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"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 discus approaches for environmental restoration and waste management activities at the Ida Laboratory, including SNF management. This EIS has been prepared in accordance wit 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 responsi and projected quantities of DOE's SNF through the year 2035, pending ultimate dispo 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 dispositic 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 Si (Appendix C); naval SNF management facilities, including management of naval SNF at (Appendix D); other generator/storage sites (Appendix E); and the Oak Ridge Reserva Test Site (Appendix F). This EIS does not select site-specific technical managemen Appendices A through F. The management options are representative of potential act 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 mitig operations through environmental restoration and to treat, store, or dispose of was 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 exten comments resulted in changes to this EIS and describes how to find specific comment responses.

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a. The Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho Na Laboratory Environmental Restoration and Waste Management Programs Environmental Im 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 SN 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 elec power to propel Navy ships and submarines. Production reactors have been used to p materials at DOE facilities and radioisotopes for industrial and medical use. Some government facilities, and commercial establishments use nuclear reactors for resea purposes, as well. Fuel that has been withdrawn from a nuclear reactor following i elements of which have not been separated, is called spent nuclear fuel, or SNF. T uranium/neptunium target materials, blanket subassemblies, pieces of fuel, and debr fuel/targets (that is, fuel/targets with radiation levels low enough to permit hanc remote operations), even though slightly irradiated, are not included. This materi 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 si reactor and fuel assemblies. Fuel assemblies are constructed in many configuratior 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, t particles. The cladding is the encapsulation (typically zirconium, aluminum, or st the fuel, confining and protecting it. For gas-cooled reactors, this may be a cera 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, s aluminum, or, for gas-cooled reactors, graphite. The size of a fuel assembly range kilogram (2.2 pounds) and a length of less than 1 meter (3 feet) to a weight of mor (1,000 pounds) and a length of more than 3 meters (10 feet). Figure 1-1 illustrate 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 (uraniu converted into fission products, some of which are radioactive with half-lives rang thousands of years. At the time of withdrawal from the reactor, most of the radioa fission products with very short half-lives. The radioactivity from SNF decreases irradiation. After 1 year, the levels are about 1 percent of that at the time of r levels have decreased by another factor of 10.

The radiation of most concern from SNF is gamma rays. Although the radiation 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 th source, the desired protection level, and the density of the shielding material. T for concrete or lead are much smaller than for water.

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

Many fuel elements that are now SNF, particularly production reactor fuel, wer dissolved in nitric acid for uranium-235 and plutonium recovery. Because the fuels short-term storage, prolonged storage sometimes presents problems. For example, sc aluminum-clad fuels, corrode during prolonged storage in water pools unless the wat pool is carefully controlled. Corrosion can result in cladding failures and the re 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 evaluatic Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Other Reactor Irradiated Nuclear Materials and their Environmental, Safety and Heal November 1993 (DOE 1993a). This evaluation was followed by a Plan of Action to Res Fuel Vulnerabilities in February 1994, which identified three phases to resolve thc 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 F issued in October 1994 (DOE 1994c). Phases I, II, and III corrective actions inclu DOE SNF storage sites. Examples of corrective action projects include installing e storage pool water quality at the Savannah River Site; transferring fuel from an ol 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 an 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 respe Successful completion of the corrective actions would reduce the potential for heal 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 Sa Recommendation 94-1 (Conway 1994) calling for DOE to develop an expedited schedule identified vulnerabilities across the DOE complex. Recommendation 94-1 was critica urgency in correcting known SNF management deficiencies. Further, Recommendation 9 lack of prioritization of corrective actions and lack of an integrated systems appr identified SNF management issues. DOE has developed a plan for implementing Recomm across the DOE complex. DOE's Implementation Plan (DOE 1995a) for Recommendation 9 submitted to the Defense Nuclear Facilities Safety Board on February 28, 1995. The prioritization of corrective actions to remedy known deficiencies utilizing a DOE c approach and considering limited budgets. The plan focuses on fulfilling outstandi parties (for example, court-ordered milestones) and fully recognizes the urgency re standing SNF management issues.

1.1.2 DOE Spent Nuclear Fuel Management

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

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

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

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

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

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

DOE faces a number of major programmatic and site-specific decisions regarding 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 managem 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 siteb	Existing (1995)		Future increases (through 2035)		
Generator or storage siteb	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	0.00d	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 locationsf	42.69	1.6	0	0	42.6
Totalg,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 Expended 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 detailed
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 elemen 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 storagea
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 storag 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 requirec

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: containerizati fissile material separation, and processing with fissile material separation. Cont processes such as canning, coating, and passivation. Canning involves placing the durable construction (such as stainless steel). Coating involves depositing a prot inhibit corrosion. Passivation involves treating the SNF to place exposed surfaces when the SNF is stored in either water or air.

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

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

The DOE will conduct additional National Environmental Policy Act reviews for development and characterization activities that help select technologies for placi 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 mas shielded casks that can weigh above 100 tons. These casks must conform to both U.S Commission and U.S. Department of Transportation regulations. Shipment by both rai common, with the chief advantage of rail being the ability to transport heavier, mc transport more SNF per shipment.

The casks serve two functions: (a) providing gamma radiation shielding from th 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 withst severe accidents. Because the SNF is generally metallic in form, most of the radic metal fuel even in maximum foreseeable transportation accidents. The risks to both have been evaluated many times, most recently in Appendix I of this EIS, and have b

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 i and directed DOE to characterize the Yucca Mountain site in Nevada for suitability United States repository. That Act authorizes disposal of DOE SNF, as well as comm first repository, subject to a limit on repository capacity and the payment of appr purposes, the DOE assumes that some or all of the SNF in its inventory that satisfi acceptance criteria could be placed in the first geologic repository developed unde Act of 1982, as amended.

Although beyond the scope of this EIS, two broad strategies may at this point b ultimate disposition of DOE SNF. The DOE could (a) work toward direct disposal of repository, or (b) chemically dissolve the fuel and produce a waste form (such as v repository disposal. Variations on these broad strategies are also possible, and b consideration. It is possible that some of DOE's SNF could qualify for direct disp 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 determ the Yucca Mountain site is a suitable candidate for geologic disposal of SNF and hi waste. The DOE, however, is in the early planning stages for a repository EIS, whi pursuant to the directives of the Nuclear Waste Policy Act of 1982, as amended. Th mid-1995 a formal notice of its intent to prepare this analysis. The repository EI evaluate potential environmental impacts, based on the best available information a associated with the repository's development and operation, and to support the Secr recommendation to the President, as required by the Nuclear Waste Policy Act of 198 repository EIS will examine the site-specific environmental impacts from constructi eventual closure of the repository, including potential post-closure radiological e Until the repository EIS is complete, no final decision could be made concerning wh accepted in a geologic repository.

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

Except perhaps for a need to develop them further, the technologies described a and safe storage are available for the management of SNF and appear adequate to mee disposition. Disposal in a repository, for example, may require canning, canisteri processing the fuel to create a vitrified waste form. Resource recovery requires d the fissile material from the waste and producing a stable waste form. These requi already been applied and are under continued development in several countries. Onc are established, the appropriate technologies can be identified and finalized to en 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 are interrelated with or tier from this SNF management review. Because the scope c includes a wide variety of proposals, multiple National Environmental Policy Act re necessary. Related reviews are identified in Table 1-4. Figure 1-3 graphically pr of the various National Environmental Policy Act reviews. Discussion in the follow primarily on reviews with an interrelationship with this SNF management review. Th in Table 1-4 are site-specific reviews of SNF management, or individual project rev relationship to SNF management.

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

Site	Subject
DOE (Headquarters)	Waste Management Programmatic EIS
	Programmatic EIS for Tritium Supply and Recyclinga
	Stockpile Stewardship and Management EIS
	EIS for a potential repository at Yucca Mountain for disposal of hig 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 Demonstration Project	Management of SNF in Storage at the West Valley Demonstration Projec onsite dry storage)
	West Valley Demonstration Project Completion and Site Closure
Savannah River	Urgent-Relief Acceptance of Foreign Research Reactor SNF[c]
	Interim Management of Nuclear Materials at Savannah River Site
Oak Ridge Reservation	High Flux Isotope Reactor SNF storage reracking
	High Flux Isotope Reactor Dry Storage Pad
Idaho National Engineering Laboratory	Programmatic SNF and Idaho National Engineering Laboratory Environme 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 S 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 A
	Transfer of Plutonium Uranium Extraction Plant and N-Reactor Irradia Encapsulation and Storage at the K-Basins
	Shutdown of the Fast Flux Test Facility
	Relocating TRIGA[e] Reactor Fuel from 308 Building (covers SNF, lightl fuel, and unirradiated fuel)
	Characterization of Stored Defense Production SNF and Associated Mat 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 anc
b. Environmental Assessment (EA): A concise public document provided by a Federal determining whether to prepare an EIS or a Finding of No Significant Impact (FONSI)
c. 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 s 2419-0 (D.S.C. January 27, 1995). That order is currently on appeal to the United
d. The EA and FONSI were determined by the District Court to be inadequate. Volum St. Vrain fuel.
e. TRIGA: Training, research, and isotope reactors built by General Atomics.

Figure 1-3. Interrelationships of National Environmental Policy Act reviews relate the management of DOE SNF. This review and the Record of Decision will be summariz in the DOE Waste Management Programmatic EIS, currently in development. Programmat nuclear weapons disposition and weapons-usable fissile materials will also provide Management Programmatic EIS. This SNF EIS will provide input to the EIS for the ma 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 caniste
National Environmental Policy Act reviews for DOE and commercial SNF will be prepar
Table 1-4 and Figure 1-3 also identify site- or project-specific National Envir
reviews currently planned or underway. This Volume 1 is a DOE-wide programmatic E
range of strategic alternatives for the management of SNF. As such, this document
intended to provide National Environmental Policy Act review of related and potenti
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
and projects that stem from the programmatic decisions. The tiering of National En
reviews as they relate to this SNF management review is shown schematically in Figu
programmatic EIS does not replace site-specific or project-specific National Envirc
documentation, except where adequate coverage is provided in this EIS to evaluate r
impacts. For the Idaho National Engineering Laboratory, the site-specific document
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 DC
Management Programmatic Environmental Impact Statement (PEIS) (previously known as
Management Programmatic Environmental Impact Statement). This PEIS evaluates propc
regarding the

Type, size, and number of waste storage, treatment, and disposal facilities
build them, including the transportation network

Proposed action formulating and implementing an integrated Waste Management

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

The alternatives are structured to ensure analysis of the impacts of the mixed
will be defined in the site treatment plans developed pursuant to the Federal Facil
The Draft Waste Management PEIS is scheduled to be available for public and age
comment by mid-1995. Although the DOE Waste Management PEIS was originally intende
programmatic analyses of alternatives for SNF management, these analyses are also p
The Waste Management PEIS is expected to summarize and consider, as part of its ana
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 si
Notice of Intent to prepare a Nuclear Weapons Complex Reconfiguration PEIS was issu
DOE has now separated the Nuclear Weapons Complex Reconfiguration EIS into two prog
(a) a PEIS for Tritium Supply and Recycling (expected completion in November 1995)
Stewardship and Management PEIS. In the original Notice of Intent, DOE proposed tc
Nation's nuclear weapons complex to be smaller, less diverse, and less expensive tc
offered the advantage of enabling the closure and remediation of the Mound and Rock
time, no new plutonium or highly enriched uranium storage facilities were envisione
production facility was being planned as part of a separate New Production Reactor
Production Reactor Program was incorporated into the Reconfiguration PEIS. DOE's n
since then for many reasons, but primary among them is the end of the Cold War. Th
include the significant reduction in the size of the Nation's stockpile of nuclear
requirements for production of tritium.

Accordingly, the Tritium Supply and Recycling PEIS addresses alternatives assoc
tritium production and the recycling of tritium recovered from weapons being retire
Alternative technologies for producing tritium are planned to be analyzed at five c
River Site, Oak Ridge Reservation, the Pantex Plant, the Idaho National Engineering
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 th 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 tenta 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 a to prepare a PEIS addressing environmental restoration and waste management (incluc activities across the entire DOE complex. DOE then invited the public to submit wr scope of the PEIS, held 23 scoping meetings across the country, and issued a draft January 1992 reflecting the comments provided. DOE held six regional public worksh Implementation Plan and recorded public comments given at these workshops. The Imp the PEIS was issued in January 1994 and addressed the comments received from scopin workshops.

On October 5, 1992, DOE published a Notice of Intent to prepare an EIS for Envi Restoration and Waste Management at the Idaho National Engineering Laboratory in th The notice invited Government agencies and the public to participate in five scopin Idaho and to provide written comments. Oral testimony from the meetings was transc available at DOE public reading rooms. The comment period lasted from October 5, 1 1992.

On September 3, 1993, DOE published a Notice of Opportunity to Comment in the F proposing to expand the scope of the Idaho National Engineering Laboratory Environm Waste Management EIS to include impacts related to transportation, receipt, process SNF at locations other than the Idaho National Engineering Laboratory. This commen September 3, 1993, and ended on October 4, 1993. Government agencies and the publi provide comments on the DOE Programmatic SNF and the Idaho National Engineering Lab Environmental Restoration and Waste Management Programs EIS. A toll-free telephone provided for questions, requests for documents or other information, and for the pu comments that were transcribed for DOE's consideration. The Implementation Plan (i 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 Idaho National Engineering Laboratory in southeastern Idaho; and the Savannah River Carolina, were logically identified as reasonable site alternatives for SNF managem 1993, Implementation Plan. In addition, four Navy shipyards and the Kesselring Sit York) with years of SNF handling experience were identified for consideration in th to naval SNF. The four Navy shipyards are the Norfolk Naval Shipyard, Portsmouth, Portsmouth Naval Shipyard, Kittery, Maine; the Pearl Harbor Naval Shipyard, Honolul Puget Sound Naval Shipyard, Bremerton, Washington.

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

1.3.2 Scope

1.3.2.1 Programmatic Spent Nuclear Fuel Disposition.

The DOE will not analyze the
ultimate disposition of SNF in this EIS. The focus of this Volume 1 of the EIS is a safe and environmentally sound manner until decisions regarding its ultimate disp implemented. Decisions regarding the actual disposition of DOE's SNF will follow a separate National Environmental Policy Act documentation. Congress has mandated th 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 tc a suitable site. Ultimate disposition of DOE SNF, however, is outside the scope of EIS.

1.3.2.2 Programmatic Spent Nuclear Fuel Stabilization.

DOE is phasing out reprocessing
activities because of decreased demand for the recovery and reuse of certain nuclea stabilization activities potentially required for safe interim storage and manageme of some degraded fuels or processing as necessary, are relevant to the safe storage scope of this EIS. Worker safety, public health, and potential environmental impac stabilization, research and development of technologies, and pilot programs are top analyzing the appropriate alternatives for interim storage of SNF and are included

In April 1992, the Secretary of Energy directed that DOE phase out defense-rel separations activities due to a reduction in the demand for new material for nuclea DOE no longer produces plutonium-239 and highly enriched uranium, and, in December committed to prohibit the use of plutonium-239 and highly enriched uranium separate during the phaseout, shutdown, and cleanout of weapons complex facilities for nucle (Reis and Grumbly 1994). However, the use of chemical separations or other process reasonable site-specific option to assure the safe interim management of some types constituents). Selection of chemical processing as a potential management option w analyses in site-specific National Environmental Policy Act reviews tiered from thi technologies for managing SNF are described in Volume 1, Appendix J. The potential representative processing technology have been evaluated to aid in the analysis of options for interim storage of SNF and are included in this EIS. The DOE selected stabilization of degrading SNF as the technology for evaluation. The DOE believes activity are representative of the overall potential impacts of other similar techn the impacts of processing only at the Hanford Site, Idaho National Engineering Labc River Site because DOE determined it would require significant resources to conside processing activities at sites with no facilities or infrastructure to support thes operations that modify the SNF form to create new forms suitable for interim storag than the activities associated with either dry storage or wet storage of intact SNF by chemical separation requires large-scale facilities for: SNF storage, SNF dissc separation operations, liquid high-level waste storage, storage for special nuclear process the liquid high-level waste into a stable form, for example, vitrification, these facilities must be supported by a complex infrastructure of services and util Idaho National Engineering Laboratory, and Savannah River Site have some or all the the infrastructure for these types of operations. The other sites (that is, Nevada Reservation) lack this level of plant facilities or high-level waste infrastructure level of capability makes evaluating the other sites less than desirable. Construc level waste infrastructure is estimated to be several billion dollars.

1.3.2.3 Programmatic Spent Nuclear Fuel Storage.

Current and projected DOE SNF
inventories are considered in this EIS. Existing storage facilities are identified and accident histories are described. SNF container design, integrity, corrosion a storage technologies, and storage facility design life are factored into the EIS an Storage options at the site of generation and other storage options are analyzed. options for each alternative includes the estimated type and size of representative needed at each site.

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 prepare
review of the safety record for past SNF transportation activity is included, along
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. Fec
that place restrictions on certain aspects of SNF shipment and limits on shipment s
and number of shipments have been accounted for in the analyses. Hazardous materia
for each shipment of SNF, include information on the carrier, the materials involve
and the containers.
The potential impacts of transporting nuclear fuel for ultimate disposition wil
appropriate National Environmental Policy Act documentation. Therefore, an alterna
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 c
being managed at DOE facilities; some is 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 rea
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 c
examination. This EIS addresses existing naval SNF inventories and fuel to be gene
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 fac
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, anc
DOE with comments. A broad spectrum of private citizens; businesses; local, state,
Native American tribes; and public interest groups are represented within this volu
Comments were received from all affected DOE and shipyard communities.
Volume 3 summarizes the comments on the EIS received by DOE during the public c
and provides responses to those comments. In addition, Volume 3 explains how publi
the selection of the preferred alternatives, discusses the extent to which public c
to the EIS, and describes how to find specific comment summaries and responses in t
Responses to comments consist of two parts. The first part summarizes the comm
second part responds to the comment(s). Identical or similar comment(s) were frequ
than one commentor and, in such cases, DOE grouped the comments and prepared a sing
group. This summarization was also appropriate due to the large volume of comments
In compliance with National Environmental Policy Act and Council on Environment
regulations, public comments on the Draft EIS were assessed and considered both inc
collectively by DOE and the Navy. Some comments resulted in modifications in the E
why comments did not warrant further response. Most comments not requiring a chang
in a response to correct factual misinterpretations, to explain or communicate gove
the scope of the EIS, to explain the relationship of the EIS to other related polic
EIS, to explain the relationship of the EIS to other related National Environmental
to refer commentors to information in the EIS, to answer technical questions, or tc
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 complian programmatic missions, public issues and concerns, national security and defense, c Public input considered in the decisionmaking and preferred alternatives selection 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 inp development of performance factors, defined as desirable attributes or characterist relative acceptability of alternatives, which were used to select candidate preferr candidate preferred alternatives were then evaluated against a number of technical sensitivities, including public perception of environmental impact, indicated stake implementation flexibility, regulatory risk, SNF processing potential, environmenta resistance to implementation, and fairness. DOE's preferred alternative reflects D should be actively managed in preparation for ultimate disposition. In addition, D supports the implementation of a path forward for the ultimate disposition of SNF, by the public. The EIS, including its preferred alternatives, will be considered b along with other factors, in arriving at a decision to be documented in a formal Re

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 eliminate damage to the environment by ensuring informed decisionmaking on major Fe significantly affecting the quality of the human environment. Consideration of pub EIS helps to ensure that the EIS is an adequate decisionmaking tool; accordingly, t as appropriate, in response to public comments. While a number of specific issues by commentors, none of the issues or concerns identified new reasonable alternative resulted in significant change in the results of the analysis of the potential envi

Based on review of public comments, coupled with the consultations held with cc as well as State and tribal governments, the main EIS enhancements include the foll

Seismic and water resources discussions were reviewed, clarified, and enhanc alternative sites, and current data and analyses were added to Volumes 1 an A discussion of potential accidents caused by a common initiator was added. stabilizing some of DOE's SNF (specifically from the N Reactor) by processi facilities located overseas was added, thus enhancing the processing option EIS. An analysis of barge transportation was added to the EIS, with respec transporting N-Reactor fuel to a shipping point for overseas processing, as the potential transport of Brookhaven National Laboratory SNF to another si In addition, an analysis of shipboard fires was added, primarily in respons related to receiving SNF containing uranium of U.S. origin from foreign res

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

In response to public comments, a brief summary of the results of a separate costs of the various alternatives was added to the EIS, although the cost e performed independently of the EIS for additional purposes. The discussion regarding the management of Fort St. Vrain SNF currently stored in Coloradc expanded. As committed to in the Draft EIS, the evaluation and discussion justice has been expanded in both Volumes 1 and 2 of the EIS. This analysi interim DOE guidance in the absence of interagency policy in this regard an public comments received regarding environmental justice. Consultation wit 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 cc of U.S. origin from foreign research reactors consists of a bounding estima addition, as a result of public comments, Volume 1 of the EIS was enhanced relationship between current DOE National Environmental Policy Act actions Likewise, the relationship between the EIS and the Spent Fuel Vulnerability clarified in this EIS. With respect to the naval SNF, Appendix D of Volume more fully explain the import of naval SNF and to discuss potential effects at naval shipyards.

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2. PURPOSE AND NEED FOR AGENCY ACTION

DOE, according to the Atomic Energy Act of 1954, as amended, is responsible f maintaining a capability to manage nuclear materials [Atomic Energy Act Sections 11 During the last four decades, DOE and its predecessor agencies have transported, re reprocessed approximately 100,000 MTHM of SNF from various sources, including DOE p reactors; the Naval Nuclear Propulsion Program; DOE, university, and other research reactors; special case commercial power reactors; and certain foreign research reactors. App of SNF was not reprocessed and is stored at various locations in the United States Approximately 100 MTHM of additional SNF is projected to be received in the next 40 in a wide range of enrichments, types, and conditions.

The end of the Cold War led DOE to reevaluate the scale of its weapons produc propulsion, and research missions. In April 1992, the Secretary of Energy directec reprocessing of SNF for recovery and recycling of plutonium and highly enriched ura nuclear weapons stockpile. In 1993, a DOE report(a) documented current and potenti and health vulnerabilities regarding existing DOE SNF storage facilities. The repc degraded fuel cladding integrity and other problems that require action to ensure c result of the Secretary's directive and the information in the DOE report, the prop efficiently, and responsibly manage existing and projected quantities of spent nucl 2035, pending ultimate disposition.

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

Volume 1 of this EIS focuses on strategies for where to conduct SNF managemen above. Decisions on the site-specific and technical implementation of the program, would be made after subsequent, tiered National Environmental Policy Act reviews, a

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

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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 add projected to be generated through the year 2035. Figure 1-2, given in Chapter 1, i 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 alternatives presented. A hybrid alternative could, for example, be developed that from one or more of the five alternatives analyzed. Moreover, the programmatic dec site-specific SNF management options. If appropriate, the decisions would be made specific National Environmental Policy Act evaluations.

In developing the alternatives, the need to comply with applicable regulations orders was assumed. Under some of the alternatives (for example, No Action and Dec would be required to renegotiate existing commitments to accept SNF from utilities Vrain), 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 Implem be implemented as appropriate. The Defense Nuclear Facilities Safety Board 94-1 In 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 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 activities associated with one or more of the defined alternatives. Therefore, env transition period activities are bounded by the impacts assessment for the defined

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

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

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

After considering a number of elements, DOE has identified Regionalization 4A type) as the preferred alternative. DOE arrived at its preferred alternative throu 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 alte screening criteria. After applying the screening criteria, additional management c nontechnical), discussed below, were used to arrive at the final preferred alternat

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

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 reg orders, and Federal facility agreements

Maintaining backup capabilities for SNF management to limit interruptions program activities

Providing the capability for 100 percent examination of naval SNF

Providing technology development for SNF treatment, storage, and ultimate

Those alternatives that did not satisfy all of the screening criteria were not these were No Action, Decentralization A and B, and Centralization. The remaining Planning Basis, Decentralization C, and Regionalization 4A and 4B, met all of the s alternatives were then evaluated based on optimizing overall performance relative t 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 informatic 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 foun Volume 1.

The remainder of this chapter is comprised of three sections. Section 3.1 sun 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 m would be discontinued, including those SNF shipments currently allowed by court orc compliance agreements. Figure 3-1 indicates SNF inventories. The technology devel to SNF management, limited to activities already approved, would continue within DC shows the distribution of fuel from 1995 through 2035.

The following subsections highlight actions associated with the No Action alte 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 c existing SNF would be maintained close to its current storage locations and there w upgrades. Activities required to safely store SNF would continue.

Specific actions proposed for the near term include proceeding with the charac production reactor fuel to establish safe interim storage limits, containerizing th basin by 1998, procuring the first 10 dry storage casks for the Fast Flux Test Faci cask storage if required for safety reasons (with emphasis on Fast Flux Test Facili sodium), and possibly consolidating SNF from defense production at the 105-KW react

Figure 3-1. Spent nuclear fuel distribution, location, and inventory for the No Ac

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 The Idaho National Engineering Laboratory would neither receive nor transport SNF e during a transition period of about 3 years (see Section 3.1.1.6). After the trans not be transferred to the Idaho National Engineering Laboratory, and the Expended C National Engineering Laboratory would be shut down. DOE would continue to transfer Idaho Chemical Processing Plant until the existing storage capacity is used.

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

SNF research and development would be limited. Existing SNF management resear development projects would continue, but the development of technology for the ulti would cease. Existing facilities, such as the Process Improvement Facility, the Re Laboratory, and the Pilot Plant Facility, would support continuing research and dev

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 inventor Site would not transport any SNF offsite and would not receive any SNF. Only onsit rearrangement would take place. DOE would temporarily move fuel currently on the S among facilities to accommodate facility upgrades.

