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

Volume 2
Part A

April 1995

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COVER SHEET

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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:

DOE Idaho Operations Office
Bradley P. Bugger
Office of Communications
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 1992/1993 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

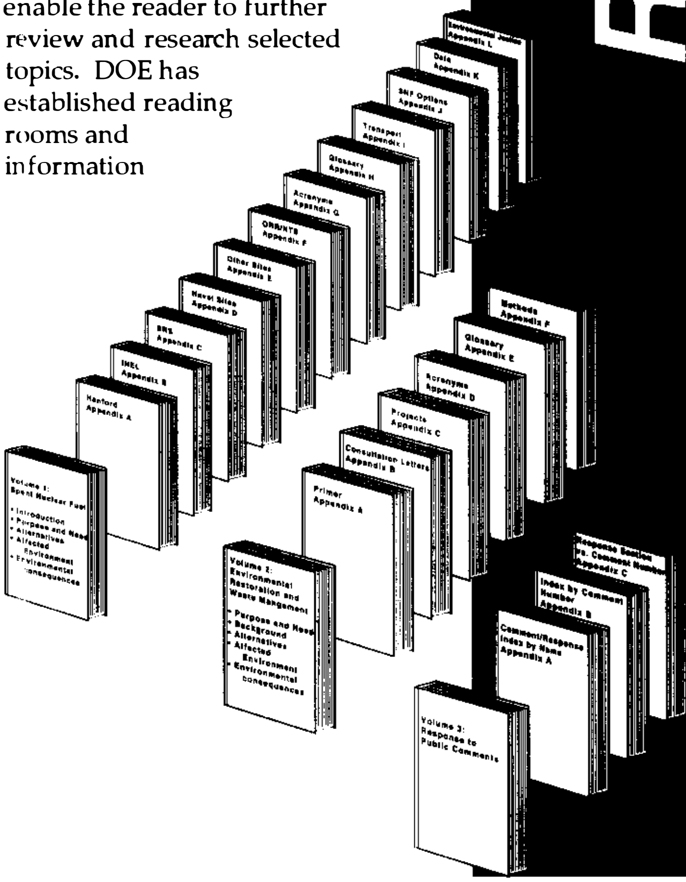
The U.S. Department of Energy's (DOE's) Environmental Impact Statement (EIS) for Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs [DOE/EIS-0203-F] is divided into three volumes:

- 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.

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Relationship Between Volumes 1 and 2

DOE is currently in the process of making two important sets of decisions. The first involves programmatic (DOE-wide) decisions regarding DOE's future spent nuclear fuel management (addressed in Volume 1 of the EIS). The second involves site-specific decisions regarding the future direction of environmental restoration and waste management programs, which include spent nuclear fuel, at the Idaho National Engineering Laboratory (addressed in Volume 2 of this EIS).

DOE's programmatic decisions regarding spent nuclear fuel affect the Idaho National Engineering Laboratory-specific decisions about spent nuclear fuel. Therefore, the spent nuclear fuel 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.

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. However 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.

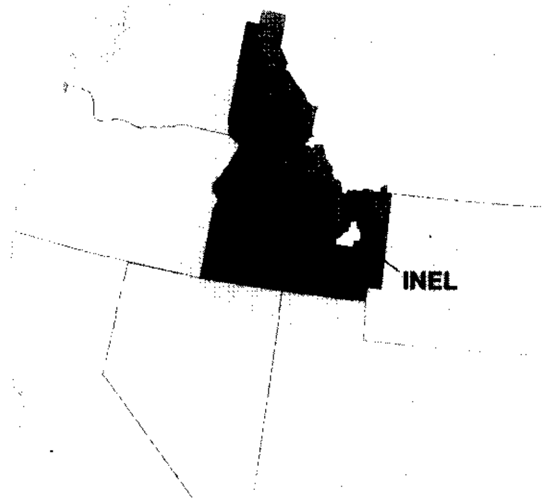
With regard to naval spent nuclear fuel, enhancements to Appendix D (Naval Spent Nuclear Fuel Management) include providing additional information in the following areas: importance of naval spent nuclear fuel examination, impacts of not refueling or defueling nuclear-powered vessels, the reasons why 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.

Volume 2 - INEL Environmental Restoration and Waste Management

Overview

The Idaho National Engineering Laboratory's mission is to develop, demonstrate, and deploy advanced engineering technologies and systems to improve national competitiveness and security, to make the production and use of energy more efficient, and to improve the quality of life and the environment. The environmental restoration program includes activities to assess and clean up inactive Idaho National Engineering Laboratory operations, including waste sites where there are known or suspected releases of harmful substances into the environment, and to safely manage contaminated surplus nuclear facilities. Waste management program activities are designed to protect Idaho National Engineering Laboratory employees, the public, and the environment in the design, construction, maintenance, and operation of treatment, storage, and disposal facilities in a cost-effective, environmentally sound, regulatory compliant, and publicly acceptable manner.



The Idaho National Engineering Laboratory is located in southeastern Idaho.

What Are Environmental Restoration and Waste Management?

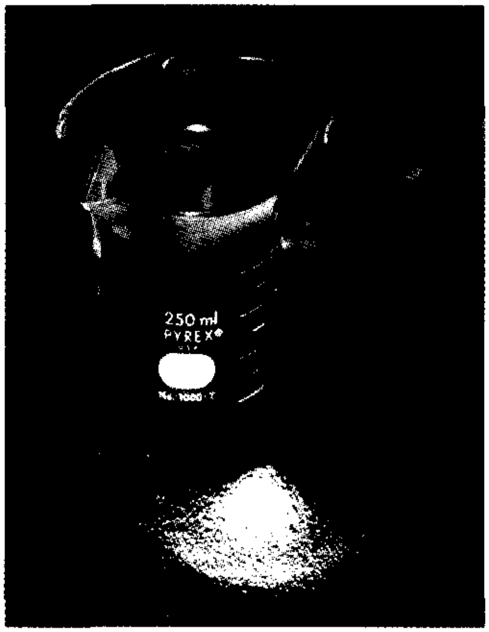
Environmental Restoration: The cleanup and restoration of sites and decontamination and decommissioning of facilities contaminated with radioactive and/or hazardous substances during past production, accidental releases, or disposal activities.

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.

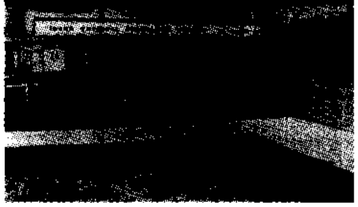
Spent Nuclear Fuel

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.

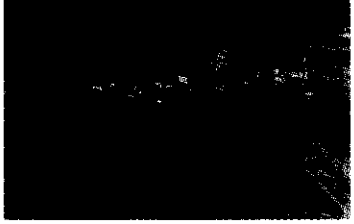
1 Test Area North

3 Idaho Chemical Processing Plant

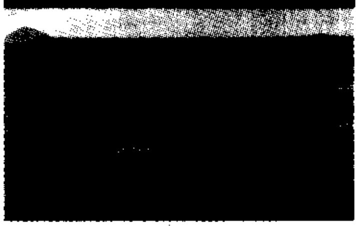


5 Power Burst Facility

2 Test Reactor Area



4 Central Facilities Area

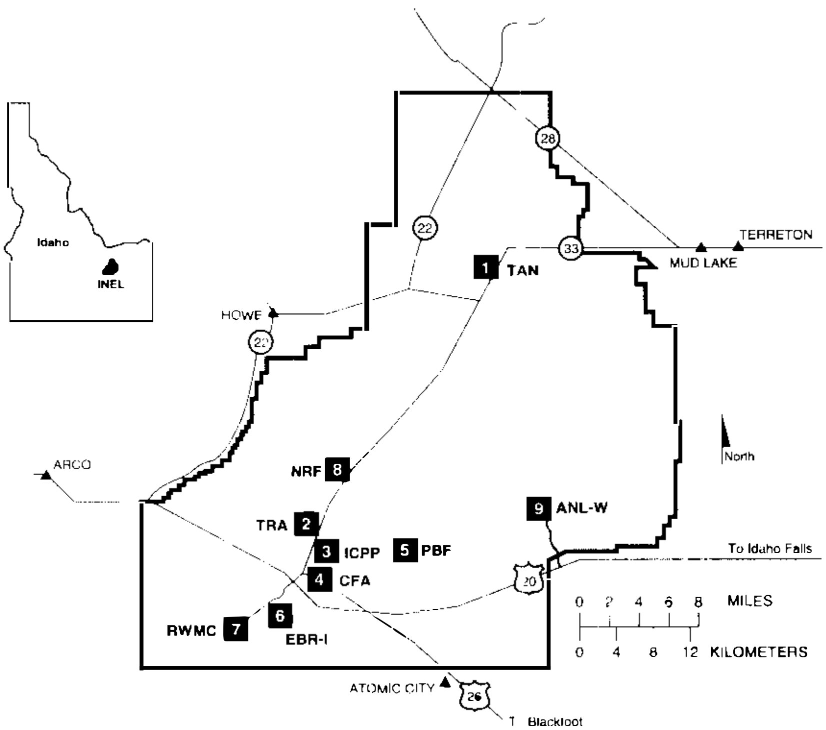


6 Experimental Breeder Reactor-I

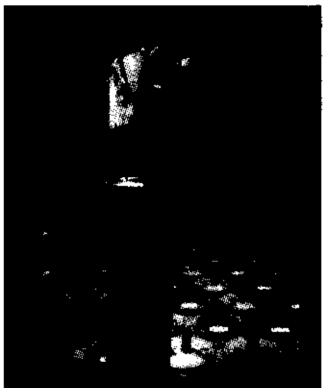
7 Radioactive Waste Management Complex

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, Storaga, 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.

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[a], 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)].

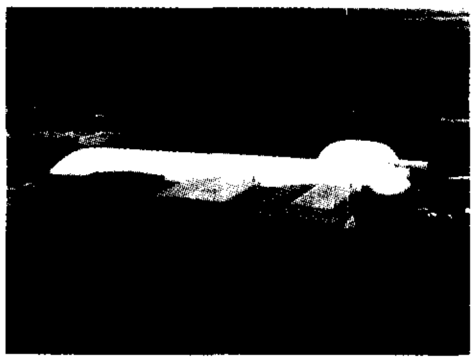
Acceptance of waste and spent nuclear fuel from other sites would be maximized. Wastes generated from environmental restoration and waste management activities onsite would be increased over that of the other alternatives. Spent nuclear fuel and environmental restoration and waste management activities at the

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).

Low-level waste burial pit

The Waste Experimental Reduction Facility

One mode of transporting waste



Air support weather shield at the Radioactive Waste Management Complex.

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 14).

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.

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

Chesapeake Central Library
298 Cedar Rd.
Chesapeake, VA 23320-5512
(804) 436-8300
Monday-Thursday 9:00 a.m to 9:00 p.m.,
Friday and Saturday 9:00 a.m to 5:00 p.m.,
Sunday 1:00 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.

Kiln Library
301 East City Hall Ave.
Norfolk, VA 23510
(804) 441-2429
Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 5:30 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.

Hampton Public Library
4207 Victoria Boulevard
Hampton, VA 23669
(804) 727-1154
Monday-Thursday 9:00 a.m. to 9:00 p.m..
Friday and Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 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 98310
(206) 377-3955
Monday-Friday 10:00 a.m. to 5:30 p.m.

