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,

Thomas P. Grumbly
Assistant Secretary for
Environmental Management

Printed with soy ink on recycled paper

Cover Sheet

RESPONSIBLE AGENCIES: Lead Federal Agency: U.S. Department of Energy
Cooperating Federal Agency: U.S. Department of the Navy

TITLE: Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement.

CONTACT: For further information on this Environmental Impact Statement call or contact:

Office of Communications
Bradley P. Bugger
DOE Idaho Operations Office
850 Energy Drive, MS 1214
Idaho Falls, ID 83403-3189
208-526-0833

For general information on the U.S. Department of Energy NEPA process call 1-800-472-2756 to leave a message or contact:

Carol Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585
202-586-4600

ABSTRACT: This document analyzes (at a programmatic level) the potential environmental consequences over the next 40 years of alternatives related to the transportation, receipt, processing, and storage of spent nuclear fuel under the responsibility of the U.S. Department of Energy. It also analyzes the site-specific consequences of the Idaho National Engineering Laboratory sitewide actions anticipated over the next 10 years for waste and spent nuclear fuel management and environmental restoration. For programmatic spent nuclear fuel management, this document analyzes alternatives of no action, decentralization, regionalization, centralization and the use of the plans that existed in 1992 and 1993 for the management of these materials. For the Idaho National Engineering Laboratory, this document analyzes alternatives of no action, ten-year plan, and minimum and maximum treatment, storage, and disposal of U.S. Department of Energy wastes.

Reader's Guide

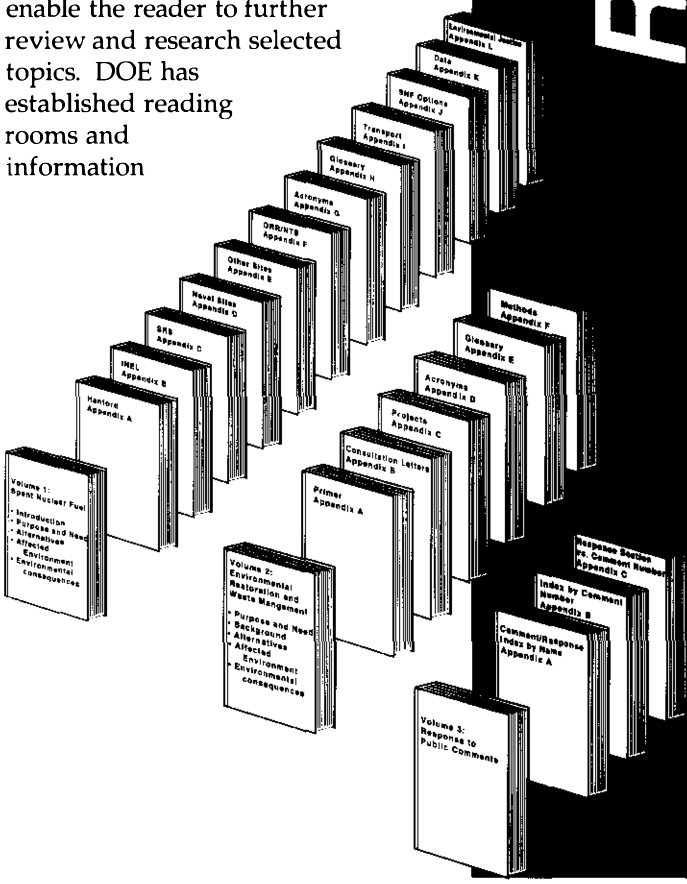
The U.S. Department of Energy's (DOE's) Environmental Impact Statement (EIS) for Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs [DOE/EIS-0203-F] is divided into three volumes:

- Volume 1, DOE Programmatic Spent Nuclear Fuel Management
- Volume 2, Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs (including site-specific spent nuclear fuel management)
- Volume 3, Comment Response Document.

Volume 1 comprises five primary sections and ten key appendices. The five primary sections provide (a) an introduction and overview to DOE's spent nuclear fuel management program throughout the nation, (b) the purpose and need for action to manage spent nuclear fuel, (c) management alternatives that are under consideration, (d) the affected environment, and (e) potential environmental consequences that may be caused by the implementation of each alternative. The information contained in these sections relies, in part, upon more detailed information and analyses in the ten key appendices. These appendices describe and assess the site-specific spent nuclear fuel management programs at three primary DOE facilities and several alternative sites, the naval spent nuclear fuel management program, offsite transportation of spent nuclear fuel, environmental consequences data, and environmental justice considerations. Two additional appendices include a glossary and a list of acronyms and abbreviations.

Volume 2 is similarly constructed. Five primary sections are presented that provide (a) the purpose and need for an integrated 10-year environmental restoration, waste management, and spent nuclear fuel management program at the Idaho National Engineering Laboratory, (b) background, (c) management alternatives under consideration, (d) the affected environment, and (e) potential environmental consequences that may be associated with the implementation of each alternative. The information presented in these sections relies, in part, upon four key appendices, which include a basic description of radioactivity and toxicology (chemical effects), agency consultation letters, detailed project summaries, and technical methodologies and key data. Two additional appendices include a glossary and a list of acronyms and abbreviations.

Volumes 1 and 2 provide an index as well as a list of references to enable the reader to further review and research selected topics. DOE has established reading rooms and information



locations across the United States where these references may either be reviewed or obtained for review through interlibrary loan. The addresses, phone numbers, and hours of operation for these reading rooms and information locations are provided at the end of this EIS Summary.

A line in the margin in Volumes 1 and 2 indicates a change since the Draft EIS.

Volume 3 comprises a primary section, called Comment Summaries and Responses, and three appendices. In the primary section individual public comments are summarized, grouped with others that are similar and organized into topical sections, called Response Sections. The appendices are designed to aid the reader in locating specific comment summaries and responses. Appendix A is an alphabetical list of commentors, showing for each the associated comment document number and response section number(s). Appendix B is a numerically ordered list of comment document numbers, showing associated commentors and response section numbers, and Appendix C provides a correlation of response section numbers to comment document numbers.

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 responses 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

Reader's Guide iii
Introduction 1
National Environmental Policy Act Process 1
General Scope of the Environmental Impact Statement 2
Comments and Reponses 5
Volume 1-Spent Nuclear Fuel 7
Overview 7
History of Spent Nuclear Fuel Management 7
Purpose and Need for Future Spent Nuclear Fuel Management 7
Technologies for Spent Nuclear Fuel Management 9
Alternatives 13
No Action Alternative 14
Decentralization Alternative 16
1992/1993 Planning Basis Alternative 18
Regionalization and Preferred Alternative 20
Centralization Alternative 22
Environmental Consequences 25
Number of Shipments 25
Public and Worker Health Effects 25
Spent Nuclear Fuel-Related Employment 29
Generation of Radioactive Wastes 33
Impact on DOE and Navy Missions 36
Cost of Implementation 37
Cumulative Impacts 37
Environmental Justice 39
Consultations and Environmental Requirements 41
Relationship Between Volumes 1 and 2 43
Volume 2 - INEL Environmental Restoration and Waste Management 45
Overview 45
Waste Management, Environmental Restoration, Spent Nuclear Fuel, and Technology Development at the INEL 47
Waste Management 47
Environmental Restoration 47
Spent Nuclear Fuel 48
Technology Development 50
Purpose and Need for Future Environmental Restoration and Waste Management 51
Alternatives 53
Alternative A (No Action) 54
Alternative B (Ten-Year Plan) 55
Alternative C (Minimum Treatment, Storage, and Disposal) 55
Alternative D (Maximum Treatment, Storage, and Disposal) 57
Preferred Alternative 59
Affected Environment at the INEL 61
Environmental Consequences 63
Air Quality 63
Cultural Resources 64
Ecology 65
Groundwater Quality 66
Normal Operations Impacts 66
Facilities 66

Workers 67
Transportation 67
Accidents 67
Facilities 67
Workers 67
Transportation 68
Environmental Justice 68
Consultations and Environmental Requirements 71
Attachment—Reading Rooms and Information Locations 73

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.

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 decisionmaking, 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).

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:

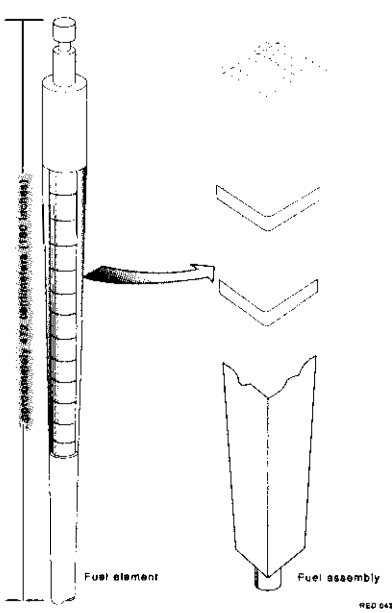
- Impacts to worker safety, public health, the environment, and socioeconomic factors related to transporting, receiving, stabilizing, and storing DOE and naval spent nuclear fuel, as well as special-case commercial fuels under DOE responsibility.

- Siting locations for spent nuclear fuel management operations, which may

What Is Spent Nuclear Fuel?

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. For purposes of this EIS, spent nuclear fuel inventory also includes uranium/neptunium target material, blanket subassemblies, pieces of fuel, and debris.

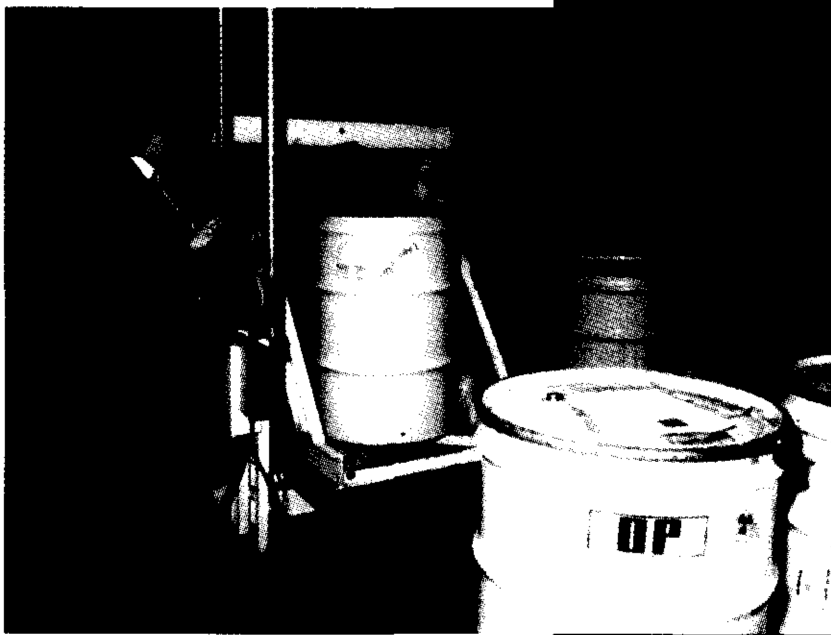
Fuel in a reactor consists of fuel assemblies that come in many configurations but generally consist of the fuel matrix, cladding, and structural hardware. The matrix, which contains the fissionable material (typically uranium oxide or uranium metal), is typically plates or cylindrical pellets. The cladding (typically zirconium, aluminum, or stainless steel) surrounds the fuel, confining and protecting it. For gas-cooled reactors, this may be a ceramic coating over fuel particles. Structural parts hold fuel rods or plates in the proper configuration and direct coolant flow (typically water) over the fuel. Structural hardware is generally nickel alloys, stainless steel, zirconium, or aluminum, or for gas-cooled reactors, graphite.



The radiation of most concern from spent nuclear fuel is gamma rays. Although the radiation levels can be very high, the gamma-ray intensities are readily reduced by shielding the fuel elements with such materials as concrete, lead, steel, and water. The shielding thicknesses are dependent on the energy of the radiation source, desired protection level, and density of the shielding material. Shielding thicknesses for concrete or lead are smaller than for water.

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.



Waste management activities at the Idaho National Engineering Laboratory.

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.

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.

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

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.