Six Savannah River Site facilities are used for the storage of SNF: the Recei Fuel, K-Reactor Disassembly Basin, L-Reactor Disassembly Basin, P-Reactor Disassemb 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 requ safety of aluminum-clad fuel. The Receiving Basin for Offsite Fuels and an upgrade utilized for continued storage of this fuel. Additionally, DOE would place the alu degrading because of corrosion, in containers to minimize the spread of radioactive case the cladding is breached. DOE would continue existing SNF-related research an

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 research activities. No SNF would be transported to the Oak Ridge Reservation, and transported offsite. SNF would be stabilized, as necessary, to ensure safe storage research and development activities would continue as planned except that the alte shutdown of the High Flux Isotope Reactor as a result of filling the existing SNF s Additional SNF management planning is not expected to be required for the Bulk Shie Oak Ridge Research Reactor through the year 2035. It is antici- pated 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 Rese storage. If this is not possible, additional storage space or cessation of reactor tions may be required after 2005. If the Advanced Neutron Source becomes opera- tional 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 d 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 p 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, hi The SNF would be stored in this condition at a location near the defueling site. N defueled or refueled at Newport News Shipbuilding, a private shipyard located in Ne would be transported to the Norfolk Naval Shipyard, in Portsmouth, Virginia, which

Under this alternative, examination of naval SNF would ultimately cease. A tr approximately 3 years would be required to procure sufficient shipping containers t removed by ongoing defueling or refueling. During this period, naval SNF would con to the Idaho National Engineering Laboratory for detailed examination and storage. period, naval SNF would no longer be transported to the Idaho National Engineering examination and subsequent storage; the SNF removed from naval reactors would remai naval sites. In addition, the Expended Core Facility at the Idaho National Enginee 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 loc transported offsite. For the purposes of this analysis, it is assumed that SNF frc would not be transported to the United States under this alternative. DOE research storage capacity could continue operating as planned. If the onsite storage capaci be expanded, new plans would have to be considered, including potential cessation c 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 sit performed, as necessary, to ensure safe storage. Loss of access to the Idaho Natic for storage of its SNF has already resulted in the construction of new onsite SNF s Therefore, implementation of the No Action alternative would have no additional imp 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 dispc 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 c 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 characterizatic procurement for Fast Flux Test Facility fuel), the following general activities wc wet and dry storage methods for defense production N-Reactor and Single-Pass Reactc storage methods for other fuels (Shippingport Core II, Fast Flux Test Facility, mis extensive research and development on defense

Figure 3-2. Spent nuclear fuel distribution, location, and inventory for the Decen

possibly a stabilization facility. In response to public comment, this alternative process defense production SNF at an overseas facility. A discussion of this optic Appendix A, Attachment B.

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

Combinations of wet and dry storage would be considered. Either a new wet stc casks or vault-type dry storage would be needed to replace existing facilities. Dr production SNF would require a new stabilization facility. Because of substantial differences between defense production fuels and the nondefense fuels, it is possik facilities would be built. Additional National Environmental Policy Act documentat 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 stc from some domestic research reactors and some foreign research reactors. Some onsi be conducted. DOE would manage the existing SNF at the Idaho National Engineering the naval SNF at the Naval Reactors Facility and the SNF in underwater pools, to ac interim storage until ultimate disposition.

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

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

The Idaho National Engineering Laboratory would examine different amounts of n depending on the option selected for the Navy Nuclear Propulsion Program (see Secti of the three options, the Expended Core Facility would ultimately be shut down. As alternative, each of the options for naval fuel would require a transition period. SNF would be transported in shipping containers to the Expended Core Facility for e 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 alternative, except that the site would receive limited SNF shipments from other lc River Site would receive research and test reactor fuel from some domestic and perh 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 basin until it is either canned, placed in wet or dry storage, or is processed. Th represented for evaluation in the EIS consists of processing existing Savannah Rive using existing chemical separations facilities (that is, F- and H-Canyons) and stor stainless-steel-clad and zirconium-clad fuel as well as future receipts of aluminur 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 Id 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 Expended Core Facility at the Idaho National Engineering Lak shut down after the transition period. For Option B, the water pool facility at th 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 Expended Core Facility woulc and planned Expended 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 Nationa would receive TRIGA fuel from the Hanford Site, SNF from naval sites, some test rea the West Valley Demonstration Project and Fort St. Vrain, and some SNF from univers foreign research reactors. The Savannah River Site would also receive some test re from university and perhaps from foreign research reactors. DOE sites would genera 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 an interim storage requirements would be implemented. Figure 3-3 identifies the movem through 2035 under this alternative. Activities related to SNF processing would in development and pilot programs to support future decisions on the ultimate disposit

<u>Figure 3-3. Spent nuclear fuel distribution, location, and inventory for the 1992/</u>

Naval SNF would continue to be transported to the Expended Core Facility at th Engineering Laboratory for examination. After examination, the SNF would be transf 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, elements currently stored in the 308 Building and the 200 Area low-level burial grc to the Idaho National Engineering Laboratory. No new SNF would be transported to t for limited quantities of materials for research in support of interim storage tech disposition. Thus, the overall inventory at the Hanford Site would decrease slight

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-relat similar to the No Action alternative; however, some consolidation of Idaho National facilities could occur. Newly generated SNF would, with minor exceptions, be trans National Engineering Laboratory or the Savannah River Site.

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

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

Naval SNF would continue to be transported to the Expended Core Facility at th Engineering Laboratory for examination. After examination, the SNF would be transf 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 forei
research reactor SNF to the Savannah River Site.
The stabilization activities and options would be the same as those for the De
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 w
those for the Decentralization alternative. The Savannah River Site would undertak
research and development programs as those described for the Decentralization alter
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 tc
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 cc
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
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 S
to the Expended Core Facility at the Idaho National Engineering Laboratory for exam
examination, the fuel would be transported to the Idaho Chemical Processing Plant f
pending ultimate disposition. No action to prepare the SNF for storage would be ne
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, implementa
could require a transition period of several years and construction of temporary SN
acquisition of dry storage containers. DOE assumes that no additional SNF interim
be constructed at the other generator/storage sites. For this alternative, SNF cur
Valley Demonstration Project, Babcock & Wilcox Research Center, and the Fort St. Vr
be transported to the Idaho National Engineering Laboratory.

3.1.4 Regionalization

The Regionalization alternative comprises Regionalization 4A, which would assi 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, an handle the increased quantity. Actions for this alternative would assign all but d 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 Regionalizat 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 Regionali

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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 woul another expended core facility at the Eastern Site because of the estimated $1 bill expended core facility. Figure 3-5 shows the movement of SNF from 1995 through 203 Regionalization 4B with the Idaho National Engineering Laboratory as the Western Re Savannah River 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 Si intermediate to those of the Decentralization and the 1992/1993 Planning Basis alte continue to store its defense production fuel. The Hanford Site would not receive would transport commercial remnants and stainless steel and nondefense production z Idaho National Engineering Laboratory. Facility upgrades,

Figure 3-5. Spent nuclear fuel distribution, location, and inventory for Regionali

and 1992/1993 Planning Basis alternatives. Minor facility additions required to cc other onsite SNF for transport offsite would also occur.

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

New facilities would also be required to receive, handle, and store offsite fu facility for research and development and pilot programs would be required to suppc An expended core facility would be built on the Hanford Site, if the naval SNF were

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

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

3.1.4.2 Idaho National Engineering Laboratory.

Regionalization 4A-Under Regionalization A, stainless-steel- and zircalc
and naval SNF would be transported to the Idaho National Engineering Laboratory. T
Engineering Laboratory would transport aluminum-clad fuel to the Savannah River Sit
capacity would be increased and facility upgrades similar to those described for th
Basis alternative would be undertaken, with replacements and additions as appropria

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

DOE would complete an expanded Dry Fuels Storage Facility, which would include
characterization and canning facility similar to the one described for the 1992/199
alternative. In addition, the same new facility projects described for the 1992/19
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
Laboratory-West.

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

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

The SNF-related research and development activities would be phased out, althc
Electrometallurgical Process Demonstration Project would continue at Argonne Nation
(but would only test processes for SNF currently on the site). Similar to the No A
of naval SNF to the Idaho National Engineering Laboratory would cease, and the Expe
would be phased out.

3.1.4.3 Savannah River Site.

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

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

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

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

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

3.1.4.4 Oak Ridge Reservation.

Regionalization 4A-Under Regionalization 4A , the Oak Ridge Reservation w receive SNF and would transport its aluminum-clad SNF to the Savannah River Site. transported to the Idaho National Engineering Laboratory.

Regionalization 4B-If the Oak Ridge Reservation were selected as the East Site for implementation of Regionalization 4B, the eastern locations would transpor Reservation for storage. In addition, naval SNF might be transported to the Oak Ri Eastern Regional Site were selected for naval fuel. SNF currently stored at other at the Oak Ridge Reservation fully stabilized. New non-DOE domestic, foreign resea SNF would arrive in a condition necessary for safe transportation but uncanned. Th stabilized, prepared, and canned at the Oak Ridge Reservation to assure safe interi development activities at the Oak Ridge Reservation would increase from current lev management complex would be built, including (a) a SNF receiving and canning facili development facility, (c) an interim dry storage area, and (d) an expended core fac Idaho National Engineering Laboratory.

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

A small quantity of Molten Salt SNF is stored in tanks at the Oak Ridge Reserv technology to stabilize this SNF for transport does not exist. Under this alternat 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 Eastern Regional Site, a Oak Ridge Reservation would be transported to the Savannah River Site. Some SNF mi transported until a stabilization process is developed because of the current inabi for transport. The option for acquiring dry storage facilities would support contin Reactor operation during the transition period.

3.1.4.5 Nevada Test Site.

Regionalization 4A would not affect the Nevada Test Site because fuel 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 impleme Regionalization 4B, SNF from western locations would be transported to the Nevada T addition, naval SNF might be transported to the Nevada Test Site if the Western Sit fuel. SNF currently stored at other DOE facilities would arrive at the Nevada Test non-DOE domestic, foreign research reactor, and naval SNF would arrive in a state n transportation but uncanned. This fuel would be stabilized, prepared, and canned a ensure safe interim storage. A new SNF management complex would be built including and canning facility, (b) a technology development facility, (c) an interim dry stc expended core facility similar to the one at the Idaho National Engineering Laborat were selected for receipt of naval fuel).

The SNF receiving and canning facility would receive SNF cask shipments from c the SNF for dry storage. A pool storage area would be included in this facility fc before dry storage. The technology development facility would be used to investiga storage technologies and pilot-scale technology development for disposal of the var interim dry storage area would consist of passive storage modules designed to safel years. Naval fuel would be examined at the new expended core facility at the Nevad storage (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 R would not be applicable to the Nevada Test Site because it does not generate or stc

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 Expended 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 Expended 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 Expended 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 Expended 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 Expended 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 c 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, befc facilities at the transporting sites would then be closed. Activities related to t 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 Laborator facility with capabilities comparable to the one in Idaho would be constructed, anc closed. Naval SNF would continue to be transported to the Expended Core Facility a 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 compl

Figure 3-6. Spent nuclear fuel distribution, location, and inventory for the Centr

Decentralization alternative, as well as of the additional capacity within those fa accommodate the SNF from the other sites and possibly a stabilization facility.

New facilities would also be required to receive, handle, and store offsite fu facility for research and development and pilot programs would be required to suppc An expended core facility would also be built at the Hanford Site.

If the Hanford Site were not selected for storage, Hanford would have to consc onsite SNF for transport to the central site. Some of the SNF would require stabil 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 ca 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 DC characterize, stabilize, and can the SNF in containers compatible with dry storage Processing Plant. Naval SNF removed from naval reactors would be transported to th Facility at the Idaho National Engineering Laboratory.

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

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

If the Idaho National Engineering Laboratory were not selected as the storage characterization facility would be constructed at the Idaho Chemical Processing Pla types of Idaho National Engineering Laboratory SNF in various shipping casks and st transport to the selected DOE facility.

Like the No Action alternative, the CPP-603 Underwater Fuel Storage Facility p be transferred to existing dry storage facilities until it is transported offsite. would not be built. SNF-related facilities at the Idaho National Engineering Labor 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). Simil alternative, naval SNF would not be transported to the Idaho National Engineering I Expended 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, inc facility for naval fuels, would have to be constructed. Near-term actions and opti those described for the Decentralization alternative.

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

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 t described for the Decentralization alternative. The Savannah River Site would buil storage facilities for the SNF received. In addition, SNF receiving, characterizat would be necessary, and an expended core facility would be built onsite for examina

Projects would be initiated to design characterization, canning, and storage f 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 tran would be necessary because the Savannah River Site would maintain the SNF in the ex described for the Decentralization alternative) until moving it to the characteriza 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 recan Reservation, however, to ensure safe interim storage. New non-DOE domestic, foreig naval SNF would arrive in a form suitable for safe transportation. If necessary, t prepared, and canned at the Oak Ridge Reservation to ensure safe interim storage. development activities would increase from current levels. A new SNF management cc including (a) an SNF receiving and canning facility, (b) a technology development f storage area, and (d) an expended core facility similar to the one currently at the Laboratory.

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

A small quantity of Molten Salt SNF is stored in tanks at the Oak Ridge Reserv technology to stabilize this SNF for transport does not exist. Under this alternat 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 t

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 necessar transportation. (However, the SNF might need to be uncanned, stabilized, prepared, Nevada Test Site to ensure safe interim storage.) New non-DOE domestic, foreign re naval 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 stc management complex would be built, including (a) an SNF receiving and canning facil development facility, (c) an interim dry storage area, and (d) an expended core fac currently at the Idaho National Engineering Laboratory.

The SNF receiving and canning facility would receive SNF cask shipments from c the SNF for dry storage. A pool storage area would be included in this facility fc placed into dry storage, as necessary. The applicability of dry storage technologi development for disposal of the various types of SNF would be investigated in the t facility. The interim dry storage area would consist of passive storage modules de 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 thi 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 c Engineering Laboratory were selected, then a transition period would be required, d would be transported to the Expended Core Facility at the Idaho National Engineerin expended core facility at the central site would be constructed. No actions would naval SNF for storage because of its corrosion resistance, high integrity, and stre

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 w 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, sev concepts and technologies have been considered for incorporation into the programma described in Section 3.1. The following section describes the concepts and technol 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 ce SNF are classified. As such, they are not releasable to foreign interests without procedure prescribed in the Atomic Energy Act and strict U.S. Nuclear Regulatory Cc requirements. Some of these classified design details and characteristics are obvi of the fuel, and others could be learned from detailed examination or analyses. Th Weapons Nonproliferation Policy is summarized in the White House Fact Sheet on Nonp Export Control Policy, dated September 27, 1993 (White House 1993). Under its nucl policy, the United States seeks to reduce or eliminate, where possible, the accumul highly enriched uranium or plutonium. These factors, along with others such as the foreign transport and storage, make this alternative impractical. Based on these c 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 ves shipyards until a decision on the ultimate disposition of the SNF is determined anc could then be removed from the ships.

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

In addition, the costs and impacts on national security resulting from such an large; it would affect the ability of the U.S. Navy to carry out its mission. The with SNF remaining installed under Navy operating procedures and of providing the a waterfront services, and utilities would be large, both for ships that are to be de that would normally be refueled and returned to duty. (Failure to remove the SNF f still needed for service would result in these ships being unavailable once their c 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 alternati DOE sites-Hanford Site, Idaho National Engineering Laboratory, and Savannah River S sites 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 thes Defense sites less attractive as site alternatives. The alternative SNF site selec addition of the Nevada Test Site and Oak Ridge Reservation as potential regionaliza sites for SNF management. The Oak Ridge Reservation represented a reasonable alte Savannah River Site for regionalization of Eastern-based SNF and the Nevada Test Si reasonable alternative site to the Idaho National Engineering Laboratory or Hanforc of Western-based SNF. These two sites also represented options for centralization activities. However, the DOE did not consider the Nevada Test Site to be a preferr of 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 faciliti infrastructure. For purposes of conducting a thorough National Environmental Polic 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 separ DOE SNF. However, DOE will not select SNF technical management options on the basi this EIS. These technology-based decisions are most appropriately made after detai type-specific or site-specific basis. The three options include (a) chemical separ facilities at the Hanford Site, Idaho National Engineering Laboratory, and Savannah separation/processing in foreign commercial facilities; and, (c) chemical separatic commercial facilities.

Chemical separation/processing at DOE sites was evaluated under certain altern foreseeable activity as a SNF stabilization technology. This activity is discussec However, the evaluation was limited to certain alternatives and certain fuel types technologies and capabilities. Future technology-based SNF management decisions wc further National Environmental Policy Act reviews were completed.

Several foreign commercial facilities exist that have the capability to proces 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 considera transportation of wet fuel, processing capability in foreign facilities, possible f certain fuel types addressed in this EIS for which management by processing in a fc considered appropriate. In such instances, final decisions on technology-based opt on further analysis in other site-specific or fuel type-specific National Environme 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 proce 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 an 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 repre transporting and handling any specific DOE SNF that might be considered for foreign Reactor SNF is low-enriched SNF and is a large fraction (in MTHM) of the currently addition, the analysis included transportation routes that maximize foreign and dom summary of these transportation impacts is included in Appendix I, Volume 1 of this

Domestic commercial facilities are not available for SNF processing for interi were eliminated from further consideration.

3.2.5 Preparations for Disposal

DOE has not yet decided whether the ultimate disposition for DOE SNF is dispos removal/recycle of the fissile material (primarily uranium). Disposal of SNF would of the repository waste acceptance criteria, and (b) completion of the characteriza SNF that would allow a determination of the specific technology needed for SNF prep canning, etc.) for each fuel type. Because of the large number of uncertainties at speculative to include in this EIS at this time. Therefore, preparation for dispos 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 therefore, differences among the five SNF management alternatives addressed in Sect The comparison of alternatives in this section concentrates on (a) the areas in whi considerable interest, and (b) programmatic factors important to DOE decisionmaking 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 staff, and infrastructure.

3.3.1 Number of Shipments

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

approximately 2,300 shipments under Decentralization Options A or B to approximatel Regionalization 4A alternative. Decentralization Option C and the 1992/1993 Planni have approximately 3,200 and 3,700 shipments, respectively, over the 40-year perioc Regionalization 4B alternative and the Centralization options, SNF is transported t 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 Si 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 t 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. T radiation exposure are (a) normal site operations, (b) transportation, and (c) acci the estimated number of latent cancer fatalities from the operation of the entire I system over a 40-year period would range from approximately zero to about two laten

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 ar such as under the Regionalization 4B alternative or Centralization alternative. Un transportation, as noted in Table 3-7, the estimated total fatalities are less than the highest estimates associated with the Centralization options. This reflects th shipments associated with these options.

In summary, estimated radiation impacts on public health are small for all alt many different siting options), and it would, therefore, not be possible to materia 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 a transportation have greater risk than that expected from transportation accidents w consequences of potential accidents are considered. The latent cancer fatalities a accidents is small across alternatives. The transportation accident with the large 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 f

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 shipme

Alternative		Maximum num Spent fuel shipmen
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 sp

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 Laboratory and Savannah River Site	0.15 to 0.17	0.51 to 0.5
Idaho National Engineering Laboratory 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 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 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 pc 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 acci
	Latent cancer fatalities	Traffic fatalities	Latent cancer fa
No Action	4.1 X 10^-6	0.047	4.1 X 10^
Decentralization(b)	0.00085 to 0.00090	0.20 to 1.01	0.00029 t 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 f (onsite) and rail (offsite).

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

Up to about one latent cancer fatality from most incident-free transportat 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 thi

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 c jobs or increase by more than 2,100 jobs averaged over the period 1995 to 2005, as 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 SN alternative. The number of jobs related to SNF management is small compared with t (2 to 4.5 percent) at the sites that would be involved in SNF management. SNF mana account for less than 4.5 percent of total employment at the sites and less than 8 any one site.

It is important to note that the relocation of large amounts of SNF under the alternative and the Centralization options would eventually result in closure of SN major DOE sites and, therefore, long-term job loss at the closed facilities. Howev 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 configuration for existing SNF will be completed, and much of the SNF would need tc transport. In the near term, the combination of building facilities at some sites transport at other sites complicates estimating the near-term SNF employment situat

Under the No Action alternative, employment would not increase substantially a closure of the Expended Core Facility at the Idaho National Engineering Laboratory of just over 500 jobs involved in SNF management following closure. The maximum nu indicated in Figure 3-11 assumes processing for stabilization and reports the maxim each site.

For any of the alternatives, no more than an average additional 2,100 jobs ove 2005 would be required for implementation. Some of the larger SNF employment requi those involving the Hanford Site) would be caused by the development and operation needed to stabilize stored SNF. If processing were not undertaken, less employment those sites. In addition, the relocation of the Expended Core Facility to sites ot 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

Figure 3-12. Change in site employment between the years 1995 and 2005 for spent n

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 Labc regionalization with the Nevada Test Site as the Western Regional Site and the Oak Eastern Regional Site would result in the highest employment peak. The peak, estim 4,600 jobs in the year 2000, includes employment at sites preparing SNF for transpc

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

3.3.4 Generation of Radioactive Wastes

When SNF is stored onsite, very little high-level, transuranic, or mixed waste 3-13). These small quantities of radioactive wastes would usually be generated dur As a result, under the No Action alternative fewer than 20 cubic meters per year (2 transuranic wastes would be generated from SNF management nationwide because SNF wc stabilized. Under the other alternatives, where stabilization activities are assum that between 20 and 190 cubic meters (26 and 250 cubic yards) of high-level waste a cubic meters (26 and 120 cubic yards) of transuranic waste would be generated each lower generation rates would occur in the Decentralization alternative, where small transported among major DOE sites (and stabilization for transport would not be nec alternatives, greater amounts of SNF would be transported among sites; therefore, m stabilization before transport and more waste would be generated. The difference b maximum volume of waste generated results principally from the contribution attribu stabilization.

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

A more detailed discussion of radioactive waste generation under each alternat 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 lc

Figure 3-13. Average volume of high-level, transuranic, and mixed waste generated

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 freç facilities (potentially losing the use of a facility because it is beyond repair). no flexibility for repairs under the No Action alternative.

Additionally, by limiting research and development to activities already apprc safely store SNF would be impacted by being unable to conduct new research and deve Action alternative would not permit development of processing and other technologie underway as of June 1995.

Under the No Action alternative, DOE would not satisfy its obligations associa university reactors, other research reactors, and special-case commercial SNF. Als alternative, DOE might not be able to fulfill agreements with states or other Feder SNF, except those specific actions already in progress, unless the agreements are c the terms of these agreements would expose DOE to adverse legal actions. In additi proceed, as it has proposed, to establish a new policy for management of foreign re contains United States origin uranium (see Section 1.2.4). These mission impacts c alternative but the No Action alternative.

The DOE recognizes a need, which is not yet well defined, to prepare SNF for i At this point, the processing and other technology required for ultimate dispositic Under the No Action alternative, no new facilities or new research and development No Action alternative would not permit development of processing and other technolc begun as of June 1995. Although the acceptance criteria for DOE-managed SNF have not yet been defined and repository disposal may alternative approaches for ultimate disposition must be developed. By not allowing this alternative, 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 fc acceptable for disposition. In addition, with facilities storing SNF throughout th other processing facilities might be required than are currently planned. Building multiple locations would impede efficient disposition of SNF produced at small reac 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 fuels at an expended core facility were not possible. Full examination would not h alternative and Decentralization Options A and B. The examinations are a critical Nuclear Propulsion Program's ongoing advanced fuel research and development progran 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 thei allowing maximum depletion of their fuel.

The verification of engineering methods and models to design naval nuclear

Although it is difficult to quantify the benefits of an outstanding safety rec operational characteristics, increased core life yields an economic advantage-a red reactor cores that must be procured and in the number of refuelings that must be pe less SNF being generated. Another advantage is the increased online availability c 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. Thi 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 futur estimate" costs cannot be developed at this time. The degree to which existing fac alternative can vary. To account for this, each alternative was analyzed for two c 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 limite 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 Laborator Site costs are shown.

Lower Cost Range - Assumed existing facilities used at the Idaho National Eng and the Savannah River Site but no existing facilities used at Hanford. Faci 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 sa National Engineering Laboratory, and Savannah River Site) in each alternative. Alt than Alternative 3 because all SNF would be moved to two sites (Idaho National Engi 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 SN infrastructure (that is, Alternatives 5A, 5B, or 5C). Transportation costs, which 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 w manage fuel under alternatives that maximize the use of sites with existing capabil 2A, 2B, 4A, or 4B). The centralization alternatives, which would require the cons facilities, could cost up to $6.7 billion more that the least costly alternative (2 based on the lower cost range results, however, the reader should recognize that th using existing facilities, combined with a commitment to upgrade facilities [over a vulnerabilities (DOE 1994c)] may significantly change the cost comparisons. In thi tend to increase toward the upper cost range.

Additional details can be found in DOE (1995b). This report is available in rooms listed in the EIS, or upon request from the Office of Communications, DOE Ida 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-effecti SNF before final disposition. The need for interim storage has led DOE to evaluate alternative management strategies to provide an optimum solution to storage challen storage technologies under evaluation for DOE SNF have been licensed and regulated Regulatory Commission. In addition, DOE SNF could eventually come under the jurisd Nuclear Regulatory Commission if it is to be disposed of in a geologic repository. considering having any new interim storage facilities reviewed to determine whether Nuclear Regulatory Commission licensing standards. This approach, if implemented, ground for the development of the technical and administrative protocols between th Regulatory Commission and DOE in the event that some type of U.S. Nuclear Regulator regulatory oversight occurs in the future.

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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. T
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 Hanforc
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 fr 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 join Walla Walla people, and Umatilla people for fishing the Hanford Reach of the Columb people retain traditional secular and religious ties to the region. Some native pl are used in religious ceremonies performed by members of the Washane or Seven Drums found on the Hanford Site.

Figure 4-1. Hanford Site location and site map. The Hanford Site is on a low- from about 105 meters (345 feet) in the southeast part to about 245 meters (804 fee 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 the Saddle Mountain.