Suzallo Library SM25
University of Washington Libraries
University of Washington
Seattle, WA 98185
(206) 543-9158
Monday-Thursday 7:30 a.m. to 12:00 midnight,
Friday 7:30 a.m. to 6:00 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 12:00 noon to 12:00 midnight

Portsmouth Naval Shipyard

Rice Public Library
8 Wentworth Street
Kittery, ME 03904
(207) 439-1553
Monday-Wednesday, Friday 10:00 a.m. to 5:00 p.m.,
Thursday 10:00 a.m. to 8:00 p.m.,
Saturday 10:00 a.m. to 4:00 p.m.

Portsmouth Public Library
8 Islington Street
Portsmouth, NH 03801
(603) 427-1540
Monday-Thursday 9:00 a.m. to 9:00 p.m.,
Friday 9:00 a.m. to 5:30 p.m.,
Saturday 9:00 a.m. to 5:00 p.m.

Pearl Harbor Naval Shipyard

Aiea Public Library
99-143 Monalua Rd.
Aiea, HI 96701
(808) 488-2654
Monday and Thursday 10:00 a.m. to 8:00 p.m.,
Tuesday, Wednesday, Friday, and Saturday 10:00 a.m. to 5:00 p.m.

Hawaii State Library
478 South King Street
Honolulu, HI 96813
(808) 586-3535
Monday, Wednesday, and Friday,
9:00 a.m. to 5:00 p.m.,
Tuesday and Thursday 9:00 a.m. to 8:00 p.m.,
Saturday 10:00 a.m. to 5:00 p.m.

Pearl City Public Library
1138 Waimano Home Rd.
Pearl City, HI 96782
(808) 455-4134
Monday-Wednesday 10:00 a.m. to 8:00 p.m.,
Thursday and Saturday 10:00 a.m. to 5:00 p.m.,
Friday and Sunday 1:00 p.m. to 5:00 p.m.

Pearl Harbor Naval Base Library
Code 90L
1614 Makalapa Dr.
Pearl Harbor, HI 96860-5350
(808) 471-8238
Tuesday-Thursday 10:00 a.m. to 7:00 p.m.,
Friday and Saturday 9:00 a.m. to 5:00 p.m.,
Sunday 1:00 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.

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Part B

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1. PURPOSE AND NEED FOR AGENCY ACTION

This section identifies the proposed action and the purpose and need for that action.

1.1 Proposed Action

To fullfill near-term goals, the U.S. Department of Energy (DOE) proposes the following action:

- to develop appropriate facilities and technologies to manage waste and spent nuclear fuels expected at the Idaho National Engineering Laboratory (INEL) in southeastern Idaho during the next ten years
- to more fully integrate all environmental restoration and waste management activities at the INEL to achieve cost and operational efficiencies, including pollution prevention and waste minimization
- to responsibly manage environmental impacts from environmental restoration and waste management activities.

1.2 Purpose and Need

DOE is responsible by law for spent nuclear fuel management, waste management, and environmental restoration at the INEL. Under the Atomic Energy Act of 1954, as amended, DOE is responsible for managing certain spent nuclear fuels. 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 responsible for managing wastes and controlling hazardous substances in a manner that protects human health and the environment. 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 and 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 remediation. To better fulfill its responsibilities, DOE needs to develop and implement a program for spent nuclear fuel management and environmental restoration and waste management activities at the INEL. To establish an effective INEL program [for the foreseeable future, focused on the near term (the next ten years)], DOE needs to make site-specific decisions that would accomplish three major goals: (a) support research and development missions at the INEL; (b) comply with legal requirements governing spent nuclear fuel, environmental restoration, and waste management; and (c) treat, store, and dispose of waste, manage spent nuclear fuel, and conduct environmental restoration activities at the INEL in an environmentally sound manner.

As part of the proposed action, DOE needs to decide upon the appropriate

- Strategy for implementing, at the INEL, DOE's national spent nuclear fuel decisions regarding transportation, receipt, processing, and storage of spent nuclear fuel

- Strategy for implementing, at the INEL, DOE's environmental restoration and waste management decisions

- Cleanup strategy for actions required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, and the Federal Facility Agreement and Consent Order of 1991

- Capabilities, facilities, research and development, and technologies for treating, storing, and disposing of each waste type at the INEL

- Actions regarding certain projects at the INEL, such as treatment technologies for sodium-bearing and high-level wastes, storage capacity for spent nuclear fuels, and treatment technologies for other radioactive and mixed wastes.

2. BACKGROUND

2.1 Environmental Impact Statement Scope and Overview

DOE is currently in the process of making major decisions regarding its future activities, both at the national level and specifically at the Idaho National Engineering Laboratory (INEL). Volume 2 of this Environmental Impact Statement (EIS) has been prepared to evaluate environmental impacts resulting from implementing DOE's national decisions at the INEL. This is done by evaluating the programs as a whole, the components of the programs (for example, waste stream management, remediation, decontamination and decommissioning; see Appendix E, Glossary, for a definition of these terms), and various specific projects. DOE intends to decide whether or not to proceed with proposed site-specific projects that would implement the alternatives for management of waste streams and spent nuclear fuel. The proposed projects are discussed in Chapter 3, Alternatives, and Appendix C, Information Supporting the Alternatives, and results of analyses are in Chapter 5, Environmental Consequences.

At the national level, two Programmatic EISs are being prepared to address decisions regarding the overall direction of DOE's Spent Nuclear Fuel (SNF) and Waste Management (WM) Programs. "Programmatic EIS" is a term for an EIS that covers matters of broad scope, such as agency policy or an agency program that includes a variety of interrelated activities. A Programmatic EIS may be the basis for subsequent analyses of narrower scope that incorporate by reference the general discussions contained in the Programmatic EIS. Volume 1 of this EIS discusses the environmental consequences of DOE's national spent nuclear fuel decisions; the Waste Management Programmatic EIS (draft scheduled to be available for public and agency review by mid-1995) will address the environmental consequences of DOE's national waste management decisions. These national decisions will have potential environmental consequences at the INEL because they will require developing a site-specific strategy to implement the national decisions.

Volume 3 summarizes the comments that DOE received on the EIS during the public comment period and provides responses to those comments. Volume 3 also includes discussions of the extent to which public comments resulted in changes to the EIS and describes how to find specific comment summaries and responses.

The foreseeable strategy for environmental restoration and waste management (ER&WM) at the INEL will include waste avoidance and minimization. Environmental restoration at the INEL will continue into the future, but expected future land use will influence methods of remediation and the amount of waste generated. Also, administering spent nuclear fuel and ER&WM activities at the INEL over the next ten years is expected to require new storage, characterization, retrieval, treatment, and disposal facilities and new waste minimization and avoidance projects. Technology development to support these projects, infrastructure improvements, and a continuing active environmental monitoring program will also be needed.

2.1.1 Environmental Impact Statement Content

The SNF and INEL ER&WM EIS has been prepared in accordance with the National Environmental Policy Act of 1969. The content of this document follows recommendations for the content of EISs made by the Council on Environmental Quality and DOE regulations implementing the National Environmental Policy Act. (Chapter 7, Consultations and Environmental Requirements, gives more details on related environmental statutes and regulations.)

This volume examines potential environmental impacts associated with four alternatives for managing waste, spent nuclear fuel, and related materials at the INEL (see Chapter 3, Alternatives). Alternative A (No Action) entails continued operation and maintenance of current facilities and programs, with only minor changes to some facilities. Alternative B (Ten-Year Plan) entails implementation at the INEL of the existing ten-year plan to comply with regulatory requirements, protect the environment, and support the INEL mission. Alternative C (Minimum Treatment, Storage, and Disposal) would minimize activities by transporting spent nuclear fuel and wastes to other sites for treatment, processing, characterization, storage, or disposal (or disposition). Alternative D (Maximum Treatment, Storage, and Disposal) would involve receiving and managing the maximum potential amount of spent nuclear fuel and waste at the INEL from other sites.

2.1.2 Environmental Impact Statement Scope

This section discusses the scope of the EIS as it relates to INEL's ER&WM and spent nuclear fuel activities and the timeframe for decisions supported by this EIS. Activities addressed in the EIS primarily include those that have produced and continue to produce radioactive (high-level,

DEFINITIONS

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. This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste.

Environmental Restoration: 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.

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 10 CFR 61. DOE is responsible for the disposal of greater-than-Class-C wastes from DOE nondefense 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 by-product 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.

INEL Industrial Waste: Material that is not subject to Resource Conservation and Recovery Act Subtitle C or Atomic Energy Act regulation. It is generated by manufacturing or industrial processes. INEL Industrial waste is also known as solid waste and is regulated by the Resource Conservation and Recovery Act, Subtitle D.

Low-Level Waste: Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, and 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 classifi d as low-level waste, provided the concentration of transuranics 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 by-product material subject to the Atomic Energy Act of 1954 (42 USC 2011, et seq.).

Radioactive Waste: Waste that is managed for its radioactive content.

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.

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

Transuranic Waste: Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, per gram of waste, except for (a) high-level radioactive waste, (b) waste that 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 40 CFR 191, or (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

Waste Management: The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

transuranic, low-level, and mixed) wastes, hazardous waste, and INEL industrial waste. Activities that fall outside the scope of the EIS are also identified. This EIS provides the analysis required under the National Environmental Policy Act for certain projects required to implement the Spent Nuclear Fuel and ER&WM Programs at the INEL.

2.1.2.1 Environmental Restoration and Waste Management Activities. Waste management activities discussed in this EIS are evaluated at both the site-wide (by waste stream management) and project-specific levels. For example, the evaluation of the INEL's waste management program addresses site-wide impacts associated with the treatment, storage, and disposal of waste generated by ongoing remediation, nuclear energy, energy research, and defense programs. Examples of project-specific evaluation related to waste management activities at the INEL include evaluating the need to construct replacement capacity for high-level waste tanks and evaluating the potential environmental consequences of incineration (for example, the Waste Experimental Reduction Facility).

For environmental restoration, potential impacts at the INEL are addressed only at the site-wide level. For example, the EIS evaluates the potential site-wide impacts associated with the INEL program for decommissioning and decontamination or dismantling of facilities scheduled for closure or reuse. Project-specific impacts of activities cannot be specifically quantified at this time, so they are only generally evaluated in this EIS. Project-specific impacts of these activities at the INEL will be quantified and evaluated in the future, as appropriate, as part of Comprehensive Environmental Response, Compensation, and Liability Act actions, in accordance with the Federal Facility Agreement and Consent Order.

Environmental restoration and waste management activities cannot be separated entirely because environmental restoration is a major waste generator. Waste from environmental restoration will in part dictate waste management activities.

2.1.2.2 Spent Nuclear Fuel Activities. This EIS also addresses all INEL activities related to spent nuclear fuel, except for reactor operations. Specific activities covered by the EIS include fuel receipt, transportation, processing, characterization, storage, and technology for ultimate disposition. Volume 1 of this EIS addresses spent nuclear fuel decisions for the entire DOE-wide system, while Volume 2 addresses spent nuclear fuel activities at the INEL.

