
Friday and Saturday 9:30 a.m. to 5:30 p.m.,
Sunday 12:30 p.m. to 5:30 p.m.

Kitsap Regional Library
Downtown Branch
612 5th Ave.
Bremerton, WA 98310
(206) 377-3955

Monday-Friday 10:00 a.m. to 5:30 p.m.

Suzallo Library SM25
University of Washington Libraries
University of Washington
Seattle, WA 98185
(206) 543-9158

Monday-Thursday 7:30 a.m. to 12:00 midnight,
Friday 7:30 a.m. to 6:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 12:00 noon to 12:00 midnight

Portsmouth Naval Shipyard
Rice Public Library
8 Wentworth Street
Kittery, ME 03904
(207) 439-1553

Monday-Wednesday, Friday 10:00 a.m. to 5:00 p.m.,
Thursday 10:00 a.m. to 8:00 p.m.,
Saturday 10:00 a.m. to 4:00 p.m.

Portsmouth Public Library
8 Islington Street
Portsmouth, NH 03801
(603) 427-1540

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 5:30 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.

Pearl Harbor Naval Shipyard
Aiea Public Library
99-143 Monalua Rd.
Aiea, HI 96701
(808) 488-2654

Monday and Thursday 10:00 a.m. to 8:00 p.m.,
Tuesday, Wednesday, Friday, and Saturday
10:00 a.m. to 5:00 p.m.

Hawaii State Library
478 South King Street
Honolulu, HI 96813
(808) 586-3535

Monday, Wednesday, and Friday,
9:00 a.m. to 5:00 p.m.,

Tuesday and Thursday 9:00 a.m. to 8:00 p.m.,
Saturday 10:00 a.m. to 5:00 p.m.

Pearl City Public Library
1138 Waimano Home Rd.

Pearl City, HI 96782

(808) 455-4134

Monday-Wednesday 10:00 a.m. to 8:00 p.m.,
Thursday and Saturday 10:00 a.m. to 5:00 p.m.,
Friday and Sunday 1:00 p.m. to 5:00 p.m.

Pearl Harbor Naval Base Library

Code 90L

1614 Makalapa Dr.

Pearl Harbor, HI 96860-5350

(808) 471-8238

Tuesday-Thursday 10:00 a.m. to 7:00 p.m.,
Friday and Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00p.m. to 5:00p.m.

Kesselring Site

Albany Public Library

Reference and Adult Services

161 Washington Ave.

Albany, NY 12210

(518) 449-3380

Monday-Thursday 9:00 a.m. to 9:00 p.m.,

Friday 9:00 a.m to 6:00 p.m.,

Saturday 9:00 a.m. to 5:00 p.m.,

Sunday 1:00p.m. to 5:00 p.m.

Saratoga Springs Public Library

320 Broadway

Saratoga Springs, NY 12866

(518) 584-7860

Monday-Thursday 9:00 a.m. to 9:00 p.m.,

Friday 9:00 a.m. to 6:00 p.m.,

Saturday 9:00 a.m. to 5:00 p.m.,

Sunday 1:00p.m. to 5:00 p.m.

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Schenectady County Library

99 Clinton Street

Schenectady, NY 12305

(518)388-4511

Monday-Thursday, 9:00 a.m. to 9:00 p.m.,

Friday and Saturday, 9:00 a.m. to 5:00 p.m.,

Sunday 1:00p.m. to 5:00p.m.

Other Locations

Main Library

University of Arizona

Tucson, AZ 85721

(602) 621-6421

Monday-Thursday 7:30 a.m. to 1:00 a.m.,

Friday 7:30 a.m. to 6:00 p.m.,

Saturday 10:00 a.m. to 6:00 p.m.,

Sunday 11:00 am. to 1:00a.m.

Main Library

University of California at Irvine

Government Publications Receiving Dock

Irvine, CA 92717

(714) 824-6836

School Hours:

Monday-Thursday 8:00 a.m. to 1:00 a.m.,

Friday 8:00 a.m. to 9:00 p.m.,

Saturday 9:00 a.m. to 6:00 p.m.,

Sunday 12:00 noon to 1:00 a.m.

Summer Hours:

Monday-Friday 8:00 a.m. to 5:00 p.m.,

Saturday and Sunday 1:00 p.m. to 5:00 p.m.

Pleasanton Public Library - Reference Desk

400 Old Bernal Avenue

Pleasanton, CA 94566

(510) 462-3535

Monday and Tuesday 1:00 p.m. to 8:00 p.m.,
Wednesday 10:00 a.m. to 8:00 p.m.,
Thursday 10:00 a.m. to 6:00 p.m.,
Closed Friday
Saturday and Sunday 1:00 p.m. to 5:00 p.m.,
San Diego Public Library
820 "E" Street
San Diego, CA 92101
(619) 236-5867

Monday-Thursday 10:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:30 a.m. to 5:30 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.
Denver Public Library
1357 Broadway
Denver, CO 80203
(303) 640-8845

Monday-Wednesday 10:00 a.m. to 9:00 p.m.,
Thursday-Saturday 10:00 a.m. to 5:30 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.
George A. Smathers Libraries, Library West
University of Florida Library, Room 241
P.O. Box 117001
Gainesville, FL 32611-7001
(904) 392-0367

Monday-Thursday 8:00 a.m. to 9:30 p.m.,
Friday 8:00 a.m. to 5:00 p.m.,
Sunday 2:30 p.m. to 9:30 p.m.
Atlanta Public Library
1 Margaret Mitchell Square
Atlanta, GA 30303
(404) 730-1700

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 2:00 p.m. to 6:00 p.m.
Reese Library
Augusta College
2500 Walton Way
Augusta, GA 30904-2200
(706) 737-1744

School Hours:
Monday-Thursday 7:45 a.m. to 10:30 p.m.,
Friday 7:45 a.m. to 5:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:30 p.m. to 9:30 p.m.

Summer Hours:
Monday-Friday 8:00 a.m. to 5:00 p.m.
Chatham-Effingham-Liberty
Regional Library
2002 Bull Street
Savannah, GA 31401
(912) 652-3600

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 6:00 p.m.,
Saturday 10:00 a.m. to 6:00 p.m.,
Sunday 2:00 p.m. to 6:00 p.m.