The principal geologic features beneath the Hanford Site, listed from the olc include the Columbia River Basalt Group (basaltic lava flows), the Ringold Formatic coarse sandy gravel to compacted silt and clay), and a series of deposits called th gravel and sand). These units are covered by a few meters or less of recent alluvi Other than gravel, there are no geologic resources of economic value on the Hanforc

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

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

The general climate of the Hanford Site is hot and dry in summer and cool in annual precipitation is 16 centimeters (6.3 inches), most of which falls during the thunderstorms occur 11 days per year, mostly during the summer. Tornadoes are extr within 160 kilometers (100 miles) of the Hanford Site about once in 3 years. Air q region is well within the State of Washington and U.S. Environmental Protection Age criteria pollutants, except that short-term particulate concentrations occasionally (PM-10 is particulate matter defined as suspended particulates with an aerodynamic micrometers.) The Class I Area (areas where degradation of air quality is to be se 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 part of the Hanford Site and forms part of the eastern boundary. The average daily cubic meters per second (120,100 cubic feet per second). The Yakima River, with an cubic meters per second (3,673 cubic feet per second), is located near the southern Site. Wastewaters are discharged to several ponds on the Hanford Site and the Colu to these surface waters, there are two intermittent creeks that form the remainder 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 floodpl the projected extent of the maximum probable flood, which is greater than the area from a 100-year flood, would not impact proposed SNF facilities. More details on f 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 cons Hanford Site discharges. Radiological monitoring shows low levels of radionuclides River water. Tritium, iodine-129, and uranium are found in somewhat higher concent the Hanford Site than upstream, but are well below concentration guidelines establi Environmental Protection Agency drinking water standards. Nonradiological water qu measured during 1989 were similar to those reported in previous years and were with Water Quality Standards.

Part of the water supply at the Hanford Site and for the nearby Tri-Cities is 1991, the combined water use for Richland, Pasco, and Kennewick was 4.3 107 cubic gallons). Richland and Kennewick derive a portion of their water used from nearby 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 u located beneath the Hanford Site in some locations at levels exceeding U.S. Environ drinking water standards and/or DOE Derived Concentration Guides. These constituen follows: radiological constituents-tritium, strontium-90, cobalt-60, antimony-125, 129, cesium-137, uranium, and plutonium; and nonradiological constituent-nitrate, c trichloroethylene, cyanide, fluoride, carbon tetrachloride, and chloroform. Grounc Site is not used for human consumption or food production with the exception of a w at the Fast Flux Test Facility visitor center. Above-background levels of tritium detected in this well; however, these levels are well below U.S. Environmental Prot water standards.

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

The Hanford Site is a shrub-steppe environment dominated by cheatgrass and sa includes 10 different types of plant communities. This plant environment supports and reptiles, 39 species of mammals, and numerous bird and insect species. Deer an animals, and coyotes are the major mammalian predators. Wetlands of varying size e River and support extensive stands of willows, grasses, aquatic plants, and other p Reach of the Columbia River, 44 species of fish have been identified. The Hanford various salmon and trout species as a spawning area and a migration route to and fr 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 insec species and three of the bird species are federally listed.

No federally listed threatened or endangered species have been observed at th However, two Federal and/or state candidate species, the loggerhead shrike (Federal sage sparrow (state candidate), were observed during a survey of the proposed SNF s habitat at the proposed site is considered priority habitat by the State of Washing shrikes, sage sparrows, burrowing owls (state candidate), pygmy rabbits (Federal ca threatened), sage thrashers (state candidate), western sage grouse (Federal and sta sagebrush voles (state monitored). Although burrowing owls were not observed at th burrows used by burrowing owls and owl pellets were observed during the survey. Nc species were found at the proposed site. The closest known ferruginous hawk (Feder threatened species) nest is approximately 8.9 kilometers (5.5 miles) northwest of t 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 air, land, and river connections. The Tri-Cities area has four major highways: U. Route 240, and Interstate 82. State Route 240 traverses the Hanford Site from sout Burlington Northern and Union Pacific railroads connect the area to more than 35 st exist at the ports of Benton, Kennewick, and Pasco. The Tri-Cities Airport, locate passenger and freight services.

For the years 1991 to 1993, the potential collective dose to the population w miles) from all Hanford Site effluents was calculated to be 0.9, 0.8, and 0.4 persc 1993, the dose to the maximally exposed offsite individual was calculated to be 0.0 per year from all exposure pathways. For perspective, collective dose to the same background radiation was calculated to be about 100,000 person-rem from an average rem (300 millirem) per year.

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

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

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

High-level radioactive waste has been accumulating at the Hanford Site since shell tanks-no new waste has been added to these tanks since 1980. Much of the liq 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 cubi cubic yards) of low-level waste was buried at the Hanford Site. In 1991, 5,300 cub yards) of low-level waste was generated at the Hanford Site. In 1992, 619,268 kilo pounds) 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 foun hazardous materials. In 1992, the Emergency Planning and Community Right-to-Know A threshold was exceeded for 53 hazardous chemicals.

4.2 Idaho National Engineering Laboratory

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

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

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

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

The population within an 80-kilometer (50-mile) circle centered at Argonne Na West on the Idaho National Engineering Laboratory has been characterized for the pu whether any disproportionately high and adverse impacts exist to minority and low-i population surrounding the Idaho National Engineering Laboratory is shown to be 7 p 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 e approximately 11,100 personnel, accounting for almost 12 percent of the total regic Approximately 38,000 persons, or 17 percent of the total regional population, were employment associated with the operation of the Idaho National Engineering Laborato direct Idaho National Engineering Laboratory employment was approximately 11,600 jc of jobs at the Idaho National Engineering Laboratory is projected to decrease to ap year 1995 and to approximately 7,250 in fiscal year 2004.

More than 1,500 prehistoric and historic archaeological resources have been i National Engineering Laboratory area, but only 4 percent of the Idaho National Engi <u>Figure 4-2. Idaho National Engineering Laboratory location and site map.</u>Laboratory and historic sites and isolates. Although not formally evaluated, these sites are for nomination to the National Register of Historic Places; the isolates have been meet eligibility requirements. The Experimental Breeder Reactor-I is listed on the Historic Places, and other structures could potentially be listed. The Shoshone-Ba region's primary Native American residents. Because they believe the land is sacre National Engineering Laboratory reserve is potentially culturally important to them the Shoshone-Bannock peoples, include all forms of traditional lifeways and usage c 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 Natic Laboratory is located, is bordered on the north and west by the Bitterroot, Lemhi, 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-sha relief comprised primarily of basaltic lava flows. These flows at the surface rang 2,100 years. The surface of the Eastern Snake River Plain is comprised primarily c thin, discontinuous, interbedded deposits of wind-blown loess and sand, waterborne floodplain alluvial sediments, and rhyolitic domes formed 1,200,000 to 300,000 year

The Eastern Snake River Plain is on an area of low seismicity that is adjacen 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 Be 28, 1983, near Borah Peak, Idaho, and had a moment magnitude of 6.9 (surface wave m epicenter was about 90 to 100 kilometers (56 to 68 miles) from the Idaho National E The largest recorded earthquake within the Intermountain Seismic Belt surface wave 7.5) occurred on August 17, 1959, near Hebgen Lake, Montana, with an epicenter 145 northeast of the Idaho National Engineering Laboratory. In addition to these earth 29 earthquakes greater than magnitude 5.5 have occurred within 322 kilometers (200 National Engineering Laboratory since 1884. The Idaho National Engineering Laborat active but long-time dormant volcanic area. The conditional probability of basalti south-central area of the Idaho National Engineering Laboratory is one incident in The probability of volcanic impact on Idaho National Engineering Laboratory facilit estimated to be less than one incident in every million years or longer.

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

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

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

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

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

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

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

The Idaho National Engineering Laboratory does not withdraw or use surface wa nor does it discharge effluents to natural surface water. However, the three surfa Idaho National Engineering Laboratory (Big and Little Lost Rivers and Birch Creek) designated uses: agricultural water supply, cold-water biota, salmonid spawning, a contact recreation. In addition, waters in the Big Lost River and Birch Creek have domestic water supply and as special resource waters.

Depths to the water table at the Idaho National Engineering Laboratory range feet) in the north to 274 meters (900 feet) in the south. Flows in the largely unc Aquifer are generally to the southwest. Groundwater flows at speeds ranging from 1 (5 to 20 feet per day). The water quality of the aquifer is generally good, and it aquifer. As of 1992, concentrations of iodine-129, cobalt-60, strontium-90, and ce the U.S. Environmental Protection Agency's maximum contaminant levels for drinking radionuclides in localized areas within the aquifer inside the Idaho National Engin boundary. However, concentrations of these radionuclides in groundwater are genera This decrease is attributed to improved waste management practices, reduced dischar radioactive decay. Individual maximum contaminant levels have not been establishec plutonium-239, plutonium-240, and americium-241. However, these radionuclides have above the established limits for gross alpha particle activity or the proposed adju maximum contaminant levels for drinking water. Extremely low concentrations of ioc have migrated offsite, but both concentrations are well below the current U.S. Envi Agency's maximum contaminant levels for drinking water.

Of the nonradioactive metals, only total chromium has exceeded maximum contam established by the Safe Drinking Water Act. Nitrates have exceeded the maximum con past near the Idaho Chemical Processing Plant but have been below the maximum conta 1988. Carbon tetrachloride, chloroform, 1,1-dichloroethylene, cis-1,2-dichloroethy dichloroethylene, tetrachloroethylene, trichlorethylene, and vinyl chloride have ex 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 Snake River Plain Aquifer was 16.4 109 cubic meters (4.3 1012 gallons) per year water is for agriculture. The aquifer is the source of all water used at the Idahc Laboratory. Site activities withdraw an average of 7.4 million cubic meters (1.9 b with a substantial portion discharged to the surface or subsurface and eventually r withdrawal represents approximately 0.4 percent of the water consumed from the East Aquifer, or 53 percent of the maximum yield of a single typical irrigation well.

Total consumption of water at the Idaho National Engineering Laboratory avera meters per second (8.8 cubic feet per second). DOE holds a Federal Reserved Water National Engineering Laboratory, which permits a groundwater pumping capacity of 2. second (80 cubic feet per second), though this capacity is not utilized. The DOE p dates back to the establishment of the Idaho National Engineering Laboratory.

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

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

About 270 vertebrate species have been observed onsite. These include 46 mam reptile, 2 amphibian, and 9 fish species. Major fur-bearing species include coyote Important big-game species include the pronghorn, mule deer, and elk. Two federall candidate animal species potentially occur on the Idaho National Engineering Labora winter resident and is locally common in the far north end and the western edge of Engineering Laboratory. Peregrine falcons are infrequently observed in the winter. to nest onsite, and neither is commonly observed near facilities. The candidate sp 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 anc 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 Savan grew to include five nuclear production reactors (now inactive), two chemical separ target fabrication facility (inactive), and support facilities.

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

Approximately 73,500 hectares (181,500 acres) of the Savannah River Site is u percent of this area (more than 65,000 hectares) is forest land. The Savannah Rive of the U.S. Forest Service) manages the forested areas, many of which are pine plan cooperative agreement with DOE. Facilities that previously produced defense nuclea approximately 5 percent of the total Savannah River Site land area. The remaining ponds, and reservoirs.

Approximately 90 percent of the Savannah River Site work force lives in six c Savannah River Site (Aiken, Allendale, Bamberg, and Barnwell counties in South Carc and Columbia counties in Georgia). In 1990, employment at the Savannah River Site representing approximately 10 percent of the employment in the six-county region of at the Savannah River Site grew to 23,351 in Fiscal Year 1992, with a payroll of mc total number of jobs at the Savannah River Site is projected to decrease to approxi Year 1995.

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

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

As of the end of Fiscal Year 1992, archaeological surveys have covered about Savannah River Site and recorded 858 archaeological sites. Of these 858 sites, mor evaluated, and 53 have been determined to be eligible for the National Register of

Three Native American groups-the Yuchi Tribal Organization, the National Coun Creek, and the Indian Peoples Muskogee Tribal Town Confederacy-have expressed
Figure 4-3. Savannah River Site location and site map.concern over sites and items these organizations about major planned actions on the Savannah River Site and asks the Savannah River Site documents prepared in accordance with the National Environm 1969.

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

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

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

The area of the Savannah River Site is historically of low-to-moderate seismi 4, the Savannah River Site is in a Uniform Building Code Seismic Risk Zone 2A. Th Branch Fault, which spans the central portion of the Savannah River Site, is consic Cretaceous/Tertiary (140 million to 1.6 million years) reactivation of a northern k Triassic age Dunbarton basin. There is no evidence to indicate that the Pen Branch defined by the U.S. Nuclear Regulatory Commission. Surface mapping, subsurface bor investigations have not identified any faulting of the sedimentary strata at the Sa 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 Bel the most recent movement, but it is not considered capable of generating major eart conclusive evidence of recent displacement along any fault within 320 kilometers (2

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

Two major earthquakes have occurred within 320 kilometers (200 miles) of the (a) the Charleston earthquake of 1886, which had an estimated Richter scale magnitu Union County, South Carolina, earthquake of 1913, with an estimated Richter magnitu occurred about 160 kilometers (100 miles) from the Savannah River Site. In June 19 with a local Richter scale magnitude of 2.6 and a focal depth of 1.0 kilometer (0.6 Savannah River Site. An earthquake with a local Richter scale magnitude of 2.0 occ River Site 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 h Average monthly temperatures range from 7.2C (45F) in January to 27.2C (81F) in Jul annual precipitation at the Savannah River Site is approximately 122 centimeters (4

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

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

Air quality at the Savannah River Site is generally good, meeting National Am Standards for criteria pollutants. The nearest Class I Area, the Congaree National 80 kilometers (50 miles) from the Savannah River Site. Tritium is the only radionu Site origin that is routinely detected in offsite air samples in concentrations abc

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 Ai 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 good. In 1992, the South Carolina Department of Health and Environmental Control c classification of the river and its tributary streams to "freshwaters" from "Class stringent water quality standards. Two elements-iron and manganese (both naturally local waters)-have historically exceeded maximum concentration limits.

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

The sediments of the southeastern Coastal Plain hydrogeologic province are gr aquifer systems divided by two major confining systems, all underlain by the Applet These aquifer systems are known regionally as the Floridan, the Dublin, and the Mid aquifers associated with these three aquifer systems are the Steed Pond, Crouch Bra Branch Aquifers.

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

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

The aquifers underlying the Savannah River Site sustain single-well yields of liters per day (2.7 million gallons per day). The Savannah River Site withdraws ap liters per year (3.7 billion gallons per year) of groundwater for domestic and ind River Site draws approximately 75.7 billion liters per year (20 billion gallons per 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 provinc River Site is near the transition area between the oak-hickory-pine forest and the consequence, species typical of both associations are present.

Plant communities adapted to dry conditions occur on more northern, upland ar River Site. (This area is sometimes referred to as the Aiken Plateau.) The most c on the northern half of the Savannah River Site are longleaf pine plantations and l sandhills. Wetter areas along streams support different groups of plant species, i bottomland hardwood forest communities. Other aquatic habitats, such as ponds, mar and Carolina bays, add considerable botanical diversity to the Savannah River Site.

Four federally listed endangered animal species occur on the Savannah River S River upstream and downstream of the Savannah River Site: the red-cockaded woodpec the southern bald eagle, and the shortnose sturgeon. The U.S. Fish and Wildlife Se the American alligator, as "threatened due to similarity of appearance" (to the enc 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 dee populations in check and to reduce the number of animal-vehicle accidents on the Sa Savannah River Site measures each animal killed during the hunts for radioactivity. measurement of cesium-137 in a Savannah River Site deer was 22.4 picocuries per gra picocuries per gram. For hogs, the maximum value was 22.9 picocuries per gram: anc picocuries per gram. The estimated maximum dose received by a Savannah River Site (49 millirem) per year. This estimate assumed a hunter whose entire meat consumpti of the Savannah River Site deer.

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

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

Atmospheric releases of radioactive material to the environment from Savannah operations from 1990 to 1992 resulted in an average dose of approximately 0.00002 r year to individuals living within an 80-kilometer (50-mile) radius of the Savannah dose equivalent due to atmospheric releases from the 1992 Savannah River Site opera of 620,100 occupying the 80-kilometer (50-mile) radius was 6.4 person-rem. Atmosph 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 discharged to the Savannah River from the Savannah River Site activities. The calc dose to the maximum exposed individual resulting from liquid releases from 1990 to (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 Carc Wentworth (Georgia) water treatment plants, respectively.

The Savannah River Site purchases power from South Carolina Electric and Gas three purchased power-line interconnects to the Savannah River Site transmission gr power consumption for the Savannah River Site was approximately 659,000 megawatt hc 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 abou day (528,400 gallons per day), which is about 50 percent of capacity. Eighteen was currently process all Savannah River Site sanitary waste. A new centralized sanita 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 ra waste onsite at the end of 1991, in 50 underground tanks, which is more than 90 per By 1993, the Savannah River Site had 9,900 cubic meters (350,000 cubic feet) of tra 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 ste trenches. Hazardous wastes in storage at the Savannah River Site total some 1.6 mi 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 t This information has been used to evaluate impacts at the Nevada Test Site under va management of SNF. More detailed information characterizing the Nevada Test Site i Appendix F, under separate cover.

The Nevada Test Site is located in southwestern Nevada in southern Nye County Site is bordered on three sides by the Nellis Air Force Base Bombing and Gunnery Ra The Nellis Range serves as a buffer zone between Nevada Test Site test areas and la The Nevada Test Site comprises about 3,500 square kilometers (1,350 square miles), largest contiguous, unpopulated land areas in the United States. The Nevada Test S underground weapons testing and as a nonnuclear test area. Congress has mandated t Government pursue the development of mined geologic repositories for the permanent high-level waste and has directed DOE to study
Figure 4-4. Nevada Test Site location and site map. the Yucca Mountain, Nevada, sit repository.

The majority of the land near the Nevada Test Site is managed by the U.S. Bur Management and used for livestock grazing. The area is surrounded by recreational 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 an most of the employees reside. Most of the offsite supporting contractors and the l indirect economic activity connected to the Nevada Test Site are also located in Cl population of the Las Vegas Metropolitan Statistical area was 735,000, with a 4.7 p since 1980. In contrast, Nye County is sparsely populated, with employment provide some mining, and Government-sector jobs. As of January 1994, the work force totale

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

On the Nevada Test Site, numerous prehistoric sites and prehistoric/historic and recommended as eligible for the National Register of Historic Places. However, located in the vicinity of the proposed SNF management facility. Historic activiti Emigrant Trail, mining camps, and later the settlements of Bullfrog-Goldfield, Las Southern Nevada, including parts of what is now the Nevada Test Site, was inhabitec Southern Paiute and Shoshone Tribes. Areas in the northern portion of the Nevada T 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 and the vegetation of the Mojave Desert and Great Basin. Because the public can be concern about changes in the area's landscape and views are not regionally unique, to have low to moderate visual sensitivity.

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

The area of the Nevada Test Site is historically of low-to-moderate seismicit the Nevada Test Site is in Uniform Building Code Seismic Risk Zones 2B and 3. Seis Nevada Test Site area generally occurs as thrust faults, normal faults, and strike- displacements are thought to have occurred as a consequence of underground nuclear 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 w be determined because of instrument problems. Two historical earthquakes with a ma scale) have been reported 110 kilometers (68 miles) southwest of Yucca Mountain anc miles) to the northeast. Most earthquakes in the area are less than 10 kilometers Historic seismic events and the length of active faults can be used to infer a maxi earthquakes in the Yucca Mountain region. Recurrence intervals for earthquakes wit than 7 are 25,000 years, greater than 6 are 2,500 years, and greater than 5 are 250

The climate in the Nevada Test Site region is characterized by high solar rac 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 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 pollut Federal standards. In recent years, the majority of radioactive effluents at the N 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 schedulec 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 T estimated dose-equivalent during 1992 for the population within 80 kilometers (50 m 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 St Air Pollutants standard of 0.01 rem (10 millirem) per year and is a very small perc 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 pe Significant changes in consumption are not anticipated.

From 1989 to 1993, Nevada Test Site electrical consumption ranged from 144,52 183,188 megawatt hours, with peak demands varying from 30.9 to 38.4 megavolt-ampere consumption is projected to be 176,440 megawatt hours, with a peak demand of 39.5 m

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

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

4.5 Oak Ridge Reservation

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

The Oak Ridge Reservation is located on approximately 34,667 acres (140 squar federally owned land. The reservation comprises forested lands, public lands, buff 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 wi city limits of Oak Ridge, Tennessee. Bordering land uses are predominantly rural, farms, forest, and pasture.

Most of the industrial and commercial development, by energy-related companie Oak Ridge Reservation, has occurred in the City of Oak Ridge in Anderson and Roane economic linkages at the Oak Ridge Reservation occur primarily within Anderson, Knc counties, where most of the offsite contractors, labor, and capital are located. E Reservation in 1990 was approximately 17,080 people, and it is projected to decreas 16,980 by the year 1999.

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

There are no identified archaeological sites or historic structures on the pr management facilities on the Oak Ridge Reservation. Invertebrate fossils remains a Cambrian to early Mississippian aged formations underlying the Oak Ridge Reservatic <u>Figure 4-5. Oak Ridge Reservation location and site map.</u>early 1700s, the Overhill were forcibly moved to Oklahoma in 1838. While the Cherokee may retain cultural af ancestral home, there are no known Native American resources on the proposed site f

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

The area of the Oak Ridge Reservation is historically of low-to-moderate seis to 4, the Oak Ridge Reservation is in a Uniform Building Code Seismic Risk Zone 2A. Reservation lies entirely within the western portion of the Valley and Ridge Provin the Cumberland Plateau. This province is characterized by numerous linear ridges a three regional thrust faults in the area. From 1811 to 1975, five major earthquake Ridge Reservation area, but none has been at an intensity that caused severe damage any volcanic activity in the area for more than one million years.

The climate of the region is characterized by moderate to high precipitation humidity, low winds, and low diurnal temperature ranges. At Oak Ridge, mean annual 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 st times as many tornadoes as the eastern half where the Oak Ridge Reservation is loca Reservation experienced a tornado from a severe thunderstorm on February 21, 1993.

A network of air monitoring stations at the Oak Ridge Reservation measures se uranium particulates, heavy metals, and several materials released by a Toxic Subst incinerator. The total dose of 0.0033 rem (3.3 millirem) per year to the maximally within the 0.01 rem (10 millirem) per year National Emission Standards for Hazardou standard. The estimated collective committed effective dose equivalent to the appr persons within 80 kilometers (50 miles) of the Oak Ridge Reservation was approximat 1992. This represents about 0.02 percent of the 280,000 person-rem that the surrou receive 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 (s Poplar, and Bear Creeks) and the Clinch River, which subsequently flow to the Tenne Dam, immediately south of the Oak Ridge Reservation, controls the flow of the Clinc Ridge Reservation. Average discharge from the dam was 150 cubic meters (5,300 cubi from 1963 to 1979. The Clinch River supplies water for the Oak Ridge Reservation a industrial uses.

Geologic units of the Oak Ridge Reservation comprise two hydrologic groups: formed by the Knox Group and Maynardsville Limestone, and (b) the Oak Ridge Reserva which include other geologic units of the area including sandstones, siltstones, an has solution conduits that store and transmit relatively large volumes of water, wh controlled by fractures and transmit limited amounts of water. The aquifer is the stream flow on the Oak Ridge Reservation. However, some flowpaths of the Knox Aqui points outside the Oak Ridge Reservation boundary. Because of the abundance of sur groundwater wells are not common. Groundwater quality is good above 300 meters (1, high total dissolved solids at depth.

Groundwater contamination has occurred in the general area of past-practice w waste storage tanks, spill sites, and contaminated inactive facilities. Principal organics, nitrates, heavy metals, and radioactivity. Exact rates and extent of the quantified. However, data indicate that most contamination remains relatively clos example of the maximum extent of groundwater contamination, nitrate has been detect (900 meters) southwest of the source. Nitrate is relatively mobile in groundwater the maximum horizontal migration of contamination. At Oak Ridge National Laborator groups have been identified and are being monitored for groundwater contamination. each waste area group will direct further groundwater studies. At the K-25 Site, c commonly detected groundwater contaminants. Elevated levels of gross alpha and grc detected in a number of wells. Uranium and technetium-99, respectively, appear to for the elevated gross alpha and gross beta levels. The metals chromium, lead, ars 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 detecte organics in some offsite monitoring wells; however, concentrations have been below standards. Fluoride has been detected at concentrations exceeding drinking water s well. The high fluoride concentration and accompanying pH are most likely from nat in the substrate.

The Clinch River supplies most of the water to the Oak Ridge Reservation, the and other cities along the river. Major surface water uses include withdrawals for supplies, commercial and recreational navigation, and other recreational water acti abundance of surface water, most community and Oak Ridge Reservation water supplies supplies rather than groundwater. One supply well exists on the reservation for us supply to a laboratory. Groundwater is used for some domestic, municipal, farm, ir purposes. A typical well in the aquitard yields under 0.25 gallons per minute (0.0 many places wells are incapable of producing enough water to support a typical hous

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

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

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

Wetland Inventory maps. Wetlands on the Oak Ridge Reservation include emergent, sc 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 c Ridge Reservation for catfish and carp. Sport fishing for bass, catfish, and other popular.

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

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

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

Low-level, hazardous, and mixed wastes are generated and managed at the Y-12 and the Oak Ridge National Laboratory. Nonhazardous wastes are generated at all th at the Y-12 Plant Sanitary Landfill. Oak Ridge Reservation generates and manages S waste. Waste management at the Y-12 Plant and the Oak Ridge National Laboratory in treatment, onsite waste disposal, preparation for proper offsite waste disposal, an Liquid and solid hazardous wastes are disposed of offsite. Some low-level radioact onsite.

4.6 Naval Sites

This section presents summary environmental characterization information on t have been evaluated under various alternatives for management or examination of nav information has been used to evaluate impacts at the sites under various alternativ More detailed information characterizing these sites is presented in Appendix D, un

The average annual radiation exposure for each naval shipyard radiation worke millirem) (NNPP 1993). The average lifetime accumulated exposure for shipyard work millirem) (NNPP 1993).