2.1.2.3 Timeframe. The Record of Decision supported by Volume 2 of this EIS will determine how DOE manages its ER&WM and spent nuclear fuel activities at the INEL for the ten-year period from 1995 to 2005. Volume 1 of this EIS uses a 40-year (1995-to-2035) timeframe for evaluating potential impacts associated with DOE's programmatic spent nuclear fuel decision. The ten-year timeframe is used in Volume 2 for the evaluation of impacts because too much uncertainty exists to estimate potential project-specific impacts at the INEL beyond the year 2005. However, some projects to be implemented beyond the ten-year timeframe are evaluated in this EIS (for example, the Waste Immobilization Facility). This is because actions taken in the ten-year timeframe may determine whether these other projects would be needed. In addition, it is assumed that any facility constructed or used during the ten-year timeframe may require decontamination and decommissioning in the future (but outside the ten-year timeframe).

2.1.2.4 Activities Outside the Environmental Impact Statement Scope. Various activities at the INEL fall outside the scope of the EIS and are not addressed in this document. In general, Volume 2 does not evaluate impacts of operations not associated with the ER&WM and Spent Nuclear Fuel Programs at the INEL. However, some non-ER&WM and nonspent-nuclear-fuel activities are mentioned in appropriate sections when they are relevant to understanding either the affected environment or activities that are expected to occur at the INEL during the next ten years. Such activities include, for example, the generation of waste to be handled by the ER&WM Program and those activities related to road maintenance, utilities, fire protection, emergency preparedness, and security. Potential effects of particular non-ER&WM and nonspent-nuclear-fuel activities are included, when appropriate, in the analysis of cumulative impacts (see Section 5.15, Cumulative Impacts and Impacts from Connected or Similar Actions).

2.1.3 Other Related National Environmental Policy Act Documents

DOE currently has a range of National Environmental Policy Act reviews under way that are interrelated with this SNF and INEL ER&WM EIS. Because the scope of spent nuclear fuel management includes a wide variety of proposals, multiple National Environmental Policy Act reviews are, or will be, necessary. Volume 1 of the EIS provides the overall programmatic National Environmental Policy Act review of the management of DOE spent nuclear fuel policies and programs. This volume (Volume 2) provides the site-specific documentation for the INEL. The National Environmental Policy Act reviews related to ER&WM programs at the INEL are listed in Table 2.1-1. The National Environmental Policy Act documentation specifically related to the management of spent nuclear fuel is discussed in Chapter 1 of Volume 1 of this EIS. Discussion in

Table 2.1-1. National Environmental Policy Act reviews related to the site-specific decision, including environmental impact statements and environmental assessments.

Description of Action	Status[a]	EIS[a]	EA[a]
Waste management operations at the Idaho National Engineering Laboratory (INEL)	ROD issued 1977	X	
Special Isotope Separation Project	ROD issued January 1989	X	
Siting, construction, and operation of New Production Reactor capacity	Draft EIS issued April 1991	X	
Transportation, receipt, and storage of spent nuclear fuel from the Fort St. Vrain Reactor to the INEL	FONSI issued February 1991[b]		X
INEL Federal Aviation Administration Explosive Detection System Independent Validation and Verification Program	FONSI issued May 1991		X
Test Reactor Area evaporation pond	FONSI issued December 1991		X
Expansion of the INEL Research Center	FONSI issued March 1994		X
High-Level Waste Tank Farm Replacement Project	FONSI issued June 1993[c]		X
Decontamination and selective demolition of Auxiliary Reactor Areas II and III	FONSI issued September 1993		X
Low-level and mixed waste processing at the Waste Experimental Reduction Facility	FONSI issued June 1994		X
Retrieval and re-storage of Transuranic Storage Area waste at the INEL	FONSI issued May 1992		X
INEL Sewer System Upgrade Project	FONSI issued April 1994		X
INEL Consolidated Transportation Facility	FONSI issued April 1993		X
Waste Characterization Facility	FONSI issued March 1995		X
Test Area North Pool Stabilization Project	EA in progress		X
Replacement of the Radiological and Environmental Sciences Laboratory	Planned		X
Interim action for the cleanup of Pit 9 at the Radioactive Waste Management Complex	FONSI issued July 1993		X

Table 2.1-1. (continued).

Description of Action	Status[a]	EIS[a]	EA[a]
Interim action to reduce contamination near the injection well and in the surrounding groundwater at Test Area North at the INEL	FONSI issued October 1992		X
Replacement of the Health Physics Instrumentation Laboratory	EA in progress		X
Continuing operation of the Specific Manufacturing Capability	FONSI issued August 1991		X
Process Equipment Waste and Process Waste Liquid Collection Systems at the Idaho Chemical Processing Plant	FONSI issued June 1990		X
Argonne National Laboratory-West Waste Handling Facility	Planned		X
Argonne National Laboratory-West Fuel Cycle Facility	FONSI issued May 1990		X
INEL new borrow source site	EA in progress		X
Plasma Hearth Process Project	EA in progress		X

a. EIS = environmental impact statement.
EA = environmental assessment.
ROD = record of decision.
FONSI = finding of no significant impact.

b. The Environmental Assessment was ruled inadequate by the United States District Court for the District of Idaho in June 1993 (PSC 1993).

c. FONSI issued for line upgrades, but not tank replacement.

the following subsections centers on major reviews with the greatest interrelationship with Volume 2 of the EIS.

2.1.3.1 Waste Management Operations, Idaho National Engineering Laboratory Environmental Impact Statement. In 1977, DOE prepared a Final Environmental Impact Statement (DOE-ID 1977) that evaluated ongoing activities and operations at INEL waste management facilities. The SNF and INEL ER&WM EIS supersedes this previous document by providing an updated baseline of operations and associated environmental impacts for INEL activities since 1977.

2.1.3.2 Waste Management Programmatic Environmental Impact Statement. Currently in preparation, the Waste Management Programmatic EIS (previously known as the ER&WM Programmatic EIS) is analyzing alternative strategies and policies to maximize efficiency for DOE's national Waste Management Programs. The SNF and INEL ER&WM EIS (Volume 2) is being coordinated with the Programmatic EIS. The Draft Programmatic EIS is scheduled to be available for public and agency review by mid-1995. The analysis in the Programmatic EIS will support DOE complex-wide decisions on the

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

- Proposed action formulating and implementing an integrated Waste Management Program

- Alternative configurations for each waste type to provide a framework for siting future facilities at specific locations.

The alternatives are structured to ensure analysis of the impacts of the mixed waste configuration that will be defined in the Site Treatment Plans developed pursuant to the Federal Facility Compliance Act.

2.1.3.3 Tritium Supply and Recycling Environmental Impact Statement. The Nuclear Weapons Complex Reconfiguration Program has evolved considerably since its original Notice of Intent to prepare a programmatic EIS was issued in February 1991. DOE has now separated the Nuclear Weapons Complex Reconfiguration EIS into two programmatic EISs: (a) a Tritium Supply and Recycling Programmatic EIS (expected completion in November 1995) and (b) a Stockpile Stewardship and Management Programmatic EIS. In the original Notice of Intent, DOE proposed to reconfigure the Nation's nuclear weapons complex to be smaller, less diverse, and less expensive to operate. DOE's needs have evolved since then for many reasons, but primarily the end of the Cold War. The tangible effects include the significant reduction in the size of the Nation's stockpile of nuclear weapons and reduced requirements for production programs.

The Tritium Supply and Recycling Programmatic EIS will address alternatives associated with new tritium production and the recycling of tritium recovered from weapons retired from the stockpile. The INEL is a candidate site for new tritium supply and recycling facilities. The scope of the planned Stockpile Stewardship and Management Programmatic EIS has yet to be determined, but proposed alternatives could potentially affect the INEL.

2.1.3.4 Waste Isolation Pilot Plant Environmental Impact Statement. The Final Supplemental EIS for the Waste Isolation Pilot Plant, the proposed Federal repository for defense-related transuranic waste located in Carlsbad, New Mexico, was issued in 1990 to support a decision to proceed with a test phase. During the test phase, a limited quantity of waste would have been placed underground at the Waste Isolation Pilot Plant (WIPP). However, following enactment of the WIPP Land Withdrawal Act in late 1992, DOE decided in 1993 not to proceed with the underground test phase but to perform laboratory tests with waste, along with numerous other in situ and offsite studies, to demonstrate compliance with U. S. Environmental Protection Agency disposal standards (40 CFR 191 Subparts B and C) and the Solid Waste Disposal Act. DOE will prepare and issue an additional supplemental EIS at the end of the test program to support a decision on whether or not to proceed with the disposal phase.

2.1.3.5 Environmental Impact Statement for a Potential Repository at Yucca Mountain for Disposal of High-Level Radioactive (Planned). The Nuclear Waste Policy Act, as amended, mandated that DOE determine the suitability of the Yucca Mountain, Nevada, site as the nation's first licensed geologic repository for spent nuclear fuel and high-level radioactive waste. DOE has tentatively scheduled the Notice of Intent for 1995, and the Record of Decision for the year 2000. Yucca Mountain is a potential repository site for spent nuclear fuel addressed in this programmatic environmental impact statement.

2.1.3.6 Draft Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel. DOE proposes to adopt and implement a policy concerning the management of spent nuclear fuel containing enriched uranium that originated in the U. S. but that would come from foreign research reactors. The implementation of this policy would result in foreign research reactor spent nuclear fuel being received at U. S. marine points of entry and transported overland to DOE sites for storage pending ultimate disposition. The Foreign Research Reactors Draft EIS is scheduled to be completed in 1995. Alternatives to be addressed in this EIS include nonrenewal of the policy; storage sites (Hanford Site, INEL, Savannah River Site, Oak Ridge Reservation, and Nevada Test Site); transportation from various points of entry; and storage technologies.

2.1.3.7 Federal Facility Compliance Act (1992). For each facility at which DOE generates or stores mixed waste, the Federal Facility Compliance Act requires DOE to prepare a plan for developing treatment capacities and technologies to treat mixed wastes to the standards promulgated by the U. S. Environmental Protection Agency. Upon submission of a plan to the appropriate regulatory agency, the Act requires the recipient to solicit and consider public comments and to approve, approve with modification, or disapprove the plan within six months.

The Draft Site Treatment Plan reflects the site-specific preferred treatment options, developed with the State's input and based on existing available information. To the extent possible, the Draft Site Treatment Plan identifies specific treatment facilities for treating the mixed waste and proposes schedules as set forth in the Act. When finalized, the Site Treatment Plan will satisfy DOE's obligation under the Act to develop and submit a treatment plan for the INEL.

2.1.4 Scoping Process

According to the National Environmental Policy Act, the purpose of the scoping process is to determine, in general, the issues to be addressed in an EIS and to identify those significant issues requiring in-depth analysis.

For the SNF and INEL ER&WM EIS, the scoping process began on October 22, 1990, when DOE published in the *Federal Register* its Notice of Intent to prepare a Programmatic EIS that would address ER&WM activities (including spent nuclear fuel) at all DOE facilities (FR 1990). Public comments were solicited, and DOE released a Draft Implementation Plan to develop the EIS. Following the release of the Draft Plan, a second comment period was conducted via six regional workshops. In these workshops, the public was invited to express opinions and ask questions about the Plan. On October 5, 1992, DOE published a Notice of Intent to prepare a site-specific EIS on its ER&WM Programs (including spent nuclear fuel) at the INEL (FR 1992). Scoping meetings were conducted in five different locations in the State of Idaho. DOE made numerous announcements in local newspapers and other media to alert the public about these meetings. The meetings provided both formal and informal ways for the public to express their views and obtain information about the intended scope of analysis. DOE also conducted numerous information briefings with representatives of State and local governments, elected officials, and the Shoshone-Bannock Indian Tribes. This was an effort to provide early notice and information about the document. During these briefings, participants provided input on their concerns and issues.