Parks Library
Iowa State University
Government Publications Department
Ames, IA 50011-2140
(515) 294-3642
School Hours:
Monday-Thursday 7:30 a.m. to 12:00 midnight,
Friday 7:30 a.m. to 10:00 p.m.,

Saturday 10:00 a.m. to 10:00 p.m.,
 Sunday 12:30 p.m. to 12:00 midnight,
 Summer Hours:

Monday-Thursday 7:30 a.m. to 10:00 p.m.,

Friday 7:30 a.m. to 5:00 p.m.,

Saturday 12:30 p.m. to 5:00 p.m.,

Sunday 12:30 p.m. to 10:00 p.m.

Boise Public Library

715 South Capitol Boulevard

Boise, ID 83702

(208) 384-4023

Monday and Friday 10:00 a.m. to 6:00 p.m.,

Tuesday-Thursday 10:00 a.m. to 9:00 p.m.,

Saturday and Sunday 12:00 noon to 5:00 p.m.

Idaho State Library

325 West State Street

Boise, ID 83702

(208) 334-2152

Monday-Friday 9:00 a.m. to 5:00 p.m.

Shoshone-Bannock Library

Bannock and Pima Streets, HRDC Building

Fort Hall, ID 83203

(208) 238-3882

Monday-Friday 8:00 a.m. to 5:00 p.m.

Idaho Falls Public Library

457 Broadway

Idaho Falls, ID 83402

(208) 529-1462

Monday-Thursday 9:00 a.m. to 9:00 p.m.,

Friday and Saturday 9:00 a.m. to 5:30 p.m.,

Sunday 1:30p.m. to 5:30p.m.

University of Idaho Library

Rayburn Street

Moscow, ID 83844-2353

(208) 885-6344

Monday-Friday 8:00 a.m. to 12:00 midnight,

Saturday 9:00 a.m. to 12:00 midnight,

Sunday 10:00 a.m. to 12:00 midnight

Pocatello Public Library

812 East Clark Street

Pocatello, ID 83201

(208) 232-1263

Monday-Thursday 9:30 a.m. to 8:00 p.m.,

Friday and Saturday 9:30 a.m. to 5:30 p.m.

Twin Falls Public Library

434 Second Street East

Twin Falls, ID 83301

(208) 733-2964

Monday, Friday, and Saturday 10:00 a.m. to 6:00 p.m.,

Tuesday-Thursday 10:00 a.m. to 9:00 p.m.

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Main Library, Third Floor

University of Illinois

801 South Morgan, Mail Code 234

Chicago, IL 60607

(312) 413-2594

Monday-Thursday 7:30 a.m. to 10:00 p.m.,

Friday 7:30 a.m. to 5:00 p.m.,

Saturday 10:00 a.m. to 5:00 pm.,

Sunday 1:00p.m. to 9:00p.m.

Documents Library, 200-D

University of Illinois

1408 W. Gregory Drive

Urbana, IL 61801

(217) 244-2060

School Hours:

Monday-Thursday 8:00 a.m. to 12:00 midnight,
 Friday 8:00 a.m. to 6:00 p.m.,
 Saturday 9:00 a.m. to 6:00 p.m.,
 Sunday 1:00 pm. to 12:00 midnight

Summer Hours:

Monday-Thursday 8:00 a.m. to 9:00 p.m.,
 Friday 8:00 a.m. to 6:00 p.m.,
 Saturday 9:00 a.m. to 5:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.

Engineering Library

Purdue University

West Lafayette, IN 47907

(317) 494-2871

School Hours:

Monday-Thursday 8:00 a.m. to 12:00 midnight,
 Friday 8:00 a.m. to 10:00 p.m.,
 Saturday 8:00 a.m. to 5:00 p.m.,
 Sunday 1:00p.m. to 12:00 midnight,

Summer Hours:

Monday-Friday 8:00 a.m. to 5:00 p.m.

Manhattan Public Library

Julliette and Poyntz

Manhattan, KS 66502

(913) 776-4741

Monday-Friday 9:00 a.m. to 9:00 p.m.,

Saturday 9:00 a.m. to 6:00 p.m.,

Sunday 2:00 p.m. to 6:00 p.m.

Massachusetts Institute of

Technology Science Library

160 Memorial Drive Building 14

Cambridge, MA 02139

(617) 253-5685

Monday-Thursday 8:00 a.m. to 12:00 midnight,

Friday and Saturday 8:00 a.m. to 8:00 p.m.,

Sunday 12:00 noon to 12:00 midnight

O'Leary Library

University of Massachusetts

1 University Ave

Lowell, MA 01854

(508) 934-3205

School Hours:

Monday-Thursday 7:30 a.m. to 12:00 midnight,

Friday 7:30 a.m. to 5:00 p.m.,

Saturday 10:00 a.m. to 6:00 p.m.,

Sunday 1:00 pm. to 12 midnight

Summer Hours:

Monday-Friday 8:30 a.m. to 9:00 p.m.,

Sunday 2:00 p.m. to 7:00 p.m.

Worcester Public Library

3 Salem Square

Worcester, MA 01608

(508) 799-1655

Monday-Thursday 9:00 a.m. to 9:00 p.m.,

Friday and Saturday 9:00 a.m. to 5:30 p.m.

Bethesda Public Library

7400 Arlington Road

Bethesda, MD 20814

(301) 986-4300

Monday-Thursday 10:00 a.m. to 8:30 p.m.,

Friday 10:00 a.m. to 5:00 p.m.,

Saturday 9:00 a.m. to 5:00 p.m.,

Sunday 1:00 p.m. to 5:00 p.m.

Gaithersburg Regional Library
 18330 Montgomery Village Avenue
 Gaithersburg, MD 20879
 (301) 840-2515

Monday-Thursday 10:00 a.m. to 8:30 p.m.,
 Friday 10:00 a.m. to 5:00 p.m.,
 Saturday 9:00 a.m. to 5:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.

Hyattsville Public Library
 6530 Adelphi Road
 Hyattsville, MD 20782
 (301) 779-9330

Monday-Thursday 10:00 a.m. to 9:00 p.m.,
 Friday 10:00 a.m. to 6:00 p.m.,
 Saturday 10:00 a.m. to 5:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.

Ann Arbor Public Library
 343 South 5th Avenue
 Ann Arbor, MI 48104
 (313) 994-2335

Monday 10:00 a.m. to 9:00 p.m.,
 Tuesday-Friday 9:00 a.m. to 9:00 p.m.,
 Saturday 9:00 a.m. to 6:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.