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

Existing Spent Nuclear Fuel Locations

1995 Inventory (Metric Tons Heavy Metal)[a]

Hanford	2,133
Idaho National Engineering Laboratory	261
Savannah River Site	206
Oak Ridge Reservation	1
Other DOE Facilities	27
Universities	2
Other	16
Total	2,646

Legend

Source	No. of locations
U.S. Department of Energy Facilities	8
Naval Sites	7
Foreign Returns (potential points of entry)	11
Special-Case Commercial	3
Domestic Non-DOE	9
Universities	29

Naval Sites[b]	State
Kesselring	New York
Newport News	Virginia
Norfolk	Virginia
Pearl Harbor	Hawaii
Portsmouth	Maine
Puget Sound	Washington
Windsor	Connecticut

DOE Facilities	State
Argonne National Laboratory-East	Illinois
Brookhaven National Laboratory	New York
Hanford	Washington
Idaho National Engineering Laboratory	Idaho
Los Alamos National Laboratory	New Mexico
Oak Ridge Reservation	Tennessee
Sandia National Laboratories	New Mexico
Savannah River Site	South Carolina

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).

b. Name of shipyard or site.

RED 0674

Figure 1. *Locations of current spent nuclear fuel generators and storage sites.*

predecessor agencies have transported, received, stored, and reprocessed more than 100,000 metric tons of heavy metal[a] 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:

> ***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?***

- 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).

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

Definition ofTerms Related to Spent Nuclear Fuel

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

stabilization (of spent nuclear fuel)—Actions taken to further confine or reduce the hazards associated with spent nuclear fuel, as necessary for safe management and environmentally responsible storage for extended periods of time. Activities that may 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 of making metals inactive or less chemically reactive. For example, the surface of steel can be passivated by chemical treatment.

the criteria. Decisions regarding the actual disposition of DOE's spent nuclear fuel would follow appropriate review under the National Environmental Policy Act, and would be subject to licensing by the U.S. Nuclear Regulatory Commission. This "path forward" would be implemented so as to minimize impacts on the first repository schedule. The current planning assumption is that any DOE material (vitrified high-level waste and/or spent nuclear fuel) qualified and selected for emplacement in the first repository would be disposed beginning in the year 2015. Disposition of the remaining DOE spent nuclear fuel and vitrified high-level waste that is not emplaced in the first repository would not be decided until the DOE recommendation on the need for a second repository (which would consider such factors as the physical and statutory limits of the first repository). The Nuclear Waste Policy Act, as amended, requires DOE to make that recommendation between January 1, 2007 and January 1, 2010.

Several technology options are available to accomplish overall spent nuclear fuel management objectives. Their selection is dependent upon fuel design and its structural integrity, fuel enrichment, and the chemical stability of the cladding including the degree of corrosion, and of the fuel matrix. These options include direct storage (limited to high-integrity fuels) or stabilization in preparation for storage.

Direct storage means storing spent nuclear fuel in essentially the same physical form in which it is removed from the reactor (that is, little or limited stabilization of the fuel elements). Fuel that has high-integrity cladding, for example naval fuel, can be direct stored, indefinitely. Both wet storage in water pools and dry storage in casks and vaults provide effective cooling and shielding for the safe storage of such high-integrity spent nuclear fuel.

Some stabilization technologies provide additional containment for spent nuclear fuel with reduced integrity. These technologies include (a) direct canning, (b) passivation, and (c) coating.

Several processing technologies are available to stabilize spent nuclear fuel without separating uranium and/or plutonium from the highly radioactive constituents. These technologies involve changing the physical and chemical form to reduce fuel volume and reactivity, or make the fuel more homogenous. 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.

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 consider the Nevada Test Site to 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.

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.

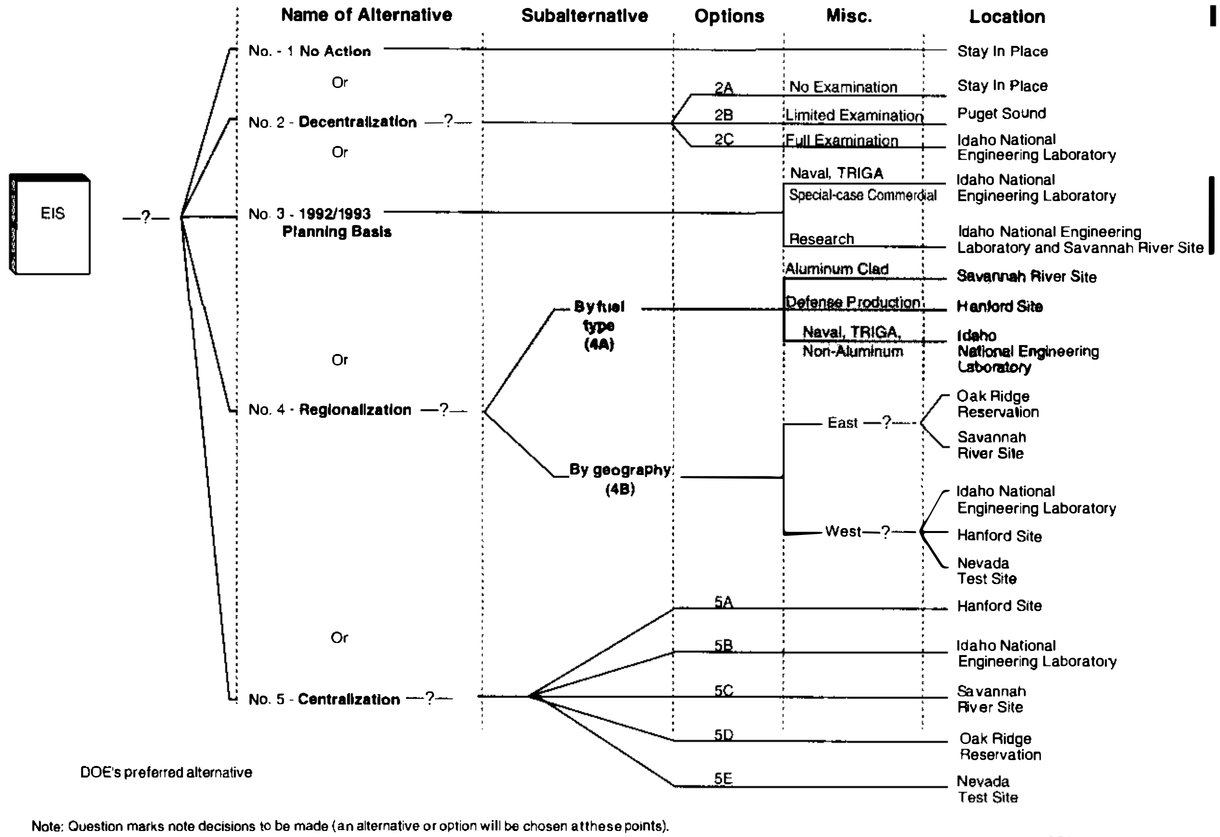


Figure 2. *Alternatives for management of DOE spent nuclear fuel.*

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

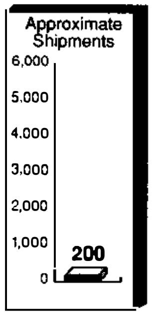
In the No Action alternative, which provides a baseline for comparison, DOE would limit actions to the minimum necessary for safe and secure management of spent nuclear fuel at or near the point where it is generated or currently located (Figure 3). Under this

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.

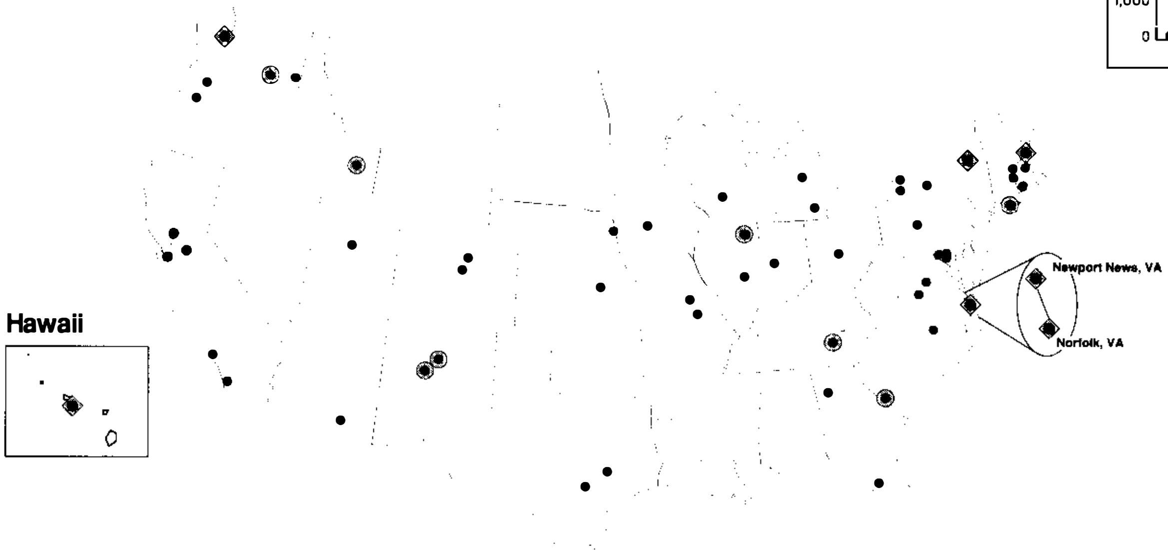
- **After an approximate three-year transition period, no shipment of spent nuclear fuel to or from DOE facilities would occur.**
- **Stabilization activities would be limited to the minimum actions required to safely store spent nuclear fuel.**
- **Naval reactor spent nuclear fuel would be stored at 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.**

1. No Action Alternative



Radiation Risk

Estimated latent cancer fatalities less than 1 over 40-year period for normal operations.



Approximate No Action Shipments Over 40 Years[a]

To: Norfolk, VA From: Newport News, VA	200

Approximate 2035 Inventory (Metric Tons Heavy Metal)

Hanford	2,132
Idaho National Engineering Laboratory	274
Savannah River Site	206
Naval Sites	55
Oak Ridge Reservation	2
Other	73
Total	2,742

Legend

Source	No. of locations
U.S. Department of Energy Facilities	8
Naval Sites	6
Special-Case Commercial	3
Domestic Non-DOE	9
Universities	29

Naval Sites[b]	State
Kesselring	New York
Norfolk	Virginia
Newport News	Virginia
Pearl Harbor	Hawaii
Portsmouth	Maine
Puget Sound	Washington

DOE Facilities	State
Argonne National Laboratory-East	Illinois
Brookhaven National Laboratory	New York
Hanford	Washington
Idaho National Engineering Laboratory	Idaho
Los Alamos National Laboratory	New Mexico
Oak Ridge Reservation	Tennessee
Sandia National Laboratories	New Mexico
Savannah River Site	South Carolina

a. Shipment numbers exclude shipments that would be made during transition period (see text).

b. Name of shipyard or site.

RED 0668

Figure 3. *Spent nuclear fuel distribution for the No Action alternative.*

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

Decentralization Alternative

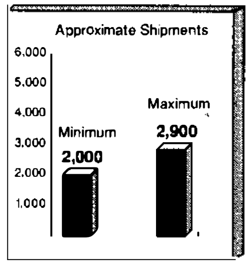
Store most spent nuclear fuel at or close to the generation site or current storage location with limited shipments to DOE facilities.

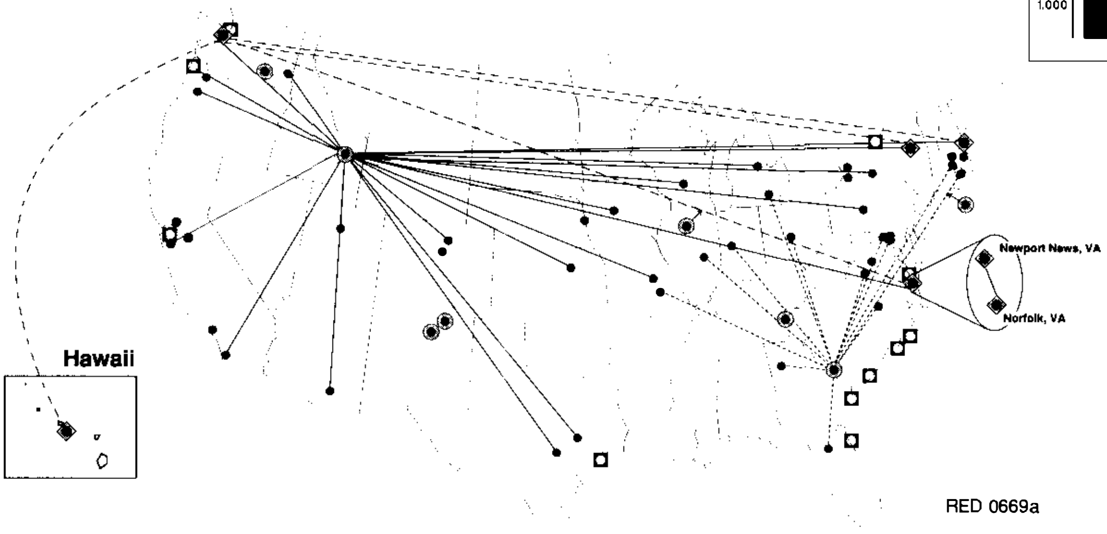
- DOE spent nuclear fuel shipments would be limited to the following:
  - Spent nuclear fuel stored or generated at universities and non-DOE facilities
  - Potential foreign research reactor fuel.
- Spent nuclear fuel processing might need to be conducted. Other forms of stabilization might occur to 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 spent nuclear fuel management, including stabilization technology.
- Three options for naval spent nuclear fuel
  - No inspection—fuel remains close to refueling/defueling site
  - Limited inspection at Puget Sound Naval Shipyard
  - Full inspection at the Idaho National Engineering Laboratory followed by storage close to refueling/defueling site.