After public comments were taken and a plan was developed for preparing the EIS, a court order was issued that expanded the scope of the EIS. On June 28, 1993, as an outgrowth of civil lawsuits involving DOE, the State of Idaho, and other parties, the U.S District Court for the District of Idaho ordered DOE to prepare a comprehensive EIS for spent nuclear fuel management. This court order addressed the need to prepare an EIS for the INEL that examines alternatives to the transport, receipt, processing, and storage of spent nuclear fuel at the INEL site. Because of the quantities and types of fuel currently located at the INEL, a fair evaluation of these activities required assessing similar activities throughout the DOE complex. Thus, DOE decided to expand its site-specific EIS for the INEL to incorporate the programmatic decision regarding the management of spent nuclear fuel within the DOE complex, previously part of DOE's Waste Management Programmatic EIS (previously known as the ER&WM Programmatic EIS). This expanded document is the SNF and INEL ER&WM EIS.

To allow the public an opportunity to comment on the scope of the SNF and INEL ER&WM EIS, DOE puhlished a Notice of Opportunity on September 3, 1993. DOE used the public and agency comments received during the scoping comment period to identify major issues and to define the alternatives that are evaluated in Volume 2. DOE's responses to comments and issues raised during the scoping comment period are given in the Implementation Plan and its amendments for this EIS (DOE-ID 1993a).

During the scoping comment periods, DOE received a total of 970 comments addressing 4,321 issues. The issues can be grouped into three types: technical issues, programmatic spent nuclear fuel issues, and other issues. Figure 2.1-1 summarizes the 3,128 issues applying to the site-specific decision evaluated in this volume.

The greatest number of issues raised during scoping were statements in opposition to spent nuclear fuel and waste being managed in Idaho. Commentors were concerned about several aspects of spent nuclear fuel and about DOE siting criteria. The most frequently raised technical issue for the INEL was related to materials and waste management. Other frequent comments focused on the National Environmental Policy Act process, DOE credibility, the range of alternatives, water quality, and the expansion of the scope of the EIS. In response to these comments, DOE decided to expand the number of alternatives evaluated in Volume 2 from two to four (see Chapter 3).

Reflecting continuing DOE and public concern, the EIS process emphasized data gathering and analyses of potential impacts to water use and water quality. Other areas emphasized include present and future waste streams, hazardous material inventories, impacts to air quality, accident analyses, and transportation analyses.

2.1.5 Response to Public Comments

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

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

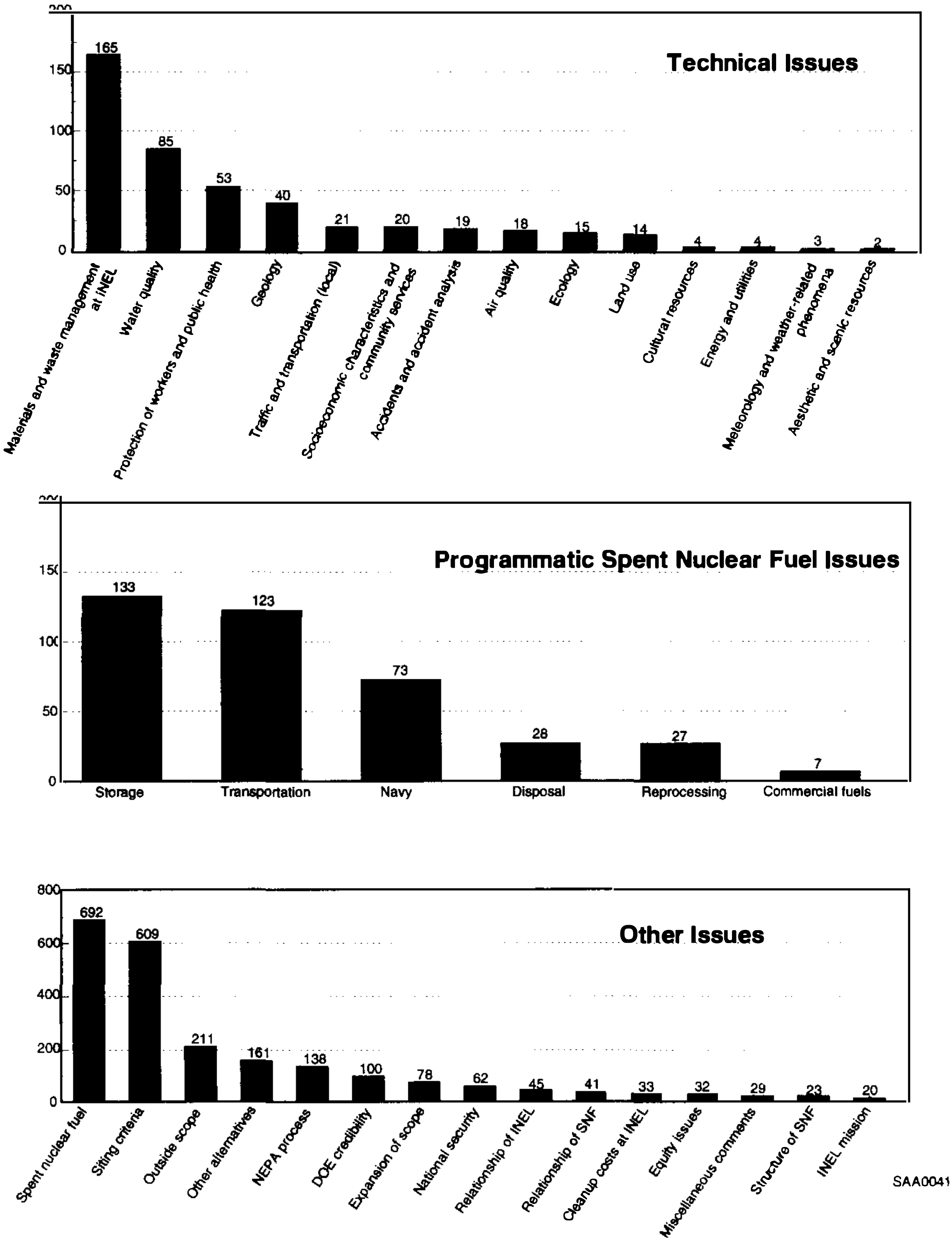


Figure 2.1-1. Comments and issues raised during the comment periods.

comments resulted in changes to the EIS, and describes how to find specific comment summaries and responses in this volume.

Responses to comments consist of two parts. The first part summarizes the comment(s), and the second part responds to the comment(s). Identical or similar comment(s) were frequently provided by more than one commentor and, in such cases, DOE grouped the comments and prepared a single response for each group. This summarization was also appropriate due to the large volume of comments received.

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

2.1.5.1 How the Department of Energy Considered Public Comments in the National Environmental Policy Act Process. As required in the Council on Environmental Quality regulations [40 CFR 1502.14(e)], DOE's preferred alternatives are identified in the Final EIS. The preferred alternatives for Volumes 1 and 2 were identified based on the consideration of environmental impacts, regulatory compliance, DOE and spent nuclear fuel programmatic missions, public issues and concerns, national security and defense, cost, and DOE policy. Public input considered in the decisionmaking and preferred alternatives selection process included concerns, desires, and opinions regarding the activities addressed in the EIS and expectations of DOE in making the management decisions on complex-wide programmatic spent nuclear fuel management and environmental restoration and waste management programs at the INEL. Public input contributed to the development of performance factors, defined as desirable attributes or characteristics that measure the relative acceptability of alternatives, which were used to select candidate preferred alternatives.

The candidate preferred alternatives were then evaluated against a number of technical and nontechnical sensitivities, including public perception of environmental impact, indicated stakeholder preferences, implementation flexibility, regulatory risk, spent nuclear fuel processing potential, environmental justice, potential resistance to implementation, and fairness. DOE's preferred alternative reflects DOE consensus that spent nuclear fuel should be actively managed in preparation for ultimate disposition. In addition, DOE's preferred alternative supports the implementation of a path forward for the ultimate disposition of spent nuclear fuel, a significant issue raised by the public. The EIS, including its preferred alternatives, will be considered by the Secretary of Energy, along with other factors, in arriving at a decision to be documented in a formal Record of Decision.

2.1.5.2 Changes to the Environmental Impact Statement Resulting from Public Comment. A major purpose of the National Environmental Policy Act is to promote efforts that will prevent or eliminate damage to the environment by ensuring informed decisionmaking on major Federal actions significantly affecting the quality of the human environment. Consideration of public comments on the Draft EIS helps to ensure that the EIS is an adequate decisionmaking tool; accordingly, this EIS has been enhanced, as appropriate, in response to public comments. While a number of specific issues and concerns were raised by commentors, none of the issues or concerns identified new reasonable alternatives requiring assessment or resulted in significant change in the results of the analysis of the potential environmental consequences.

Based on review of public comments, coupled with the consultations held with commenting agencies as well as State and tribal governments, the main EIS enhancements include the following:

- Seismic and water resources discussions were reviewed, clarified, and enhanced for all alternative sites, and current data and analyses were added to Volumes 1 and 2, as appropriate. A discussion of potential accidents caused by a common initiator was added. The option of stabilizing some of DOE's spent nuclear fuel (specifically from the N Reactor) by processing it at available facilities located overseas was added, thus enhancing the processing options discussed in the EIS. An analysis of barge transportation was added to the EIS, with respect to the option of shipping N-Reactor fuel to a shipping point for overseas processing, as well as to support the potential 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 containing uranium of U. S. origin from foreign research reactors.

- In Volume 2 of the EIS, the air quality analysis was revised to upgrade the existing baseline conditions and impacts of alternatives in terms of the amount of Prevention of Significant Deterioration increment consumed, thus updating the baseline conditions presented for the INEL. Additionally, the Waste Experimental Reduction Facility project summary was enhanced and clarified. The EIS was also revised to reflect current projections of employment, including the projected downsizing of the INEL due to contractor consolidation.

- In response to public comments, a brief summary of the results of a separate evaluation of the costs of the various alternatives was added to the EIS, although the cost evaluation was performed independently of the EIS for additional purposes. The discussion of the options regarding the management of Fort St. Vrain spent nuclear fuel currently stored in Colorado has been expanded. As committed to in the Draft EIS, the evaluation and discussion of environmental justice has been expanded in both Volumes 1 and 2 of the EIS. This analysis was based on interim DOE guidance in the absence of interagency policy in this regard and reflects limited public comments received regarding environmental justice. Consultation with the commenting Native American tribes is reflected in the environmental justice analysis, as well as in the various sections of the EIS, as appropriate.