4.6.1 Puget Sound Naval Shipyard

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

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

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

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

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 bounc
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 h
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 q
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 Expended 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 shir
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

Norfolk Naval Shipyard is located in the Tidewater region of Virginia and is of Portsmouth (see Figure 4-7). Newport News Shipyard, where some naval nuclear sh located in Newport News, Virginia (see Figure 4-8). Six city areas are within 24 k Norfolk Naval Shipyard: Portsmouth, Chesapeake, Norfolk, Virginia Beach, Hampton a and Suffolk. About 1.5 million people (USBC 1992) reside within an 80-kilometer (5 shipyard, and about 8,500 shipyard workers are employed at the shipyard.

The population within 80 kilometers (50 miles) of the Norfolk Naval Shipyard characterized for the purposes of identifying whether any disproportionately high a minority and low-income communities. The population surrounding the Norfolk Naval

Figure 4-7. Norfolk Naval Shipyard location and vicinity map.Figure 4-8. Newport

information and the definitions and approach presented in Appendix L.

Norfolk Naval Shipyard occupies over 486 hectares (1,200 acres) and includes 500 administrative, industrial, and support structures along 4 miles of shoreline. within its boundaries is covered with structures or paved with concrete or asphalt. a controlled industrial area and a nonindustrial area. All piers, dry docks, and w naval nuclear propulsion plant work are within the controlled industrial area.

No prehistoric archaeological sites or submerged cultural resources have been shipyard. Drydock I is a National Historic Landmark. There are no Native American ceremonial sites in the areas where naval SNF activities would be conducted.

Norfolk Naval Shipyard is located in Uniform Building Code Seismic Risk Zone second lowest of four risk categories. No volcanic hazards exist.

The general climate of the area is mild and moist, with predominant winds frc southwest. In summer, afternoon thunderstorms are very common. Thunderstorms occa isolated tornadoes throughout the region, but they move through the area rapidly al Hurricanes and tidal flooding are not uncommon; tornados are infrequent. The Code (40 CFR Part 81) states that the Air Quality Control Region that includes this site nonattainment for ozone and is better than national standards for total suspended p dioxide. The area has no specific classification for carbon monoxide and nitrogen I Area is the Swanquarter National Wilderness Area, which is approximately 160 kilc from the site.

Norfolk Naval Shipyard is located on the Southern Branch of the Elizabeth Riv industrialized area of the city of Portsmouth, Virginia, 13 kilometers (8 miles) up of the James and Elizabeth Rivers. The Southern Branch is a deep water river that provides access to heavy industry in the vicinity of the shipyard. The Southern Br a source of drinking water.

Shallow groundwater underlies the whole region. Designated as the Columbia A comprised of interbedded gravel, sand, silt, and clay and is unconfined throughout Columbia Aquifer is the Yorktown Aquifer, which is a major source of domestic, comm industrial water. This aquifer is the usual source of drinking and domestic consum localities within the region not served by municipal water systems.

The shipyard area is highly developed, and its surface is about 95 percent cc materials. Several federally designated threatened or endangered species exist in habitats have not been identified on shipyard property. No state-listed rare, thre exist within the 24-kilometer (15-mile) tidal influence zone.

There are three main road corridors within the city of Portsmouth. These roa Portsmouth Boulevard, and George Washington Highway, and they provide access to sub and residential areas. The Downtown and Midtown Tunnels link Portsmouth and Norfol connecting arteries to the regional interstate highway network consisting of Inters Interstate 64 crosses Hampton Roads and Interstate 664 crosses the lower James Rive cities to Newport News and Hampton on the peninsula.

Norfolk Southern and CSX operate extensive rail transportation networks for f Norfolk and Newport News are the Nation's largest terminals for coal exports, and, have a large capacity for containerized and bulk cargos. Lines operated by CSX and subsidiaries serve the shipyard at the north and south ends and at Southgate and St Since 1965, all 10 shipments of naval SNF originating at the Norfolk Naval Shipyard to the Expended Core Facility at the Idaho National 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 4.1.2 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-D 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 transp 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 Har (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 Shir characterized for the purposes of identifying whether any disproportionately high a minority and low-income communities. The population surrounding the Pearl Harbor N shown to be 68 percent minority and 7 percent low-income, based on U.S. Bureau of C the definitions and approach presented in Appendix L.

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

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

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

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

Past tsunami inundation levels have been about 1 meter (3 feet) above mean se tsunami wave elevations for the 10-, 100-, and 500-year event are 0.2, 0.6, and 1.2 feet), respectively, for adjacent coastal areas. Maximum reasonably foreseeable ty rise would be approximately 4.3 meters (14.5 feet) above mean sea level.

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

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 Haleakala National Park, on the Island of Maui, which is 188 kilometers (117 miles)

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

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

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

The traffic into and out of the base is a combination of commuting traffic, r and service traffic. Kamehameha Highway is the primary access route to the base fr Pearl City/
central Oahu direction. Both Kamehameha Highway and Interstate Highway H-1 provide Base from Honolulu.

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

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

4.6.5 Kesselring Site

The Kenneth A. Kesselring Site is located about 24 kilometers (15 miles) nort
Schenectady, New York, and 13 kilometers (8 miles) west of Saratoga Springs (see Fi
three operating naval nuclear propulsion prototype plants and support facilities.
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-
reservation.

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

The population within 80 kilometers (50 miles) of the Kesselring Site has bee
purposes of identifying whether any disproportionately high and adverse impacts exi
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
Government acquisition in 1948. There are no known archaeological, architectural,
American Indian sites in the secure area where SNF storage would take place.

The site lies on primarily unconsolidated material, primarily of glacial orig
Where it exists, the overburden can be up to several hundred feet thick. The overb
basic kinds of depositional units: glacier debris, lake, and ice-contact/outwash d
glaciers overlie much of the bedrock and form the elliptical hills throughout most
glacier deposits are a dense and poorly sorted mixture of clay, silt, sand, gravel,
stratified lake clay and silt deposits are mapped over the southeastern quadrant of
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 sout
damage) area to the north of the site. The maximum intensity earthquake within 161
of the site had a Modified Mercalli Intensity Scale value of VII. The most recent
occurred at Lake George, New York, on April 30, 1931. Because the site is located
caused this quake, an earthquake of similar intensity could occur at the site. The
the vicinity of the site.

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

The Code of Federal Regulations (40 CFR Part 81) states that the Air Quality
includes this site is in marginal nonattainment for ozone and is better than nation
suspended particulate matter and sulfur dioxide. The area has no specific classifi
and nitrogen dioxide. The nearest Class I Area is at Lye Brook Wilderness, Suarder
74 kilometers (46 miles) from the site.

The Kesselring Site is located in a predominately rural area. There are 13 w
Site; current operations do not impact these wetlands. Federally or state-listed t
species located in the Saratoga County area include the bald eagle, the karner blue
falcon, and the red-shouldered hawk. There are, however, no records of any of thes

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

Two lines of the Delaware and Hudson Railroad cross the region within 16 kilc the site. The main north-south line runs through Ballston Spa, just over 8 kilomet and a trunkline runs just over 8 kilometers (5 miles) to the northeast into the cen

SNF from the Kesselring Site has been sent to the Expended Core Facility at t Engineering Laboratory since 1961. Shipping containers are transported by truck tc line where the containers were loaded onto rail cars. Since 1961, 20 shipments of to the Expended Core Facility from the Kesselring Site.

The annual airborne emissions from the site do not result in measurable radia 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 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 s Site, Idaho National Engineering Laboratory, the Savannah River Site, and the Oak R university and domestic research reactors; and three locations where specific types reactor SNF for which DOE is responsible are stored. This section summarizes envir characterization information for these sites that might be affected by programmatic management. More detailed information characterizing the sites is presented in App cover.

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

4.7.1 DOE Test and Experimental Reactors

In addition to facilities at the Hanford Site, Idaho National Engineering Lak Site, and Oak Ridge Reservation, experimental reactors are located at, and small qu storage at, the following four DOE sites: Brookhaven National Laboratory, Los Alan 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 kilomete New York City, in a primarily suburban area. About 410,000 people reside in Brookh houses the Laboratory, and 8,000 people live within 0.8 kilometer (0.5 mile) of the

In terms of meteorology, the laboratory can be characterized, like most Easte well-ventilated site. The annual precipitation during 1991 was 45.3 inches (115 ce 3.1 inches (8.0 centimeters) below the 40-year annual precipitation average of 48.4

Suffolk County, in which the site is located, is classified as being in nonat for the criteria pollutant ozone. The county is in attainment of standards for car sulfur dioxide, nitrogen dioxide, and lead.

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

Groundwater flow under the Laboratory site is complex, moving in different di sections of the site, but generally with a velocity estimated to range from 30 to 4 18 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 Nati 1988 to 1992 have resulted in calculated average doses to hypothetical maximally ex 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 Mexi (24 miles) northwest of Santa Fe. The resident population of Los Alamos county in 3,900 Los Alamos National Laboratory employees reside in the adjacent Rio Arriba an

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

The Los Alamos National Laboratory is located on the Pajarito Plateau, which canyons separated by long narrow mesas. It lies within Seismic Zone 2B, and seismi identified three active faults in the area. Studies suggest seismic events with a been produced in the last 500,000 years.

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

The releases of radioactive effluents from Los Alamos National Laboratory ove 1991 have resulted in a calculated average dose to the hypothetical maximally expos 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 approximately 10 kilometers (6.5 miles) southeast of downtown Albuquerque, New Mexi population of Albuquerque was about 385,000.

The climate at Sandia National Laboratories is characteristic of a semi-arid annual rainfall of about 21 centimeters (8.1 inches). Severe weather affecting fac extremely rare. The Sandia National Laboratories is within the Albuquerque-Mid Ric Intrastate Air Quality Control Region, portions of which are designated as nonattai Environmental Protection Agency for Colorado.

The Sandia National Laboratories is located on the Albuquerque East Mesa in a a region of high seismic activity but of low magnitude and intensity. More than 1, 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 avera cubic meters per second (37.3 cubic yards per second). No perennial streams flow t National Laboratories area, and flooding is not a high probability at Kirtland Air groundwater is distinguished by a fault complex underlying the area; depths range f to 100 feet) on the east side of the complex and from 115 to 152 meters (380 to 500 Groundwater flow west of the complex is generally toward the north and northwest, a 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 th area. The site is surrounded by a 826-hectare (2,040-acre) green belt forest prese 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 thec tornado strike at Argonne National Laboratory-East is about one every 1,200 years, struck by tornadoes in 1976 and 1978, with minor damage.

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

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

4.7.2 Domestic Research and Test Reactors

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

These 55 U.S. Nuclear Regulatory Commission licensed facilities, 40 of which universities, are located in 28 states. They are located in a wide variety of area to industrial research parks and urban university campuses, which does not permit a affected environment for these facilities. Information on the environments of thre U.S. Nuclear Regulatory Commission-licensed research reactors [the National Institu Technology (former National Bureau of Standards), the Massachusetts Institute of Te 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-acr Gaithersburg, Maryland, about 20 miles northwest of downtown Washington, D.C. The Gaithersburg, a Washington suburban area, was about 39,500. The nearest site bounc kilometer (0.25 mile) southwest of the reactor.

The climate of the area is moderate, with infrequent occurrences of severe we number of winter storms and hurricanes have affected the general area, the site is the recurrence interval for a tornado at the site is about one in 2,000 years. Air 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 regic (Seismic Zone 1). The maximum ground acceleration for the site area was estimated

There are no discharges from the National Institute of Standards and Technolc streams or groundwater; liquid wastes are processed before discharge to the local s have averaged 2.7 curies of tritium and 1.9 millicuries of other beta-gamma emitter 1992. Over the same period, the site released airborne emissions containing an ave argon-41 and 353 curies of tritium per year, well below the license limits for the collective doses are not reported, and because site meteorological data are not mon 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-feet) concrete shielding, (1-acre) site in a heavily industrialized section of Cambridge, Massachusetts, a fe Massachusetts Institute of Technology campus and about 1.6 kilometer (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 uns conditions with strong winds. Severe weather conditions are uncommon, and flooding expected even under record rainfall conditions. Air quality is typical of an urban

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

There are no discharges from the Massachusetts Institute of Technology reactc groundwater; liquid wastes are processed before discharge to the local sanitary sew averaged 0.074 curies of tritium and 9.5 millicuries of other beta-gamma emitters p 1992. Over the same period, the reactor released airborne effluents containing an curies of argon-41, well below the license limits for the reactor. However, indivi not reported, and because site meteorological data are not monitored, doses cannot 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 Missouri, located south of the main business district of Columbia, Missouri. The p was about 69,000 in 1990. Agriculture is the predominant regional activity, althou small industrial activities in the area.

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

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

There are no discharges from the University of Missouri/Columbia Research Rea streams or groundwater; liquid waste is processed before discharge to the local san averaged 0.21 curie of tritium and 25.6 millicuries of other beta-gamma emitters pe Over the same period, the reactor released airborne effluents containing an annual curies of argon-41 and about 7 curies of tritium, well below the license limits for individual or collective doses are not reported, and because site meteorological da 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 resp the facilities discussed previously, no additional SNF is either being generated at storage facilities. These facilities include the West Valley Demonstration Project the former Fort St. Vrain Nuclear Power Plant in Colorado; and the Babcock & Wilcox Lynchburg, Virginia. Their environmental characterizations are summarized in the f 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 com processing plant, within a larger 1,341-hectare (3,345-acre) site known as the West Service Center. The Center is located in Cattaraugus County, a rural area of weste 50 kilometers (31 miles) south of Buffalo, New York, and 40 kilometers (25 miles) e

A 60-meter (200-foot) onsite meteorological tower is operated by DOE at the W

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 mete per hour). The precipitation for 1992 was 18 centimeters (7.1 inches) above the a centimeters (40.9 inches). The onsite 1992 wind data and National Weather Service the Buffalo airport did not compare well, thereby indicating that the Buffalo airpc predicting conditions at the West Valley Demonstration Project.

The West Valley Demonstration Project is located within the Cattaraugus Highl transitional zone between the Appalachian Plateau Province and the Great Lakes Plai any consequence is recognized within the site. The Clarendon-Linden structure is t earthquake- (fault-) producing feature known to exist in the region. It is approxi miles) from the site. The site has experienced a moderate amount of relatively min historical times, ground motion at the site probably has not exceeded a Modified Me horizontal acceleration of 0.05g. It is estimated that the maximum earthquake on t structure would produce an earthquake of Modified Mercalli Intensity of VI or VII a acceleration of approximately 0.12g at the site.

The West Valley Demonstration Project is located in the Cattaraugus Creek dra part of the Great Lakes - St. Lawrence watershed. All surface drainage from the We Project is to Buttermilk Creek, which flows into Cattaraugus Creek and ultimately i 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 sour Environmental Protection Agency. This unit is included in the sole source designat 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 Plattev mile) west of the South Platte River, and 56 kilometers (35 miles) north of Denver. consists of 1,132 hectares (2,798 acres). Based on the 1980 census, the populatic mile) radius of the site was estimated to be 3,148, with 1,662 residing in the town 1982). Most of the land in the immediate area of the site is disturbed, agricultur

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

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

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

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 city of Lynchburg are centrally located within the area of Amherst, Appomattox, Bed Counties. The combined population of these counties is about 180,000.

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

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 scattere dimensions lying eastward from the main chain of the Blue Ridge Mountains. The sit 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 been recorded with intensities sufficient to cause some damage, but these were not Earthquakes are not expected to cause serious damage to the Lynchburg facilities nc hazardous materials.

The James River is formed about 154 kilometers (96 miles) upstream of the sit the Jackson and Cowpasture Rivers. The James River flows generally south-southeast Ridge Province to the Atlantic Ocean through the Hampton Roads and Chesapeake Bay. flow rate of the James River at the plant is estimated to be about 110 cubic meters feet per second). The largest recent flood occurred in November 1985 and had a flc (534 feet) above mean sea level at Lynchburg. The groundwater elevation is between (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 Disposa Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Rep Washington, D.C., February.

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

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

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5. ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental consequences of implementin alternatives described in Chapter 3. To focus on the most significant issues in th Program, this chapter summarizes and simplifies the more detailed site-specific ana consequences presented under separate cover as self-contained appendices to Volume provide a collection of summary information across DOE sites, SNF interim storage a 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 alternativ 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 as the 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 impacts that cannot be completely analyzed.

This chapter is organized into eight sections. The disciplines (topical area potential impacts, are of general public interest, or may help to discriminate amon discussed in Section 5.1. In general, the consequences presented in Section 5.1 re impacts, electricity use, waste generation, and radiological and transportation imp 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, una environmental effects, the relationship between short-term use and long-term produc irretrievable commitments of resources, potential mitigation measures, and environm respectively.

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

For more detailed information on analyses of environmental impacts, and for a analyses supporting the consequences reported here, refer to the appropriate site-s 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 t developing the discussion of environmental consequences. The summary tables in App comparison of quantitative impacts (for example, increases or decreases in direct e implementation of an alternative) among sites.

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

80-kilometer (50-mile) radius surrounding each of 10 potential sites of proposed ac kilometer (50-mile) radius is in keeping with analysis conducted under the National Act regarding proposed DOE activities to identify environmental impacts from propos kilometer (50-mile) radius represents the limit in which any impacts are considered significance. Minority and low-income communities surrounding each alternative sit the use of a Geographical Information System, based on 1990 U.S. Census data. Demo 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, foc discriminator disciplines-those that may differentiate among sites, have the potent 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 alt site.

5.1.1 Background

The following discussion provides background and perspective for the environm 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 result construction and operation. Secondary effects include changes that result from reg nonpayroll expenditures, and payroll spending by site employees. For the major DOE projections (regardless of SNF management decisions) indicate that jobs will be los years for all sites. Potential SNF management impacts onsite and regional employme light of this trend.

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

With employment as an indicator, small changes in population are anticipated, changes in demand on regional supporting infrastructures. The number of direct job under each alternative as a result of SNF management activities was estimated for e employment graphs shown on Figures 5-1 through 5-9 (presented and discussed fully w represent the 10-year average of the incremental change in direct employment result management. Secondary effects, such as the need for additional housing and improve are discussed if an impact is indicated. Details on the socioeconomic impact analy projections from which comparisons were made, are provided in Appendices A through increases and decreases that are presented in the text are 10-year averages rather increase or decrease in any single year as presented in Appendix A through F. Plea appendix 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 c and are discussed in Section 5.2.9. However, power consumption under some of the a exceed existing capacity at certain sites and this is discussed in more detail in t requirements by site and by alternative vary significantly depending on whether a s SNF. For example, at the Hanford Site, the annual increase in power use from SNF m could vary from 0 megawatt-hours per year under the No Action alternative when stor 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 app megawatt-hours per year of electricity. Therefore, the power requirements would be alternatives where both processing and operating an expended core facility occur si of electricity use in Figures 5-1 through 5-9 show the maximum and minimum incremen consumption that would result from implementing the alternative. Current capacitie 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, dependin may yield high-level, transuranic, low-level, mixed, and hazardous wastes. The was further treated to make them safe for transport, storage, or disposal. The capacit storing of high-level and transuranic wastes is generally limited. Low-level waste onsite at the major DOE facilities. Hazardous wastes are normally treated in some in approved disposal facilities onsite or offsite. A few categories of mixed waste are in storage awaiting development of treatment capabilities. The graphs of waste through 5-9 illustrate the estimated annual average of low-level waste and high-lev waste that each alternative would generate between 1995 and 2005. Site-specific de waste management and the current status of waste management activities at the sites 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 public near nuclear facilities. Therefore, this EIS places more emphasis c exposure to radiation than on other topics, even though the effects of radiation ex circumstances evaluated in this EIS are small. This subsection explains basic conc of radiation effects to provide the background for later discussions of impacts.

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

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

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

Radiation can also cause a variety of ill-health effects in people. The most effect to depict the consequences of environmental and occupational radiation expos latent cancer fatalities. This effect is referred to as latent cancer fatalities b 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 pers 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 indivi that may be more sensitive to radiation than workers (for example, infants).

These concepts may be applied to estimate the effects of exposing a populatic example, in a population of 100,000 people exposed only to background radiation [0. per year], 15 latent cancer fatalities per year would be inferred to be caused by t persons 0.3 rem (300 millirem) per year 0.0005 latent cancer fatalities per persc fatalities per year].

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

How should one interpret a noninteger number of latent cancer fatalities, suc is to interpret the result as a statistical estimate. That is, 0.05 is the average expected if the same exposure situation were applied to many different groups of 10 groups, nobody (0 people) would incur a latent cancer fatality from the 0.001 rem (member would have received. In a small fraction of the groups, 1 latent fatal canc exceptionally few groups, 2 or more latent fatal cancers would occur. The average the groups would be 0.05 latent fatal cancers (just as the average of 0, 0, 0, and likely outcome is 0 latent cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on Consider the effects, for example, of exposure to background radiation over a lifet latent cancer fatalities" corresponding to a single individual's exposure over a (p 0.3 rem (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 ef exposure on the exposed individual would produce a 1.1-percent chance that the indi latent fatal cancer caused by the exposure. Said another way, about 1.1 percent of estimated to die of cancers induced by the radiation background.

The dose-to-risk conversion factors presented above and used in this EIS to r exposures to latent cancer fatalities are based on the "1990 Recommendations of the Commission on Radiation Protection" (ICRP 1991). These conversion factors are cons by the U.S. Nuclear Regulatory Commission in its rulemaking "Standards for Protecti (FR 1991). In developing these conversion factors, the International Commission on reviewed many studies, including Health Effects of Exposure to Low Levels of Ionizi and Sources, Effects and Risks of Ionizing Radiation. These conversion factors rep estimates for relating a dose to its effect; most other conversion factors fall wit associated with the conversion factors that are discussed in NAS/NRC (1990). The c where the dose to an individual is less than 20 rem (20,000 millirem) and the dose (10,000 millirem) per hour. At doses greater than 20 rem (20,000 millirem), the cc relate radiation doses to latent cancer fatalities are doubled. At much higher dos than latent cancer fatalities, may be the primary concern. Unusual accident situat radiation doses to individuals are considered special cases.

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

Population(c)	Latent cancer fatality	Nonfatal cancer	Genetic effects	Total detriment
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 ar cancers per person-rem of radiation dose. Genetic effects as used here apply to pc individuals.

b. Source: ICRP (1991).

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

During SNF handling and transportation, the principal radiation hazard is the emitting from the SNF. In comparison, the hazard from release of radioactive fissi 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, attenuated or stopped with the insertion of shielding materials such as lead, steel and the worker. Because radiation intensity decreases with distance, maintaining a meters also offers adequate protection from the radiation from unshielded SNF. For requires sufficient shielding on shipping casks to reduce radiation levels at 2 met 0.01 rem (10 millirem) per hour or less. At 100 meters (328 feet), the distance ef rem (10 millirem) per hour by a factor of about 2,500, which would not be detectabl

During SNF interim storage, trace quantities of radioactive isotopes (princip particulate fission products) may also be released to the environment from severely releases would result in small doses to the workers in the immediate vicinity of th atmospheric dispersion and groundwater pathways, would ultimately result in very sm of the nearby general population.

Accidents involving SNF can also result in radiation releases and exposures. very small fraction of the radioactive material within the SNF is released. This i solid form and the radioactive elements are intermingled within the solid SNF. Sig radioactive elements can be released only when the accident generates enough energy particles of SNF to be released to the atmosphere. For most accidents, the energy much damage to the SNF and a small fraction of the radioactive material is releasec

One type of accident, an accidental nuclear criticality (uncontrolled chain r quantities of direct radiation, as well as fission products and heat. Within a few incidents, doses from direct radiation can be fatal. Further away, doses are princ fission product gases and particulates. This type of accident is well understood a handling solid materials such as SNF.

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

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

For example, if the frequency of an accident were 0.2 occurrences per year an cancer fatalities resulting from the accident were 0.05, the risk would be 0.01 lat (0.2 occurrences per year 0.05 latent cancer fatalities per occurrence = 0.01 late year). Another way to express this risk (0.01 latent cancer fatalities per year) i subject to the accident continued for 100 years, one latent cancer fatality would b accidents 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 Idahc 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 c 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 accidenta 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 considerec opposed to voluntary risks such as operating a motor vehicle.

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

A number of existing accident analyses were evaluated to find a small group w 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 desi 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 r evaluated included those with an estimated probability ranging from 1 chance in 1,0 10,000,000 per year.

Appendices A through F summarize the possible accidents involving SNF operati sites and evaluate the potential consequences of the accidents that present the hig estimated frequency of occurrence multiplied by consequences, to the workers and th might be expected, 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 release conditions, and the estimated probabilities were based on existing safety analyses operations at each site, or for comparable operations at other sites. The accident the 40 to 50 years of operational experience with SNF at the sites.

Accident consequences were analyzed utilizing radioactive and toxic material each accident. The downwind concentrations of materials released in accidents were 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 fa release occurs, (b) a hypothetical resident at the site boundary nearest to the fac (called the maximally exposed offsite individual), and (c) the general population w miles) of the release location. The potential impacts to workers in the immediate analyzed qualitatively.

Dispersion in air from the release site was estimated with both typical (50th (95th percentile) meteorological conditions. The unlikely weather conditions repre 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 ti 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 meteorologic c 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 incluc hazards from construction and normal operation. Accidents that may affect occupati were evaluated for each of the alternatives at each of the potentially affected sit maximum reasonably foreseeable accidents include chemical spills, fires, and worker accidents estimated to exceed the most widely accepted accident exposure (toxicolog the Emergency Response Planning Guideline-3 and the Threshold Limit Value of the Am of Governmental Industrial Hygienists, are summarized in Section 5.1, Volume 1. Ex concentrations would result in an unacceptable likelihood that the worker or public develop life-threatening or very serious toxicological effects. The analysis methc descriptions are discussed in Appendices A through F.