Zanhow Library
 Saginaw Valley State University
 7400 Bay Road
 University Center, MI 48710
 (517) 790-4240

School Hours:

Monday-Thursday 8:00 a.m. to 11:00 p.m.,
 Friday 8:00 a.m. to 4:30 p.m.,
 Saturday 9:00 a.m. to 5:00 p.m.,
 Sunday 1:00 p.m. to 9:00 p.m.

Summer Hours:

Monday-Thursday 8:00 a.m. to 10:30 p.m.,
 Friday 8:00 a.m. to 4:30 p.m.,
 Saturday 10:00 a.m. to 2:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.

Ellis Library

University of Missouri
 Columbia, MO 65201
 (314) 882-0748

School Hours:

Monday-Thursday 7:30 a.m. to 12:00 midnight,
 Friday 7:30 a.m. to 11:00 p.m.,
 Saturday 9:00 a.m. to 9:00 p.m.,
 Sunday 12:00 noon to 1:00 a.m.

Summer Hours:

Monday and Thursday 8:00 a.m. to 8:00 p.m.,
 Tuesday, Wednesday, and Friday 8:00 a.m. to 5:00 p.m.,
 Saturday 12:00 noon to 5:00 p.m.

Curtis Laws Wilson Library

University of Missouri Library
 Rolla, MO 65401-0249
 (314) 341-4227

School Hours:

Monday-Thursday 8:00 a.m. to 12:00 midnight,
 Friday 8:00 a.m. to 10:30 p.m.,
 Saturday 8:00 a.m. to 5:00 p.m.,
 Sunday 2:00 p.m. to 12:00 midnight,

Summer Hours:

Monday-Friday 8:00 a.m. to 5:00 p.m.

D.H. Hill Library

North Carolina State University
PO. Box 7111
Raleigh, NC 27695-7111
(919) 515-3364
School Hours:
Monday-Thursday 7:00 a.m. to 1:00 a.m.,
Friday 7:00 a.m. to 9:30 p.m.,
Saturday 9:30 a.m. to 6:00 p.m.,
Sunday 1:00 p.m. to 1:00 a.m.

Summer Hours:
Monday-Thursday 7:00 a.m. to 11:00 p.m.,
Friday 7:00 a.m. to 6:00 p.m.,
Saturday 9:30 a.m. to 5:30 p.m.,
Sunday 1:00 p.m. to 11:00 p.m.

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Omaha Public Library
215 S 15th Street
Omaha. NE 68102
(402)444-4800

Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:00 a.m. to 5:30 p.m.,
Sunday 1:00p.m. to 5:00p.m.

General Library
University of New Mexico
Albuquerque, NM 87131-1466
(505) 277-5441

School Hours:
Monday-Thursday 8:00 a.m. to 9:00 p.m.,
Friday 8:00 a.m. to 5:00 p.m.,
Saturday and Sunday 12:00 noon to 4:00 p.m.,

Summer Hours:
Monday-Friday 8:00 a.m. to 6:00 p.m.,
Saturday 10:00 a.m. to 5:00 p.m.

U.S. DOE Community Reading Room
1450 Central Avenue, Suite 101
MS C314
Los Alamos, NM 87544
(505) 665-2127

Monday-Friday 9:00 a.m. to 5:00 p.m.
Lockwood Library
State University of New York-Buffalo
Buffalo, NY 14260-2200
(716) 645-2816

School Hours:
Monday-Thursday 8:00 a.m. to 10:45 p.m.,
Friday 8:00 a.m. to 9:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 pm. to 9:00p.m.,

Summer Hours:
Monday, Wednesday, Thursday and
Friday 9:00 a.m. to 6:00 p.m.,
Tuesday 9:00 a.m. to 10:00 p.m.
Sunday 1:00 p.m. to 9:00 p.m.

Engineering Library
Cornell University
Carpenter Hall, Main Floor
Ithaca, NY 14853
(607) 255-5762

School Hours:
Monday-Thursday 8:00 a.m. to 11:00 p.m.,
Friday 8:00 a.m. to 6:00 p.m.,
Saturday 10:00 a.m. to 6:00 p.m.,
Sunday 12:00 noon to 11:00 p.m.,
Summer Hours:

Monday-Friday 8:00 a.m. to 6:00 p.m.,
 Saturday 12:00 noon to 6:00 p.m.
 Cardinal Hayes Library
 Manhattan College
 4531 Manhattan College Parkway
 Riverdale, NY 10471
 (718) 920-0100
 School Hours:
 Monday-Thursday 8:00 a.m. to 11:00 p.m.,
 Friday 8:00 a.m. to 6:30 p.m.,
 Saturday 10:00 a.m. to 5:00 p.m.,
 Sunday 1:00 p.m. to 11:00 p.m.,
 Summer Hours:
 Monday-Thursday 8:30 a.m. to 6:30 p.m.,
 Friday 8:00 a.m. to 4:00 p.m.
 Brookhaven National Laboratory
 25 Brookhaven Avenue, Building 477 A
 PO. Box 5000
 Upton, NY 11973-5000
 (516) 282-3489
 Monday-Friday 8:30 a.m. to 9:00 p.m.,
 Saturday and Sunday 9:00 a.m. to 5:00 p.m.
 Columbus Metropolitan Library
 96 South Grant Avenue
 Columbus, OH 43215
 (614) 645-2710
 Monday-Thursday 9:00 a.m. to 9:00 p.m.,
 Friday and Saturday 9:00 a.m. to 6:00 p.m.,
 Sunday 1:00 p.m. to 5:00 p.m.
 Kerr Library
 Oregon State University
 Corvallis, OR 97331-4905
 (503) 737-0123
 Monday-Friday 7:45 a.m. to 12:00 midnight,
 Saturday and Sunday 10:00 a.m. to 12:00 mid-
 night,
 Summer Hours:
 Monday- Friday 7:45 a.m. to 9:00 p.m.,
 Saturday 10:00 a.m. to 5:00 p.m.,
 Sunday 10:00 to 9:00 p.m.
 Brantford Price Millar Library
 Portland State University
 934 S.W. Harrison
 Portland, OR 97201
 (503) 725-4617
 Monday-Thursday 8:00 a.m. to 12:00 midnight,
 Friday 8:00 a.m. to 10:00 p.m.,
 Saturday 10:00 a.m. to 10:00 p.m.,
 Sunday 11:00 a.m. to 12:00 midnight
 Pattee Library
 Pennsylvania State University
 University Park, PA 16801
 (814)865-2112
 School Hours:
 Monday-Thursday 8:00 a.m. to 12:00 midnight,
 Friday 8:00 a.m. to 10:00 p.m.,
 Saturday 8:00 a.m. to 9:00 p.m.,
 Sunday 1:00 p.m. to 12:00 midnight,
 Summer Hours:
 Monday-Thursday 7:45 a.m. to 10:00 p.m.,
 Friday 7:45 a.m. to 9:00 p.m.,
 Saturday 8:00 a.m. to 9:00 p.m.,
 Sunday 1:00p.m. to 10:00p.m.
 Narragansett Public Library