- Other enhancements include a clarification that potential shipment of spent nuclear fuel containing uranium of U. S. origin from foreign research reactors consists of a bounding estimate of 22 metric tons (24 tons) of heavy metal. In addition, as a result of public comments, Volume 1 of the EIS was enhanced to clarify the relationship between current DOE National Environmental Policy Act actions and this EIS. Likewise, the relationship between the EIS and the Spent Fuel Vulnerability Action Plans was clarified in this EIS. With respect to the naval spent nuclear fuel, Appendix D of Volume 1 was modified to more fully explain the import of naval spent nuclear fuel and to discuss potential effects of terrorist attacks at naval shipyards.

2.2 Idaho National Engineering Laboratory Overview

2.2.1 General Site Description

The INEL site occupies about 230,000 hectares (890 square miles) of dry, cool desert in southeastern Idaho. It is located in the Eastern Snake River Plain (Figure 2.2-1), southwest of Yellowstone National Park [211 kilometers (132 miles)]; north of Salt Lake City, Utah [374 kilometers (234 miles)]; and east of Boise, Idaho [317 kilometers (198 miles)]. The INEL site lies west of the Snake River and near numerous national forests and recreational areas. Population centers near the site are Idaho Falls to the east, Blackfoot to the southeast, Pocatello to the south-southeast, and Arco to the west.

2.2.2 Organization and Administration

The INEL is a government-owned site managed by DOE and administered by three DOE operations offices: (a) the Idaho Operations Office (DOE-ID); (b) the Idaho Branch Office of Pittsburgh Naval Reactors (IBO); and (c) the Chicago Operations Office (DOE-CH). Lockheed Idaho Technologies Company supports DOE-ID's activities at the INEL. Westinghouse Electric Corporation (WEC) supports the Idaho Branch Office of the Pittsburgh Naval Reactors, and Argonne National Laboratory (ANL) supports DOE-CH at the INEL.

As INEL Site Manager, DOE-ID is responsible for site services, environmental control and management, and overall safety and emergency planning functions. Thus, DOE-ID is responsible for ER&WM activities. The INEL ER&WM Program is under the DOE Headquarters Office of Environmental Management (EM) established in November 1989. These ER&WM activities are defined and carried out within the regulatory environment described in Section 2.2.11, Regulatory Framework for Environmental Restoration and Waste Management, and Chapter 7, Consultations and Environmental Requirements.

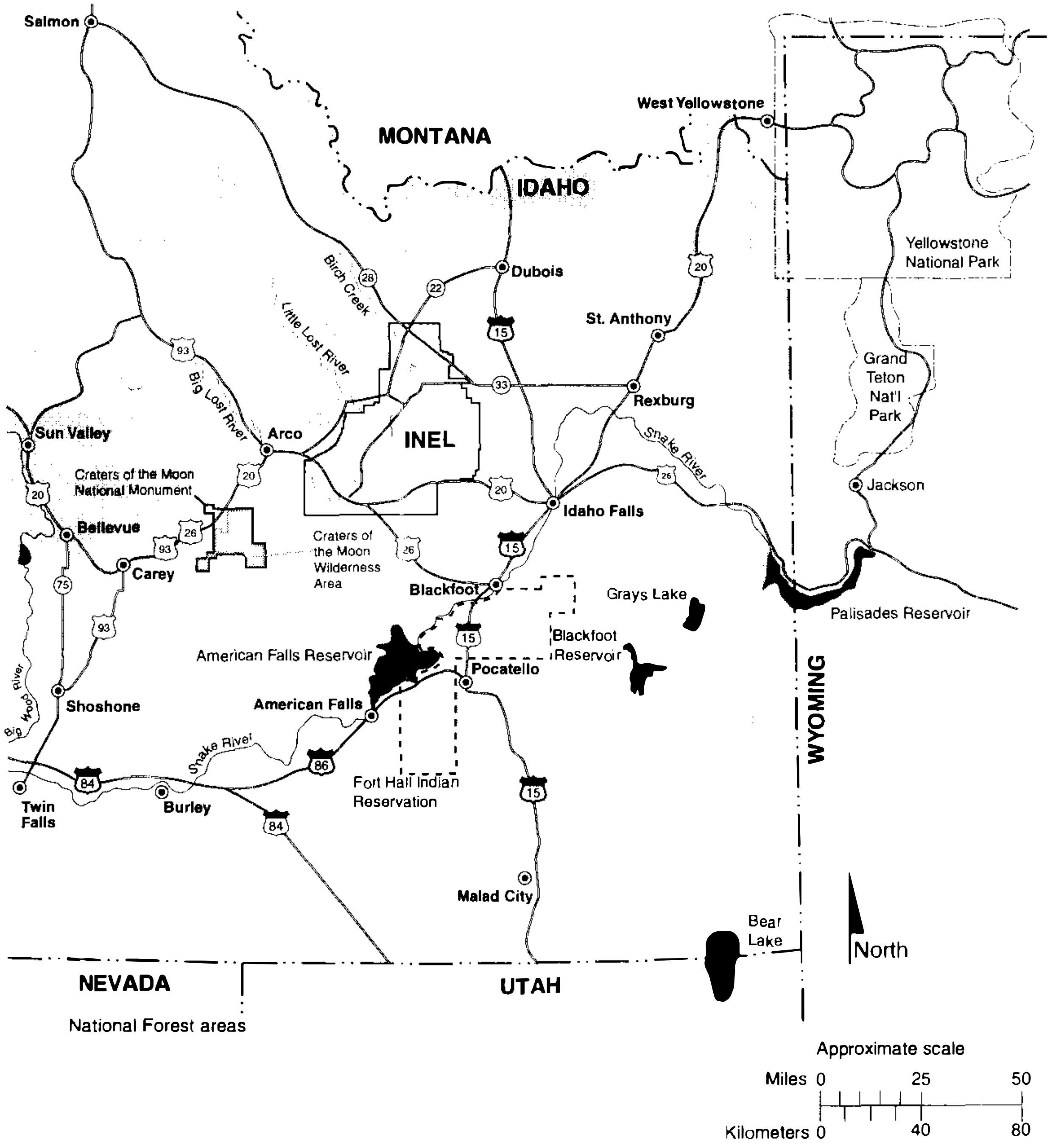


Figure 2.2-1 Location of the Idaho National Engineering Laboratory in southeastern Idaho.

2.2.3 Historic and Current Mission

The INEL has long provided research and engineering support to the military, commercial, and government segments of the U. S. economy. Specific activities on the INEL have shifted over time to meet changing national needs. These shifts included changing from the application of nuclear power for commercial and naval uses, to spent nuclear fuel reprocessing and waste storage, to the current emphases on science and technology related to advancing and improving remediation and waste management at the INEL and applying the knowledge gained from the INEL experience to other national needs.

Despite the long history and different operations carried out at the INEL, most of the site has not been affected by direct land disturbances. One result of the activities conducted to meet the historic missions of the INEL is the creation of nine major facility areas. These areas and their transportation corridors encompass the majority of industrial development and disturbances on the INEL site, but comprise only 2 percent of the total land area of the site. Public roads and utility rights of way that cross the site comprise an additional 6 percent of the total land area of the site.

2.2.3.1 History of the Implementation of the INEL Mission.

During World War II, the U. S. Navy and the U. S. Army Air Corps used a portion of the present site as a gunnery range. In 1949, the site was formally established as the National Reactor Testing Station. Over time, 52 different reactors, most of them first-of-a-kind facilities, were built here. Most of these reactors were phased out or dismantled after their research missions were completed, but several are currently operating or operable (see Section 2.2.4, Major Facility Areas). Highlights of this program include the Experimental Breeder Reactor-I, now a National Historic Landmark, which produced the first usable electrical power from nuclear energy in 1951; and the

SITE HISTORY

- 1949 - Formally established
- 1950s - Test of first nuclear submarine reactor
- 1951 - Site reactor first to generate electricity from nuclear fission
- 1952 - Radioactive Waste Management Complex opened
- 1953 - Idaho Chemical Processing Plant began operation
- 1955 - Site reactor powered City of Arco
- 1970 - Transuranic waste no longer buried
- 1974 - Site became Idaho National Engineering Laboratory (INEL)
- 1975 - INEL designated National Environmental Research Park
- 1987 - Consent Order and Compliance Agreement signed
- 1989 - INEL on U. S. Environmental Protection Agency's National Priorities List
- 1991 - Federal Facility Agreement and Consent Order signed
- 1992 - Decision to phase out reprocessing at the Idaho Chemical Processing Plant

Boiling Water Reactor Experiment-III, which, in 1955, was the first reactor to light an American town (Arco, Idaho).

Beginning in the 1950s, the Naval Reactors Facility tested and operated prototypes of nuclear reactors for submarines and surface ships. In addition, this facility was a training station for crews on these ships. The Navy discontinued training on the Large Ship Reactor (A1W) facility at the Naval Reactors Facility in 1994 and has announced the 1995 closure of the Submarine Reactor (S5G) prototype.

Another effort supporting U. S. nuclear programs was reprocessing spent nuclear fuel to recover uranium at the Idaho Chemical Processing Plant. Reprocessing was begun in 1953 and phased out by DOE in April 1992.

Between 1954 and 1989, defense-related nuclear waste was transported to the INEL site, primarily from the Rocky Flats Plant in Colorado. Until 1970, this mostly transuranic waste was buried in shallow pits and trenches at the Radioactive Waste Management Complex. After 1970, transuranic waste was stored above ground in specially designed interim storage facilities.

Since the mid-1970s, one of the specific purposes of the INEL has been to advance science and technology related to environmental characterization and restoration of sites contaminated by earlier operations. In 1974, the National Reactor Testing Station was renamed the Idaho National Engineering Laboratory to reflect its broader mission, which now includes research and engineering for nonnuclear, as well as nuclear, energy programs. One year later, the INEL was designated as a National Environmental Research Park, one of seven in the nation. These parks were established by DOE to provide protected land areas for research and education in the environmental sciences and to demonstrate the compatibility of energy technology development and use with environmental quality. The INEL site provides an outdoor laboratory where scientists can study changes in the natural environment caused by human activities. DOE has continued to further emphasize the mission of developing restoration and waste management technologies and to implement the requirements from the signing of the Consent Order and Compliance Agreement in 1987 and, since the listing of the INEL on the National Priorities List, the Federal Facility Agreement and Consent Order in 1991, which superseded the Consent Order and Compliance Agreement.

2.2.3.2 Current Mission. The current INEL mission is to develop, demonstrate, and deploy advanced engineering technology 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. Areas of primary emphasis at the INEL include waste management and minimization, environmental engineering and restoration, energy efficiency, renewable energy, national security and defense, nuclear technologies, and advanced technology and methods. The ER&WM Program has DOE's top priority at the INEL.

Specific aspects of the Environmental Restoration Program mission are to (a) assess and clean up sites where there are known or suspected releases of harmful substances into the environment and (b) safely manage contaminated surplus nuclear facilities as they are decommissioned. Aspects of the Waste Management Program mission are to (a) protect the safety of INEL employees, the public, and the environment in the design, construction, maintenance, and operation of INEL treatment, storage, and disposal facilities, and (b) operate these facilities in a manner that is cost-effective, is environmentally sound, complies with regulations, and is publicly acceptable. While fulfilling these missions, DOE is committed to bringing all INEL facilities into compliance with local, State, and Federal regulations.

2.2.4 Major Facility Areas

Mission activities including those associated with ER&WM occur primarily in nine major facility areas that were developed since the INEL site was established. This section describes the nine areas that exist at the INEL site (see Figure 2.2-2) and the Idabo Falls operations facilities. As the figure shows, most of the facility areas are located in the southwestern portion of the site. These facilities are the result of implementing both historic and current missions.