Industrial accidents that do not involve the release of chemicals could occur proposed storage and generation locations during the transition/construction phase rates. Construction accidents would primarily occur during the construction perioc approximately 8 years under the Centralization alternative). Construction fataliti approximately one per year at the centralized site for the Centralization alternati transported to the centralized facility, normal operations would not be expected tc fatal accident frequency is estimated to be less than one accident per year. The s the centralized facilities would be expected to have less than one fatal accident p 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 while other alternatives, such as the Centralization options, would involve extensi and have greater transportation impacts.

SNF is transported in large, heavy containers called shipping casks. Shippin stringent Federal standards and are designed and constructed to contain the radioac severe transportation accidents. There are also standards that describe the routin shipments. Because of the stringent standards for SNF shipping casks, the U.S. Nuc Commission has estimated that shipping casks will withstand 99.4 percent of truck a sustaining damage sufficient to breach the shipping cask. Only in the worst physic conditions, which are clearly of low probability, can the shipping cask be so damag significant release of radioactivity to the environment.

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

In contrast to the nonradiological impacts, the radiological impacts are due present in SNF shipments. In the case of incident-free transportation, the radiolc radiation field that surrounds the SNF shipping cask. These impacts are estimated general population along the transportation route. In the case of transportation a impacts would result from the radioactivity released from the SNF shipping cask dur impacts are also estimated for the general population along the transportation rout

This EIS evaluated a full range of transportation accidents, up to and incluc low probability, estimated to be on the order of one in 1 million years. In additi severe transportation accidents were evaluated. The probability of these severe ac on the order of one in 10 million years.

For both incident-free transportation and transportation accidents, methodolc U.S. Nuclear Regulatory Commission was used to estimate impacts. These impacts wer of the estimated number of radiation-related cancer fatalities and the estimated nu fatalities from vehicular emissions and traffic accidents associated with each alte C, D, F, and I contain more details on the methodology, data, and assumptions used 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 exce operations or in the event of an accident. For routine operations, the results of provide realistic estimates of source terms, which when combined with conservative of radiation, produce estimates of risk that are very unlikely to be exceeded. The have been calculated using the same source terms and other factors, so this EIS prc means of comparing potential impacts on human health and the environment.

The analyses of hypothetical accidents are based on the calculations that in sequences of events and models of effects that have not occurred. The models have estimates of the probabilities, source terms, pathways for dispersion and exposure, health and the environment that are as realistic as possible. In many cases, the p postulated is very low and little experience is available; thus, the consequences a required the use of models or values for input that produce estimates of consequenc

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 Expended Core Facility at the Idahc 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 d 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 increm

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 Hanforc 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 associ
alternative between 1995 and 2005. Implementation of the No Action alternative wou
shutdown of the Expended Core Facility at the Idaho National Engineering Laboratory
of approximately 500 permanent jobs from a region with a relatively low population
of the Expended Core Facility would initially result in an increase in direct emplc
jobs over 3 years to handle the transport of containers, but then the 500-person wc
a caretaker work force of 10 (see Appendix D, Volume 1). This results in the loss
approximately 240 jobs over the 10-year period or 3 percent of the Idaho National E
work force, as shown in Figure 5-1. At the Hanford and Savannah River Sites, there
change or less than a 1 percent increase in direct employment, respectively, from i
alternative. The peak employment would be 50 additional workers at the Savannah Ri
approximately 0.3 percent of the 1995 baseline.

Naval sites would require very few additional workers to secure the naval SNF
monitor its condition. The incremental labor required for SNF management at the na
drawn from the existing work force and would be insignificant with respect to curre
those sites. At the university and other Government reactors, there would be a nee
maintenance personnel for reactors that would shut down. While this would not be a
employment at those sites because the staff required to run the reactors would no l
be an increase in the staff that would be involved directly in SNF management. Acr
be a decrease in employment of less than 0.1 percent of the total workforce. There
the No Action alternative would have 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
sites, this change is very small and easily accommodated. Ongoing SNF operations a
baseline electric power usage, and the proposed actions under the No Action alterna
intensive. At the Idaho National Engineering Laboratory, the shutdown of the Expen
result in about a 5 percent reduction in electric power consumption below existing
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 gene
management over the next 10 years under the No Action alternative. Day-to-day SNF
storage activities would annually generate approximately 20 cubic meters per year (
of transuranic wastes and approximately 400 cubic meters per year (520 cubic yards
waste at the Savannah River Site. These volumes would be generated by activities r
SNF, including the onsite consolidation of existing fuels and refurbishment of exis
No high-level waste would be generated at any of the sites under the No Action alte
levels of all wastes would be generated by the Hanford Site and the Idaho National

At the naval sites, implementation of the No Action alternative would result
limited amounts of solid municipal wastes and low-level radioactive waste. Wastes
storage of naval SNF would be controlled and managed in accordance with existing si
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
handle and store SNF. Radiological impacts from normal operations and accidents ar
below.

Radiological Impacts From Normal Operations-The airborne releases from

SNF interim storage pools at the Hanford Site, Idaho National Engineering Laborator Site were estimated to result in low-level exposures to the population in the vicin additional latent cancers within that population expected. For naval sites, there releases; direct radiation is the only mechanism of exposure associated with the dr technologies that would be used under this alternative. The estimated annual laten general population are illustrated in Figure 5-1.

Radiological Impacts From Accidents-

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

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

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

An onsite worker at the maximum exposure location downwind of the spent fuel estimated to receive doses that correspond to an estimated probability of a latent 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 order of 70 to 140 rem (70,000 to 140,000 millirem). Acute doses of this magnitude 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 inhal products.

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

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

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

The highest risk to workers is an inadvertent nuclear criticality in the Idah Plant CPP-603 Underwater Fuel Storage Facility, which has an estimated probability 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 estir is 4.0 10-8 latent cancer fatalities per year.

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

Fuel-handling accidents have the highest estimated frequency of occurrence at but because of their lower consequences, fuel-handling accidents do not represent t under the No Action alternative. The frequency of fuel-handling accidents is direc 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 c the Idaho Chemical Processing Plant are limited adverse effects to vegetation or wi contamination requiring cleanup around the accident site. More extensive contamina expected should a cell breach occur at the Hot Fuels Examination Facility. Additic identified include the potential for a 1-year restriction in agricultural use of up Idaho National Engineering Laboratory site, the potential interdiction of affected nearby lands, and the potential for temporary restricted access to affected public acres).

The Expended Core Facility at the Idaho National Engineering Laboratory would a transition period of approximately 3 years. Potential accidents during this peri Attachment F of Appendix D under the subheading of the Decentralization alternative

Savannah River Site. Under the No Action alternative, a wide range of accident initiators were considered for the existing SNF wet storage activities, in operational events, external hazards such as aircraft crashes, and natural phenomen Five types of SNF-related accidents are identified in Section 5.15 and Attachment A include (a) a fuel assembly breach because of dropping, objects falling onto the as cutting into the fuel part of an assembly, (b) an inadvertent nuclear criticality i (c) a fire and explosion in an adjacent facility, and (d) spills of contaminated st the storage facility or to the ground outside of the facility. The initiators for operational events and natural phenomena such as earthquakes. Aircraft-crash-initi considered to be reasonably foreseeable because of their very low frequency.

The highest risk accident, both to the general population and workers, was ic assembly breach accident with an estimated frequency of 0.16 per year. The estimat this accident corresponds to 8.5 10-3 latent cancer fatalities in the general popu (50 miles). The estimated risk, taking into account the probability of occurrence latent cancer fatalities per year. The estimated dose to the maximally exposed off to an estimated probability of a latent cancer fatality of 1.6 10-7 per year.

A co-located worker downwind of the accident is estimated to receive a dose t estimated probability of 4.8 10-6 latent cancer fatalities. The estimated risk fc cancer fatalities per year.

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

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

Naval Facilities. Under the No Action alternative, newly generated SNF naval sites, which differs from the historical practice of SNF management at the Ic Laboratory. The naval sites are generally located in densely populated areas. As of an accident involving naval SNF at a naval site would be higher than the same ac National Engineering Laboratory.

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

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

The highest risk to workers occurs at Norfolk. The probability of an airplan estimated to be 1 chance in 1,000,000 per year of operation. An onsite worker appr (about 330 feet) downwind of the accident is estimated to receive a dose that corre a latent cancer fatality of 7.4 10-2. The estimated risk for a worker is 7.4 10- year.

It is not likely that any fatalities would occur in workers in the vicinity k 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 inhal radioactivity if the container seal were breached. The low probability of the airp with the probability that workers would be close enough to be affected, coupled wit 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 fc 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 stor analysis of these accidents indicated that they were similar in kind and consequenc 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 w Nevada Test Site because no SNF is currently managed at the site. Two accidents we 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 ris 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 resu latent cancer fatalities to the worker and 2.3 latent cancer fatalities to the gene 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 ha chemicals to the workplace or the environment. The specific accident was defined a 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 facili Hanford Site could result in the release of polychlorinated biphenyls and sulfuric KW Basins. Should these releases occur, workers and the general public travelling could be subjected to chemical concentrations that might cause fatalities or seriou general public at the reservation boundary would be subjected to approximately 20 p guideline value.

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

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

A diesel spill and fire was identified as the maximum reasonably foreseeable naval sites. Such an accident would be expected to produce toxic gas concentration should it occur, would be expected to cause fatalities or serious health effects fr dioxide, oxides of nitrogen, and nitric acid) that are produced during the fire. W 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 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 Expended Core Facility at the Idahc Laboratory to offsite locations. Onsite transportation of SNF would occur at the H National Engineering Laboratory, and Savannah River Site.

Incident-Free Transportation-For the No Action alternative, the inciden 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 em 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 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, witr 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 Expended 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 Expended 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-closin
Facility would result in the loss of an average of approximately 240 direct jobs ov
National Engineering Laboratory (Figure 5-2), with an ultimate loss of about 500 jc
decrease in employment at the Idaho National Engineering Laboratory of approximatel
Decentralization C option, the Expended Core Facility would continue to operate at
Engineering Laboratory with no socioeconomic consequences. At the Hanford and Sava
this alternative would result in significant new construction, employing an additic
Hanford Site and 200 to 220 workers at the Savannah River Site over a 10-year peric
options chosen for SNF management at those sites. The higher value reflects an inc
employment of approximately 3 percent at the Hanford Site and approximately 1 perce
River Site. The peak in employment would be an additional 1,100 workers at the Han
approximately 6 percent of the 1995 baseline.
Figure 5-2. Summary of impacts for the Decentralization alternative. (The maximum

Increases in construction activity over the short-term at the Hanford Site cc
market and put additional demands on school capacity. Operations after the constru
very small consequences through the overall project timeframe. No secondary effect
are expected at the Savannah River Site.

At the naval sites, the Decentralization alternative would require constructi
to construct fuel storage areas and to staff these areas, but it is expected that t
the sites or the local area, and there would not be a significant socioeconomic imp
communities. Nevertheless, staff required would be approximately
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 Decen
As previously discussed in Section 5.1.1.2, the variation in power use by site show
whether processing occurs or not. As an example, if the Hanford Site were to choos
processing option, the power required for the storage option would be less than 1 p
use; however, if a processing option were selected, then power use could increase t
existing site use (see Appendix K). At each of the sites, the increase in electric
accommodated with the existing site electric power infrastructure. At Hanford, if
selected, an extension of existing utilities in the 200 Area to the project area wc
maximum potential electricity usage shown at the Savannah River Site would be assoc
processing option that requires the operation of the F- and H-Canyons. These have
and onsite and offsite utilities are adequate for their operation. At the Idaho Na
Laboratory, the principal differences among options are due to the operation or shu
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 mana
the next 10 years relative to the baseline are shown in Figure 5-2. The combined v
transuranic, and mixed waste generated annually, if processing options were impleme
average from approximately 18 to 44 cubic meters per year at the Savannah River Sit
respectively. In contrast, if wet storage options for N-Reactor fuel were selectec
high-level, transuranic, or mixed waste would be expected to be generated. Figure
volume of low-level waste that would be generated from implementation of the Decent
should be noted that the volume of low-level waste would increase if a processing c
either the Hanford Site or the Savannah River Site. Additional volumes of low-leve
generated at the Savannah River Site from the limited receipt of SNF shipments from
addition of a new canning facility. Low-level waste would only be generated at the
Engineering Laboratory under the Decentralization alternative, where the Expended C
continue to operate. Operation of an Expended Core Facility could result in the an
approximately 430 cubic meters (526 cubic yards) of low-level waste (Appendix D).

At the naval sites, the implementation of the Decentralization alternative wc

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 op
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 l
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 b
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 do
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 Expended 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 und 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 Appenc 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 conseq were estimated to be 1.7 latent cancer fatalities. The probability of occurrence c slightly greater than 1.0 10-7 per year. This probability accounts for the accide number of miles traveled, the percentage of the total distance that occurs in a sub 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 fc evaluated in this EIS. Consistent with this guidance, an accident of similar sever suburban area, but occurring in an urban area, would not be reasonably foreseeable. miles traveled in an urban area would be only a few percent of the total transporta probability of occurrence of less than 1.0 10-7 per year. Thus, the maximum reasc transportation accident in an urban area would be less severe than postulated to oc is estimated to result in 0.065 latent cancer fatalities. (A more complete discuss 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 alternati Idaho National Engineering Laboratory, and Savannah River Site. The maximum reason accident for this alternative occurs at the Idaho National Engineering Laboratory, 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 remain at those sites, and newly generated SNF from DOE, university, and other Gove be transported to the Idaho National Engineering Laboratory or the Savannah River S case commercial SNF and naval SNF would be transported to the Idaho National Engine storage. Existing research and development of technologies improving the safe and DOE sites would continue, and new projects would commence. Examination of naval fu conducted at the Expended Core Facility at the Idaho National Engineering Laborator

The implications of this alternative for major DOE sites would be similar to Decentralization alternative. New storage facilities would be built at the major D facilities or to accept newly generated SNF from other sites. Degraded fuels at th the Hanford Site might be stabilized to improve safe storage.

The sites that would be affected by the 1992/1993 Planning Basis alternative Idaho National Engineering Laboratory, and Savannah River Site. The environmental 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 describec 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 additic workers over 10 years, less than a 2 percent increase above baseline site employmen at Hanford would be the same as that described for the Decentralization alternative 1,100 additional workers at the Hanford Site, an increase of approximately 6 percen baseline. Secondary socioeconomic impacts at the Hanford Site would be similar to the Decentralization alternative.

There would be no socioeconomic impact at the naval sites because current pra altered. Storage facilities would not need to be constructed at the individual nav 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 5-3. The impact on power consumption at the sites would be the same as that descri

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 imp
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 implementa
Planning Basis alternative. The volume of low-level waste and the combined volume
transuranic, and mixed waste would be similar to the volumes generated under the De
alternative for the Hanford and Savannah River Sites (see Figures 5-2 and 5-3). Th
maximum values shown for these sites reflect whether a storage option or a processi
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 wa
be generated by the Electrometallurgical Process Demonstration Project. The volume
generated at the Idaho National Engineering Laboratory would be from the constructi
storage and characterization facilities at the site. Adequate storage capacity exi
until 2005, when additional capacity would be expected to be required for managing
(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 Ba
would be essentially the same as estimated for the Decentralization option. Figure
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 alter
Hanford Site would not result in accident risks significantly different from those
Decentralization alternative (Section 5.15 of Appendix A).

Idaho National Engineering Laboratory. Under the 1992/1993 Planning Ba
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 (Se
B). The consequences of fuel-handling accidents would be the same as described unc
alternative, but increased SNF shipments, and consequently more handling of SNF, cc
frequency of fuel-handling accidents about three times higher than for the No Actic
(Slaughterbeck et al. 1995). Because of the increased frequency of fuel-handling a
from fuel-handling accidents may exceed the risk from SNF storage accidents.

Savannah River Site. The implementation of the 1992/1993 Planning Basi
the Savannah River Site would not result in accident consequence estimates
that differ from those identified under the Decentralization alternative (Section 5
Appendix C). Because of increases in amount of SNF handled, the accident frequenci
to increase.

The accident frequency for the highest risk accident, the fuel assembly breac
be about 0.40 fuel assembly breaches per year of operation with implementation of t
results in estimated risk to the general public, maximally exposed offsite individu
3.4 10-3, 4.0 10-7, and 1.9 10-6 latent cancer fatalities per year of operation,

Naval Facilities. With implementation of the 1992/1993 Planning Basis
naval facilities, all storage and examination activities occur at the Idaho Nationa
The maximum risk accident at this facility was not the maximum risk accident at the
Engineering Laboratory, so it is not discussed further in this volume. See Attachm
details.

Other Generator/Storage Locations. For the 1992/1993 Planning Basis al
accident risks at the Oak Ridge Reservation and other SNF interim storage sites tha
SNF elsewhere would be similar to the accident risks under the No Action alternativ

5.1.4.5 Nonradiological Accidents.

The maximum reasonably foreseeable chemical accident at the Idaho National Engineering Laboratory, Savannah River Site, and other genera would be similar to those described under the No Action alternative. The Hanford S similar to those in the Decentralization alternative.

Two independent accidents were evaluated to describe the maximum reasonably f chemical hazards during the operation of the Expended Core Facility at the Idaho Na Laboratory. Such a release could subject workers to chemical concentrations that c 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, f non-DOE research reactors would transport SNF to the Idaho National Engineering Lak Savannah River Site. Commercial SNF stored at the West Valley Demonstration Projec stored at the Fort St. Vrain site would be transported to the Idaho National Engine research reactor SNF stored at various DOE sites would be transported to the Idaho Laboratory and the Savannah River Site. Naval SNF would be transported from naval Expended Core Facility and irradiated test specimens would be transported between t Facility and offsite locations. Onsite transportation would relocate SNF from one stabilization or storage.

Incident-Free Transportation-For the 1992/1993 Planning Basis alternati incident-free transportation of SNF was estimated to result in total fatalities tha over the 40-year period 1995 through 2035. These fatalities were the sum of the es radiation-related latent cancer fatalities and the estimated number of nonradiologi emissions.

The reason for a range of fatalities was due to two factors: (a) the option transport for DOE SNF (see Appendix I) and (b) different SNF management options at Site (see Appendix C). Navy shipments would be made using a combination of truck c were assumed to be made using 100 percent truck or 100 percent rail.

The estimated number of radiation-related latent cancer fatalities for transp from 0.029 to 0.11, the estimated number of radiation-related latent cancer fatalit population ranged from 0.044 to 0.30, and the estimated number of nonradiological f emissions ranged from 0.045 to 0.071.

Onsite shipments of SNF were estimated to result in 0.0028 to 0.0036 fatality SNF were estimated to result in 0.14 to 0.45 fatality. These fatalities were also number of radiation-related latent cancer fatalities and the estimated number of nc from vehicular emissions.

Transportation Accidents-The cumulative transportation accident risks c year operational period were estimated to be 0.0010 latent cancer fatality and 0.70 were transported by truck. If all SNF were transported by rail, the corresponding 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) w accident has a probability of occurrence of about 2.0 10-7 per year and would resu cancer fatalities in the exposed population. For comparison, the same population w experience about 100,000 cancer fatalities from other causes. The probability of t urban population zone would be less than 1 10-7 per year. In a rural population z consequences would be estimated to be about 0.2 latent cancer fatalities.

Onsite transportation of SNF would occur under the 1992/1993 Planning Basis a Hanford Site, the Idaho National Engineering Laboratory, and the Savannah River Sit reasonably foreseeable accident for this alternative occurs at the Idaho National E the potential impacts would be the same as those described under the No Action alte

5.1.5 Regionalization Alternative

There are two alternatives under Regionalization: Regionalization 4A would r to fuel type; Regionalization 4B would relocate SNF according to location.

Under Regionalization 4A, certain types of SNF from other DOE sites, and SNF other Government reactors, special-case commercial SNF, and foreign research reactc transported to either the Idaho National Engineering Laboratory or Savannah River S research and development of technologies improving the safe and secure storage of S continue, and new projects would commence. Naval SNF would be examined at the Expe at the Idaho National Engineering Laboratory, then stored at the Idaho Chemical Prc

The implications of Regionalization 4A are essentially the same as those of t Basis alternative because there would be minor differences in the amounts of fuel t destination under these alternatives (see Figure 5-4).

Under Regionalization 4B, however, two regional sites would be selected, and to one site or the other. In the west, either the Hanford Site, Idaho National Eng Nevada Test Site would be the regional site; in the east, either the Savannah River Reservation would be designated. SNF stored or generated west of the Mississippi R transported to the Western Regional Site, and SNF stored or generated east of the M transported to the Eastern Regional Site. An expended core facility would be built Western Regional Site (unless the Western Regional Site were the Idaho National Eng which case no new facility would be required). Research and development would be c regional sites.

Regionalization 4B affects more sites than Regionalization 4A. Only one site management responsibility in the east and in the west; thus, SNF management activit at those sites not selected as regional sites. If the Idaho National Engineering L the Western Regional Site, the Expended Core Facility in Idaho would be closed, anc built at either the Eastern or Western Regional Site. If the Oak Ridge Reservation Regional Site, SNF now at Savannah River would be transported to the Oak Ridge Rese require the development of new storage facilities at the Reservation. Some fuels m before transport. If the Savannah River Site were selected as the Eastern Regional differences between Regionalization 4B and Regionalization 4A except that an expenc be built at the site. In the west, transport of Hanford SNF to another site would N-Reactor fuels, the great majority of the SNF now stored there. Some Idaho Nation Laboratory fuels would also require stabilization if they were transported to anoth management facilities would be required at any Western Regional Site selected becau of SNF that would be received.

Figure 5-4. Summary of impacts for Regionalization 4A (by fuel type). (The maximu

This alternative would affect only the five major DOE sites. The environment these sites are described below.

5.1.5.1 Socioeconomics.

Under Regionalization 4A, the socioeconomic impacts at the Idaho National Engineering Laboratory would be the same as those described for the 1992/1 alternative described in Section 5.1.4.1. The peak employment under Regionalizatic additional 470 workers at the Hanford Site, approximately 3 percent above the 1995 Implementation of Regionalization 4A would have no socioeconomic consequences at ei Reservation or the Nevada Test Site because this would result in no changes to exis site.

Impacts of Regionalization 4A on the naval sites would be the same as that de 1992/1993 Planning Basis alternative because naval SNF would be transported to the Facility in Idaho for examination and storage at the Idaho National Engineering Lak

If either the Hanford Site, Idaho National Engineering Laboratory, or Savanna selected as a regional site under Regionalization 4B, there would be an eventual re equal to existing employment for SNF management at these sites. This would add to loss of jobs at each of these sites. In the short term, additional jobs would be r transport offsite (see Figure 5-5). The closure of the Expended Core Facility at t Engineering Laboratory, however, would lead to a short-term loss of jobs as well, i loss at that site.

Sites that were selected as regional sites would have generally increased emp levels (see Figure 5-6). Site employment levels would also increase at whatever si were constructed (Figure 5-7). Employment at the Oak Ridge Reservation and Nevada increase if these sites were chosen as the Eastern and Western Regional Sites. Ope at both the Oak Ridge Reservation and Nevada Test Site could ultimately result in t approximately 500 jobs per year at both sites, a 3-percent increase above current s Ridge Reservation and a 6-percent increase above current site employment at the Nev the expended core facility or a 7- and 13-percent increase with an expended core fa (Figure 5-6). The peak annual employment from implementation of Regionalization 4E additional 1,100 workers at the Nevada Test Site. The secondary impacts of increas the Oak Ridge Reservation or the Nevada Test Site could result in an increased hous Nevada Test Site, overall socioeconomic impacts could be absorbed within the projec 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 w summarized in Appendix K.)

Figure 5-6. Summary of impacts for Regionalization 4B (by geography) if sites were illustrated in all graphs. Input data are summarized in Appendix K.)

Figure 5-7. Summary of impacts for Regionalization 4B (by geography) if sites were graphs. Input data are summarized in Appendix K.)

For the naval sites, implementing Regionalization 4B would have no socioeconc

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 alternat 5-3 and 5-4). There would be no effect on power consumption at the Oak Ridge Reser Site, or naval sites from the implementation of Regionalization 4A.

Figures 5-5, 5-6, and 5-7 illustrate the minimum and maximum change from base from implementing Regionalization 4B with and without an expended core facility anc selected as the regional site. Regionalization at the Hanford Site or the Nevada T impact on power consumption at these sites.

Figure 5-5 illustrates the impact on power consumption if a site were not sel The increase in electricity consumption at the Hanford Site and the Savannah River required to prepare or process the SNF for transport as required. The decrease in Idaho National Engineering Laboratory would be from shutdown of the Expended Core F

Figure 5-6 shows the minimum and maximum percent change, without an expended over baseline site power consumption if a site were selected as a regional center. Savannah River Site, the power consumption increases slightly with the transport of Regionalization at the Oak Ridge Reservation would result in a small (less than 3 p power demand. The site electricity supply at each of these sites would be more tha regionalization at the Nevada Test Site would increase power consumption about 13 p site usage and may require additional transmission lines or another substation at t and K).

Regionalization 4B with an expended core facility onsite is illustrated in Fi requirements at each of the major DOE sites would increase with the addition of an examination of naval SNF. Power consumption at the Nevada Test Site would increase percent above baseline and about 40 percent at Hanford if the processing (figure ma selected. The storage only options (figure minimum) at the Hanford site would resu increase in electricity consumption. The Nevada Test Site would require additional another substation to handle additional loads. The increased load could be handleć Site, and relatively minor increases could occur at the Idaho National Engineering

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, Regic transported offsite, Regionalization 4B without an expended core facility located a Regionalization 4B with an expended core facility located at the selected site. Th volumes generated from SNF management activities at a nonselected site would decrea years, but at the selected sites the annual generation rate of waste from SNF manag increase with implementation of the Regionalization alternative. The construction facility at any site would also increase the annual volume of low-level waste gener

The annual waste volumes generated from SNF management activities associated Regionalization 4A are illustrated in Figure 5-4. The effects of Regionalization 4 described for the 1992/1993 Planning Basis alternative in Section 5.1.4.3 (see Figu

Figure 5-5 illustrates the effect of not being selected as a regional center.