2. Decentralization

Radiation Risk

Estimated latent cancer fatalities less than 1 over 40-year period for normal operations.





- U.S. Department of Energy Facilities
- ············ Shipments going to Savannah River Site
- ——— Shipments going to Idaho National Engineering Laboratory
- – – – – – Shipments going to Puget Sound Naval Shipyard

• Domestic Non-DOE

Approximate Shipments	
To: Idaho National Engineering Laboratory	30
To: Savannah River Site	190

Fuel Source

Savannah River Site Destination:
- Armed Forces Radiobiology Research Institute
- National Institute of Standards and Technology

Idaho National Engineering Laboratory Destination:
- Aerotest
- Dow
- General Atomic
- General Electric
- U.S. Geological Survey
- U.S. Air Force
- Veterans Administration Medical Center

• University

Approximate Shipments	
To: Idaho National Engineering Laboratory	260
To: Savannah River Site	260

◘ Foreign Fuel [a] (potential points of entry)

Approximate Shipments	
To: Idaho National Engineering Laboratory	460
To: Savannah River Site	550

◈ Naval Fuel Shipments

2A. No Exam [b]

Approximate Shipments	
To: Norfolk, VA	200
From: Newport News, VA	

2B. Limited Exam [b]

Approximate Shipments	
To: Puget Sound, WA	50
To: Norfolk, VA	180

2C. Full Exam [c]

Approximate Shipments	
To: Idaho National Engineering Laboratory	580
From: Idaho National Engineering Laboratory	580

a. Foreign fuel could enter the US at any one of the identified points of entry for transport to the INEL or SRS.
b. Shipment numbers exclude shipments that would be made during transition period (see text).
c. All shipments to the Idaho National Engineering Laboratory for examination and then back to shipyards for storage.

RED 0669

Figure 4. *Spent nuclear fuel distribution for the Decentralization alternative.*

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

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.

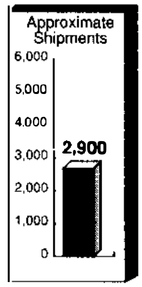
- Fuel would be transported as follows:
  - TRIGA fuel from the Hanford Site to the Idaho National Engineering Laboratory; Hanford Site receives limited fuel for research of storage and dispositioning technologies
  - Naval fuel to the Idaho National Engineering Laboratory for examination and storage
  - 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.

1992/1993 Planning Basis Alternative

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.

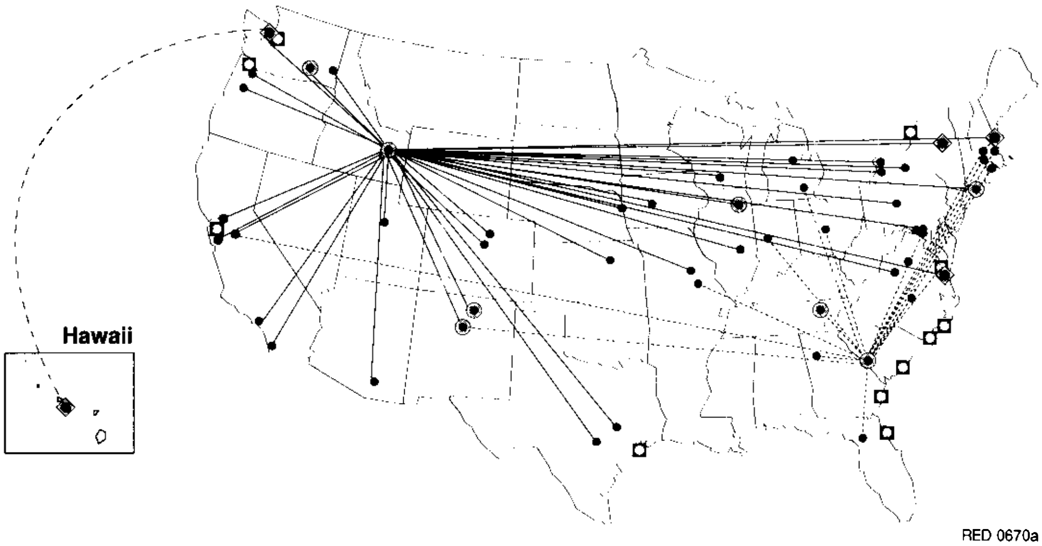
Some existing spent nuclear fuel at other sites would be consolidated at the Idaho National Engineering Laboratory or Savannah River Site. The Savannah River Site and Idaho National Engineering Laboratory would also receive some test reactor fuel and some fuel from university and foreign research reactors. 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

3. 1992 - 1993 Planning Basis



Radiation Risk

Estimated latent cancer fatalities less than 1 over 40-year period for normal operations.



········ Shipments going to Savannah River Site
——— Shipments going to Idaho National Engineering Laboratory
- - - - - Shipments going to Puget Sound Naval Shipyard and then to the INEL

DOE

Production reactor SNF remains at Hanford

Fuel Source

- **DOE Research**
  - **Brookhaven National Laboratory, NY**
  - **Hanford, WA**
  - **Oak Ridge Reservation, TN**
  - **Idaho National Engineering Laboratory, ID**
  - **Los Alamos National Laboratory, NM**
  - **Savannah River Site, SC**
  - **Sandia National Laboratories, NM**
  - **Argonne National Laboratory-East, IL**
- **Special Case Commercial**
  - **West Valley, NY**
  - **Lynchburg, VA**
  - **Fort St. Vrain, CO**

Approximate Shipments	
To: Idaho National Engineering Laboratory (INEL)	410
To: Savannah River Site (SRS)	120

◈ Naval Fuel

Approximate Shipments	
To: INEL for examination and storage	580

• University

Approximate Shipments	
To: INEL	260
To: SRS	260

◻ Foreign Fuel [a] (potential points of entry)

Approximate Shipments	
To: INEL	460
To: SRS	550

• Domestic Non-DOE

Approximate Shipments	
To: INEL	30
To: SRS	190

a. Foreign fuel could enter the U.S. at any one of the identified points of entry for transport to the INEL or SRS

Figure 5. *Spent nuclear fuel distribution for the 1992/1993 Planning Basis alternative.*

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.

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.

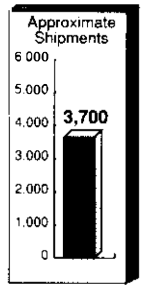
Under this alternative, other generator and storage locations would continue to ship spent nuclear fuel to the Idaho National Engineering Laboratory and Savannah River Site. No additional storage facilities would be constructed at these originating locations.

Regionalization and Preferred Alternative

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

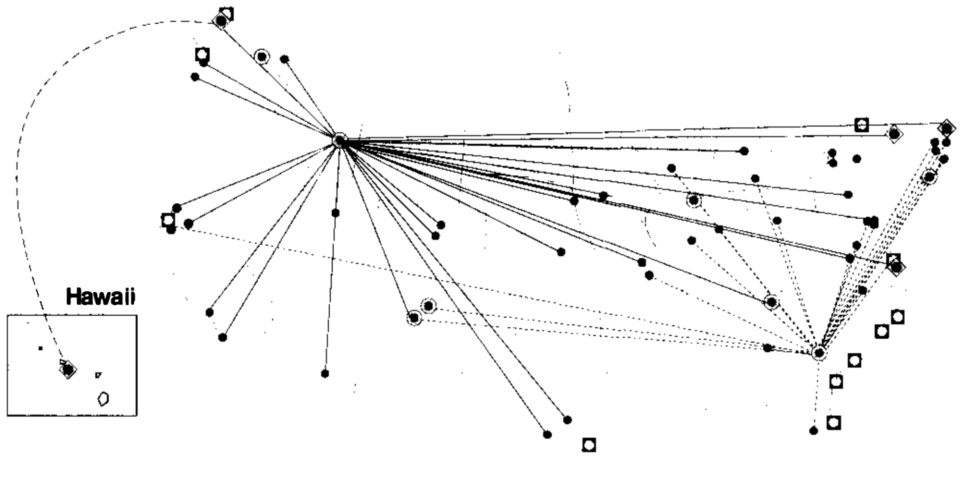
4. DOE - Regionalization (by Fuel Type)

Alternative 4A - Preferred Alternative



Radiation Risk

Estimated latent cancer fatalities less than 1 over 40-year period for normal operations.



Shipments going to Savannah River Site
Shipments going to Idaho National Engineering Laboratory
Shipments going to Puget Sound Naval Shipyard and then to the INEL

DOE

Production reactor SNF remains at Hanford

Approximate Shipments

To: Idaho National Engineering Laboratory (INEL)	1,050
To: Savannah River Site (SRS)	280

University

Approximate Shipments

To: INEL	120
To: SRS	400

Foreign Fuel [a] (potential points of entry)

Approximate Shipments

To: INEL	170
To: SRS	840

Domestic Non-DOE

Approximate Shipments

To: INEL	30
To: SRS	190

Naval Fuel

Approximate Shipments

To: INEL for examination and storage	580

RED 0671

a. Foreign fuel could enter the U.S. at any one of the identifed points of entry for transport to the INEL or SRS

Figure 6. *Spent nuclear fuel distribution for Regionalization Alternative 4A.*

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.

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.

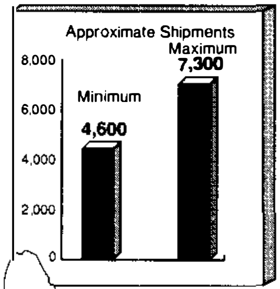
All spent nuclear fuel from the other generator and storage sites would be transported to the selected central DOE site.

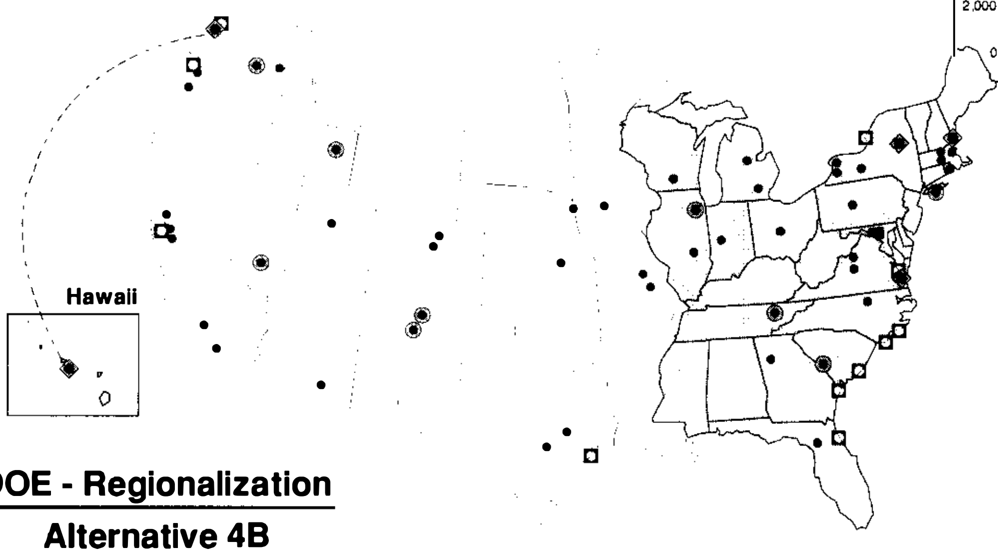
4. DOE - Regionalization (by Geography)

Alternative 4B

Radiation Risk

Estimated latent cancer fatalities less than 1 over 40-year period for normal operations.