The specific facilities described in this section include both those where spent nuclear fuel and ER&WM activities occur (proposed actions evaluated in this EIS) and where nonspent-nuclear-fuel/ ER&WM activities occur (actions generally not evaluated in this EIS with the exception of the wastes they would generate). Information on Spent Nuclear Fuel and ER&WM Program activities is presented in Sections 2.2.5 (Spent Nuclear Fuel), 2.2.6 (Environmental Restoration), 2.2.7 (Waste Management), and 2.2.10 (Activities Not Directly Related to Spent Nuclear Fuel or Environmental Restoration and Waste Management).

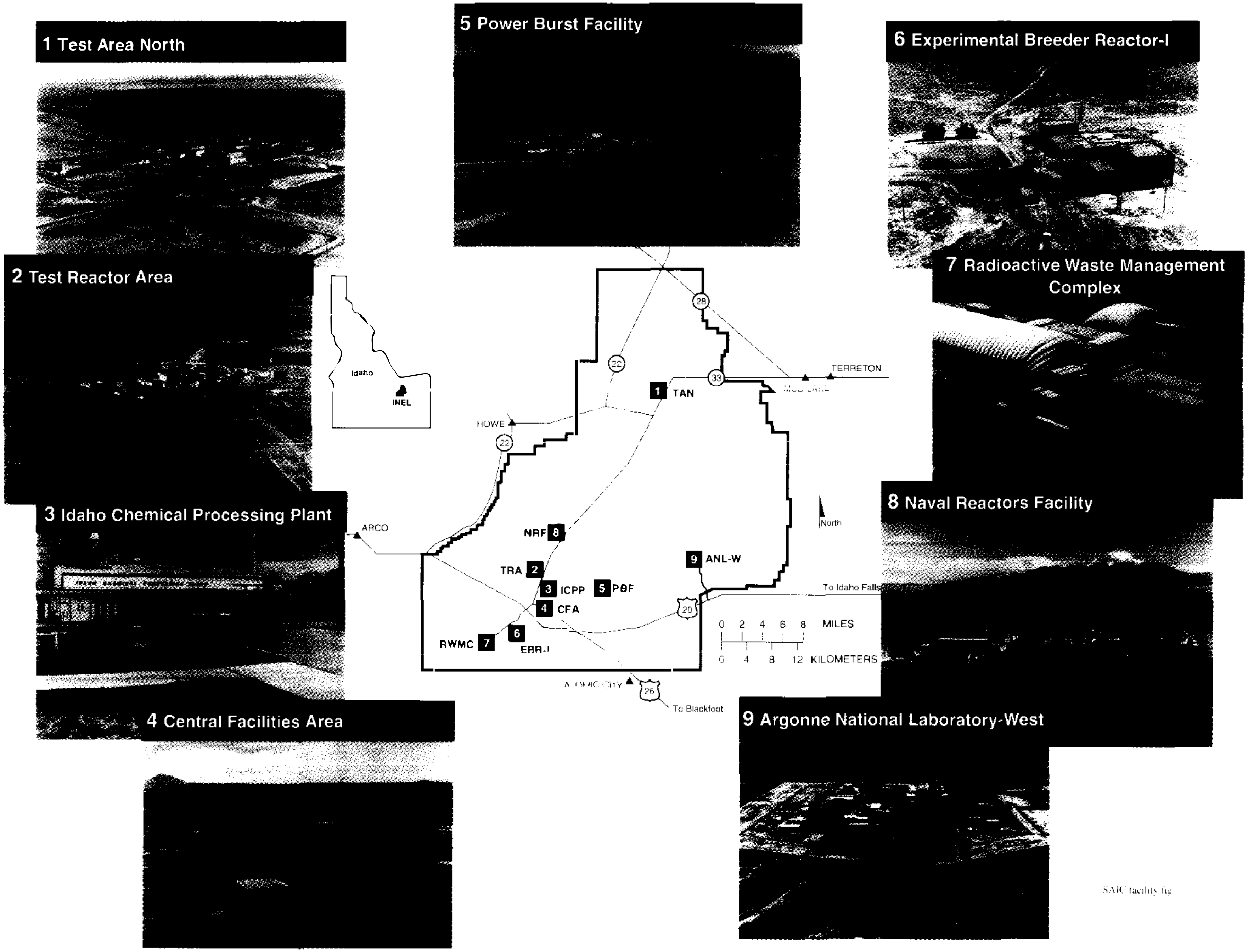


Figure 2.2-2. Major facility areas located at the Idaho National Engineering Laboratory site.

The nine major facility areas at the INEL site are Test Area North, Test Reactor Area, Idaho Chemical Processing Plant, Central Facilities Area, Power Burst Facility, Experimental Breeder Reactor-I/Boiling Water Reactor Experiment, Radioactive Waste Management Complex, Naval Reactors Facility, and Argonne National Laboratory-West. In addition to the major facility areas located at the site, numerous support facilities are located in the City of Idaho Falls. The facilities at the site plus all supporting DOE facilities in Idaho Falls make up the INEL.

2.2.4.1 Test Area North. The Test Area North is located in the northern portion of the INEL site on State Highway 33 about 24 kilometers (15 miles) east of the town of Howe and 19 kilometers (12 miles) west of the town of Mud Lake. This facility area covers a total area of about 80 hectares (200 acres).

Test Area North's original purpose was to house the Aircraft Nuclear Propulsion Project, a now-discontinued project to develop nuclear-powered aircraft. Later, this facility area included the Loss-of-Fluid Test Facility, which was used in light-water-reactor accident testing. Structures associated with these earlier operations still exist at Test Area North. Test Area North's current purpose includes handling and evaluating irradiated material, supporting energy research and defense programs (including production of tank armor), demonstrating dry cask storage of spent nuclear fuel, performing flow tests to support reactor safety studies, and storing spent nuclear fuel.

Test Area North's four key facilities related to spent nuclear fuel and ER&WM are the Initial Engine Test Facility, which was used for the Aircraft Nuclear Propulsion Project, has been inactive since 1978, and consists of seven vacant buildings; the Technical Support Facility, which is used for handling and examining radioactive materials, contains the Process Experimental Pilot Plant, and consists of 40 structures having administrative, service, and maintenance functions; the Water Reactor Research Test Facility, which is used for reactor flow experiments, includes the Thermal-Hydraulic Experimental Facility Assembly and Test Building, and contains eight structures; and the Containment Test Facility, formerly the Loss-of-Fluid Test Facility, which houses the Specific Manufacturing Capability project that produces tank armor for the U. S. Army and consists of 34 structures.

2.2.4.2 Test Reactor Area. The Test Reactor Area covers about 40 hectares (100 acres) and is located in the southwestern portion of the INEL site. This facility area contains over 70 buildings, many of which were built as early as 1952. The Test Reactor Area's current purpose is to study the effects of radiation on materials, fuels, and equipment and to perform chemistry and physics experiments. The Test Reactor Area's major facilities include three reactors, four low-power reactors, and a hot cell operation for handling highly radioactive materials. The three reactors are the Materials Test Reactor, the Engineering Test Reactor, and the Advanced Test Reactor. The Materials Test Reactor and Engineering Test Reactor have been deactivated and are planned for decontamination and decommissioning. The Advanced Test Reactor is still operating. It is used for materials testing under reactor conditions and for producing radioisotopes used in medicine, research, and industry.

The four low-power reactors used for criticality measurements are the Engineering Test Reactor Critical Facility (in decommissioning and decontamination), the Advanced Test Reactor Critical Facility (on line), the Advanced Reactivity Measurement Facility (shutdown status), and the Coupled Fast Reactivity Measurement Facility (shutdown status).

2.2.4.3 Idaho Chemical Processing Plant. The Idaho Chemical Processing Plant covers approximately 100 hectares (250 acres) and contains over 150 buildings. Twenty-one additional buildings are planned for construction. The Idaho Chemical Processing Plant is located near the Test Reactor Area in the southwestern part of the INEL site.

The Idaho Chemical Processing Plant's original purpose was to function as a one-of-a-kind reprocessing facility for government-owned nuclear fuels from research and defense reactors. The plant recovered uranium from spent nuclear fuel so that it could be reused.

The Idaho Chemical Processing Plant's current purpose is to

- Receive and store DOE-assigned spent nuclear fuels
- Prepare high-level liquid and solid waste for disposition in a repository
- Develop technologies for the disposition of spent nuclear fuel, sodium-bearing waste, and high-level waste

- Develop and apply technologies to minimize waste generation and manage radioactive and hazardous wastes.

Major operating facilities at the Idaho Chemical Processing Plant include both storage and treatment facilities. Storage facilities provide spent nuclear fuel storage (pools and dry storage), calcine (dry granular waste) storage (in bins), and liquid high-level waste storage (in underground tanks). Treatment facilities include a waste solidification facility for treatment of liquid high-level waste and sodium-bearing waste (New Waste Calcining Facility) and an evaporator used to concentrate low-level waste and mixed low-level waste. Another treatment facility prevents radioactive waste from being discharged to the percolation ponds and recovers nitric acid for reuse. Mixed and low-level waste is handled and stored in the Hazardous and Radioactive Mixed Waste Staging Area and the Hazardous Chemical/Radioactive Waste Facility. Other operating facilities include process development and robotics laboratories.

2.2.4.4 Central Facilities Area. The Central Facilities Area encompasses about 220 hectares (550 acres) in the southwestern portion of the INEL site and contains over 80 buildings. The Central Facilities Area's purpose is to provide technical and support services for the INEL site. These services include environmental monitoring and calibration laboratories, communication systems, security, fire protection, medical services, warehouses, a cafeteria, vehicle and equipment pools, DOE-ID West office, and bus operations

Major Central Facilities Area facilities include two waste operations facilities, the Hazardous Waste Storage Facility and the INEL Landfill Complex. The Hazardous Waste Storage Facility temporarily stores hazardous wastes pending transport to a commercial, offsite, U. S. Environmental Protection Agency-permitted treatment and disposal site. The Landfill Complex is a facility used to dispose of INEL industrial waste.

2.2.4.5 Power Burst Facility. The Power Burst Facility is located in a 280-hectare (700-acre) area in the southernmost portion of the INEL site off U. S. Highway 20. The original purpose of the Power Burst Facility was for Special Power Excursion Reactor Tests (I-IV), which were severe-damage tests of nuclear fuels and materials used in reactors. This facility is planned for use in a cancer research and treatment program. The reactor support facilities are being used for waste management-related research, including the development of radioactive waste volume-reduction techniques and waste immobilization research.

The Power Burst Facility has four major facilities: the Waste Experimental Reduction Facility, which was designed to treat low-level and mixed low-level waste for volume reduction and removal of Resource Conservation and Recovery Act hazardous waste; the Mixed Waste Storage Facility, which provides temporary storage for mixed low-level waste; the Waste Experimental Reduction Facility Waste Storage Building, which stores waste awaiting treatment in the Waste Experimental Reduction Facility and augments the capacity of the Mixed Waste Storage Facility; and the Waste Engineering Development Facility, which is used for treatment, decontamination, and technology development activities.