Decentralization and 1992/1993 Planning Basis alternatives, the annual generation r transuranic, mixed, and low-level wastes would ultimately decrease at the affected inventory would be transported offsite. However, characterization and stabilizatic transport would generate transient increases in waste volumes.

The effect of being selected as a regional center without a replacement expen illustrated in Figure 5-6. Implementation of this Regionalization 4B alternative w the Hanford Site and Savannah River Site as the 1992/1993 Planning Basis alternativ Reservation and Nevada Test Site would generate waste from SNF management activitie alternative. Regionalization at either of these two sites would be expected to gen cubic meters (21 cubic yards) of transuranic waste and approximately 200 cubic mete low-level waste annually from operating an SNF management complex.

Figure 5-7 illustrates the effect on annual waste volume generation of being center with the addition of an expended core facility to examine naval SNF. The ad 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

The effects from implementing either of the Regionalization alternatives at t the same as that described for the 1992/1993 Planning Basis alternatives in Section

5.1.5.4 Radiological Impacts.

Radiological exposures to both workers and the public for Regionalization 4A would to be similar to the 1992/ 1993 Planning Basis alternative. These are not discussed further in this section. Figure 5-4 illustrates the potential latent can within 80 kilometers (50 miles) from SNF operations at the major sites for Regional

Radiological exposures to both workers and the public for Regionalization 4B 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 illustr fatalities to the population within 80 kilometers (50 miles) from SNF operations fc SNF is transported offsite, or if the site is selected as the regional site without facility, respectively.

For any of the Regionalization alternatives, the maximum estimated latent can 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 Decentralization alternative. The selection of the Hanford Site as the regional si accident risks significantly different from those identified for the Decentralizati Appendix A), although higher activity under this alternative would increase the ann accidents. The probability of the cask impact and fire accident scenario was estir the Hanford Site were selected as a regional site.

Selecting a different site as the regional site would reduce the estimated ac identified for the Decentralization alternative because the existing wet storage fa and the amount of SNF handled at the dry storage facility would change slightly. T the dry storage cask impact and fire was estimated to be 5 in 1,000,000 such that t the highest risk accident, would be 4.1 10-4 latent cancer fatalities in the gener operation.

Idaho National Engineering Laboratory. While the consequences of poten storage and handling accidents would be similar for all alternatives, the estimated accidents depends on the amount of SNF handled under the alternatives. For alterna SNF is transported to another site, SNF storage and handling risks would be reduced SNF generated at the Idaho National Engineering Laboratory research reactors. Unde the consequences and risks of accidents associated with SNF storage would be the sa the No Action alternative (Section 5.15, Appendix B). The consequences of fuel-han be the same as described under the No Action alternative, but increased transportin would result in a frequency of fuel-handling accidents about five times higher than alternative (Slaughterbeck et al. 1995). Because of the increased frequency of fue the public from fuel-handling accidents may exceed the risk from SNF storage accide

If the Idaho National Engineering Laboratory were selected as a regional site 4B, the highest consequences to the offsite population result from accidents involv 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 Pl accident with the highest consequence and risk to workers would be an inadvertent n processing that has an estimated probability of 1 chance in 1,000 per year of opera probability of a latent cancer fatality in a worker approximately 100 meters (330 f accident would be 3.6 x 10-3, corresponding to an estimated risk to a worker of 3.6 fatalities per year of operation. The consequences of fuel-handling accidents woul under the No Action alternative, but increased transporting and handling of SNF res fuel-handling accidents about 20 times higher than for the No Action alternative (S Because of the increased frequency of fuel-handling accidents, risk to the public f may exceed the risk from SNF storage and processing accidents.

If the Idaho National Engineering Laboratory were not selected as a regional Regionalization 4B, the consequences and risks of accidents associated with SNF stc as described under the No Action alternative (Section 5.15 of Appendix B). The con handling accidents would be the same as described under the No Action alternative, transporting and handling of SNF would result in a frequency of fuel-handling accic higher than for the No Action alternative (Slaughterbeck et al. 1995). Because of fuel-handling accidents, risk to the public from fuel-handling accidents may exceec storage accidents.

Savannah River Site. Accident risks under Regionalization 4A would be same as those for the 1992/1993 Planning Basis alternative. The accident frequency accident, a fuel assembly breach, would be expected to be about 0.44 fuel assembly operation with implementation of this alternative. The estimated risk of latent ca public, maximally exposed offsite individual, and co-located worker would be 3.7 1 10-6 per year of operation, respectively.

The implementation of Regionalization 4B at the Savannah River Site, includin dry storage, wet storage, and processing followed by dry storage, would not result different from those identified for the same options under the Decentralization alt Attachment A of Appendix C). Because of an increase in the amount of SNF handled, frequency for some accidents would increase.

Under Regionalization 4B, the accident frequency for the highest risk acciden breach, would be expected to be about 0.41 fuel assembly breaches per year of opera implementation of this alternative. This results in a proportional increase in ris workers. The estimated risk of latent cancer fatalities to the general public, max individual, and co-located worker would be 3.5 10-3, 4.1 10-7, and 2.0 10-6 per respectively. With regionalization elsewhere, the highest risk accident would stil breach with an estimated risk approximately the same as with the No Action alternat

Naval Facilities. The accident risks associated with the implementatic Regionalization alternative at sites other than the Idaho National Engineering Labc detail in Attachment F of Appendix D. That evaluation considered the accidents ass an expended core facility and wet and dry storage facilities at the Hanford Site, S Ridge Reservation, and Nevada Test Site. Accidents evaluated were the same set of the Decentralization alternative. The maximum risk accidents, for either the gener at sites where an expended core facility might be located if they are associated wi are discussed under the affected sites.

Oak Ridge Reservation. The Oak Ridge Reservation would not be affectec Regionalization 4A. The implementation of Regionalization 4B at the Oak Ridge Rese expected to be similar to implementation of the Centralization alternative, except requirements would be needed. Section 5.15 (Part 3) of Appendix F indicates that t would be similar for both alternatives and that it is reasonable to assume that the risks described for the Centralization alternative would envelop the Regionalizatic

A wide range of accident scenarios were considered, including accidents initi events, external hazards such as aircraft crashes, and natural phenomena such as ea risk SNF-related accidents identified were (a) a fuel assembly breach as a result c objects falling on the assembly, or cutting into the fuel portion of the assembly, severe impact that results in breach of a transport cask and fire, (d) an aircraft facility, (e) an aircraft crash into the SNF dry cell facility, (f) a wind-driven m and (g) and aircraft crash into a water storage pool.

The highest risk to the general population would be a fuel assembly breach, w 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 pop the probability of occurrence of this accident, would be 3.4 10-3 latent cancer fa estimated probability of maximum latent cancer fatalities to the maximally exposed 6.0 10-6.

The dropped fuel cask accident has the maximum risk to workers with an estima than 1 in 10,000 per year. A worker downwind of the accident was estimated to rece corresponds to an estimated probability of 1.9 10-3 latent cancer fatalities. The would be 1.9 10-7 latent cancer fatalities per year.

Workers in the immediate vicinity of the cask drop accident could receive ver the doses would not result in a fatality. For that accident, workers could be expe when it drops and receive both direct radiation as well as inhale airborne fission expected to quickly evacuate the area and thus reduce their potential radiation exp

Nevada Test Site. The implementation of Regionalization 4B at the Neva would also be expected to be similar to implementation of the Centralization altern requirements would be less. Section 5.15 (Part 2) of Appendix F indicates that the would be similar for both alternatives and that it is reasonable to assume that the risks described for the Centralization alternative would envelop the Regionalizatic

A wide range of accident scenarios were considered for the Centralization alt apply to Regionalization 4B, including accidents initiated by operational events, e 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 th dropped fuel cask (highest risk to workers).

The fuel assembly breach is the highest risk to the general population with a 0.16 per year and an estimated offsite population dose corresponding to 6.6 10-4 l The estimated risk to the general population, taking into account the probability c accident, would be 1.1 10-4 latent cancer fatalities per year. The potential dose offsite individual would correspond to a probability of a latent cancer fatality of

The dropped fuel cask accident was the highest risk accident to workers with of less than 1 in 10,000 per year. A worker approximately 100 meters (330 feet) dc would have a probability of a latent cancer fatality of 1.9 10-3. The estimated r 10-7 latent cancer fatalities per year of operation.

Workers in the immediate vicinity of the cask drop accident could receive ver the doses would not result in a fatality. For that accident, workers could be expe when it drops and receive both direct neutron and gamma radiation as well as inhale products. Workers would be expected to quickly evacuate the area and thus reduce t exposure.

Other Generator/Storage Locations. For Regionalization 4A and 4B, the would be expected to be similar to the accident risks under the No Action alternati

5.1.5.5 Nonradiological Accidents.

The maximum reasonably foreseeable chemical accident
at the Idaho Engineering National Laboratory, Savannah River Site, and other genera would be similar to those described under the No Action alternative. An accident d wet storage facility at the Hanford Site could release sulfuric acid and subject wc health effects.

Two independent accidents have been evaluated to describe the maximum reasona chemical accident during the operation of the expended core facility at each of its release could subject workers to chemical concentrations that could cause fatalitie but would not subject the public to such concentrations except at potential locatic Reservation 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 trans the 1992/1993 Planning Basis alternative with differences occurring in the destinat on fuel type. Onsite shipments would relocate SNF for continued safe storage or st

Incident-Free Transportation. For Regionalization 4A, the incident-fre SNF was estimated to result in total fatalities that ranged from 0.17 to 0.61 over through 2035. These fatalities represent the sum of the estimated number of radiat fatalities and the estimated number of nonradiological fatalities from vehicular en

The reason for a range of fatalities was due to two factors: (a) the option transport for DOE SNF (see Appendix I), and (b) different SNF management options at Site (see Appendix C). Navy shipments would be made using a combination of truck a shipments were assumed to be made using 100 percent truck or 100 percent rail.

The estimated number of radiation-related latent cancer fatalities for transp from 0.031 to 0.15, the estimated number of radiation-related latent cancer fatalit population ranged from 0.054 to 0.41, and the estimated number of nonradiological f emissions ranged from 0.052 to 0.084.

Onsite shipments of SNF were estimated to result in 0.0025 to 0.0034 fataliti of SNF were estimated to result in 0.17 to 0.61 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 operational period were estimated to be 0.0011 latent cancer fatality and 0.77 traf transported by truck. If all SNF were transported by rail, the corresponding risks 0.00037 latent cancer fatality and 0.76 traffic fatality.

As in the 1992/1993 Planning Basis alternative, the maximum reasonably forese transportation accident involves a rail shipment of special-case commercial SNF in 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/ alternative.

Onsite transportation of SNF would occur under Regionalization 4A at the Hanf National Engineering Laboratory, and Savannah River Site. The maximum reasonably f 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 trans the 1992/1993 Planning Basis alternative with differences occurring in the destinat geographical considerations. Non-naval SNF originating from western United States entry would be transported to the Idaho National Engineering Laboratory, Hanford Si Non-naval SNF originating from eastern United States locations or points of entry w the Savannah River Site or Oak Ridge Reservation. Naval SNF would not be split on because the Navy would operate a facility for examining naval SNF at one of the DOE shipments at major DOE sites may relocate SNF from one facility or another for cont stabilization, if applicable.

Incident-Free Transportation. For the six Regionalization 4B alternati free transportation of SNF was estimated to result in total fatalities that ranged Engineering Laboratory and Oak Ridge Reservation alternative) to 0.90 (Nevada Test Reservation alternative). The other four alternatives would result in fatalities b These fatalities were over the 40-year period 1995 through 2035 and represent the s number of radiation-related latent cancer fatalities and the estimated number of nc from vehicular emissions.

The reason for a range of fatalities was due to two factors: (1) the option transport for DOE SNF (see Appendix I), and (2) the six regionalization alternative be made using a combination of truck or rail; DOE shipments were assumed to be made truck or 100 percent rail.

For regionalization at the Idaho National Engineering Laboratory and Oak Ridg estimated number of radiation-related latent cancer fatalities for transportation w estimated number of radiation-related latent cancer fatalities for the general popu estimated number of nonradiological fatalities from vehicular emissions was 0.059.

For regionalization at the Nevada Test Site and Oak Ridge Reservation, the es radiation-related latent cancer fatalities for transportation workers was 0.21, the radiation-related latent cancer fatalities for the general population was 0.60, and nonradiological fatalities from vehicular emissions was 0.091.

For regionalization at the Idaho National Engineering Laboratory and Oak Ridg shipments of SNF were estimated to result in 0.0025 fatalities. Offsite shipments result in 0.13 fatalities. These fatalities also represent the sum of the estimate latent cancer fatalities and the estimated number of nonradiological fatalities frc

For regionalization at the Nevada Test Site and Oak Ridge Reservation, onsite estimated to result in 0.0023 fatalities. Offsite shipments of SNF were estimated These fatalities also represent the sum of the estimated number of radiation-relate and the estimated number of nonradiological fatalities from vehicular emissions.

Transportation Accidents. Cumulative accident risks for transportation range from 0.00090 latent cancer fatalities and 0.72 traffic fatalities for regiona Engineering Laboratory and Savannah River Site, to 0.0012 latent cancer 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 t regionalization at the Idaho National Engineering Laboratory and Oak Ridge Reservat cancer fatalities and 0.91 traffic fatalities for regionalization at the Nevada Tes Reservation.

As in the 1992/1993 Planning Basis alternative, the maximum reasonably forese transportation accident would involve a rail shipment of special-case commercial SN population zone under neutral (average) weather conditions. The accident has a prc that ranges from about 2.7 10-7 per year for regionalization at the Hanford Site a about 3.7 10-7 per year for regionalization at the Nevada Test Site and Savannah R consequences would be the same for each alternative and would be the same as those 1992/1993 Planning Basis alternative.

Onsite transportation of SNF would occur under Regionalization 4B at the Hanf National Engineering Laboratory, and Savannah River Site. The maximum reasonably f 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 transport of five sites: the Hanford Site, Idaho National Engineering Laboratory, Savannah R Reservation, or Nevada Test Site. SNF management activities at unselected sites wc related research and development activities would be conducted at the selected site facility would also be located there.

The implications of this alternative would be similar to those of Regionaliza western sites, but if an eastern site were selected, considerably greater volumes c than under any other alternative because the site would receive fuels from the Hanf National Engineering Laboratory. Therefore, substantially larger storage facilitie this alternative than under any other. New facilities with the largest capacity fc Oak Ridge Reservation and Nevada Test Site because they do not now have the capacit fuels and do not currently store significant volumes of SNF. The potential environ 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 a l management activities (see Figure 5-7). The change in site employment would range than 3 percent of total site employment at the Idaho National Engineering Laborator of about 13 percent above existing site employment at the Nevada Test Site when an were constructed at the site. The intensity of this impact at the major DOE sites whether the SNF management programs used existing personnel or required workers to and (b) future actions at each site competing for the available labor pool. Under 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 c percent above the projected 1995 baseline. If the site were not selected, the pea additional 580 workers at the Hanford Site or approximately 3 percent above the prc either the Hanford Site, Idaho National Engineering Laboratory, or Savannah River S a central site under the Centralization alternative, there would ultimately be a re to existing employment for SNF management at these sites. This would add to the fc each of these sites. In the short term, additional jobs would be required to prepa (see Figure 5-5). The closure of the Expended Core Facility at the Idaho National however, would lead to a long-term loss of jobs as well, increasing the rate of jok

Sites selected as central sites would generally have increased employment ove Figure 5-6). This increased direct employment would also result in an indirect inc surrounding communities. At the Oak Ridge Reservation, the associated population g increases in capital expenditures to meet the increased demand of housing, utilitie generation, wastewater treatment, and water, transportation, and education faciliti centralization activities could strain the housing market and add to school-capacit centralization at the Savannah River Site or the Idaho National Engineering Laborat potential impacts on the demand for community resources and services would be minir at the Nevada Test Site, there is a potential increase in housing demand. Overall centralization at the Nevada Test Site could be absorbed within the projected expan 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 Regiona is transported offsite or where the SNF is transported to the regional site except Power consumption minimum increase would be about 8 percent over the site baseline River Site from the construction and operation of additional wet storage facilities alternative. Figures 5-8 and 5-9 illustrate the Centralization impacts for the twc 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 wit Nevada Test Site would be similar to Regionalization 4B at the Nevada Test Site wit expended core facility also located at that site (Figure 5-6).

Under the Centralization alternative at Hanford, the power consumption would 3 percent if SNF were only stored and could rise as much as 40 percent if processin the increase in power required for processing appears large (as a percent of baseli Savannah River Site, much of the difference would be the result of a higher Savanna 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 Region Figures 5-5 and 5-7). If a site were not selected as the central site, the annual from SNF management activities would ultimately decrease; however, transient activi package the fuel could be substantial. The site selected as the central site woulc of wastes generated from SNF management activities. The increase in waste would nc proportional to the larger amount of SNF being managed onsite because the originati characterize and can their fuel before transport so it could be placed directly int The waste volumes would be generated from transferring fuel from water pools at som and canning small amounts of new fuel, and operating the expended core facility. F the effects of not being selected as well as being selected as the central site for

<u>Figure 5-8. Summary of impacts for the Centralization option if sites were not sel</u>
Appendix K.)

<u>Figure 5-9. Summary of impacts for the Centralization option if sites were selecte</u>
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 s expected to be low and similar in magnitude. Accident analysis for both existing a storage facilities indicates that the probabilities of accidents with the potential be extremely low.

Figure 5-7 illustrates the estimated latent cancer fatalities among the popul (50 miles) from SNF operations at each of the major sites. For each major site, th potential impacts associated with site SNF operations with centralization at anothe centralization at that site.

Accident risks from SNF activities would be principally because of handling a and, therefore, would be expected to be similar for each of the centralization site would be due to activities at the existing SNF sites necessary to prepare the SNF f site.

SNF Facility Accidents-

Hanford Site. The implementation of the Centralization alternative at would be expected to result in accident risks for some accidents slightly different Decentralization alternative (Section 5.15 of Appendix A). The amount of SNF handl facility would be greater, resulting in an increase in the accident probability for and fire to 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 popu 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 alternat 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 genera latent cancer fatalities per year of operation. The corresponding highest risk acc 4.75 10-7 potential latent cancer fatalities per year of operation.

Idaho National Engineering Laboratory. The implementation of the Centr alternative at the Idaho National Engineering Laboratory is estimated in Section 5. in additional accident scenarios and accident risks from those identified for the N the assumed resumption of chemical processing of SNF at the Idaho Chemical Processi consequences and risks from SNF-related accidents would be the same as Regionaliza National Engineering Laboratory is selected as a regional site.

The implementation of the Centralization alternative at a site other than the Engineering Laboratory would result in potential accident consequences and risks th Regionalization 4B when the Idaho National Engineering Laboratory is not selected a

Savannah River Site. The implementation of the Centralization alternat Savannah River Site, including the three options of dry storage, wet storage, and p storage, is assessed in Section 5.15 and Attachment A of Appendix C to result in ac different from those identified for the same options under the Decentralization alt increase in the amount of SNF handled, however, the accident frequency for some acc

The accident frequency for the highest risk accident, a fuel assembly breach, about 0.84 fuel assembly breaches per year of operation with implementation of this 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, re centralization elsewhere, the highest risk accident would still be the fuel assembl risk approximately the same as with the No Action alternative.

Oak Ridge Reservation. The accident risks associated with implementati 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 alternative at the Nevada Test Site are presented in detail in Section 5.15 (Part 2 accident risks are summarized under Regionalization 4B.

Other Generator/Storage Locations. The accident risks under the Centra alternative would be expected to be the same as the accident risks under the No Act

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 even exceed exposure guidelines would be similar to those described under the 1992/1993 alternative.

Two independent accidents have been evaluated to describe the maximum reasona chemical hazard during the operation of the expended core facility at each of its p release could subject workers to chemical concentrations that would exceed the Emer Planning Guideline value but would not subject the public to such concentrations ex 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 ge would be transported to one of five sites: the Hanford Site, Idaho National Engine Savannah River Site, Oak Ridge Reservation, or Nevada Test Site.

Incident-Free Transportation-For the five Centralization alternative si incident-free transportation of SNF was estimated to result in total fatalities tha (centralization at the Oak Ridge Reservation) to 1.7 (centralization at the Savanna 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 nonradiologi emissions.

The range of fatalities was due to two factors: (a) the option of using truc SNF (see Appendix I) and (b) the five centralization options. Navy shipments woulc combination of truck and rail; DOE shipments were assumed to be made using 100 perc percent rail.

For centralization at the Oak Ridge Reservation, the estimated number of radi cancer fatalities for transportation workers was 0.050, the estimated number of rac fatalities for the general population was 0.073, and the estimated number of nonrac from vehicular emissions was 0.083.

For centralization at the Savannah River Site the estimated number of radiati fatalities for transportation workers was 0.43, the estimated number of radiation-r fatalities for the general population was 1.2, and the estimated number of nonradic vehicular emissions was 0.11.

For centralization at the Oak Ridge Reservation, onsite shipments of SNF were 0.0023 fatalities. Offsite shipments of SNF were estimated to result in 0.20 fatal also the sum of the estimated number of radiation-related latent cancer fatalities nonradiological fatalities from vehicular emissions.

For centralization at the Savannah River Site, onsite shipments of SNF were e 0.0035 fatalities. Offsite shipments of SNF were estimated to result in 1.7 fatali also the sum of the estimated number of radiation-related latent cancer fatalities nonradiological fatalities from vehicular emissions.

Transportation Accidents-Cumulative accident risks for transportation b would range from 0.0048 latent cancer fatalities and 1.0 traffic fatalities for cen National Engineering Laboratory, to 0.0020 latent cancer fatalities and 1.44 traffi centralization at the Savannah River Site. Cumulative accident risks for transport from 0.0013 latent cancer fatalities and 0.95 traffic fatalities for centralization Engineering Laboratory, to 0.0014 latent cancer fatalities and 1.19 traffic fatalit Nevada Test Site.

For centralization at either the Hanford Site or Idaho National Engineering I maximum reasonably foreseeable offsite transportation accident would involve a rail special-case commercial SNF in a suburban population zone under neutral (average) w accident has a probability of occurrence of about 5 10-7 per year and the conseque as those described under the 1992/1993 Planning Basis alternative.

For centralization at the Oak Ridge Reservation or the Nevada Test Site, the foreseeable offsite transportation accident involves a rail shipment of special cas urban population zone under neutral (average) weather conditions. The accident has occurrence of about 1 10-7 per year and could result in an estimated 36 latent can exposed population for Oak Ridge Reservation; for the Nevada Test Site, the acciden approximately 36 latent cancer fatalities. For comparison, the same population wou experience about 540,000 cancer fatalities from other causes. The probability of t under stable (worst-case) weather conditions is less than 1 10-7 per year for urba probability of occurrence is 5.7 10-7 per year if the accident occurred in a rural result in an estimated 2 latent cancer fatalities.

For centralization at the Savannah River Site, the bounding offsite transport involve a rail shipment of commercial SNF in a suburban population zone under stabl conditions. The accident has a probability of occurrence of about 1.2 10-7 per ye estimated 55 latent cancer fatalities in the exposed population. For comparison, t be expected to experience about 42,000 cancer fatalities from other causes. The pr occurring in an urban population zone is less than 1 10-7 per year. In a rural pc consequences would be approximately 3 percent of the suburban zone consequences.

Onsite transportation of SNF would occur under the Centralization alternative Idaho National Engineering Laboratory, and Savannah River Site. The bounding accic sites occurs at the Idaho National Engineering Laboratory, and the potential impact those described under the No Action alternative.

Table 5-2 summarizes the comparison of incident-free transportation fatalitie management alternatives. Table 5-3 provides the comparison of transportation accic SNF management alternatives.

Table 5-2. Comparison of incident-free transportation total fatalities for alterna period.

	Minimum(a,b) total fatalities	Maximum(b total fatalitie
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, exc by both truck (onsite) and rail (offsite).

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

5.2 Issues Not Discussed In Detail

This section discusses potential impacts for issues that are not discussed in are small and do not distinguish among alternatives, but about which the public may interest. The discussion for each discipline generally concentrates on sites and al the largest expected impacts, demonstrating that the environmental consequences for are not of sufficient importance to be given strong consideration in the programmat process.

5.2.1 Land Use

The proposed alternatives would not result in major impacts on land use at ei the naval sites. The largest amount of land that would be disturbed at any of the D 53 hectares (130 acres) at the Hanford Site. This would occur under the Centralizat and would take less than 0.5 percent of the land at that site. Less than 6.5 hectar 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 would be located near existing facilities or new facilities would be built on previ industrialized land. Additional land might be required for infrastructure and buffe SNF management facility is required. Because less than 0.5 percent of the land at a sites would be needed and the current land we at the naval sites would not change, determined not to be a discriminating factor (discriminator) among sites or alterna considered further in this volume, Detail on land we impacts is presented in Appenc through F. The EIS does not explicitly consider land that is currently used for SNF land that might or might not be made available for other uses under some alternativ

5.2.2 Cultural Resources

Cultural, archaeological, historic, and architectural resources are defined a historic sites, districts, structures, and evidence of human use that are considere culture, subculture, or a community for scientific, traditional, religious, or othe

Most of the major DOE sites and some of the naval sites contain areas of arch cultural, or historical interest. Direct impacts to archaeological resources would ground disturbance activities. Indirect impacts would result from improved visitor land status, or other actions that would limit future scientific investigation. Alt sites have not been surveyed completely, the locations for the construction of prop have generally been evaluated for their cultural importance. No known cultural resc affected by construction under any of the proposed alternatives. Specific surveys w 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 during construction, earth-moving activities would stop and the State Historic pres would be contacted immediately. If Native American or Native Hawaiian resources wer involved, their leaders would also be contacted. Impacts to cultural resources were 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 locatec areas with public access. Where new facilities would be visible to the public, simi already visible. At naval sites, SNF storage locations would be located at existing Aesthetic and scenic resources would not be significantly affected by SNF managemen are not considered further in this chapter. Discussion of impacts on aesthetic and contained in Appendices A through F.