DOE - Regionalization

Alternative 4B (West - Hanford)

Approximate Shipments[a]

To: Hanford	2,700
Naval shipments if Expended Core Facility at Hanford	580

DOE - Regionalization

Alternative 4B (West - INEL)

Approximate Shipments

To: Idaho National Engineering Laboratory (INEL)	2,500
Naval shipments if Expended Core Facility at the INEL	580

DOE - Regionalization

Alternative 4B (West - NTS)

Approximate Shipments[a]

To: Nevada Test Site (NTS)	4,400
Naval shipments if Expended Core Facility at NTS	580

Legend

Source

- U.S. Department of Energy Facilities
- Naval Sites
- Foreign Returns (potential points of entry)
- Special-Case Commercial
- Domestic Non-DOE
- Universities

Sites ship to either Hanford, INEL or NTS

Sites ship to either ORR or SRS'

------ Shipments going to Puget Sound Naval Shipyard and then to the regional site

DOE - Regionalization

Alternative 4B (East - SRS)

Approximate Shipments[a]

To: Savannah River Site (SRS)	1,600
Naval shipments if Expended Core Facility at SRS	580

DOE - Regionalization

Alternative 4B (East - ORR)

Approximate Shipments[a]

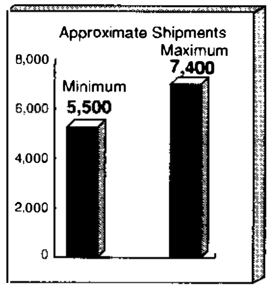
To: Oak Ridge Reservation (ORR)	2,300
Naval shipments if Expended Core Facility at ORR	580

RED 0672

a. Shipment numbers exclude shipments that would be made during transition period (see text).

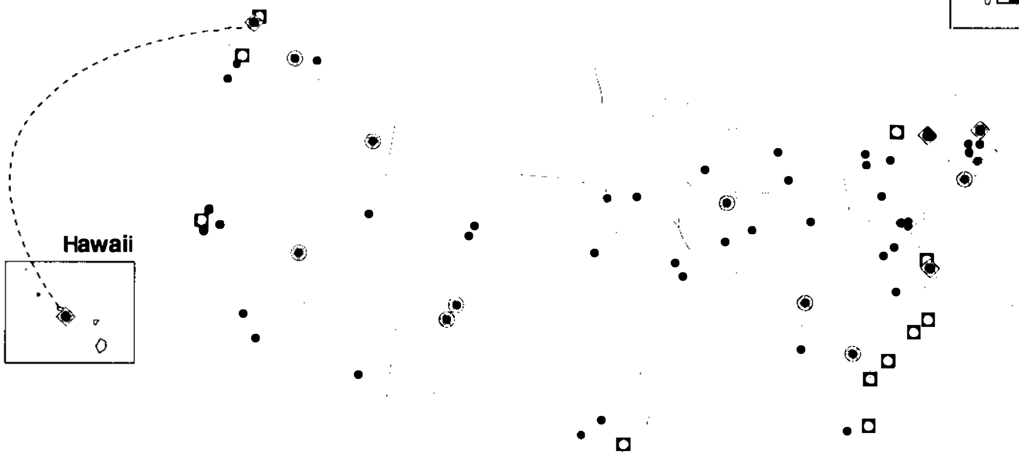
Figure 7. *Spent nuclear fuel distribution for Regionalization Alternative 4B.*

5. Centralization



Radiation Risk

Estimated latent cancer fatalities less than 2 over 40-year period for normal operations.



Legend

Source

- **U.S. Department of Energy Facilities**
- **Naval Sites**
- **Foreign Returns (potential points of entry)**
- **Special-Case Commercial**
- **Domestic Non-DOE**
- **Universities**
- ...... Shipments going to Puget Sound Naval Shipyard and then to the central site

Centralization
Alternative 5A (Hanford)

Approximate Shipments[a]

To: Hanford	**5,100**
Naval Shipments	**580**

Centralization
Alternative 5B (INEL)

Approximate Shipments

To: Idaho National Engineering Laboratory (INEL)	**4,900**
Naval Shipments	**580**

Centralization
Alternative 5C (SRS)

Approximate Shipments[a]

To: Savannah River Site (SRS)	**6,000**
Naval Shipments	**580**

Centralization
Alternative 5D (ORR)

Approximate Shipments[a]

To: Oak Ridge Reservation (ORR)	**6,700**
Naval Shipments	**580**

Centralization
Alternative 5E (NTS)

Approximate Shipments[a]

To: Nevada Test Site (NTS)	**6,800**
Naval Shipments	**580**

a. Shipment numbers exclude shipments that would be made during transition period (see text).

RED 0673

Figure 8. *Spent nuclear fuel distribution for the Centralization alternative.*

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 to 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).

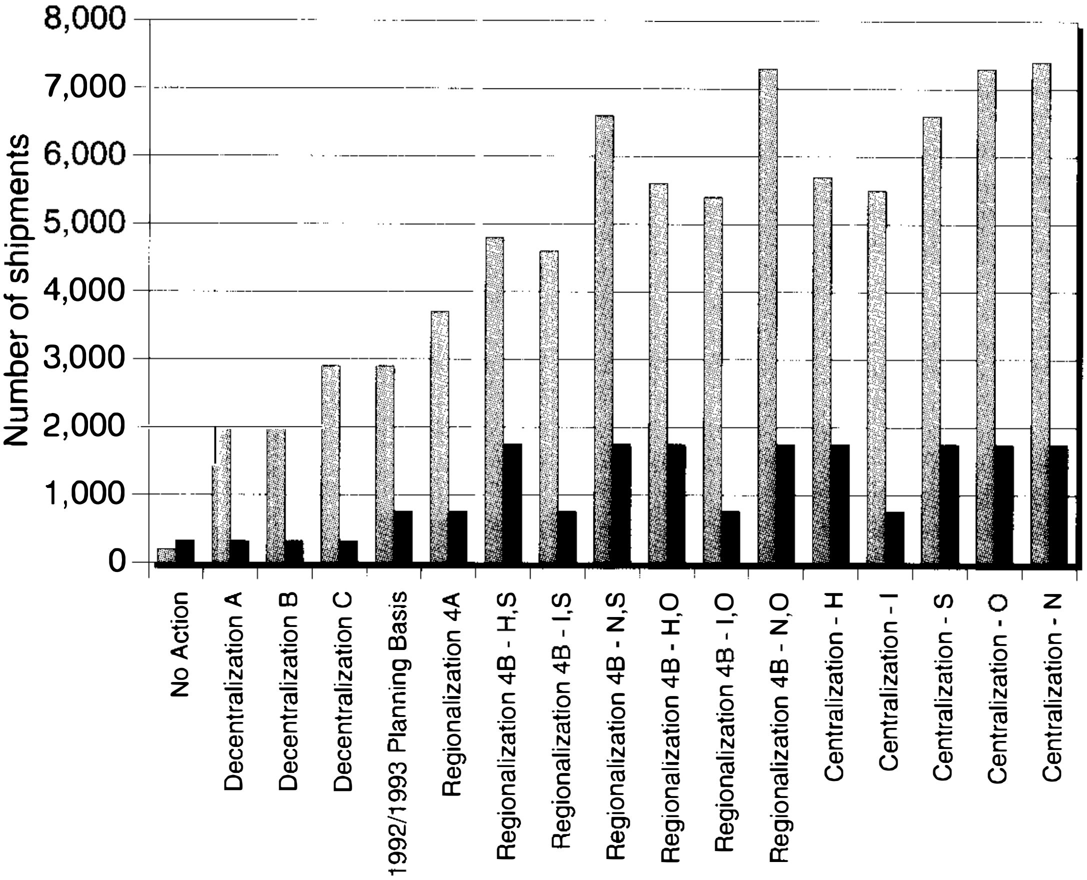
Decentralization Option C and the 1992/1993 Planning Basis alternative each would involve approximately 2,900 shipments over the 40-year period.

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

Environtal Consequences



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

Spent fuel
Test specimens[a]

a. Test specimens are small quantity fuel samples shipped for laboratory analysis

Figure 9. *Number of spent nuclear fuel and test specimen shipments between the years 1995 and 2035.*

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

Latent Cancer Fatalities Caused Per Rem for an Individual Member of the General Public

Dose:

Radioactivity from all sources combined, including natural background radiation and medical sources, produces about a 0.3 rem dose to the average individual per year.

Probability:

The probability of receiving the above dose is essentially one.

Average life span:

72 years is considered to be the average lifetime.

Latent cancer fatalities caused per rem for an individual member of the general public:

0.0005 cancers are estimated to be caused by exposure to 1 rem.

Calculation:

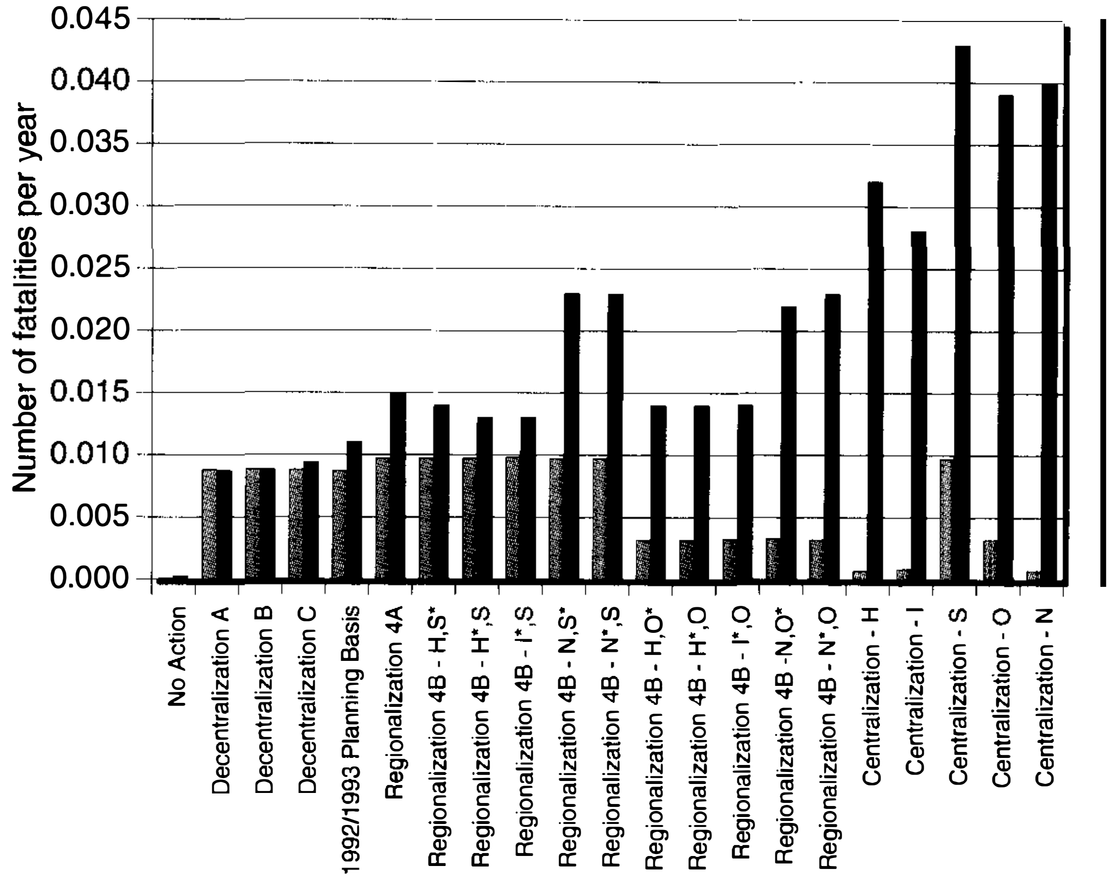
Dose rate x life span x cancers caused per rem =
0.3 rem/year x 72 years x 0.0005 cancers per rem =
0.01 fatal cancers per individual lifetime.

Risk:

Probability x fatal latent cancers = 1 x 0.01 = 0.01 fatal cancer, which is a probability of about 1 in 100 of death from exposure to natural background radiation and medical sources over a lifetime.

about 0.05 latent cancer fatalities per year (Figure 10). In general, the greatest radiation exposure from normal spent nuclear fuel site activities and incident-free transportation results when large quantities of spent nuclear fuel are transported among sites, such as under Regionalization Alternative 4B or the Centralization alternative. Under incident-free transportation, the estimated total latent cancer fatalities are less than two for all alternatives, with the highest estimates being those associated with the Centralization options. This reflects the higher number of shipments associated with these options.