35 Kingston Road
 Narragansett, RI 02882
 (401) 789-9507
 Monday 10:00 a.m. to 9:00 p.m.,
 Tuesday-Friday 10:00 a.m. to 6:00 p.m.,
 Saturday 10:00 a.m. to 5:00 p.m.
 (Saturday hours September to May only)
 Charleston County Main Library
 404 King Street
 Charleston, SC 29403
 (803) 723-1645
 Monday-Thursday 9:30 a.m. to 9:00 p.m.,
 Friday-Saturday 9:30 a.m. to 6:00 p.m.,
 Sunday 2:00 p.m. to 5:00 p.m.
 South Carolina State Library
 1500 Senate Street
 Columbia, SC 29201
 (803) 734-8666
 Monday-Friday 8:15 a.m. to 5:30 p.m.,
 Saturday 9:00 a.m. to 1:00 p.m.
 Clinton Public Library
 118 South Hicks Street
 Clinton, TN 37716
 (615) 457-0519
 Monday and Thursday 10:00a.m. to 8:00p.m.,
 Tuesday, Wednesday, Friday, and
 Saturday 10:00 a.m. to 5:00 p.m.
 Harriman Public Library
 601 Walden Street
 Harriman, TN 37748
 (615) 882-3195
 Monday-Thursday 9:00 a.m. to 5:00 p.m.,
 Friday and Saturday 9:00a.m. to 1:00p.m.
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 Kingston Public Library
 1000 Bradford Way Building #3
 Kingston, TN 37763
 (615) 376-9905
 Monday and Thursday 10:00 a.m. to 7:30 p.m.,
 Tuesday, Wednesday, and
 Friday 10:00 a.m. to 5:30 p.m.,
 Saturday 10:00 a.m. to 2:00 p.m.
 Lawson McGhee Public Library
 500 West Church Avenue
 Knoxville, TN 37902
 (615) 544-5750
 Monday-Thursday 9:00 a.m. to 8:30 p.m.,
 Friday 9:00 a.m. to 5:30 p.m.,
 Saturday and Sunday 1:00 p.m. to 5:00 p.m.
 Oak Ridge Public Library
 Civic Center
 Oak Ridge, TN 37830
 (615) 482-8455
 Monday-Thursday 10:00 a.m. to 9:00 p.m.,
 Friday 10:00 a.m. to 6:00 p.m.,
 Saturday 9:00 a.m. to 6:00 p.m.,
 Sunday 2:00 p.m. to 6:00 p.m.
 Oliver Springs Public Library
 607 Easterbrook Avenue
 Oliver Springs, TN 37840
 (615) 435-2509
 Tuesday-Thursday 2:00 p.m. to 4:00 p.m.,
 Saturday 9:00 a.m. to 12:00 midnight
 Rockwood Public Library

117 North Front Avenue
Rockwood, TN 37854
(615) 354-1281
Monday, Wednesday, Friday. and
Saturday 10:00 a.m. to 5:00 p.m.,
Tuesday and Thursday 10:00 a.m. to 8:00 p.m.
General Library

University of Texas
PCL 2.402X
Austin, TX 78713
(512) 495-4262

School Hours:
Monday-Friday 8:00 a.m. to 12:00 midnight,
Saturday 9:00 a.m. to 12:00 midnight,
Sunday 12:00 noon to 12:00 midnight,
Summer Hours:

Monday-Friday 8:00 a.m. to 10:00 p.m.,
Saturday 9:00 a.m. to 10:00 p.m.,
Sunday 12:00 noon to 10:00 p.m.

Evans Library
Texas A&M University, MS 5000
College Station, TX 77843-5000
(409) 845-8850

School Hours:
Monday-Thursday 7:00 a.m. to 12:00 midnight,
Friday 7:00 a.m. to 7:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00p.m. to 11:00p.m.,
Summer Hours:

Monday.Thursday 7:00 a.m. to 11:00 p.m.,
Friday 7:00 a.m. to 7:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 p.m. to 11:00p.m.

Marriott Library
University of Utah
Salt Lake City, UT 84112
(801) 581-8394

School Hours:
Monday-Thursday 7:00 a.m. to 11:00 p.m.,
Friday 7:00 a.m. to 8:00 p.m.,
Saturday 9:00 a.m. to 8:00 p.m.,
Sunday 11:00a.m. to 11:00p.m.

Summers Hours:
Monday-Thursday 7:00 a.m. to 10:00 p.m.,
Friday 7:00 a.m. to 5:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.

Alderman Library
University of Virginia
Charlottesville, VA 22903-2498
(804) 924-3133

School Hours:
Monday.Thursday 8:00 a.m. to 12:00 midnight,
Friday 8:00 a.m. to 9:00 p.m.,
Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 12:00 noon to 12:00 midnight,
Summer Hours:

Monday.Thursday 8:00a.m. to 10:00 p.m.,
Friday 8:00 a.m. to 6:00 p.m.,
Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 2:00 p.m. to 10:00 p.m.

Owen Science & Engineering Library
Washington State University
Pullman, WA 99164-3200

(509) 335-4181

School Hours:

Monday-Thursday 8:00 a.m. to 11:00 p.m.,

Friday 8:00 a.m. to 9:00 p.m.,

Saturday 12:00 noon to 9:00 p.m.,

Sunday 12:00 noon to 11:00p.m.,

Summer Hours:

Monday and Thursday 7:30 a.m. to 11:00 p.m.,

Tuesday, Wednesday, and

Friday 7:30 a.m. to 6:00 p.m.,

Saturday and Sunday 12:00 noon to 6:00 p.m.

Foley Center

Gonzaga University

East 502 Boone Avenue

Spokane, WA 99258

(509) 328-4220, extension 3125

School Hours:

Monday-Thursday 8:00 a.m. to 12:00 midnight,

Friday and Saturday 8:00 a.m. to 9:00 p.m.,

Sunday 11:00 a.m. to 12:00 midnight,

Summer Hours:

Monday-Friday 8:00 a.m. to 5:00 p.m.,

Saturday 10:00 a.m. to 5:00 p.m.,

Sunday 1:00 p.m. to 7:00 p.m.