Near the Power Burst Facility area is the Auxiliary Reactor Area, which encompasses 22 buildings.

The Auxiliary Reactor Area's original purpose was to test portable power reactors for the U. S. Army. The program has been phased out, and all reactors have been removed or dismantled. All remaining buildings at the Auxiliary Reactor Area have been identified for decontamination and decommissioning. All buildings in the area are vacant except for intermittent small-scale testing programs.

2.2.4.6 Experimental Breeder Reactor-I/Boiling Water Reactor Experiment. This facility area is located in the southwestern portion of the INEL site and encompasses about 4 hectares (10 acres). This facility area originally housed the Experimental Breeder Reactor-I, which became the first reactor to generate usable amounts of electricity. This facility is a National Historic Landmark. Nearby is the Heat Transfer Reactor Experiment Test engine assemblies, which were operated as part of the Aircraft Nuclear Propulsion Program. Also nearby is the Boiling Water Reactor Experiment area. This area originally included five separate experimental reactors, which are not being used and are being, or have been, decontaminated and decommissioned.

2.2.4.7 Radioactive Waste Management Complex. This facility area is the most southwestern of all areas at the INEL site. It contains over 35 buildings and covers about 58 hectares (144 acres).

The original purpose of the Radioactive Waste Management Complex was to dispose of solid radioactive wastes generated at the INEL site and defense wastes (mostly transuranic).

The current purpose of the facility is to provide waste management for interim storage of transuranic waste and disposal of low-level waste. It also supports research and development projects to improve treatment and interim storage of transuranic waste, low-level waste disposal, buried waste remediation technologies, and environmental remediation.

At the Radioactive Waste Management Complex, two main areas, including several major facilities, are operating: the Transuranic Storage Area and the Subsurface Disposal Area. The Transuranic Storage Area is dedicated to the management of transuranic waste, including interim storage operations, certification, technology development, and future transport to the Waste Isolation Pilot Plant. The Stored Waste Examination Pilot Plant, located in the Transuranic Storage Area, is currently on operational standby. The Transuranic Storage Area also includes the following: three asphalt transuranic storage pads, TSA-1, 2, & 3; an area that stores wastes from buried waste retrieval studies, TSA-R; and an Intermediate Level Transuranic Storage Facility, which handles waste with radiation levels that require remote handling. Four new engineered storage modules meeting Resource Conservation and Recovery Act requirements will be constructed by June 1995 for the waste stored on two of the asphalt pads currently covered by air-support structures.

The Subsurface Disposal Area is dedicated to the permanent disposal of low-level waste generated at the INEL site. Related projects support studies of buried waste, remediation technologies, and contaminant migration. The Subsurface Disposal Area includes pits, trenches, and concrete-lined and unlined soil vaults for low-level disposal. One disposal pit (Pit 9) is the subject of a comprehensive demonstration project for buried waste remediation.

2.2.4.8 Naval Reactors Facility. The Naval Reactors Facility area, which covers about 28 hectares (70 acres), is located in the south-central portion of the INEL site. It contains over 70 buildings. The Naval Reactors Facility is under the jurisdiction of the Naval Nuclear Propulsion Program, a joint DOE-Navy program. Its current purposes are as a research and development facility, for training for nuclear power plant operators, and for inspection of naval spent fuel. However, all reactor operations and training at this facility will cease by May 1995.

The major facility at the Naval Reactors Facility is the Expended Core Facility, where naval fuel and fuel from the facility itself are received and examined to support fuel development and performance analyses. The Expended Core Facility also removes structural material from the fuel assemblies prior to transferring the fuel to the Idaho Chemical Processing Plant for storage.

2.2.4.9 Argonne National Laboratory-West. This facility area is the most southeastern facility area on the site and the closest to Idaho Falls [about 43 kilometers (27 miles)]. It houses several major complexes and numerous buildings.

The original purpose of the Argonne National Laboratory-West was as a testing ground for breeder reactor technology. The Experimental Breeder Reactor-II, the first pool-type liquid metal reactor, generated electricity for the INEL site prior to it being shut down in 1994.

The facility area consists of several major complexes, including the Experimental Breeder Reactor-II, the Transient Reactor Test Facility, the Zero Power Physics Reactor, the Hot Fuel Examination Facility, the Fuel Cycle Facility, and the Fuel Manufacturing Facility. The Experimental Breeder Reactor-II was being used to demonstrate the Integral Fast Reactor concept. The Transient Reactor Test Facility and the Zero Power Physics Reactor are used to conduct reactor analysis and safety experiments. The Hot Fuel Examination Facility provides a large inert-atmosphere containment for handling and examining irradiated reactor fuel. The Fuel Cycle Facility has been modified for the Integral Fast Reactor program to demonstrate remote reprocessing and refabrication in the fuel cycle. The Fuel Manufacturing Facility is used to manufacture metallic fuel elements for the fuel cycle.

Supporting facilities at Argonne National Laboratory-West include the Radioactive Liquid Waste Treatment Facility, the Radioactive Scrap and Waste Facility, the Radioactive Sodium Storage Facility, and the Sodium Process Facility. The Radioactive Liquid Waste Treatment Facility processes low-level (aqueous) liquid waste. Transuranic waste from Argonne National

Laboratory-West is stored at the Radioactive Scrap and Waste Facility. Contact-handled mixed waste is stored in the Radioactive Sodium Storage Facility (sodium-contaminated), and remote-handled mixed waste is stored at the Radioactive Scrap and Waste Facility. The Sodium Process Facility was built to process reactor sodium.

2.2.4.10 Idaho Falls Operations. About 30 percent of the INEL's employees work in Idaho Falls and provide administrative and scientific support and nonnuclear laboratory services. The major facility associated with ER&WM is the INEL Research Center, which is the location for a wide variety of disciplines and features a prominent plasma research center, biotechnical center, materials research laboratory, and measurement sciences laboratory. Other major facilities include DOE-ID office buildings, the Willow Creek Building, the INEL Supercomputing Center, the Engineering Research Office Building, and many technical support buildings.

2.2.5 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 by reprocessing. Spent nuclear fuel consists of the unused part of the fuel, fission products, transuranics, and the metal cladding or graphite that surrounds the fuel. Spent nuclear fuel still contains material that can potentially be reclaimed and reused.

2.2.5.1 Current Spent Nuclear Fuel Management. Two basic sources of fuel are handled at the INEL: naval vessel and prototype spent nuclear fuel; and university, commercial, U. S. government (including DOE), and foreign reactor spent nuclear fuel. Figure 2.2-3 shows the current spent nuclear fuel activities and their locations at the INEL site.

Spent nuclear fuel removed from nuclear-powered naval vessels and prototypes has been transported to the Naval Reactors Facility at the INEL site. Shipments have been restricted since June 1993 until this SNF and INEL ER&WM EIS is completed and the Record of Decision has been published.

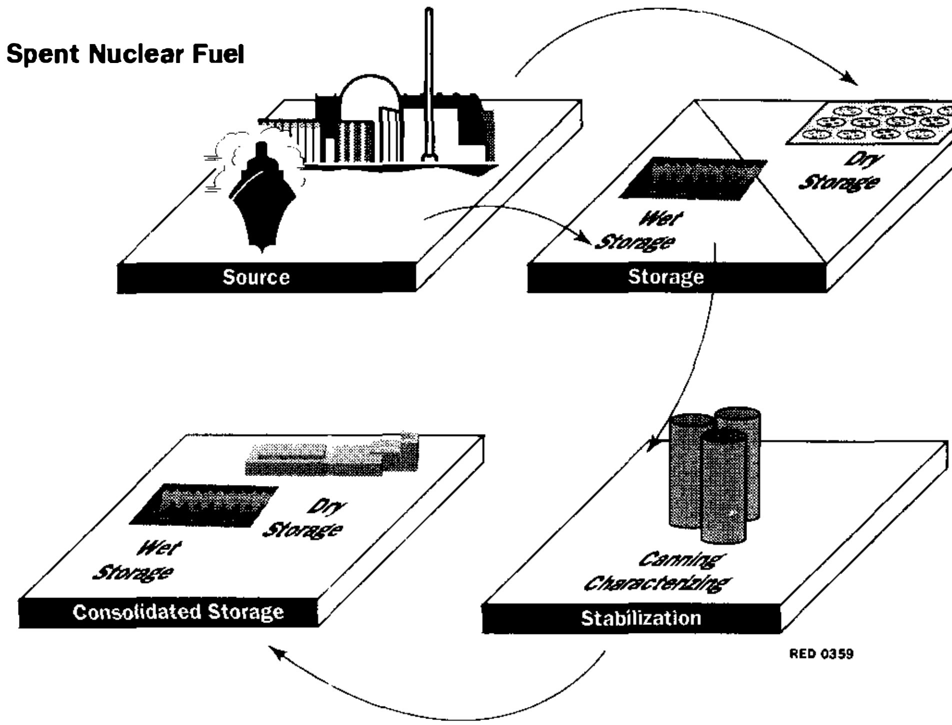


Figure 2.2-3. Current spent nuclear fuel management program at the Idaho National Engineering Laboratory.

Spent fuel is unloaded from shipping containers into water pools at the Expended Core Facility for examination. The examined naval spent nuclear fuel is transferred to the Idaho Chemical Processing Plant at a rate of 1 metric ton of heavy metal per year.

Spent nuclear fuel has also been received at the INEL site from university, commercial and industrial, DOE and other U. S. government, and foreign reactors. Some spent nuclear fuel, such as fuel from university reactors and from the Fort St. Vrain reactor in Colorado, was transported directly to the Idaho Chemical Processing Plant for storage. Damaged Three Mile Island fuel from Pennsylvania was transported directly to Test Area North for examination and storage.

Spent nuclear fuel continues to be generated and transported on the INEL site. Advanced Test Reactor operations continue to generate about 0.1 metric ton of heavy metal per year of spent nuclear fuel that is transported to the Idaho Chemical Processing Plant for storage. The Experimental Breeder Reactor-II operations at Argonne National Laboratory-West continued to generate, through 1994, about 0.3 metric ton of heavy metal per year of spent nuclear fuel. This fuel is stored at Argonne National Laboratory-West. Naval reactor spent nuclear fuel currently examined at the Naval Reactors Facility is transferred to the Idaho Chemical Processing Plant for storage.

At the INEL site, spent nuclear fuel is stored at five facility areas in various dry and wet storage facilities awaiting final disposition. The areas are Test Area North, Test Reactor Area, Idaho Chemical Processing Plant, Power Burst Facility, and Argonne National Laboratory-West. Because fuel is not being reprocessed and disposition options have not yet been selected for spent nuclear fuel, all onsite spent nuclear fuel generation increases the amount stored at the site.

Several specific spent nuclear fuel management activities occur at the Idaho Chemical Processing Plant. As described in Chapter 3, Alternatives, spent nuclear fuel stored underwater at the north and middle basins of Building 603 is to be removed by December 31, 1996, and the entire Underwater Fuel Storage Facility at Building 603 is to be emptied by December 31, 2000. Fuel is being transferred to newer storage facilities at the Idaho Chemical Processing Plant. Equipment is scheduled to be operational by late 1995 that would stabilize the fuel for consolidated storage.

DOE is developing spent nuclear fuel management plans for a timeframe (that is, 40 years) that is anticipated to be sufficient to cover the period during which ultimate disposition for the DOE's spent nuclear fuel will be established and implemented.