The risk of latent cancer fatalities associated with facility accidents is



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

Operations
Transportation[a]

* Location of Expended Core Facility

a. Total fatalities are the sum of the estimated number of radiation-related latent cancer fatalities for workers and the general population and the estimated number of nonradiological fatalities from vehicular emissions. Average annual risk for incident free transportation was determined by dividing the cumulative risks over the entire transportation campaign by the estimated duration of the transportation compaign. Cumulative risks are presented in Chapter 5 of EIS Volume 1.

Figure 10. *Maximum estimated latent cancer fatalities per year in the general population from normal spent nuclear fuel site operations and total fatalities from incident-free transportation.*

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.

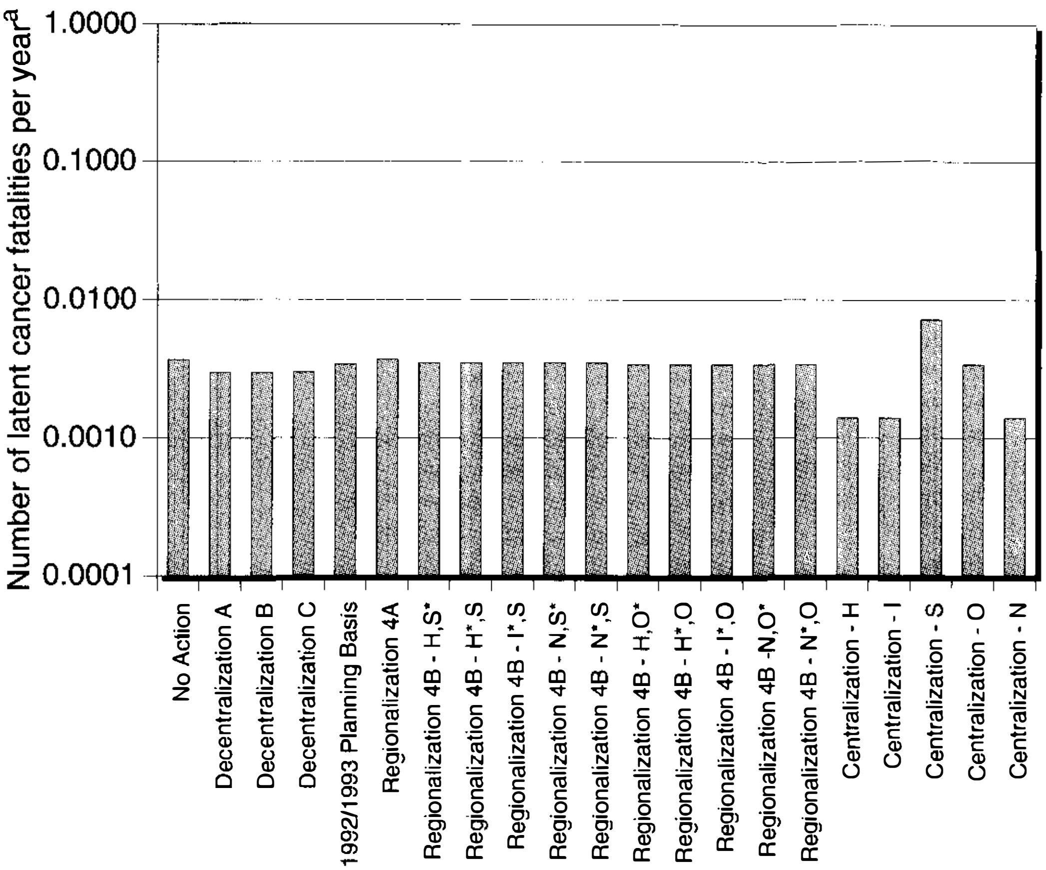
Up to about two fatalities could result over the 40-year period from nonradiological traffic accidents. By comparison about 40,000 people are killed annually in U.S. traffic accidents.

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 2,100 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.



Key:

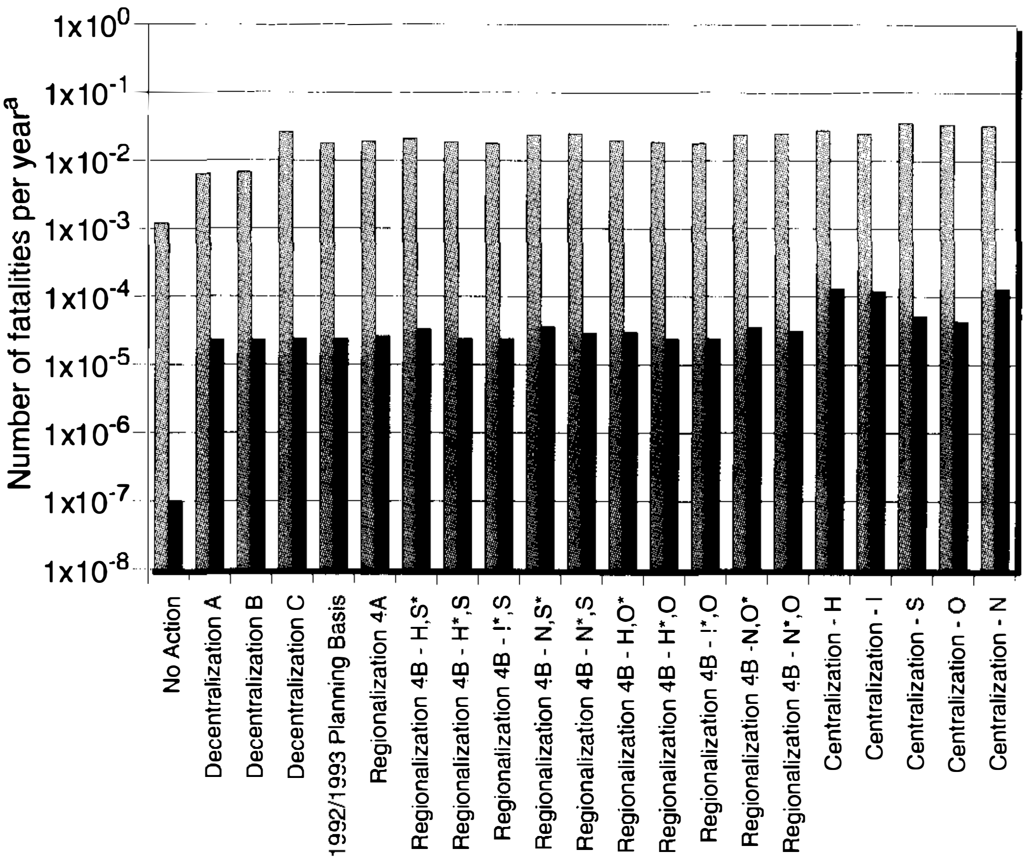
Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

* Location of Expended Core Facility

a. Facility risks are based on the product of the probability and consequences of the respective maximum foreseeable facility accident for each alternative and expressed in latent cancer fatalities per year.

Figure 11. *Estimate of risk of latent cancer fatalities in general population from facility accidents for spent nuclear fuel management activities.*



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

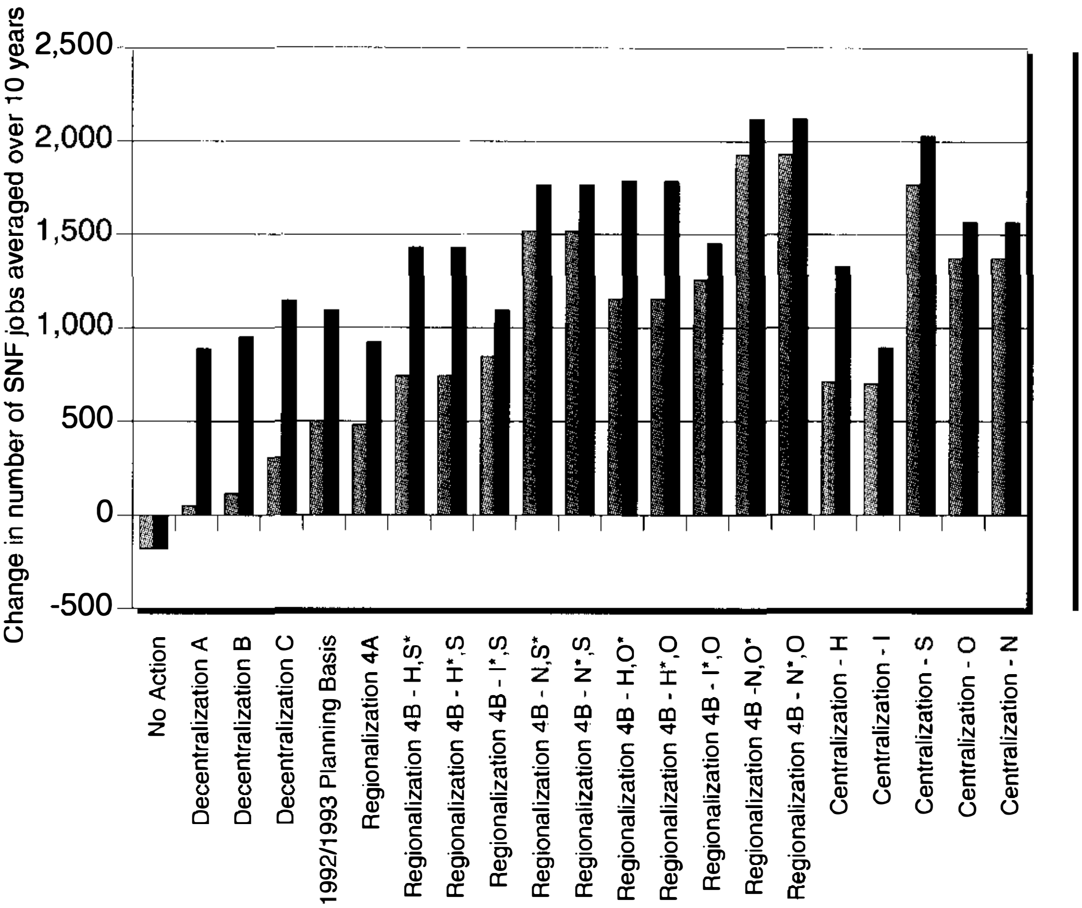
Traffic fatality risk
Radiological risk

* Location of Expended Core Facility

a. Radiological risk is in terms of latent cancer fatalities per year from spent nuclear fuel shipments; traffic fatality risk is in terms of estimated nonradiological traffic accident fatalities per year from spent nuclear fuel shipments.

b. Average annual risk was determined by dividing the cumulative accident risks over the entire transportation campaign by the estimated duration of the transportation campaign. Cumulative transportation accident risks are presented in Chapter 5 of EIS Volume 1.

Figure 12. *Estimate of average annual risk[b] from transportation accidents for spent nuclear fuel management activities.*



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

Min[a]
Max[a]

* Location of Expended Core Facility

a. The maximum values occur with processing; the minimum values occur without processing.

Figure 13. *Change in the number of jobs averaged over the years 1995 to 2005 for spent nuclear fuel management activities.*

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 1,150 jobs would be required over the period 1995 to 2005 for implementation. Some of the more significant spent nuclear fuel employment requirements (particularly those involving the Hanford Site) would result from the development and operation of processing facilities needed to stabilize stored spent nuclear fuel. In addition, relocating the Expended Core Facility to sites other than the Idaho National Engineering Laboratory would result in an increase of about 500 jobs in the support of naval spent nuclear fuel examinations at those sites, and would result in a corresponding loss of approximately 500 jobs at the Idaho National Engineering Laboratory.

Thus, minor employment-related impacts are anticipated. To mitigate these impacts, DOE would coordinate its planning efforts with local communities and county planning agencies to address changes in community services, housing, infrastructure, utilities, and transportation. Such coordination with local planning agencies is intended to avoid placing undue burdens on local agency resources.