Madison Public Library

201 W. Mifflin Street

Madison, WI 53703

(608) 266-6350

Monday-Wednesday 8:30 a.m. to 9:00 p.m.,

Thursday and Friday 8:30 a.m. to 5:30 p.m.,

Saturday 9:00 a.m. to 5:30 p.m.

Teton County Public Library

320 South King Street

Jackson, WY 83001

(307) 733-2164

Monday, Wednesday

and Friday 10:00 a.m. to 5:30 p.m.,

Tuesday and Thursday 10:00 a.m. to 9:00 p.m.,

Saturday 10:00 a.m. to 5:00 p.m.,

Sunday 1:00 p.m. to 5:00 p.m.

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DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (User's Guide and Summary)

A USER'S GUIDE TO THE SNF & INEL-EIS

* U.S. Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Final Environmental Impact Statement

Introduction

This User's Guide is intended to help you find information in the SNF & INEL EIS (that's short for U.S. Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement). The first section of this Guide gives you a brief overview of the SNF & INEL EIS. The second section is organized to help you find specific

information in the Environmental Impact Statement-whether you're interested in a management alternative, a particular site (such as Hanford), or a discipline (such as land use or water quality).

Section 1: Overview

Elements of this Environmental Impact Statement

DOE is in the process of making important decisions regarding spent nuclear fuel, environmental restoration, and waste management programs. To address these issues, DOE has prepared an Environmental Impact Statement: SNF & INEL EIS. The SNF & INEL EIS is a three-volume document:

Volume 1-Programmatic (DOE-wide)

Spent Nuclear Fuel Management: Analyzes the potential environmental consequences over the next 40 years of alternatives related to the transportation, receipt, processing, and storage of DOE's spent nuclear fuel.

Volume 2-INEL Environmental Restoration and Waste Management (ER & WM) Programs: Analyzes the site-specific consequences of INEL actions anticipated over the next 10 years for waste and spent nuclear fuel management and environmental restoration.

Volume 3-Comment Summaries and Responses: Summarizes public comments on the draft Environmental Impact Statement, and provides DOE responses. The SNF & INEL EIS has a Summary for the entire Environmental Impact Statement, and summaries specific to Volume 1 and Volume 2. Volumes 1 and 2 each have a Purpose and Need for Agency Action section.

The Alternatives section in Volumes 1 and 2 summarizes and briefly compares the features of each alternative being considered. As required by the National Environmental Policy Act, volumes 1 and 2 each include a "No-Action" alternative. The Affected Environment section in Volumes 1 and 2 describes current conditions that might be affected by the alternatives under consideration: ecology, air, water, geology, cultural resources, land use, aesthetics, noise, health and safety, socioeconomics, transportation, and energy and utilities.

The Environmental Consequences section in Volumes 1 and 2 provides an evaluation of potential impacts of the alternatives. These include total (cumulative) impacts, impacts that can't be avoided, short-term use of the environment compared to long-term productivity resources that would be committed, and means to reduce or avoid (mitigate) adverse environmental impacts.

Volume 1 (Programmatic Spent Nuclear Fuel Management) contains several site-specific appendices, providing detailed information on the above subjects at each site being considered for spent nuclear fuel management:

- Appendix A - Hanford Site
- Appendix B - INEL
- Appendix C - Savannah River Site
- Appendix D - Naval Spent Nuclear Fuel Management
- Appendix E - Other Generator/Storage Locations
- Appendix F - Nevada Test Site and Oak Ridge Reservation

The remaining Volume 1 appendices contain supplemental information:

- Appendix G - Acronyms/ Abbreviations -
- Appendix H - Glossary
- Appendix I - Offsite Transportation of Spent Nuclear Fuel
- Appendix J - Spent Nuclear Fuel Management
- Appendix K - Environmental Consequences Data
- Appendix L - Environmental Justice
- Appendix M - FEIS Distribution

Volume 2 (INEL Environmental Restoration and Waste Management Programs) contains six appendices:

- Appendix A - Primer on Radioactivity and Toxicology
- Appendix B - Consultation Letters
- Appendix C - Information Supponing the Alternatives
- Appendix D - Acronyms/ Abbreviations
- Appendix F - Glossary
- Appendix F - Technical Methodologies and Key Data

Volume 3 summarizes on the Draft Environmental Impact Statement that were received during the public comment period, and provides DOE responses to those comments. The Introduction to Volume 3 also includes discussions of:

- How public comments influenced selection of the preferred alternatives
- The extent to which public comments resulted in changes to the Environmental Impact Statement
- How to find specific comment summaries and responses in Volume 3.

In Volume 3, individual public comments are summarized, grouped with others that are similar, and organized into nine topical sections, called response sections. The response sections are:

1. Preference for Alternatives
2. NEPA-Related Comments
3. Policy
4. Proposed Action and Alternatives
5. Technical Issues
6. Spent Nuclear Fuel Management

Specific

7. INEL ER&WM Programs Specific

8. Naval Program Specific

9. Miscellaneous

Also in Volume 3 are three appendices to help the reader locate specific comment summaries and responses. If you made a comment, you can find DOE's response in Volume 3 with the help of these appendices.

How do I find a response to my comment on the

Draft EIS?

1. Turn to Appendix A in Volume 3 and find your name (or organization or agency), and note the comment document number assigned to your comment.
2. In the same entry, find the response section number where the response to the comment is located.
3. Turn to the Table of Contents in Volume 3 under the heading Comment Summaries and Responses, where response section numbers are listed in numerical order, to find the page on which the response section number that applies to the comment appears.
4. Turn to the appropriate page to find a response to a summary of the comment.

Example:

1. The first alphabetical entrant, Dinah Abbott, has been assigned comment document number 615.
2. Ms. Abbott's first entry is for response number 01.01.01.01-(005); four other response numbers are applicable to her comments.
3. That first entry is in Section 1.1.1.1, entitled "Action alternatives" under Specific Preferences for SNF Management Alternatives.
4. Section 1.1.1.1 begins on page 1-1. The selected entry for Ms. Abbott is Response 005 in that section and is located on page 1-2.