5.2.4 Geologic Resources

None of the sites has known significant geologic resources that would be affe alternatives. Except for the potential existence of gold, tungsten, and molybdenum Test Site, geologic resources at the candidate sites consist of surficial sand, gra that have low economic value. The alternatives that involve constructing new facili in disturbing or extracting surface deposits to construct the facilities. New const increase the use of surface deposits (that is, sand and gravel deposits), but becau 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 locat with low to moderate seismic potential with respect to more seismically active area States (Algermissen et al. 1982, 1990). Because any new facility would be construct current seismic design criteria for a given area, seismic concerns are not a discri 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 in of pollutants to the atmosphere. At the major DOE sites, the projected emissions fr management activities would not contribute to nonattainment of state or Federal sta would be no impact on nonradiological ambient air quality at the naval sites (Appen 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 visibil areas but would not cause nonattainment of state or Federal standards. Because SNF activities would not be expected to cause either radiological or nonradiological ai exceed state or Federal standards at any site for any alternative considered, or tc air quality in any other respect, air quality impacts are not discussed further in potential radiological impacts on health are discussed in Section 5.1. The computer evaluating air quality impacts, and detailed results are discussed in Appendices A

5.2.6 Water Resources

The proposed alternatives would have small impacts on water resources at each candidate sites. Compared with existing activities at all proposed SNF sites, addit consumption would be minor and would relate primarily to the increased demand of a force because SNF water pools use recycled water. The maximum increase of water usa baseline at any candidate site would be approximately 5 percent. There would be net employment at the Oak Ridge Reservation, and the Nevada Test Site; however, water r would not be expected to be appreciably affected under any alternative. Nevertheles Test Site, where available water is limited, a cumulative water supply impact is pc of groundwater withdrawal from the Frenchman Flat hydrographic area at the Nevada T support a proposed SNF facility on groundwater yields are unknown and require addit The Frenchman Flat hydrographic area is part of the Ash Meadows sub-basin whose per has greatly exceeded its annual water withdrawals. Some potential also exists for m

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 cou
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 woul
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 th 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 t 9 percent at the Savannah River Site. A central sewage treatment system would have constructed for the SNF facilities at the Nevada Test Site under the Regionalizatic alternatives if the Nevada Test Site were selected as a regional or central site. T capacities at all sites could manage the estimated changes in utility usage rates f 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" acti projects at the potentially affected sites not related to SNF management, as well a by other Government agencies, private businesses, or individuals. This type of an a important because significant cumulative impacts can result from several smaller ac themselves do not have significant impacts. The programmatic cumulative impacts frc implementation of the DOE SNF Management Program are discussed in Section 5.3.1. Th 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 Progra alternatives would not be expected to significantly contribute to cumulative impact a small change in regional employment, little use of nonrenewable resources, low ra 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 comp 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, increa regional or central site would be compensated for by changes at nonselected sites, very small.

Reasonably foreseeable projects that could contribute to cumulative impacts a 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 manageme of the priorities being given to site management, and are being covered by the Wast Programmatic EIS and site-specific EISs. It is expected that SNF management activit consistently smaller impacts than the environmental restoration and waste managemen that the overall impact of SNF management would not contribute significantly to cum on either a regional or a nationwide basis.

The transport of DOE and naval SNF over highways and railways is only one of of radiological dose to the general public. The potential transport of commercial S a repository, assumed to be in Nevada for purposes of analysis, the proposed transp 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. Ava data and projected future doses are summarized in Appendix I.

During analysis, the potential for significant cumulative impacts to other re considered; none were found. Cumulative impacts are described qualitatively because considerations do not require detailed information that depends on specific facilit More detailed cumulative effects analysis will be performed for any actions that ar 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 ope duration of the SNF interim management program (approximately 40 years). Impacts fr construction and operation of SNF facilities would be cumulative with the impacts c

planned facilities or actions such as environmental restoration and waste managemen
unrelated to SNF. Cumulative effects involving site-specific projects that are plan
simultaneously with SNF management activities at the major DOE sites are discussed
appendices. Not all planned facilities were factored into the assessment of cumulat
pending funding approval or resolution of DOE policy issues.

The following sections discuss cumulative impacts to those environmental resc
in Appendices A through F. During analysis, the potential for significant cumulativ
environmental resources (that is, geologic resources, aesthetic and scenic resource
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
continued mission of the sites. The largest proportion of any site that would be re
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
activities coupled with other actions have the potential to strain or overburden th
resources of certain areas, particularly if either the Regionalization or Centraliz
selected with an expended core facility located at the site. For example, these cum
could contribute to housing shortages, the need for additional schools, and increas
utilities and transportation.

Each site is anticipating an overall decline in site employment over the next
therefore, the existing work force could be reassigned to SNF management activities
was assumed that the construction activities associated with the proposed SNF manag
alternatives would require the in-migration of construction workers. Although these
activities are short-term with a duration of a few years, when addressed cumulative
reasonably foreseeable activities, there could be a socioeconomic impact in the com
surrounding the Hanford Site, Nevada Test Site, and Oak Ridge Reservation. For exam
Hanford Site cumulative employment, housing requirements, and needs for schools wou
to 1 percent over those based on present Hanford employment for SNF management acti

Impacts to socioeconomic resources associated with the implementation of prop
actions at the Idaho National Engineering Laboratory, Savannah River Site, naval si
generator sites are not expected to be sufficient to have a cumulative effect on th
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 L
naval sites, including those from the proposed SNF management alternatives, would n
limits for nonradioactive air pollutants and would not threaten to exceed the limit
limits for nonradioactive air pollutants and would not threaten to exceed the limit
pollutants or the 40 CFR Part 61 limit of 0.01 rem (10 millirem) per year for radic

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 i
cumulative impacts to water resources under normal operations. The proposed SNF fac
related management operations are designed to generate no liquid releases of wastew
subsurface or water resources containing radiological constituents or hazardous che
facilities would be constructed using state-of-the-art technologies, including secc
and leak detection and water balance monitoring equipment. Liquid effluent discharg

activities will be monitored for the presence of radioactive and chemical constitue
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 ha Site and as much as 13 hectares (31 acres) of previously disturbed land at the Idah Engineering Laboratory. No impacts to biotic resources would be expected at the Sav 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 pla including construction related to SNF management could result in habitat loss for F candidate species (for example, loggerhead shrike, sage sparrows, burrowing owls, p At the Nevada Test Site, the proposed SNF facilities would be constructed within th desert tortoise, a federally listed threatened species. Therefore, the proposed SNF activities in addition to other planned actions could result in a small cumulative desert tortoise.

5.3.2.6 Occupational and Public Heath.

The sources of radiation exposure to individuals consist of natural background radiation from cosmic, terrestrial, and i 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 of the population within 80 kilometers (50 miles) of the site, medical exposure acc 15 percent of the annual dose, and the combined doses from weapons test fallout, cc industrial products, and air travel account for approximately 3 percent. DOE nuclea Savannah River Site account for less than 0.1 percent of the total radiation exposu

The radiological impacts from SNF management operations are exposures to both the general public from normal operations and the risk of additional radiation expc accidents. The major concerns with these exposures are whether the doses are suffic immediate harm and bow much they will increase the probabilities, among the exposed latent cancer fatalities, nonfatal cancers, and genetic effects. Of further concern management-related exposures are in addition to those exposures and risks affecting 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 limi affecting emissions from DOE and naval sites is the Clean Air Act standard (40 CFR Subpart H for DOE; Subpart I for the Navy) for airborne radionuclide emissions from This rule limits airborne emissions to those amounts that would not cause any membe to receive in any year an effective dose equivalent of more than 0.01 rem (10 milli Implementation of any of the alternatives at any of the sites is not expected to re releases exceeding this limit. The naval sites have demonstrated to the U.S. Envirc Agency that, at 0.0001 rem (0.1 millirem) per year, they are at 1 percent of the li SNF management facilities is not expected to change that conclusion. Data available sites (see Appendices A through F) indicate that over the 40-year planning period, radioactive emissions from the existing, the potential SNF management activities, a foreseeable future site activities at any of the sites would not be expected to res latent cancer fatality among the general population surrounding the site, except fc Reservation. With centralization at the Oak Ridge Reservation, operation of the prc management facilities over their expected 40-year lifetimes is estimated to result dose of approximately 2,500 person-rem. This equates to approximately two latent ca over the period.

Cumulative Impacts on the Site Work Force - The cumulative impact of selection of either of the alternatives coupled with the existing and reasonably fc the potential to increase the radiological exposure to workers at the sites transpc 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 reasonabl 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 accoun 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 x 10^- 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 Sit Idaho National Engineering Laboratory, Savannah River Site, Oak Ridge Reservati and Nevada Test Site
General transportation	Nationwide transport of radioactive mate for medical, industrial, fuel cycle, and purposes
Reasonably foreseeable activities:	
Geologic repository	Shipments of commercial SNF and defense high-level waste to the geologic reposit Yucca Mountain, Nevada
Waste Isolation Pilot Plant	Shipments of transuranic waste to the Wa Isolation Pilot Plant at Carlsbad, New M (including a 5-year Test Phase and 20-ye Disposal Phase)
Submarine reactor compartments	Shipments of reactor compartments from P Sound Naval Shipyard to Hanford
Return of isotope capsules	Shipments of cesium-137 isotope capsules Hanford Site
Uranium billets	Shipment of low-enriched uranium billets the Hanford Site to the United Kingdom

Table 5-5. Summary of transportation radiological cumulative impacts.

	Occupational latent	General population la

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 Id 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.

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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 ex 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 F 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 b 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 D 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. Fo 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 d relationship between short-term influences from the implementation of an SNF manage alternative and the associated long-term effects.

The proposed alternatives for SNF management would require the short-term use resources; for example, energy, materials of construction, and labor to achieve the securing SNF to minimize the risk to workers, to the public, and to the environment no action were taken, degradation of the fuel and SNF facilities would occur with t releases to the environment. Releases to the environment could contaminate land nea storage, thereby reducing the potential future use. By consolidating and containing specific locations, the potential for impacting the environment would be reduced at locations. After the implementation of a comprehensive SNF management strategy, thc currently used for SNF management could be released to allow other productive use, research or technology development.

The premature shutdown of research reactors due to a lack of sufficient SNF i space under the No Action alternative could have an impact upon the national and re 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 sites where these reactors are located, many of them universities, are unique train students in many fields of research and development: materials science, environment physics, biology, and electronics.

In the medical arena, research reactors have proven to be vital to cancer the imaging, studies of the biological effects of radiation, and other important medica Demand for medically important radioisotopes would not decrease merely because the off. The continued demand for radioisotopes would be met by placing orders with rem reactors, which may be farther away from the place where they are needed. Many medi important isotopes (for example, iodine-131) have such short half-lives that the am must include enough to allow for radioactive decay during shipment. Therefore, shut would result in the need to produce and transport larger quantities of radiopharmac

Shutdown of research reactors could produce an impact on commercial enterpris engaged in the doping of silicon crystals through neutron irradiation. The doped si widely used in electronic components such as the computers used in automobile engin

Graduates trained at these facilities contribute to a wide variety of nuclear Government agencies involved with (a) monitoring nuclear technology, for example, r agencies, Federal and international inspections, (b)hardware for inspections, and (monitoring.

Development of new SNF interim management facilities would commit lands to th from the time of construction through cessation of operations. At that time, these converted to other uses or decontaminated, decommissioned, and the site restored tc use. Existing SNF management facilities could also be converted to other uses or th following their decommissioning.

See Appendices A through F for site-specific discussions on the relationship 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 re recycled, or resources that would be consumed or reduced to unrecoverable forms. Fc construction and operation of an SNF facility at any of the locations under conside consume irretrievable amounts of electrical energy, fuel, construction materials, a chemicals. Some construction materials are recyclable and, therefore, should not be irreversible and irretrievable commitments of resources. Furthermore, some of the r be irretrievable because of the nature of the commitment or the cost of reclamation human resources used for the construction and operation of the proposed SNF facilit irretrievably lost since these resources would be unavailable for use in other work the whole, however, SNF management is not particularly resource intensive. See Appe through F for site-specific discussions on irreversible and irretrievable commitmen

5.7 Potential Mitigation Measures

This section summarizes measures that DOE(a) could implement to avoid or redu the environment. Possible mitigation measures are generally the same for all altern summarized by resource category below. Although the environmental effects describec Sections 5.1 through 5.3 may not require mitigation, the range of potential mitigat described below. For all sites, impacts to land use and aesthetic and scenic resour 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 t for releases to air and water. To control both the volume and toxicity of waste gen reduce impacts on the environment, pollution prevention practices would be implemen

DOE is responding to Executive Order 12856, Federal Compliance with Right to and Pollution Prevention Requirements, and associated DOE orders and guidelines by use of toxic chemicals; improving emergency planning, response, and accident notifi encouraging the development and use of clean technologies and the testing of innova prevention technologies. Pollution prevention programs have been implemented at eac Program components include waste minimization, source reduction and recycling, and practices that preferentially procure products made from recycled materials. Portic prevention program have been implemented at the existing DOE and naval sites for ne For example, the waste minimization program at the Savannah River Site has decrease all waste types generated by material substitutions.

Implementation of the pollution prevention plans minimizes the amount of wast during SNF management activities.

5.7.2 Socioeconomics

The SNF management alternatives would require additional workers for construc stabilization, monitoring, and maintenance of SNF. This would produce a socioeconom depending on the available site work force, regional labor pool, and community infr socioeconomic impacts would be expected from implementation of the SNF management a

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a. Because this is an EIS issued by the DOE, it contains language concerning compli applicable environmental requirements, taking appropriate mitigative measures to re environmental impacts, and other matters phrased in the context of DOE as the party actions. As a cooperative agency, and because Navy sites are also evaluated in this will also assure compliance with applicable environmental requirements and take oth measures for its facilities in a consistent and appropriate fashion.

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the mitigation measures described below could be used to further minimize the effec community.

Construction and operation-related impacts resulting from increased labor anc requirements could be reduced by coordinating with local communities and county pla Effective planning would address changes in community services, housing, infrastruc 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 certa have been proposed to proceed concurrently could also be adjusted to minimize socic impacts.

5.7.3 Cultural Resources

Impacts to cultural resources could occur during construction and earth-movin associated with the SNF management alternatives. Areas of proposed ground disturban assessed for the potential to contain important archaeological and paleontological DOE operations office is responsible for establishing and maintaining mitigation ag actions to be taken in the event of discovery of archaeological resources or human construction. These agreements will be negotiated with their potentially affected t historic preservation officers. These agreements would be referenced in future site Environmental Policy Act documentation when appropriate. An example of a possible m measure for archaeological resources would be avoidance or data recovery prior to c Other measures would be necessary to mitigate potential impacts to values of Native Native Hawaiian populations, including involvement in the selection of a mitigation impacts to archaeological sites, spiritual geographical features, and land use. Thi SNF Program's participation in liaison programs to understand Native American or Na concerns.

For paleontological resources, assessments could include literature searches, and consultation with recognized paleontological experts in the region or limited t geologically similar disturbed areas. If significant paleontological resources were mitigation plan for recovery, stabilization, and caring of the resources would be i construction.

For example, at the Hanford Site, certain site activities would have the pote affect prehistoric archaeological sites. In this case, the specific activity plans determine potential effects before initiation of activities. The activity will then these sites. If avoidance of these sites would not be possible, mitigation measures developed in conjunction with the appropriate state agencies and Native American tr

To avoid impacts during operation such as unauthorized artifact collection, w educated through programs and briefing sessions to inform personnel of applicable l regulations for site protection. These educational programs would stress the import 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 leaks or a release to soils as a result of SNF activities. DOE would appropriately contaminated from SNF management activities.

5.7.5 Air Resources

Certain actions under the SNF management alternatives would impact air qualit example, the construction of new facilities could negatively impact air quality thr 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 use of the mitigation measures described below would further minimize the potential

DOE would meet applicable regulations regarding the maintenance of air qualit radiological and nonradiological emission sources. DOE does not foresee impacts to SNF management that would warrant measures beyond those employed consistent with gc construction, engineering, and operations, and management practices.

5.7.6 Water Resources

The implementation of some of the SNF management alternatives would require l volumes of water for the stabilization of SNF. DOE would control water consumption appropriate application of water recycling, water conservation measures and equipme catchment basins, and worker training programs. Constant process monitoring and mas design to current standards, including double-wall confinement of all vessels and p included in design and operating standards by DOE to limit potential operational re processing or storage facility to essentially zero.

5.7.7 Ecological Resources

Implementation of the SNF management alternatives could impact terrestrial re wetlands, aquatic resources, and threatened and endangered species either directly activities that disturb habitat or indirectly through construction activities that runoff into wetlands or aquatic environments.

To avoid potential impacts to endangered, candidate, or state-identified sens preconstruction surveys would be completed to determine the presence of these speci habitat. If protected species or primary habitat for these species are located near be disturbed, DOE would evaluate the project design and other program activities tc modifications would avoid negative impacts. DOE would consult with the U.S. Fish an Service to develop the most appropriate action-specific mitigation measures.

Wetland habitat would be delineated in accordance with applicable U.S. Army C Engineers procedures and wetlands located near proposed activities would be avoidec avoidance were not possible, specific mitigation measures could be developed in con 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 ex habitat at another location onsite.

5.7.8 Noise

Construction and operation from SNF management would result in the generation consistent with light industrial activity. DOE does not foresee noise impacts from that would warrant mitigation measures beyond those employed consistent with good c engineering, operational, and management practices.

Noise impacts to the public and other noise-sensitive receptors could be redu noise buffer areas between sources and receptors, constructing noise walls and othe 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 alternat add to the current work force and to additional commuting traffic. At sites with in concerns, roads could be widened with the addition of lanes or implementation of tr management. DOE would also consider using high-occupancy vehicles (such as vans or implementing car-pooling or ride-sharing programs, or staggering schedules to reduc for increased traffic congestion. See Section 5.7.12 for discussion of transportati mitigation.

5.7.10 Occupational and Public Health and Safety

Implementation of the SNF management alternatives would increase the potentia exposure either through direct exposure or through air emissions. Although these ef discussed in Section 5.2, the as low as reasonably achievable principle would be us radiation exposure of workers and the public. Pollution prevention practices would to avoid or reduce production of potentially harmful substances. Waste minimization practiced to reduce the toxicity and volume of secondary wastes to be managed. Furt would update their current worker training, emergency planning, emergency preparedn emergency response programs as needed to address new SNF management actions for the 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 t

Under certain alternatives, additional transmission lines or substations may need t infrastructure and, at the Nevada Test Site, a sewage treatment facility for the SN facility would need to be constructed. However, DOE would reduce the need for certa (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 t SNF with the consequence being a significant release of radioactive or other hazarc the environment. Although the probability is very small, as discussed in Section 5. locations considered for SNF management have emergency action plans and equipment t accidents and other emergencies to limit the magnitude of potential impacts from an plans include training of workers, local emergency response agencies (such as fire the public; communication systems and protocols; readiness drills; and mutual aid a plans would be updated to cover any new SNF facilities and activities. DOE would cc 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 En Justice in Minority Populations and Low-Income Populations (FR 1994), was released agencies. This order directs Federal agencies to incorporate environmental justice missions. As such, Federal agencies are specifically directed to identify and addre disproportionately high and adverse human health or environmental effects of their policies, and activities on minority populations and low-income populations. Appenc provides an assessment of the areas surrounding the 10 sites under consideration fc of SNF under all programmatic alternatives considered in this volume. Because DOE i process of developing guidance, the approach used in this analysis might depart son guidance eventually issued.

The overall review indicated that the potential impacts calculated for each c each of the alternative sites considered for the management of all or some portion naval SNF only) present no significant risk and do not constitute a reasonably fore impact to the surrounding population. This includes both the impacts of facility op transport of SNF, and the risk of reasonably foreseeable accident scenarios postula which are small. Therefore, the impacts of the programmatic management of DOE SNF u alternatives evaluated in this EIS do not constitute a disproportionately high and any particular segment of the population, minorities or low-income communities incl

Characterization of the numbers and location of minority and low-income popul dependent on how these populations are defined and what assumptions are used in con analysis. As discussed in Appendix L, at the time this EIS and the Draft Environmen Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Reactor Spent Nuclear Fuel (Draft FRR SNF EIS) were prepared, the Federal Interagen Group on environmental justice had not issued final guidance on the definitions of low-income populations, or the approach to be used in analyzing environmental justi the Executive Order (FR 1994). Final internal DOE guidance on environmental justice been adopted. As a result, both the definitions and assumptions used by and within conducting environmental justice analyses can vary and the resulting demographic re on a case-by-case basis. For example, this EIS and the Draft FRR SNF EIS present de characterizations derived from the same United States Census Bureau database, but t used different definitions and assumptions. Several of the same candidate interim S sites were evaluated in both documents. As discussed in Appendix L, variations in t and assumptions led to differences in the characterization of minority and low-incc surrounding these potential interim SNF management sites. Nevertheless, although th characterizations differ, the impacts resulting from the proposed action under all no significant risk to the population as a whole. Therefore, no disproportionately effects would be expected for any particular segment of the population, including m low-income populations, regardless of which set of definitions and assumptions were

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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, includin 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 tc 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 al of national standards of performance for new or modified stationary sources of atmc USC -7411) and requires specific emission increases to be evaluated so as to preven deterioration in air quality (42 USC -7470). Hazardous air pollutants, including r separately (42 USC -7412). Air emissions are regulated by the U.S. Environmental F 40 CFR Parts 50 through 99. In particular, radionuclide emissions and hazardous ai under the National Emission Standard for Hazardous Air Pollutants Program (see 40 C CFR Part 63).

Safe Drinking Water Act, as amended [42 USC -300 (F) et seq.]. The primary c of the Safe Drinking Water Act, as amended, is to protect the quality of the public sources of drinking water. The implementing regulations, administered by the U.S. Agency unless delegated to the states, establish standards applicable to public wat promulgate maximum contaminant levels, including those for radioactivity, in public are defined as public water systems that serve at least 15 service connections usec regularly serve at least 25 year-round residents. Safe Drinking Water Act requirem promulgated by the U.S. Environmental Protection Agency in 40 CFR Parts 100 througk radionuclides, the regulations in effect now specify that the average annual concen photon radioactivity from manmade radionuclides in drinking water shall not produce equivalent to the total body or any internal organ greater than 0.004 rem (4 millir contaminant level for gross alpha particle activity is 15 picocuries per liter. Th Protection Agency proposed revisions to limits on regulating radionuclides July 18 has not been finalized. For purposes of analysis, however, the more conservative s programs established by the Safe Drinking Water Act include the Sole Source Aquifer Protection Program, and the Underground Injection Control Program.

Clean Water Act, as amended (33 USC -1251 et seq.). The Clean Water Act, whi amended the Federal Water Pollution Control Act, was enacted to "restore and mainta physical and biological integrity of the Nation's water." The Clean Water Act proh toxic pollutants in toxic amounts" to navigable waters of the United States. Secti Act, as amended, requires all branches of the Federal Government engaged in any act a discharge or runoff of pollutants to surface waters to comply with Federal, state requirements.

In addition to setting water quality standards for the Nation's waterways, th supplies guidelines and limitations for effluent discharges from point-source disch authority for the U.S. Environmental Protection Agency to implement the National Pc Elimination System permitting program. The National Pollutant Discharge Eliminatic administered by the Water Management Division of the U.S. Environmental Protection regulations in 40 CFR Part 122 et seq. Idaho has not applied for National Pollutan System authority from the U.S. Environmental Protection Agency. Thus, all National Elimination System permits required for the Idaho National Engineering Laboratory a 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) tc Act. Section 402(p) requires that the Environmental Protection Act establish regul for stormwater discharges associated with industrial activity. Stormwater discharg industrial activity are permitted through the National Pollutant Discharge Eliminat Permit requirements are published at 40 CFR Part 122.

Resource Conservation and Recovery Act, as amended (42 USC -6901 et seq.). T treatment, storage, or disposal of hazardous and nonhazardous waste is regulated un Disposal Act, as amended by the Resource Conservation and Recovery Act and the Haza Waste Amendments of 1984. Pursuant to Section 3006 of the Act, any state that seek enforce a hazardous waste program pursuant to the Resource Conservation and Recover U.S. Environmental Protection Agency authorization of its program. The U.S. Envirc Agency regulations implementing the Resource Conservation and Recovery Act are foun 260 through 280. These regulations define hazardous wastes and specify hazardous w handling, treatment, storage, and disposal requirements.

The regulations imposed on a generator or a treatment, storage, and/or dispos according to the type and quantity of material or waste generated, treated, stored, method of treatment, storage, and/or disposal also impacts the extent and complexit also Section 7.2.5).

Comprehensive Environmental Response, Compensation, and Liability Act, as amended (42 USC -9601 et seq.). The Comprehensive Environmental Response, Compensa Liability Act, as amended, provides a statutory framework for the cleanup of waste substances and-as amended by the Superfund Amendments and Reauthorization Act-provi emergency response program in the event of a release (or threat of a release) of a environment. Using the Hazard Ranking System, Federal and private sites are rankec the National Priorities List. The Comprehensive Environmental Response, Compensati as amended, requires such Federal facilities having such sites to undertake investi necessary. The Act also includes requirements for reporting releases of certain ha 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 faci owned by DOE, provide various information (such as inventories of specific chemical releases that occur from these sites) to the State Emergency Response Commission an Emergency Planning Committee to ensure that emergency plans are sufficient to respc releases of hazardous substances. Implementation of the provisions of this Act beg 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 requiremen 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 Cc provides the U.S. Environmental Protection Agency with the authority to require tes substances, both new and old, entering the environment, and regulates them where ne complements and expands existing toxic substance laws such as -112 of the Clean Air Clean Water Act. The Toxic Substances Control Act came about because there were nc regulations for the potential environmental or health effects of the thousands of n each year before they were introduced into the public or commerce. The Toxic Subst regulates the treatment, storage, and disposal of certain toxic substances, specifi biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, an The asbestos regulations under the Toxic Substances Control Act were ultimately ove regulations pertaining to asbestos removal, storage, and disposal are promulgated t Emission Standard for Hazardous Air Pollutants Program (40 CFR Part 61, Subpart M) chlorofluorocarbons, Title VI of the Clean Air Act Amendments of 1990 requires a re chlorofluorocarbons beginning 1991, and prohibits production beginning 2000.