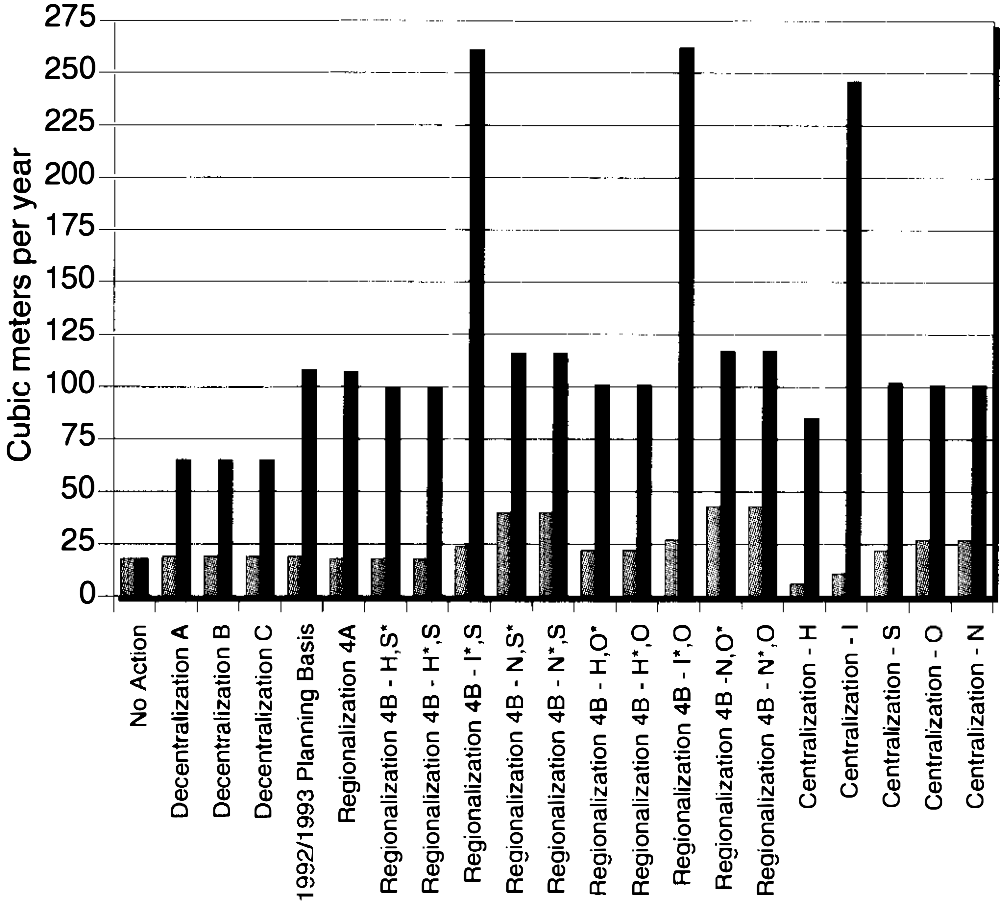
Generation of Radioactive Wastes

When spent nuclear fuel is stored onsite, very little high-level, transuranic, or mixed waste is generated (see Figure 14). These small quantities of radioactive wastes would usually be generated during stabilization activities. As a result, under the No Action alternative fewer than 20 cubic meters (26 cubic yards) per year of transuranic wastes would be generated from spent nuclear fuel management nationwide because spent nuclear fuel would not be stabilized. Under all other alternatives, where stabilization activities would occur, between 20 and 190 cubic meters (26 and 250 cubic yards) of high-level waste and between 20 and 90 cubic meters (26 and 120 cubic yards) of transuranic waste would be generated each year. The lower generation rates would occur in the Decentralization alternative, where small amounts of spent nuclear fuel would be transported among major DOE sites (and stabilization for transport would not be necessary).

For all other alternatives, greater amounts of spent nuclear fuel would be transported among sites; therefore, more spent nuclear fuel would require stabilization before transport and more waste would be generated.

Low-level waste also is generated as a result of spent nuclear fuel management. Figure 15 indicates an estimated range of annual volumes for each of the alternatives. The higher values are principally the result of processing for stabilization.

To control the volume of waste generated and reduce impacts on the environment, pollution prevention practices would be implemented.



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

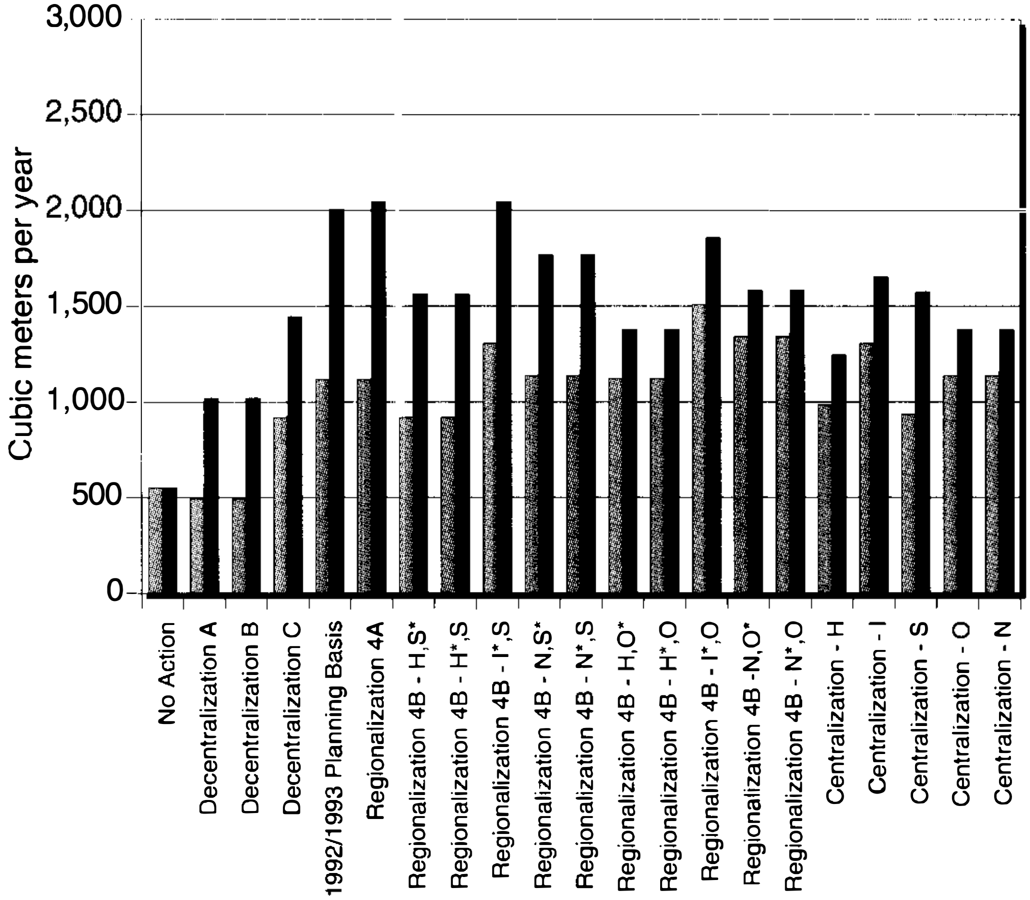
Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

Min[a]
Max[a]

* Location of Expended Core Facility

a. The maximum values occur with processing; the minimum values occur without processing.

Figure 14. *Average volume of high-level, transuranic, and mixed waste generated per year over the years 1995 to 2005 for spent nuclear fuel management activities.*



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with spent nuclear fuel stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

Min[a]
Max[a]

* Location of Expended Core Facility

a. The maximum values occur with processing; the minimum values occur without processing.

Figure 15. *Average volume of low-level wastes generated per year over the years 1995 to 2005 for spent nuclear fuel management activities.*

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.

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).

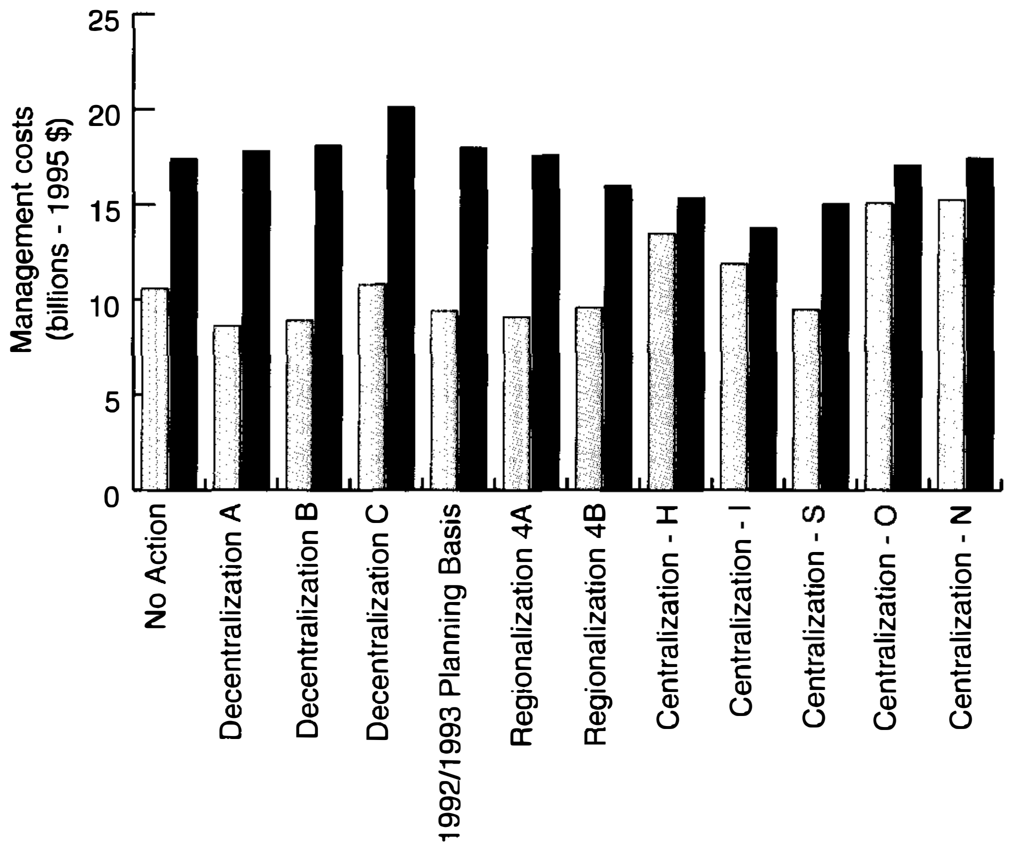
Cumulative Impacts

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



Key:

Decentralization A: No examination of naval fuels
Decentralization B: Limited examination of naval fuels at Puget Sound Naval Shipyard
Decentralization C: Full examination of naval fuels at Idaho National Engineering Laboratory with SNF stored at naval sites
Regionalization 4A: Regionalization by fuel type
Regionalization 4B: Regionalization by geography

Site initials:
H: Hanford Site
I: Idaho National Engineering Laboratory
S: Savannah River Site
O: Oak Ridge Reservation
N: Nevada Test Site

□ min[a]
■ max[b]

a. Minimum (lower) cost range with maximum use of existing facilities
b. Maximum (upper) cost range with minimum use of existing facilities

SAA0081

Figure 16. Management costs for interim storage of spent nuclear fuel through the year 2035.

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)] surrounding each of the sites under consideration. Analysis of environmental justice concerns was based on a qualitative assessment of 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.

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.

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 components of the Idaho National Engineering Laboratory-specific alternatives have been constructed to bear a relationship to those of Volume 1.

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.

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.

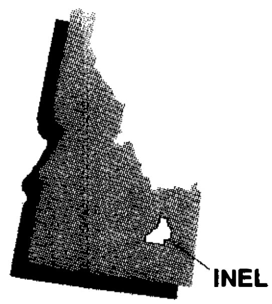
Ten-Year Plan and Preferred Alternative (for spent nuclear fuel)
- Examine and store naval spent nuclear fuel.
- Receive additional offsite spent nuclear fuel.
- Transfer aluminum-clad spent nuclear fuel to Savannah River Site.
- Phase out Idaho Chemical Processing Plant-603 storage pools.
- Expand storage 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.

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.



The Idaho National Engineering Laboratory is located in southeastern Idaho.

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, and disposal of waste, as well as associated surveillance and maintenance activities.

Spent nuclear fuel management at the Idaho National Engineering Laboratory includes (a) accepting and examining shipments from generators or from other storage sites, (b) setting standards and approving methods for storing spent nuclear fuel and preparing (stabilizing) it for such storage, (c) constructing and operating facilities for stabilization, plus interim storage, (d) consolidating storage and retiring outdated storage facilities, and (e) developing criteria and technologies for ultimate disposition of spent nuclear fuel (or its components). DOE is developing spent nuclear fuel management plans for a 40-year timeframe that are anticipated to be sufficient to cover the period during which ultimate disposition will be established and implemented for DOE's spent nuclear fuel.

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.

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.

Table 1. Functions of major facility areas at the Idaho National Engineering Laboratory.