Information

A complete copy of the SNF & INEL EIS and a list of reference documents are available in public reading room and information locations. Their addresses are included in the Summary. For further information on the SNF & INEL EIS or to request additional copies, call or contact:

Office of Communications
Bradley P. Bugger
DOE Idaho Operations Office
850 Energy Drive, MS 1214
Idaho Falls, ID 83403-3189
(208) 526-0833

Section 2: Finding Answers to

Your Questions

The SNF & INEL EIS has various tools that are intended to make the reader's job easier. Volumes 1 and 2 of the SNF & INEL EIS each have a table of contents, an index to topics (section 8 of each volume), and a glossary that defines terms (Appendix H in Volume 1, and Appendix E in Volume 2). The SNF & INEL EIS also has a separate Summary for the entire Environmental Impact Statement, and summaries specific to Volume 1 and Volume 2. Volume 3 has a table of contents and an introduction. The following pages provide information on major topics (such as sites evaluated, health and safety, and jobs), including directions for finding these topics in the SNF & INEL EIS.

How is the SNF & INEL EIS structured for

detail?

DOE has structured the SNF & INEL EIS in a way that enables readers to study the results in varying levels of detail. Readers interested in the broad picture will probably have their needs met by the Summary. Readers interested in the details of how analyses were performed will find that information in the various appendices. The main sections of Volumes 1 and 2 contain an intermediate level of detail.
Figure INEL structure

Where do I find more information on how spent

nuclear fuel is currently managed?

DOE is currently responsible for spent nuclear fuel at various sites across the country. Most of this fuel is currently stored at three locations: Hanford Site, the INEL, and the Savannah River Site. The sites are discussed in Volume 1 and its appendices. Five sites are considered for management of naval spent nuclear fuel only (as detailed in Appendix D of Volume 1). DOE manages over 100 different types of spent nuclear fuel. The SNF & INEL EIS examines ways to safely manage spent nuclear fuel, given certain "programmatic considerations" such as current facilities, technologies, transportation modes, safety and security measures, and state and Federal agreements.

The following table indicates where information on spent nuclear fuel management is found in Volume of the SNF & INEL EIS. Volume 2 discusses 2.2.

Programmatic Spent Nuclear Fuel Management - Volume I
 For Information About...

See...

	Spent Fuel Management Program (inventory, types, storage)	Section 1.1.2; Section 2. Appendices A, B, C, and F; Section 2 of Appendices E
DOE	Technologies for Management of Spent Fuel	Section 1.1.3; Sections 3 of Appendix J
	Traffic and Transportation	Appendix I; Sections 4.11 5.11 of Appendices A, B, C, Section 2.4 of Appendix D Attachment D of Appendix
Naval Nuclear Propulsion Program	Spent Fuel Management	
	Traffic and Transportation	Section 4 of Appendix D; Attachment A of Appendix

Where do I find more information on applicable

laws and regulations?

Laws and regulations applicable to the SNF & INEL EIS include Federal laws, Executive Orders, and DOE regulations, as well as the state and local laws applying to each site. These laws address a range of issues, from radioactive and hazardous waste management to endangered species, transportation, and health and safety.

Programmatic Spent Nuclear Fuel Management - Volume I	
For Information About...	See...
Federal Laws and Regulations	Sections 3.3.7 and 7.1.1
Executive Orders	Section 7.1.2
DOE Regulations and Orders	Sections 7.1.3
Transportation Regulations	Section 7.1.4; Section 2 of Appendix I
Hanford Site	Section 2.2 of Appendix A
INEL	Section 2.2 of Appendix B
Savannah River Site	Section 2.2 of Appendix C
Nevada Test Site	Section 2.2 of Appendix F
Oak Ridge Reservation	Section 2.2 of Appendix F
Naval Sites	Section 2.3 of Appendix D
INEL ER & WM Programs - Volume 2	
For More Information About...	See Section...
ER & WM Regulatory Framework	2.2.11
Federal Laws and Regulations	7.2.1
Executive Orders	7.2.2
DOE Orders and Regulations	7.2.3
Idaho Laws and Regulations	7.2.4
INEL Compliance/Permits	7.2.5 and 7.3

Where do I find more information on the major

issues addressed in the EIS?

See sections 1 and 2 of Volumes I and 2 of the SNF & INEL EIS.

Programmatic Spent Nuclear Fuel Management - Volume 1	
For Information About...	See Section...
Overview of DOE Spent Nuclear Fuel Management	1.1
Related National Environmental Policy Act Documents	1.2
Scope of Volume 1	1.3
Purpose and Need for Agency Action	2
INEL ER & WM - Volume 2	
For Information About	See Section...
Content and Scope of Volume 2	2.1.1 and 2.1.2
Related National Environmental Policy Act Documents	2.1.3

INEL	2.2.1 and 2.2.2
History and Current Mission	2.2.3
Major Facility Areas	2.2.4
Spent Nuclear Fuel	2.2.5
Environmental Restoration	2.2.6
Waste Management	2.2.7
Technology Development	2.2.9

Where do I find information on the sites being

considered for spent nuclear fuel management? The SNF & INEL EIS considers ten potential sites for management of spent nuclear fuel: five DOE sites and (for management of naval spent nuclear fuel only) five naval sites. There are about 50 other sites where spent nuclear fuel is generated or stored (for example, university research reactors).

The following tables show you where to find information on proposed alternatives; site conditions; potential impacts of the proposed alternatives, including potential accidents and natural hazards; and proposed methods for reducing the impacts.

Where do I find information on Volume 1

alternatives?

Programmatic Spent Nuclear Fuel Management-Volume 1

Five alternatives are considered for spent nuclear fuel management:

1. No Action
2. Decentralization
3. 1992/93 Planning Basis
4. Regionalization
5. Centralization

The following five tables show where to locate information in Volume 1 about each of these alternatives. Each table shows where you can find information about the effects of an alternative on sites being considered for spent fuel management.

For a discussion of alternatives that were eliminated from further evaluation, see Section 3.2 and Appendix D-Section 3.6.

No Action- Under this alternative, DOE would take minimum actions required for safe and secure management of spent nuclear fuel at, or close to, the generation site or current storage locations.

Figure No ActionDecentralization- Under this alternative, DOE would manage all existing and projected spent nuclear fuel inventories at one DOE site until ultimate disposition.

Figure Decentralization1992/93 Planning Basis- Under this alternative, DOE would transport and store newly generated spent fuel at INEL or Savannah River Site. DOE would consolidate some existing fuels at INEL.