Pollution Prevention Act of 1990 (42 USC -13101 et seq.). The Pollution Prev of 1990 establishes a national policy for waste management and pollution control th reduction, followed sequentially by environmentally safe recycling, treatment, and or releases to the environment should only occur as a last resort. In response, DC participation in the Superfund Amendments and Reauthorization Act Section 313, U.S. Protection Agency 33/50 Pollution Prevention Program. The goal, for facilities alr 313 compliance, is to achieve a 33 percent reduction in the release of 17 priority 1993 baseline. On August 3, 1993, Executive Order 12856 was issued, expanding the that DOE must reduce its total releases of all toxic chemicals by 50 percent by Dec DOE is also requiring each DOE site to establish site-specific goals to reduce gene

Federal Facility Compliance Act. The Federal Facility Compliance Act, enacte 1992, waives sovereign immunity for fines and penalties for Resource Conservation a violations at Federal facilities. However, a provision postpones fines and penalti waste storage prohibition violations at DOE sites and requires DOE to prepare plans required treatment capacity for mixed waste stored or generated at each facility. by the host state or the U.S. Environmental Protection Agency, after consultation w and a consent order must be issued by the regulator requiring compliance with the p Compliance Act further provides that the DOE will not be subject to fines and penal restriction storage prohibition violations for mixed waste as long as it is in comp plan and consent order and meets all other applicable regulations.

National Historic Preservation Act, as amended (16 USC -470 et seq.). The Na Historic Preservation Act, as amended, provides that sites with significant nationa the National Register of Historic Places. There are no permits or certifications r However, if a particular Federal activity may impact a historic property resource, Advisory Council on Historic Preservation will generally generate a Memorandum of A stipulations that must be followed to minimize adverse impacts. Coordinations with Preservation officer are also undertaken to ensure that potentially significant sit appropriate mitigative actions are implemented.

Archaeological Resource Protection Act, as amended (16 USC -470aa et seq.). Act requires a permit for any excavation or removal of archaeological resources frc Excavations must be undertaken for the purpose of furthering archaeological knowlec and resources removed are to remain the property of the United States. Consent mus Indian tribe owning lands on which a resource is located before issuance of a permi 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 repatriatic collections and collections held by museums receiving Federal funding that are cult

American tribes. Major actions to be taken under this law include (a) establishing monitoring and policy-making responsibilities, (b) developing regulations for repat 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 activit land.

American Indian Religious Freedom Act of 1978 (42 USC -1996). This act reaff Native American religious freedom under the First Amendment and sets United States preserve the inherent and constitutional right of American Indians to believe, expr traditional religions. The act requires that Federal actions avoid interfering wit 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 burdeni religion unless the Government demonstrates a compelling governmental interest and compelling Government interest and is the least restrictive means of furthering tha

Endangered Species Act, as amended (16 USC -1531 et seq.). The Endangered Sp Act, as amended, is intended to prevent the further decline of endangered and threa restore these species and their habitats. The Act is jointly administered by the U Commerce and the Interior. Section 7 of the Act requires consultation with the U.S to determine whether endangered and threatened species or their critical habitats a vicinity of the proposed action.

Migratory Bird Treaty Act, as amended (16 USC -703 et seq.). The Migratory B Treaty Act, as amended, is intended to protect birds that have common migration pat States and Canada, Mexico, Japan, and Russia. It regulates the harvest of migrator things such as the mode of harvest, hunting seasons, and bag limits. The Act stipu any time, by any means, or in any manner to "kill . . . any migratory bird." Althc project is required under the Act, DOE is required to consult with the U.S. Fish an regarding impacts to migratory birds and to evaluate ways to avoid or minimize thes with the U.S. Fish and Wildlife Service Mitigation Policy.

Bald and Golden Eagle Protection Act, as amended (16 USC -668-668d). The Bal Golden Eagle Protection Act makes it unlawful to take, pursue, molest, or disturb b eagles, their nests, or their eggs anywhere in the United States (Section 668, 668c obtained from the U.S. Department of the Interior to relocate a nest that interfere or recovery operations.

Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq. 71:8301 et seq.). Wild and Scenic Rivers Act, as amended, protects certain selected rivers of the Nat outstanding scenic, recreational, geological, fish and wildlife, historical, cultur These rivers are to be preserved in a free-flowing condition to protect water quali conservation purposes. The purpose of the Act is to institute a national wild and designate the initial rivers that are a part of that system, and to develop standar rivers in the future.

Occupational Safety and Health Act of 1970, as amended (29 USC -651 et seq.). Occupational Safety and Health Act establishes standards to enhance safe and health places of employment throughout the United States. The Act is administered and enf Occupational Safety and Health Administration, a U.S. Department of Labor agency. Occupational Safety and Health Administration and the U.S. Environmental Protection mandate to reduce exposures to toxic substances, the Occupational Safety and Health 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 recognized hazards likely to cause death or serious physical harm. Employees have occupational safety and health standards and all rules, regulations, and orders iss Occupational Safety and Health Administration regulations (published in Title 29 of Regulations) establish specific standards telling employers what must be done to ac working environment. DOE places emphasis on compliance with these regulations at D prescribes through DOE orders the Occupational Safety and Health Act standards that as 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 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 t Control Act of 1972, as amended, directs all Federal agencies to carry out "to the authority" programs within their jurisdictions in a manner that furthers a national 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 wi Standards, directs Federal agencies, including DOE, to comply with applicable admin 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 pos proposed activity on any potential eligible or listed resources.

Executive Order 11514 (National Environmental Policy Act) directs Federal age 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 est procedures to ensure that the potential effects of flood hazards and floodplain man any action undertaken in a floodplain and that floodplain impacts be avoided to the

Executive Order 11990 (Protection of Wetlands) directs governmental agencies extent practicable, any short- and long-term adverse impacts on wetlands wherever t alternative.

Executive Order 12344 (Naval Nuclear Propulsion Program) [enacted as permanen Public Law 98-525 (42 USC -7158)] prescribes the authority and responsibility of th 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 exec departments and agencies the responsibility for undertaking remedial actions for re 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 departm

Executive Order 12856 (Right to Know Laws and Pollution Prevention Requiremen directs all Federal agencies to reduce and report toxic chemicals entering any wast emergency planning, response, and accident notification; and encourage clean technc 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 agen environmental justice by identifying and addressing, as appropriate, disproportiona human health or environmental effects of its programs, policies, and activities on low-income populations in the United States and its territories and possessions. T Interagency Working Group on Environmental Justice and directs each Federal agency within prescribed time limits to identify and address environmental justice concern each Federal agency to collect, maintain, and analyze information on the race, nati and other readily accessible and appropriate information for areas surrounding faci have a substantial environmental, human health, or economic effect on the surroundi 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 jurisdict ocean or Antarctica)." According to the Executive Order, major Federal actions sig environment of foreign countries may also require environmental analyses under cert 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 establ comprehensive health, safety, and environmental program for its facilities. The re through which DOE manages its facilities are the promulgation of regulations and th orders.

The DOE regulations are generally found in Title 10 of the Code of Federal Re regulations address such areas as energy conservation, administrative requirements safety, and classified information. For purposes of this EIS, relevant regulations Procedures for DOE Nuclear Activities; 10 CFR Part 830.120, Quality Assurance; 10 C Radiation Protection of the Public and the Environment (proposed); 10 CFR Part 835, Radiation Protection; 10 CFR Part 1021, Compliance with the National Environmental CFR Part 1022, Compliance with Floodplains/
Wetlands Environmental Review Requirements.

DOE orders generally set forth policy and the programs and internal procedure those policies. The major DOE orders pertaining to the eventual construction and c within the DOE Complex are listed in Table 7-1. The following sections provide a b selected orders:

DOE Order 5440.1E, National Environmental Policy Act Compliance Program. Thi order establishes authorities and responsibilities of DOE officials and sets forth implementing the National Environmental Policy Act. This order was issued by DOE c 1992.

DOE Order 5480.1B, Environment Safety and Health Program for Department of Energy Operations. This order establishes the Environment, Safety and Health Progr operations.

7.1.4 Hazardous and Radioactive Materials Transportation Regulations

Transportation of hazardous and radioactive materials, substances, and wastes U.S. Department of Transportation, U.S. Nuclear Regulatory Commission, and U.S. Env Protection Agency regulations. These regulations may be found in 49 CFR Parts 171 Parts 383 through 397, 10 CFR Part 71, and 40 CFR Part 262, respectively.

U.S. Department of Transportation regulations contain requirements for identi hazardous or radioactive. These regulations interface with those of the U.S. Nucle or U.S. Environmental Protection Agency regulations for identifying material, but t Transportation hazardous material regulations govern the hazard communication (such labelling, vehicle placarding, and emergency response telephone number) and shippin required entries on shipping papers or U.S. Environmental Protection Agency waste m

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; Ch
5480.3	Safety Requirements for the Packaging and Transportation of Hazardous 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 anc 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 regulat develop a path forward toward meeting any Resource Conservation and Recovery Act re might apply.

7.2 Consultation

The National Environmental Policy Act requires that Federal, state, and local jurisdiction or special expertise regarding any environmental impact be consulted a National Environmental Policy Act process. Agencies involved include those with au applicable permits, licenses, and other regulatory approvals, as well as those resp significant resources (for example, endangered species, critical habitats, or histc agencies will be sent copies of the Final EIS.

Consultations with Federal and state agencies and native America tribes were Table 7-2 shows the dates and locations of the meetings held. Volume 2, Appendix E correspondence generated as a result of these meetings.

Table 7-2. Meetings held in response to agency or nation comments on the Departmen Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laborator 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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8. INDEX

Subjects are indexed by section, figure, table, and appendix designations only.

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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 Na
Engineering Laboratory Environmental Restoration and Waste Management Programs Fina
Environmental Impact Statement.
CONTACT: For further information on this Environmental Impact Statement call or c
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For general information on the U.S. Department of Energy NEPA process call 1-800-47
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 environmen
quences over the next 40 years of alternatives related to the transportation, recei
of spent nuclear fuel under the responsibility of the U.S. Department of Energy. It
specific consequences of the Idaho National Engineering Laboratory sitewide actions
next 10 years for waste and spent nuclear fuel management and environmental restora
matic spent nuclear fuel management, this document analyzes alternatives of no acti
regionalization, centralization and the use of the plans that existed in 1992 and 1
of these materials. For the Idaho National Engineering Laboratory, this document an
no action, ten-year plan, and minimum and maximum treatment, storage, and disposal
of Energy wastes.
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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 becaused 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 I 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.

Contents

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

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(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 ot 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?

- 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 lab
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 commentors 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 commentors expressed strongly held opinions about the EIS, DOE, and the Navy and/or the alternatives. Some commentors 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 commentors 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
Summary 5
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.

6 Summary

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

Technologies for spent nuclear fuel management are required to ensure safe, environmentally sound, and economic management until ultimate disposition is implemented. Ultimate disposition of DOE's spent nuclear

a. A metric ton of heavy metal is the unit used throughout this document to indicate the amount of spent nuclear fuel It corresponds to 1,000 kilograms (2,200 pounds) of heavy metal (uranium, plutonium. thorium).

(Side_bar #: 4)

What Spent Nuclear Fuel Management Decisions Will Be Made Based on this EIS?

Where should DOE locate specific spent nuclear fuel management activities?

What capabilities, facilities, and technologies are needed for spent nuclear fuel management?

What research and development activities are needed to support the spent nuclear fuel management program?

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fuel is a high priority. Two broad strategies may at this point be envisioned for the ultimate disposition of DOE spent nuclear fuel. The Department could (a) work toward direct disposal of spent fuel in a geologic repository or (b) chemically dissolve the fuel and produce a waste form (such as vitrified glass) for repository disposal. Variations on these broad strategies are also possible and both remain under consideration. It is possible that much of DOE's spent fuel could qualify for direct disposal. Aggressive characterization and, if appropriate, preparation programs would be necessary to support the first repository schedule. Sufficient quantity and quality of information is still not available to determine at this time whether the Yucca mountain site is a suitable candidate for geologic disposal of spent nuclear fuel and high-level radioactive waste. The DOE, however, is in the early planning stages for a repository EIS, which will be prepared pursuant to the directives of the Nuclear Waste Policy Act, as amended. The DOE plans to issue in mid-1995 a formal notice of its intent to prepare this analysis. The repository EIS is being prepared to evaluate potential environmental impacts, based on the best available information and data, that would be associated with the repository's development and operation, and to support the Secretary of Energy's final recommendation to the President, as required by the Nuclear Waste Policy Act, as amended. The repository EIS will examine the site specific environmental impacts from construction, operation, and eventual closure of the repository, including potential post-closure radiological effects to the environment. Until the repository EIS is complete, no final decision could be made concerning what DOE spent nuclear fuel would be accepted in a geologic repository.

As part of its spent nuclear fuel management program, DOE would (1) stabilize the spent nuclear fuel as needed to ensure safe interim storage, (2) characterize the existing spent nuclear fuel inventory to assess compliance with the repository acceptance criteria as they are developed, and (3) determine what processing, if any, is required to meet

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(Side_bar #: 5)

Definition of Terms Related to Spent Nuclear Fuel

management (of spent nuclear fuel)-Emplacing, operating, and administering facilities, transportation systems, and procedures to ensure safe and environmental responsible handling and storage of spent nuclear fuel pending (and in anticipation a decision on ultimate disposition.

stabilization (of spent nuclear fuel)-Actions taken to further confine or reduce th hazards associated with spent nuclear fuel, as necessary for safe management and environmentally responsible storage for extended periods of time. Activities that m be necessary to stabilize spent nuclear fuel include canning, processing, and passivation.

canning-The process of placing spent nuclear fuel in canisters to retard corrosion,

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 o4 making metals inactive or less chemically reactive. For example, the surface of steel can be passivated by chemical treatment.

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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

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(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

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(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 facilitie
  - Potential foreign research reactor fuel.
. Spent nuclear fuel processing might need to be conducted. Other forms of stabili
  occur to provide for safe storage and/or transport.
. Some facilities would be upgraded/replaced and additional storage capacity requi
  alternative would be constructed.
  Onsite fuel transfers would occur for improved safe storage.
. Research and development activities would be undertaken for spent nuclear fuel m
  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 stc
    refueling/defueling site.

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16 Summary
Figure (Summary 17)Figure 4. Spent nuclear fuel distribution for the Decentralizati
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
18 Summary
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 Expended 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

20 Summary

Figure (Summary 21)Figure 6. Spent nuclear fuel distribution for Regionalization Al 4A.

Summary 21

quantities of fuel. Naval fuel would be transported to the Expended 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 Expended 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 Expended 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 Expended 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 Expended 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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22 Summary
Figure (Summary 23)Figure 7. Spent nuclear fuel distribution for Regionalization Al
4B.
Summary 23
Figure (Summary 24)Figure 8. Spent nuclear fuel distribution for the Centralization
alternative.
24 Summary

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

Summary 25

Figure (Summary 26)Figure 9. Number of spent nuclear fuel and test specimen shipmen the years 1995 and 2035.

26 Summary

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

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(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 I in 100

of death from exposure to natural background
radiation and medical sources over a lifetime.

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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

Summary 27

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.

28 Summary

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.
Summary 29
Figure (Summary 30)Figure 11. Estimate of risk of latent cancer fatalities In gener population from facility accidents for spent nuclear fuel management activities.
30 Summary
Figure (Summary 31)Figure 12. Estimate of average annual risk(b) from transportatic 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.
32 Summary
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 I 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.
Summary 33
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.
34 Summary
Figure (Summary 35)Figure 15. Average volume of low-level wastes generated per year years 1995 to 2005 for spent nuclear fuel management activities.
Summary 35
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 Expended 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
Summary 37
Figure (Summary 38)Figure 16. Management costs for interim storage of spent nuclear through the year 2035.
38 Summary
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 with in 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)j surrounding each of the sites under consideration. Analysis of environmental justice concerns was based on a qualitative assessment of
Summary 39
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

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(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.

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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

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(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 nuclea fuel and preparing (stabilizing) it for such storage, (c) constructing and operatin facilities for stabilization, plus interim storage, (d) consolidating storage and r outdated storage facilities, and (e) developing criteria and technologies for ultim 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 establishe implemented 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

	technologies, and environmental cleanup technologies.
Naval Reactors Facility (Expended Core Facility)	Receive and conduct examination of spent nuclear fuel support fuel development and performance analyses.
Argonne National Laboratory-West	Develop and test breeder reactor technology; store transuranic waste; support research and development of spent nuclear fuel treatment technologi

Spent Nuclear Fuel
Since the 1950s, spent nuclear fuel removed from nuclear-powered naval vessels and naval reactor prototypes has been transported to the Naval Reactors Facility located at the Idaho National Engineering Laboratory Spent nuclear fuel has also been received from university commercial, industrial, DOE, and other U.S Government and foreign reactors. Spent nuclear fuel continues to be generated at the Idaho National Engineering Laboratory by reactor
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operations. Naval spent nuclear fuel, currently examined at the Naval Reactors Facility, is transferred to the Idaho Chemical Processing Plant for storage at a rate of about 1 metric ton of heavy metal per year. Spent nuclear fuel is stored at a number of site areas in various dry and wet storage facilities awaiting ultimate disposition.
Figure (Summary 49)Major facility areas located at the Idaho National Engineering I
Summary 49

Technology Development

Figure (Summary 50)Dry storage of spent nuclear fuel
Technology development supports the Environmental Restoration, Waste Management, and Spent Nuclear Fuel Programs by designing and testing potential technical solutions to specific problems. Broad program areas include research, development, demonstration, testing, and evaluation; technology integration; development of safe and efficient packaging systems; emergency response management; education; and laboratory analysis. Types of current technology development activities include minimizing waste; testing cleanup technologies; evaluating and testing methods to treat calcined, sodium-bearing, and high-level `wastes; and designing sensors and other environmental monitoring equipment and systems. An example of research activity includes investigating treatment technologies to prepare fuel for ultimate disposition.

(Side_bar #: 16)
Waste at the Idaho National Engineering Laboratory
Alpha Low-Level Waste: Waste that was previously classified as transuranic waste bu transuranic concentration lower than the currently established limit for transurani waste requires additional controls and special handling (relative to low-level wast cannot be accepted for onsite disposal under the current waste acceptance criteria; case waste.
Greater-Than-Class-C Waste: Low-level radioactive waste that is generated by the cc and that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class as specified in Title 10 Code of Federal Regulations Part 61. DOE is responsible fc Greater-Than-Class-C wastes from DOE non-defense programs.
Hazardous Waste: Under the Resource Conservation and Recovery Act, a solid waste, c of solid wastes, which because of its quantity, concentration, or physical, chemica characteristics may (a) cause, or significantly contribute to, an increase in morta serious irreversible, or incapacitating reversible, illness; or (b) pose a substant hazard to human health or the environment when improperly treated, stored, transpor otherwise managed. Source, special nuclear material, and byproduct material, as def Energy Act, are specifically excluded from the definition of solid waste.
High-Level Waste: The highly radioactive waste material that results from the reprc nuclear fuel, including liquid waste produced directly from reprocessing and any sc the liquid that contains a combination of transuranic and fission product nuclides permanent isolation. High-level waste may include other highly radioactive material Regulatory Commission, consistent with existing law, determines by rule requires pe

Low-Level Waste: Waste that contains radioactivity and is not classified as high-le
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 classifi
provided the concentration of transuranic elements is less than 100 nanocuries per
Mixed Waste: Waste that contains both hazardous waste under the Resource Conservati
Recovery Act and source, special nuclear, or byproduct material subject to the Atom
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 tran
per gram of waste, with half-lives greater than 20 years, except for (a) high-level
(b) waste that the DOE has determined, with the concurrence of the Administrator of
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 Commis
for disposal on a case-by-case basis in accordance with Title 10 Code of Federal Re

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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.

(Side_bar #: 17)

What Are the INEL Decisions to Be Made Based on This EIS?

Spent Nuclear Fuel: What is the appropriate strategy of the Idaho National Engineer
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 Faci
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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(Side_bar #: 18)

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.

Summaly 53

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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(Side_bar #: 19)

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)
. Expended 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 = Minimu 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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(Side_bar #: 20)
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)-ll 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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(Side_bar #: 21)
Alternative B (Ten-Year Plan)
Spent Nuclear Fuel: Receive additional offsite spent nuclear fuel; transfer aluminu clad spent nuclear fuel to Savannah River Site; examine and store naval spent nucle fuel; complete Expended 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)-ll, Boiling Water Reactor Experiment (BORAX)-V, Engineering Test Reactor, Materials Test Reactor, Fue Processing Complex, Fuel Receipt/Storage Facility, Headend Processing Plant, Waste Calcine Facility, and Central Liquid Waste Processing Facility; clean up groundwate contamination and vadose zone; retrieve and treat Pit 9 wastes.
High-Level Waste: Convert liquid to calcine (solid); construct a facility to immobi 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 treatme 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; construc 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.

(Side_bar #: 22)
Alternative C (Minimum Treatment, Storage, and Disposal)
Spent Nuclear Fuel: Transport Idaho National Engineering Laboratory spent nuclear f 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 grounc
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)

(Side_bar #: 23)
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 (BOF
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
Summary 57
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 Manageme
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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- genera ted 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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(Side_bar #: 24)
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)-ll, 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.

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 fanning, ranching, and mining. The Idaho National Engineering Laboratory accounts for approximately 10 percent of the total regional employment.

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

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 agences 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)j; (b) degree to which these areas have been surveyed for resources and the number of potentially affected structures [6 for Alternative A (No
64 Summary
Action) and 11 for Alternative C (Minimum Treatment, Storage, and Disposal) bb 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 1 980s 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-i 29 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-i 29, 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-i 29. 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
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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 alteratives, 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

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

Minority Populations and Low-Income Populations" was released to Federal agencies. In accordance with the Executive Order, an interagency Federal Working Group on Environmental Justive 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 or the Building
Westminister, 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 ot 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
Worchester, 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.4o 9:00 p.m.,
Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 1:00p.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 1:00a.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.
Summary 77
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 Managemen 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 he 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 comments 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 infonnation in the various appendices. The main sections of Volumes 1 and 2 contain an intermediate level of detail.
Figure INEL structure

Where do 1 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 nuclar 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...

DOE	Spent Fuel Management Program (inventory, types, storage)	Section 1.1.2; Section 2. Appendices A,B, C, and F; Section 2 of Appendices E
	Technologies for Management ot 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,
Naval Nuclear Propulsion Program	Spent Fuel Management	Section 2.4 of Appendix D Attachment D of Appendix
	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 Regulatorv 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

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 exis and projected spent nuclear fuel inventories at one DOE site until ultimate disposition.
Figure Decentralization1992/93 Planning Basis- Under this alternative, DOE would tr 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 preferr 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 RegionalizationCentralization- Under this alternative, DOE would manage all and projected spen 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 altetnative 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-tetrm 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 infoimation 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

No Action	2.1.1 3.1	3.3 Table 3.3-1	5.3.2 5.4.2 5.5.2 5.6.2	5.9.2 5.10 5.11.2 5.12	5.15 5.16
Ten-Year Plan	2.1.1 3.1	3.3 Table3.3-1	5.1 5.2.3 5.3.3 5.4.3 5.5.3 5.6.2	5.7 5.8.3 5.9.3 5.10 5.11.2 5.12	5.13.3 5.14.4 5.15 5.16
Minimum TSD	2.1.1 3.1	3.3 Table 3.3-1	5.1 5.2.4 5.3.4 5.4.4 5.5.4 5.6.2	5.7 5.8.4 5.9.4 5.10 5.11.2 5.12	5.13.4 5.14.5 5.15 5.16
Maximum TSD	2.1.1 3.1	3.3 Table 3.3-1	5.1 52.5 53.5 5.4.5 5.5.5 5.6.2	5.7 5.8.5 5.9.5 5.10 5.11.2 5.12	5.13.5 5.14.6 5.15 5.16

Note: Indexed according to sections and tables.
*Subjects addressed in this column, for each alternative are: introduction, land us 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...	See Section...
Preferred Alternative Decision Process	3.4.1
Conclusions	3.4.2
Spent Nuclear Fuel Management	3.4.3
Environmental Restoration	3.4.4
Waste Management	3.4.5
Environmental Consequences	3.4.6
Cumulative Impacts from Connected or Similar Actions	3.4.7
Unavoidable Adverse Environmental Effects	3.4.8
Short-Term Use of Environment and Maintenance of Long-Term Productivity	3.4.9
Irretrievable Commitments of Resources	3.4.10
Potential Mitigation	3.4.11
Environmental Justice	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) -

	No Action	Decentral-ization	1992/93 Planning Basis	Regional-ization	Central-ization
Health and Safety	3.3.2 5.1.2.4 5.1.2.5 5.3.2.6	3.3.2 5.1.3.4 5.1.3.5 5.3.2.6	3.3.2 5.1.4.2 5.1.4.4 5.3.2.6	3.3.2 5.1.5.4 5.1.5.S 5.3.2.6	3.3.2 5.1.6. 5.1.6. 5.3.2.
Transportation	5.1.2.6 5.3.2.7 App. I-4.2.1 App. I-5.3.1	5.1.3.6 5.3.2.7 App. I-4.2.2 App. I-5.3.2	5.1.4.6 6.3.2.7 App. I-4.2.3 App. I-5.3.3	5.1.5.6 5.3.2.7 App. I-4.2.4 App. I-5.3.4	5.1.6 5.3. App. I- App. I-
Waste Management	3.3.4 5.1.2.3	3.3.4 5.1.3.3	3.3.4 5.1.4.3	3.3.4 5.1.5.3	3.3.4 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 Utlities	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	not identified	3.3.13,5.14; F-5	5.19.1
Environment			
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

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