Major facility area	Function performed
Test Area North	Handle and evaluate irradiated materials; support energy and defense programs; demonstrate dry cask storage 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 in standby, three deactivated); perform chemistry and physics experiments.
Idaho Chemical Processing Plant	Receive and store spent nuclear fuel; prepare high-level liquid and solid waste for disposition; develop and apply technologies for eventual disposition of spent nuclear fuel, disposition of 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 technologies.
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 to 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 technologies.

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 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.

1 Test Area North

2 Test Reactor Area

3 Idaho Chemical Processing Plant

4 Central Facilities Area

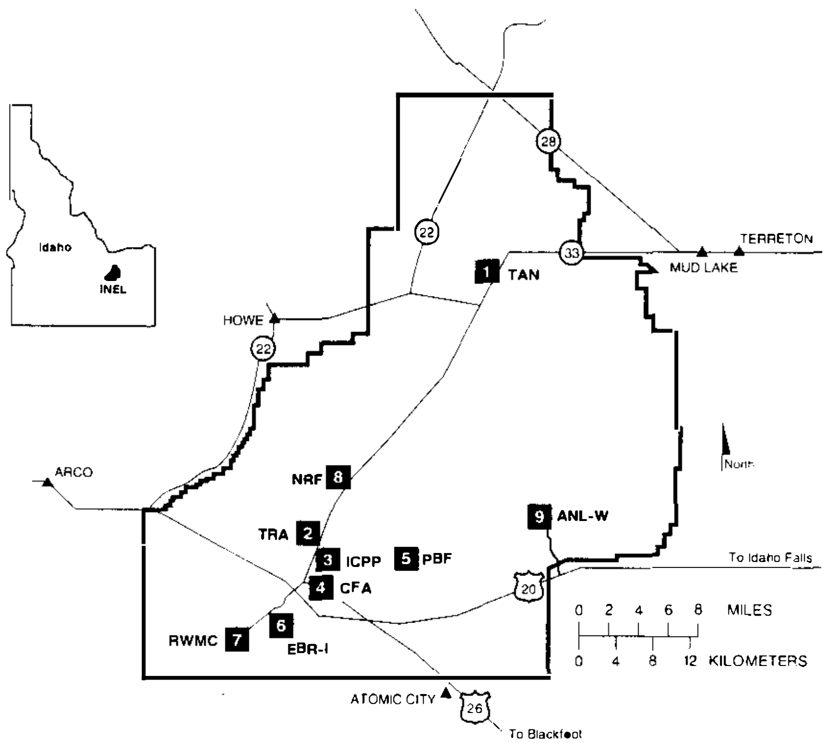
5 Power Burst Facility

6 Experimental Breeder Reactor-I

7 Radioactive Waste Management Complex

8 Naval Reactors Facility

9 Argonne National Laboratory-West



Major facility areas located at the Idaho National Engineering Laboratory.

Dry storage of spent nuclear fuel

Technology Development

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.

Waste at the Idaho National Engineering Laboratory

Alpha Low-Level Waste: Waste that was previously classified as transuranic waste but has a transuranic concentration lower than the currently established limit for transuranic waste. Alpha low-level waste requires additional controls and special handling (relative to low-level waste). This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste.

Greater-Than-Class-C Waste: Low-level radioactive waste that is generated by the commercial sector and that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class C low-level waste as specified in Title 10 Code of Federal Regulations Part 61. DOE is responsible for the disposal of Greater-Than-Class-C wastes from DOE non-defense programs.

Hazardous Waste: Under the Resource Conservation and Recovery Act, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Source, special nuclear material, and byproduct material, as defined by the Atomic Energy Act, are specifically excluded from the definition of solid waste.

High-Level Waste: The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High-level waste may include other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.

Low-Level Waste: Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nanocuries per gram of waste.

Mixed Waste: Waste that contains both hazardous waste under the Resource Conservation and Recovery Act and source, special nuclear, or byproduct material subject to the Atomic Energy Act.

Special-Case Waste: Waste that is owned or generated by DOE that does not fit into typical management plans developed for the major radioactive waste types.

Transuranic Waste: Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes, per gram of waste, with half-lives greater than 20 years, except for (a) high-level radioactive waste, (b) waste that the DOE has determined, with the concurrence of the Administrator of the U.S. Environmental Protection Agency, does not need the degree of isolation required by Title 40 Code of Federal Regulations Part 191, and (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Title 10 Code of Federal Regulations Part 61.

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.

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

Spent Nuclear Fuel: What is the appropriate strategy of the Idaho National Engineering Laboratory to implement DOE's national spent nuclear fuel decisions regarding transportation, receipt, processing, and storage of spent nuclear fuel? What is the appropriate storage capacity for spent nuclear fuel?

Environmental Restoration and Waste Management: What is the appropriate strategy of the Idaho National Engineering Laboratory to implement DOE's national environmental restoration and waste management decisions?

What are the appropriate cleanup activities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, and the Federal Facility Agreement and Consent Order of 1991?

What are the necessary capabilities, facilities, research and development, and technologies for treating, storing, and disposing of each waste type?

What treatment technologies should be used for sodium-bearing and high-level wastes and other radioactive and mixed waste?

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

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.

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.

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 projects 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 and its appendices is to provide sufficient analysis for another 12 projects (listed below) to allow timely deployment if needed for the project. DOE would evaluate the remaining 25 projects on a case-by-case basis to determine if any additional National Environmental 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 = Minimum Treatment, 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, and 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.

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 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)-II 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 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

Alternative B (Ten-Year Plan)

Spent Nuclear Fuel: Receive additional offsite spent nuclear fuel; transfer aluminum-clad spent nuclear fuel to Savannah River Site; examine and store naval spent nuclear fuel; complete 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)-II, Boiling Water Reactor Experiment (BORAX)-V, Engineering Test Reactor, Materials Test Reactor, Fuel Processing Complex, Fuel Receipt/Storage Facility, Headend Processing Plant, Waste Calcine Facility, and Central Liquid Waste Processing Facility; clean up groundwater contamination and vadose zone; retrieve and treat Pit 9 wastes.

High-Level Waste: Convert liquid to calcine (solid); construct a facility to immobilize both liquid and solid calcine.

Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new storage; treat offsite and onsite transuranic and alpha low-level waste; transport transuranic waste offsite for disposal; accept transuranic waste from offsite for treatment.

Low-Level Waste: Treat onsite and offsite; construct and operate additional treatment and disposal facilities onsite.

Mixed Low-Level Waste: Treat onsite by incineration and nonincineration; construct and operate facilities to treat waste by incineration and nonincineration; construct and operate disposal facility; transport waste offsite for treatment and disposal.

Greater-than-Class-C Waste: Receive sealed sources for recycle or storage; construct dedicated storage facility.

Hazardous Waste: Transport offsite for treatment, storage, and disposal.

Alternative C (Minimum Treatment, Storage, and Disposal)

Spent Nuclear Fuel: Transport Idaho National Engineering Laboratory spent nuclear fuel inventory to another DOE site; continue to examine and store naval spent nuclear fuel during approximate three-year transition period; phase out spent nuclear fuel handling facilities; demonstrate electrometallurgical process at Argonne National Laboratory-West.

Environmental Restoration: Conduct all planned projects for all Waste Area Groups; decontaminate and decommission Auxiliary Reactor Area (ARA)-II, and Boiling Water Reactor Experiment (BORAX)-V; focus on institutional controls to the extent possible for cleanup projects; clean up groundwater and vadose zone; and treat Pit 9 wastes.

High-Level Waste: Select technology and plan immobilization facility; develop treatment to minimize volume of high-activity waste; construct replacement liquid storage tanks.

Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new storage; transport transuranic waste offsite for disposal; transport waste to offsite DOE facility for storage.

Low-Level Waste: Transport to other DOE facilities for treatment, storage, and disposal.

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.

Alternative D (Maximum Treatment, Storage, and Disposal)

Spent Nuclear Fuel: Examine and store naval spent nuclear fuel; receive DOE spent nuclear fuel; expand storage capacity in pools at Building 666 of the Idaho Chemical Plant; phase in expanded dry storage; phase out storage pools at Building 603 of the Idaho Chemical Processing Plant; phase in spent nuclear fuel stabilization; demonstrate electrometallurgical process.

Environmental Restoration: Conduct planned projects for all Waste Area Groups; decontaminate and decommission Auxiliary Reactor Area (ARA)-II, 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; focus on residential future land use to the extent possible for cleanup projects; clean up groundwater and vadose zone; retrieve and treat Pit 9 wastes.

High-Level Waste: Convert liquid to calcine; select technology and plan immobilization facility; develop treatment to minimize high-activity waste; construct replacement liquid storage tanks.

Transuranic Waste: Retrieve/move transuranic and alpha low-level waste to new storage; transport transuranic waste offsite for disposal; accept offsite transuranic waste; treat offsite and onsite transuranic waste and alpha low-level waste; dispose of alpha low-level waste at new onsite facility.

Low-Level Waste: Receive offsite waste; treat waste onsite; construct and operate additional treatment and disposal facilities onsite.

Mixed Low-Level Waste: Receive offsite waste; treat waste onsite by incineration and nonincineration; construct facilities for onsite incineration and nonincineration treatment; construct and operate new 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.

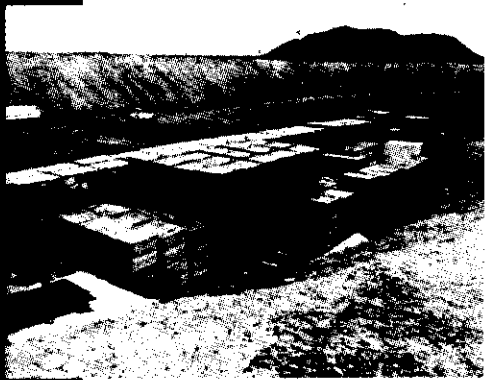
Hazardous Waste: Transport waste offsite for treatment, storage, and disposal; possibly construct onsite treatment, storage, and disposal facility.

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)

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



Low-level waste burial pit

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).

The Waste Experimental Reduction Facility

Air support weather shield at the Radioactive Waste Management Complex.

One mode of transporting waste

Preferred Alternative

Under the Preferred Alternative, similar to the activities described under Alternative B (Ten-Year Plan), existing environmental restoration and waste management facilities and projects would continue to be operated. In addition to existing facilities and projects, projects proposed under Alternative B for 1995 through 2005 would be implemented to meet the current Idaho National Engineering Laboratory mission and to comply with negotiated agreements and commitments (see Projects Related to Alternatives on page 54).

Ongoing spent nuclear fuel management, environmental restoration, and waste management activities would be continued and enhanced to meet current and expanded spent nuclear fuel and waste handling needs. These enhanced activities would be needed to comply with regulations and agreements and would result from acceptance of additional offsite-generated materials and waste. Waste generation from onsite sources would increase (reflecting regulatory requirements and increased environmental restoration activities).

Spent nuclear fuel, transuranic, and mixed low level waste would be received from other sites. INEL would receive waste depending on decisions based on Site Treatment Plans negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic Environmental Impact Statement. The transuranic waste and mixed low-level waste received from other DOE sites would be treated, and the residue returned to the original DOE site (generator) or transported to an approved offsite disposal facility, as negotiated under the Federal Facility Compliance Act with the State of Idaho and the Environmental Protection

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)-II, 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.

Agency, and with other affected States. Ongoing remediation and decommissioning and decontamination projects would be continued and additional projects would be conducted.

Affected Environment at the INEL

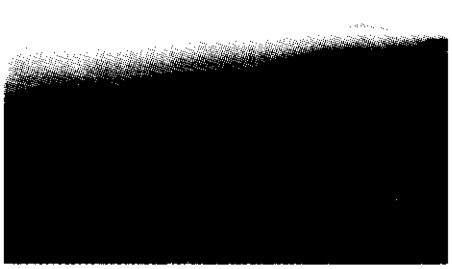
The Idaho National Engineering Laboratory is located on 890 square miles (230,000 hectares) west of the City of Idaho Falls in southeast Idaho. The site sits on the Eastern Snake River Plain and is bordered by the Bitterroot, Lemhi, and Lost River mountain ranges. Local rivers and streams drain the mountain 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-129) and tritium have ever migrated beyond the site boundary; tritium no longer migrates offsite and iodine-129 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



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

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 agencies, businesses, or individuals. This impact analysis found that the contribution to cumulative impacts from operation of projects associated with the alternatives would be low relative to other projects, and within limits prescribed by applicable standards.