Figure 1992/93 Planning BasisRegionalization- Under Regionalization 4A, the preferred DOE would distribute spent nuclear fuel among DOE sites primarily on the basis of fuel type. Under Regionalization 4B, DOE would distribute spent nuclear fuel among DOE sites primarily on the basis of location; sites west of the Mississippi River would ship to a western regional site, and sites east

of the Mississippi would ship to an eastern regional site. All naval spent nuclear fuel would be examined and stored at either the western or eastern regional site.

Figure Regionalization Centralization- Under this alternative, DOE would manage all and projected spent nuclear fuel inventories at one DOE site until ultimate disposition.

Figure Centralization

What is the preferred alternative for Volume 1?

In compliance with the National Environmental Policy Act, DOE has identified its preferred alternatives in the Final Environmental Impact Statement. The preferred alternative for Volume 1 is Regionalization 4A. See the beginning of Chapter 3 of Volume 1 for an explanation of how this alternative was chosen.

Where do I find information on Volume 2

alternatives?

INEL ER & WM Programs-
Volume 2

Four alternatives are evaluated in Volume 2:

1. No Action-Complete all near-term actions identified and continue operating most existing facilities.
2. Ten-Year Plan-Complete identified projects and initiate new projects to enhance cleanup, manage INEL waste and spent nuclear fuel, prepare waste for disposal, and develop technologies for the ultimate disposition of spent nuclear fuel.
3. Minimum Treatment, Storage, and Disposal (TSD)-Minimize TSD activities at the INEL. Conduct minimum cleanup and decontamination and decommissioning prescribed by regulation. Transfer spent nuclear fuel and waste from environmental restoration activities to another site.
4. Maximum TSD-Expand TSD activities at the INEL to accommodate waste and spent nuclear fuel from DOE facilities. Conduct maximum cleanup and decontamination and decommissioning.

Appendix C contains information supporting the alternatives, including project summaries. Alternatives eliminated from further evaluation are discussed in Section 3.2.

The following table shows where to find information in Volume 2 about the four alternatives, including their impacts. Alternatives evaluated in Volume 2

Alternative	Description	Comparison of Impacts	Impacts*
5.1			5.7 5.13.2
5.2.2			5.8.2 5.14.3

			5.3.2	5.9.2	5.15
	2.1.1	3.3	5.4.2	5.10	5.16
No Action	3.1	Table 3.3-1	5.5.2	5.11.2	
			5.6.2	5.12	

	2.1.1	3.3	5.1	5.7	5.13.3
			5.2.3	5.8.3	5.14.4
Ten-Year Plan	3.1	Table 3.3-1	5.3.3	5.9.3	5.15
			5.4.3	5.10	5.16
			5.5.3	5.11.2	
			5.6.2	5.12	

	2.1.1	3.3	5.1	5.7	5.13.4
			5.2.4	5.8.4	5.14.5
Minimum TSD	3.1	Table 3.3-1	5.3.4	5.9.4	5.15
			5.4.4	5.10	5.16
			5.5.4	5.11.2	
			5.6.2	5.12	

	2.1.1	3.3	5.1	5.7	5.13.5
			5.2.5	5.8.5	5.14.6
Maximum TSD	3.1	Table 3.3-1	5.3.5	5.9.5	5.15
			5.4.5	5.10	5.16
			5.5.5	5.11.2	
			5.6.2	5.12	

Note: Indexed according to sections and tables.

*Subjects addressed in this column, for each alternative are: introduction, land use housing, cultural resources, scenic resources, geology, air, water, ecology, noise transportation, health and safety, services, accidents, cumulative impacts, and un environmental effects.

What is the preferred alternative for Volume 2?

The preferred alternative for Volume 2 is essentially the same as the Ten-Year Plan alternative, but includes elements of other alternatives for some waste types.

Section 3.4 of Volume 2 discusses this preferred alternative, including how it was chosen, plans, and potential impacts.

Under Preferred Alternative - Volume 2

For information About...

Preferred Alternative Decision Process

Conclusions

Spent Nuclear Fuel Management

Environmental Restoration

Waste Management

Environmental Consequences

Cumulative Impacts from Connected or Similar Actions

Unavoidable Adverse Environmental Effects

Short-Term Use of Environment and Maintenance of

Long-Term Productivity

Irretrievable Commitments of Resources

Potential Mitigation

Environmental Justice

See Section...

3.4.1

3.4.2

3.4.3

3.4.4

3.4.5

3.4.6

3.4.7

3.4.8

3.4.9

3.4.10

3.4.11

3.4.12

Where do I find information on the affected

environment?	
Programmatic Spent Nuclear Fuel Management (Volume I) -	
Affected Environment	
For Information About...	See...
Hanford Site	Section 4.1 and Appendix A
INEL	Section 4.2 and Appendix B
Savannah River Site	Section 4.3 and Appendix C
Nevada Test Site	Section 4.4 and Appendix F
Oak Ridge Reservation	Section 4.5 and Appendix F
Naval Sites	Section 4.6 and Appendix D
Puget Sound Naval Shipyard	Section 4.6.1 and Appendix D
Norfolk Naval Shipyard	Section 4.6.2 and Appendix D
Portsmouth Naval shipyard	Section 4.6.3 and Appendix D
Pearl Harbor Naval shipyard	Section 4.6.4 and Appendix D
Kesselring Site	Section 4.6.5 and Appendix D
Other Generator/Storage Locations	Section 4.7 and Appendix E

Where can I get more information on the

potential impacts of the alternatives?
 The impacts, or environmental consequences, are examined in several ways in Volumes 1 and 2 of the SNF & INEL EIS:

- What are the direct impacts under normal, day-to-day conditions?
- What are the total (cumulative) impacts, when the impacts of the alternatives are added together with the impacts of other, past and reasonably foreseeable projects?
- Among the identified impacts, which will happen no matter what actions are taken to reduce the unavoidable adverse impacts)?
- What are the impacts of short-term use weighed against long-term gains?
- Are there any resources to be used that will not be replaced (irreversible and irretrievable commitment of resources)?

Information regarding impacts is in Appendices A-F of Volume 1 and in the sections of Volume I listed in the following table. For Volume I, results of the analysis of impacts are compiled in Appendix K.