Cultural Resources

Methods to identify, evaluate, and mitigate impacts to cultural resources have been established through the National Historic Preservation Act, as amended; the Archaeological Resource Protection Act; the Native American Graves Protection and Repatriation Act; and the American Indian Religious Freedom Act. Potential impacts to cultural resources were assessed by identifying project activities that could affect known or expected significant resources and determining whether a project activity would have an effect on significant resources. A project would affect a significant resource if it would alter the resource's characteristics.

Geographically, the Idaho National Engineering Laboratory site is included within a large territory once inhabited by and still of importance to the Shoshone-Bannock Tribes. However, the site lies outside the land boundaries established by the Fort Bridger Treaty and is occupied by the DOE.

Because some projects are not yet fully defined, the impacts to cultural resources cannot be completely identified. The impacts to cultural resources would depend on the (a) amount of surface disturbance [ranges from about 40 acres (16 hectares) under Alternative A (No Action) to about 1,340 acres (542 hectares) under Alternative D (Maximum Treatment, Storage, and Disposal)]; (b) degree to which these areas have been surveyed for resources and the number of potentially affected structures [6 for Alternative A (No

Action) and 11 for Alternative C (Minimum Treatment, Storage, and Disposal), 66 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 effects have not been observed at the population, community, or ecosystem levels.

Under Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), limited environmental restoration activities would be undertaken, resulting in the long-term presence of radioactive and hazardous wastes in the environment. Plants and animals would continue to be exposed to these wastes. The Preferred Alternative and Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would result in a decrease in radioactive uptake over the long-term as environmental restoration activities proceed.

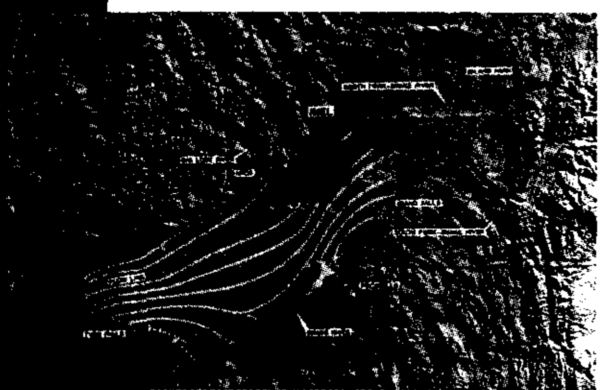
Implementation of any alternative would result in the loss of habitat from facility modification and construction. Alternative D would have the greatest estimated consequences, followed by Alternative B, the Preferred Alternative, Alternative C and Alternative A. Implementation of Alternative D (Maximum Treatment, Storage, and Disposal) would claim about 1,340 acres (542 hectares), of which 232 acres (94 hectares) would be revegetated, resulting in a net loss of about 1,108 acres (448 hectares). Alternative B and the Preferred Alternative would have similar impacts, with the latter claiming about 783 acres (317 hectares), of which 232 acres (94 hectares) would be revegetated, resulting in a long-term net loss of 551 acres (223 hectares). Alternative C would disturb about 355 acres (144 hectares) including 232 acres (94 hectares) that would be revegetated. Alternative A (No Action) would have the least relative impact, disturbing only about 40 acres (16 hectares) of habitat.

Estimated habitat loss from each alternative was assessed in light of other DOE and non-DOE projects. When these projects were considered together, it was estimated that Alternative A (No Action) would disturb 260 acres (105 hectares), followed by Alternatives C (Minimum Treatment, Storage, and Disposal) [576 acres (233 hectares)], B (Ten-Year Plan) [823 acres (333 hectares)], and D (Maximum Treatment, Storage, and Disposal) [1,560 acres (631 hectares)]. For the Preferred Alternative this cumulative habitat loss would be similar to Alternative B and less than Alternative D. To minimize habitat loss, DOE conducts surveys and consults with appropriate Federal and State agencies before facility construction or modification. If necessary, current project planning would be modified to minimize surface disturbances.

Groundwater Quality

Previous operations have introduced radionuclides, nonradioactive metals, inorganic salts, and organic compounds into the subsurface. Radionuclide concentrations in the Snake River Plain Aquifer beneath the site have generally decreased since the mid 1980s because of changes in disposal practices, radioactive decay, adsorption of radionuclides to rocks and minerals, and dilution by natural surface water and groundwater entering the aquifer. Extremely low concentrations of iodine-129 and tritium (both below maximum contaminant levels) have migrated outside of site boundaries. Although nonradioactive metals, inorganic salts, and organic compounds have been detected in the aquifer, none have migrated beyond site boundaries. Modeling to estimate radionuclide (and other constituent) migration was performed. Tritium, iodine-129, and strontium-90 are discussed because they appear to have had the most impact on groundwater quality.

Drinking water at the Idaho National Engineering Laboratory site may contain small concentrations of tritium, strontium-90, and iodine-129. Over a 50-year working period, this radioactivity could result in a maximum of about a 22-millirem dose to an individual worker. This radiation dose is well within regulatory limits and is small compared to other sources of occupational radiation exposure.



Relationship of Snake River Plain to the INEL

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.

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 occuring 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 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.[a] 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 U.S. Bureau of Census as minority and about 14 percent as low-income.

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.

Attachment—Reading Rooms and Information Locations

U.S. Department of Energy Reading Rooms

Public Reading Room for U.S. Department of Energy Headquarters
Room 1E-190, 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.

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

Cheaapeake 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 p.m 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 1:00 p.m. to 5:00 p.m.

Kiin 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 1:00 p.m. to 5:00 p.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 1:00 p.m. to 5:00 p.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 96310
(206) 377-3955
Monday-Friday 10:00 a.m. to 5:30 p.m.

Suzalio 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
6 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 03601
(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 6:00 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 96613
(808) 586-3535
Monday, Wednesday, and Friday, 9:00 a.m. to 5:00 p.m.,
Tuesday and Thursday 9:00 a.m. to 6:00 p.m.,
Saturday 10:00 a.m. to 5:00 p.m.

Pearl City Public Library
1136 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 1:00 p.m. to 5:00 p.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 1:00 p.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 1:00 p.m. to 5:00 p.m.

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 1:00 p.m. to 5:00 p.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 a.m. to 1:00 a.m.

Main Library
University of California at Irvine
Government Publications Receiving Dock
Irvine, CA 92717
(714) 824-6836
School Hours:
Monday-Thursday 8:00 a.m. to 1:00 a.m.,
Friday 8:00 a.m. to 9:00 p.m.,
Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 12:00 noon to 1:00 a.m.
Summer Hours:
Monday-Friday 8:00 a.m. to 5:00 p.m.,
Saturday and Sunday 1:00 p.m. to 5:00 p.m.

Pleasanton Public Library - Reference Desk
400 Old Bernal Avenue
Pleasanton, CA 94566
(510) 462-3535
Monday and Tuesday 1:00 p.m. to 8:00 p.m.,
Wednesday 10:00 a.m. to 8:00 p.m.,
Thursday 10:00 a.m. to 6:00 p.m.,
Closed Friday
Saturday and Sunday 1:00 p.m. to 5:00 p.m.,

San Diego Public Library
820 "E" Street
San Diego, CA 92101
(619) 236-5867
Monday-Thursday 10:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:30 a.m. to 5:30 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.

Denver Public Library
1357 Broadway
Denver, CO 80203
(303) 640-8845
Monday-Wednesday 10:00 a.m. to 9:00 p.m.,
Thursday-Saturday 10:00 a.m. to 5:30 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.

George A. Smathers Libraries, Library West
University of Florida Library, Room 241
P.O. Box 117001
Gainesville, FL 32611-7001
(904) 392-0367
Monday-Thursday 8:00 a.m. to 9:30 p.m.,
Friday 8:00 a.m. to 5:00 p.m.,
Sunday 2:30 p.m. to 9:30 p.m.

Atlanta Public Library
1 Margaret Mitchell Square
Atlanta, GA 30303
(404) 730-1700
Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday and Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 2:00 p.m. to 6:00 p.m.

Reese Library
Augusta College
2500 Walton Way
Augusta, GA 30904-2200
(706) 737-1744
School Hours:
Monday-Thursday 7:45 a.m. to 10:30 p.m.,
Friday 7:45 a.m. to 5:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:30 p.m. to 9:30 p.m.
Summer Hours:
Monday-Friday 8:00 a.m. to 5:00 p.m.

Chatham-Effingham-Liberty Regional Library
2002 Bull Street
Savannah, GA 31401
(912) 652-3600
Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 6:00 p.m.,
Saturday 10:00 a.m. to 6:00 p.m.,
Sunday 2:00 p.m. to 6:00 p.m.

Parks Library
Iowa State University
Government Publications Department
Ames, IA 50011-2140
(515) 294-3642
School Hours:
Monday-Thursday 7:30 a.m. to 12:00 midnight,
Friday 7:30 a.m. to 10:00 p.m.,
Saturday 10:00 a.m. to 10:00 p.m.,
Sunday 12:30 p.m. to 12:00 midnight,
Summer Hours:
Monday-Thursday 7:30 a.m. to 10:00 p.m.,
Friday 7:30 a.m. to 5:00 p.m.,
Saturday 12:30 p.m. to 5:00 p.m.,
Sunday 12:30 p.m. to 10:00 p.m.

Boise Public Library
715 South Capitol Boulevard
Boise, ID 83702
(208) 384-4023
Monday and Friday 10:00 a.m. to 6:00 p.m.,
Tuesday–Thursday 10:00 a.m. to 9:00 p.m.,
Saturday and Sunday 12:00 noon to 5:00 p.m.

Idaho State Library
325 West State Street
Boise, ID 83702
(208) 334-2152
Monday-Friday 9:00 a.m. to 5:00 p.m.

Shoshone-Bannock Library
Bannock and Pima Streets, HRDC Building
Fort Hall, ID 83203
(208) 238-3882
Monday-Friday 8:00 a.m. to 5:00 p.m.

Idaho Falls Public Library
457 Broadway
Idaho Falls, ID 83402
(208) 529-1462
Monday-Thursday 9:00 a.m. to 9:00 p.m,
Friday and Saturday 9:00 a.m. to 5:30 p.m.,
Sunday 1:30 p.m. to 5:30 p.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.

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 p.m.,
Sunday 1:00 p.m. to 9:00 p.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 p.m. 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 1:00 p.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 p.m. 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. to 9:00 p.m.,
Saturday 9:00 a.m. to 6:00 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.

Zanhow Library
Saginaw Valley State University
7400 Bay Road
University Center, MI 48710
(517) 790-4240
School Hours:
Monday-Thursday 8:00 a.m. to 11:00 p.m.,
Friday 8:00 a.m. to 4:30 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 p.m. to 9:00 p.m.
Summer Hours:
Monday-Thursday 8:00 a.m. to 10:30 p.m.,
Friday 8:00 a.m. to 4:30 p.m.,
Saturday 10:00 a.m. to 2:00 p.m.,
Sunday 1:00 p.m. to 5:00 p.m.

Ellis Library
University of Missouri
Columbia, MO 65201
(314) 882-0748
School Hours:
Monday-Thursday 7:30 a.m. to 12:00 midnight,
Friday 7:30 a.m. to 11:00 p.m.,
Saturday 9:00 a.m. to 9:00 p.m.,
Sunday 12:00 noon to 1:00 a.m.
Summer Hours:
Monday and Thursday 8:00 a.m. to 8:00 p.m.,
Tuesday, Wednesday, and Friday 8:00 a.m. to 5:00 p.m.,
Saturday 12:00 noon to 5:00 p.m.

Curtis Laws Wilson Library
University of Missouri Library
Rolla, MO 65401-0249
(314) 341-4227
School Hours:
Monday-Thursday 8:00 a.m. to 12:00 midnight,
Friday 8:00 a.m. to 10:30 p.m.,
Saturday 8:00 a.m. to 5:00 p.m.,
Sunday 2:00 p.m. to 12:00 midnight.
Summer Hours:
Monday-Friday 8:00 a.m. to 5:00 p.m.

D.H. Hill Library
North Carolina State University
P.O. 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.

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 1:00 p.m. to 5:00 p.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 p.m. to 9:00 p.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
P.O. 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 midnight,
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 1:00 p.m. to 10:00 p.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 10:00 a.m. to 8:00 p.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 9:00 a.m. to 1:00 p.m.

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 1:00 p.m. to 11:00 p.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 11:00 p.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 11:00 a.m. to 11:00 p.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 8:00 a.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 11:00 p.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.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1995 - 691-011 / 01920 REGION NO. 10

U.S. Department of Energy
SNF and INEL EIS
P.O. Box 1625
Idaho Falls, ID 83415-2518