	Programmatic Spent Nuclear Fuel Management (Volume I) - 1992/93				
	No Action	Decentral-ization	Planning Basis	Regional-ization	Central-ization
	3.3.2	3.3.2	3.3.2	3.3.2	3.3.2
Health and Safety	5.1.2.4	5.1.3.4	5.1.4.2	5.1.5.4	5.1.6.
	5.1.2.5	5.1.3.5	5.1.4.4	5.1.5.S	5.1.6.
	5.3.2.6	5.3.2.6	5.3.2.6	5.3.2.6	5.3.2.
	5.1.2.6	5.1.3.6	5.1.4.6	5.1.5.6	5.1.6
Transportation	5.3.2.7	5.3.2.7	6.3.2.7	5.3.2.7	5.3.
	App. I-4.2.1	App. I-4.2.2	App. I-4.2.3	App. I-4.2.4	App. I-
	App. I-5.3.1	App. I-5.3.2	App. I-5.3.3	App. I-5.3.4	App. I-
	3.3.4	3.3.4	3.3.4	3.3.4	3.3.4
Waste Management	5.1.2.3	5.1.3.3	5.1.4.3	5.1.5.3	5.1.6.

	5.3.2.9	5.3.2.9	5.3.2.9	5.3.2.9	5.3.2.
	5.1.2.2	5.1.3.2	5.1.4.2	5.1.5.2	5.1
Energy and Utilities	5.3.2.8	5.3.2.8	5.3.2.8	5.3.2.8	5.3.2.3
	3.3.3	3.3.3	3.3.3	3.3.3	3.3.3
Jobs and Housing	5.1.2.1	5.1.3.1	5.1.4.1	5.1.5.1	5.1.6.1
	5.3.2.2	5.3.2.2	5.3.2.2	5.3.2.2	5.3.2.2
Radiological	5.1.2.4	5.1.3.4	5.1.4.4	5.1.5.4	5.1.6.4
Nonradiological (Chemical)	5.1.2.5	5.1.3.5	5.1.4.5	5.1.5.5	5.1.6.5

Note: Indexed according to sections and appendices.
 Programmatic Spent Nuclear Fuel Management (Volume 1) -

Impacts	
For Information About..	See...
Environment	
Water	Sections 5.2.6 and 5.3.2.4 and A
Air	Sections 5.2.5 and 5.3.2.3 and A
Ecology	Sections 5.2.7 and 5.3.2.5 and A
Geology	Section 5.2.4 and Appendices A-
Noise	Section 5.2.8 and Appendices A-
Scenic	Section 5.2.3 and Appendices A-
Cultural Resources	Section 5.2.2 and Appendices A-D
Land Use	Sections 5.2.1 and 5.3.2.1 and A
Energy and Utilities	Sections 5.1.1.2.5.2.9. and 5.3. Appendices A-D, F
Missions	
DOE	3.3.5.1
Navy	3.3.5.2

What steps could be taken to reduce the

impacts?

Volumes 1 and 2 of the SNF & INEL EIS include information on possible methods to reduce, or minimize, the impacts of the alternatives; this information is called possible mitigation measures.

Programmatic Spent Nuclear Fuel Management (Volume I) -

Reduction of Impacts	
For Information About...	See...
Health and Safety	Section 5.7.10 and Appendices A,C,D
Traffic and Transportation	Section 5.7.9 and Appendices A-C
Cultural Resources	Section 5.7.3 and Appendices A-C
Accidents	Section 5.7.12 and Appendices A-D
Jobs and Housing	Section 5.7.2 and Appendices A,C
Site Utilities/Support Services	Section 5.7.11 and Appendices A-D, F
Environment	
Water	Section 5.7.6 and Appendices A,C
Air	Section 5.7.5 and Appendices A,C
Ecology	Section 5.7.7 and Appendices A,C
Soils/Geology	Section 5.7.4 and Appendices A,C
Pollution Prevention	Section 5.7.1 and Appendices A-D
Noise	Section 5.7.8 and Appendices A-D

What about the affected environment, potential

impacts, and mitigation measures at INEL? The following table shows where (in Volume 2) you can find information on these subjects with regard to INEL's ER & WM Programs. Technical methodologies and key data used in analyses for Volume 2 are in Appendix K INEL ER & WM Programs (Volume 2)

	Affected Environment	Impacts	Re Im
Health and Safety	4.12: F-4	3.3.11,5.12,5.15.8; F-4	5.19.8
Traffic and Transportation	4.11	3.3.10,5.11,5.15.7	5.19.7
Cultural Resources	4.4	3.3.3,5.4,5.15.3,5.16.1	5.19.1
Land Use	4.2	3.3.1,5.2,5.15.1	not id
Jobs and Housing	4.3; F-1	3.3.2,5.3,5.15.2; F-1	not id
Accident Environment	not identified	3.3.13,5.14; F-5	5.19.1
Water	4.8; F-2	3.3.7,5.8,5.15.5,5.16.4;F-2	5.19.5
Air	4.7; F-3	3.3.6,5.7,5.15.4,5.16.3;F-3	5.19.4
Ecology	4.9	3.3.8,5.9,5.15.6,5.16.5	5.19.6
Geology	4.6; F-2	3.3.5,5.6; F-2	5.19.3
Noise	4.10	3.3.9,5.10	not id
Scenic	4.5	3.3.4,5.5,5.16.2	5.19.2
Facilities/Services			
INEL Services	4.13	3.3.12,5.13	5.19.9
Energy and	4.13	5.13	5.19.9

Note: Indexed according to sections and appendices.

Where do I find information on environmental

justice?

In accordance with Executive Order 12898, DOE assessed the potential for disproportionately high and adverse consequences on minority populations and low-income populations under the alternatives being considered in Volumes 1 and 2 of the SNF & INEL EIS. DOE concluded that none of the alternatives being considered in either volume would have such adverse consequences for any segment of the population, minorities or low-income communities included.

Programmatic Spent Nuclear Fuel Management (Volume 1)

For Information About...	See...
Environmental Justice	Section 5.8 and Appendix L
Public Comment	Section L-2 of Appendix L
Community Characteristics	Section L-3 of Appendix L
Assessment	Section L-4 of Appendix L
Conclusions	Section L-5 of Appendix L

INEL ER & WM Programs (Volume 2)

For Information About...	See Section...
Environmental Justice	5.20
Public Comment	5.20.1
Community Characteristics	5.20.2
Assessment	5.20.3
Issues Raised by Shoshone-Bannock Tribes	5.20.4
Conclusion	5.20.5

For further information on the SNF & INEL EIS or to request

additional copies, call or contact:

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 (208) 526-0833

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