2.2.5.2 Vulnerability Assessment. In August 1993, the Secretary of Energy commissioned a comprehensive baseline assessment of the environmental, safety, and health vulnerabilities associated with the storage of spent nuclear fuel in the DOE complex. A multidisciplinary working group comprised of DOE employees and contractors assessed 66 facilities at eight sites to evaluate the inventory and condition of DOE's reactor-irradiated nuclear material, which includes spent nuclear fuel and reactor-irradiated target material. The working group also evaluated the condition of facilities that store spent fuel and identified the vulnerabilities and problems that are currently associated with these facilities. DOE made the working group report to the Secretary

(DOE 1993a) available to the public in December 1993. The working group ultimately identified 106 vulnerabilities associated with spent nuclear fuel storage, including 33 at the INEL site. DOE (1993a) identified eight DOE facilities with major vulnerabilities, including one facility at the INEL, the CPP-603 Fuel Storage Facility.

DOE issued a Phase I Plan of Action to address spent fuel storage vulnerabilities in February 1994 (DOE 1994a), a Phase II Plan of Action in April 1994 (DOE 1994b), and a Phase III Plan of Action in October 1994 (DOE 1994c). A summary of specific corrective actions to address the spent fuel storage vulnerabilities identified at the INEL site are listed in Table 2.2-1. This is not a complete list of the corrective actions but does include those with potential adverse environmental consequences. Many of the corrective actions are currently underway or have been completed. These activities and other planned activities for which the National Environmental Policy Act review is complete before the Record of Decision for this EIS is issued were analyzed under Alternative A (No Action). Activities underway (or to be underway as of June 1995) to address the major vulnerabilities identified at the CPP-603 Fuel Storage Facility would (a) reduce the potential environmental impacts associated with corroded spent fuel, and (b) minimize the release of fissile material to the fuel storage basin. These activities include the following:

- Replacing the failed System for Nuclear Auxiliary Power fuel containers with stainless steel overpacks

- Installing redundant stainless steel rigging on corroded spent nuclear fuel storage equipment

- Transferring spent nuclear fuel out of the north and middle basins of CPP-603 to CPP-666.

Many of the specific INEL spent nuclear fuel Plan of Action projects could result in emissions, worker exposure, or other potential environmental impacts. The potential environmental impacts that could result from each project or corrective action item were not analyzed individually but were collectively enveloped by the spent nuclear fuel management activities reported and analyzed for each alternative in Volume 2. Successful completion of the corrective actions would reduce the near-term environmental, safety, and health risks associated with spent fuel storage at the INEL site.

Table 2.2-1. Corrective actions addressing spent nuclear fuel storage vulnerabilities at the Idabo National Engineering Laboratory.

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
Hot Fuels Examination Facility at Argonne National Laboratory-West			
Lack of an approved safety analysis report for the facility	ID.A.1.1	• Safety analysis report will be updated when mission is defined	To be determined
Radioactive Scrap/Waste Facility			
Corrosion of in-ground carbon steel fuel storage containers - Argonne National Laboratory-West	ID.A.2.1	• Complete relocation of 296 cylinders into new liners (1994–97)	September 1997
		• Complete installation of 608 new liners (1994–99)	September 1999
Zero Power Physics Reactor			
Potential localized radioactive releases from cladding separation from fuels stored in storage vault	ID.A.5.1	• Reencapsulate fuel in sealed inert canisters	Complete
		• Periodically inspect a sample of stored fuel for degradation	Ongoing
Test Area North			
Inadequate corrosion monitoring at Test Area North	ID.E.1.1	• Remove non-Three Mile Island spent fuel stored in aluminum coffins	September 1995
		• Remove non-Three Mile Island spent fuel stored in stainless steel modules	September 1998
		• Transfer all spent fuel from Test Area North Storage Pool	November 1999

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
Test Area North Pool			
Lack of leak detection and leak trending of Test Area North Storage Pool water inventory	ID.E.1.2	• Evaluate leak detection; monitoring system on order	January 1995
Long-term ownership of Test Area North Pool and disposition of residual reactor-irradiated nuclear materials inventory	ID.E.1.3	• Remove non-Three Mile Island spent fuel stored in aluminum coffins	September 1995
		• Remove non-Three Mile Island spent fuel stored in stainless steel modules	September 1998
Test Area North-607 Basin			
Potential deficiency in seismic design of basin	ID.E.1.4	• Complete corrective actions for ID.E.1.1	See ID.E.1.1
Materials Test Reactor Canal			
Inadequate corrosion monitoring	ID.E.3.1	• Remove and visually inspect selected materials for corrosion	Complete
		• Complete transfer of spent fuel into interim dry storage	September 1998
Lack of leak detection and leak trending of Materials Test Reactor Canal water inventory	ID.E.3.2	• Evaluate leak detection instrumentation and make decision	Complete
Canal has no clear DOE ownership (is an orphan facility)	ID.E.3.3	• Office of Nuclear Energy (NE-44) has been identified as the owner	Complete

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
Advanced Reactivity Measurement Facility			
Inadequate corrosion monitoring at Advanced Reactivity Measurement Facility/Coupled Fast Reactivity Measurement Facility Canal	ID.E.4.1	• Remove and visually inspect selected materials for corrosion	Complete
		• Complete transfer of spent fuel into interim dry storage	September 1996
Advanced Reactivity Measurement Facility/Coupled Fast Reactivity Measurement Facility Canal			
Has no programmatic ownership (is an orphan facility)	ID.E.4.2	• Office of Nuclear Energy (NE-44) has been identified as the owner	Complete
Power Burst Facility			
Inadequate corrosion monitoring	ID.E.5.1	• Remove and visually inspect selected materials for corrosion	Complete
		• Complete transfer of spent fuel into interim dry storage	September 1997
CPP-603 Basins			
Corrosion of aluminum associated with fuel and release of fissile material and radionuclides into the basin environment	ID.W.1.1	• Overpack failed System for Nuclear Auxiliary Power fuel containers	Complete
		• Complete upgrade of basin radionuclide removal/support systems	September 1995
		• Complete canning and transfer of 428 fuel units	December 2000

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
CPP-603 Basins (continued)			
Uncharacterized water content of fuel now stored or to be encapsulated in containers	ID.W.1.2	• Establish technology for nondestructive examination of canisters and measurement of contents	December 1995
		• Complete fuel storage canister water content measurements	September 1997
Institutional criticality control of stored reactor-irradiated nuclear materials	ID.W.1.3	• Complete development of Basis for Interim Operation for unresolved safety questions	Complete
		• Complete procedures and training to implement Basis for Interim Operation	Complete
No repacking capability at CPP-603 (required to help minimize the effects of corrosion on the fuel assemblies and ensure safe storage of the fuel)	ID.W.1.4	• Complete Operational Readiness Review activities for canning	April 1997
		• Complete canning and transfer of 423 fuel units	December 2000
Excessive corrosion of fuel handling units at CPP-603	ID.W.1.6	• Transfer 199 fuel units from CPP-603 to CPP-666	Complete
		• Transfer 179 fuel units from CPP-603 to CPP-666	December 1995
		• Transfer remaining fuel units from CPP-603 to CPP-666	December 1996

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
CPP-603 Basins (continued)			
Lack of leak detection and leak trending of release of fission products into the environment from the spent fuel storage basins at CPP-603	ID.W.1.7	• Complete installation of higher accuracy level monitoring equipment	Ongoing
		• Continue periodic observation of three monitoring wells	Ongoing
Worker exposures and releases to the environment during encapsulation of fuel in CPP-603 basins	ID.W.1.10	• Complete removal of accessible sludge	To be determined
		• Complete upgrade of basin radionuclide removal/support systems	September 1995
		• Implement operating procedures for fuel recovery/encapsulation	Ongoing
Basin wall failure and superstructure collapse from a large seismic event	ID.W.1.11	• Complete Basin Water Removal Program Plan	September 1996
		• Complete transfer of fuel to CPP-666 or dry storage	December 2000
		• Complete removal of basin water	December 2003
Excessively corroded and cracked carbon steel yokes and baskets could fail, potentially resulting in a criticality	ID.W.1.12	• Overpack failed System for Nuclear Auxiliary Power fuel containers	Complete
		• Complete canning and transfer of 428 fuel units	December 2000

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
CPP-666 Basins			
Corrosion of aluminum clad fuel and release of fissile material and radionuclides into the CPP-666 basin environment	ID.W.2.1	• Implement improved monitoring and control of CPP-666 water	September 1997
		• Design and procure new stainless steel baskets	September 1999
Susceptibility to damage and downgrading of engineered safety features at CPP-666 basins	ID.W.2.2	• Review criticality configuration and document controls	September 1994
		• Evaluate engineered safety features and monitoring/preventive maintenance programs	September 1996
CPP-603/Irradiated Fuel Storage Facility			
Ignition of brittle cardboard fuel containers at the facility	ID.W.3.2	• Complete electrical upgrade project	October 1995
		• Complete transfer of fuels in cardboard containers to Oak Ridge	September 1995
Roof collapse and control room equipment failure from a large seismic event	ID.W.3.3	• Complete seismic evaluation of fuel storage rack inside vault	January 1995
		• Complete seismic evaluation of concrete structure and roof	September 1995

Table 2.2-1. (continued).

Facility and concern	Identification number[a]	Corrective action	Scheduled completion date
CPP-603 Fuel Element Cutting Facility			
Possible degraded Peach Bottom fuel	ID.W.4.2	• Inspect containers to determine condition and support retrieval	March 1995
CPP-749 Drywells			
Potentially degrading aluminum fuel cans and baskets	ID.W.5.2	• Complete 8 fuel transfers into second generation drywells	September 1995
		• Complete 25 fuel transfers into second generation drywells	September 1996

a. Tracking and identification number from DOE (1994c).

The working group report identified a vulnerability associated with a lack of a path for the ultimate disposition of spent nuclear fuel stored at INEL facilities. The Plan of Action identifies the completion of this EIS as a corrective action to address this vulnerability. In fact, this EIS is intended to support decisions needed to safely manage spent nuclear fuel until future decisions regarding its ultimate disposition are made and implemented.

In addition to the Spent Fuel Working Group report on vulnerabilities and the associated plans of action to resolve the identified vulnerabilities, the Defense Nuclear Facilities Safety Board issued Recommendation 94-1 calling for DOE to develop an expedited schedule for resolving identified vulnerabilities across the DOE complex. Recommendation 94-1 was critical of DOE's lack of urgency in correcting known spent nuclear fuel management deficiencies. Further, Recommendation 94-1 criticized DOE's lack of prioritization of corrective actions and lack of an integrated systems approach to resolving previously identified spent nuclear fuel management issues. DOE has developed a plan for implementing Recommendation 94-1 across the DOE complex. The implementation plan was submitted to the Defense Nuclear Facilities Safety Board on February 28, 1995 (DOE 1995). The plan includes a prioritization of corrective actions to remedy known deficiencies utilizing a DOE complex-wide systems approach and in consideration of limited budgets. The plan focuses on fulfilling outstanding commitments to other parties (for example, court-ordered milestones) and fully recognizes the urgency required to rectify long-standing spent nuclear fuel management issues.

2.2.6 Environmental Restoration

Since the 1970s, the INEL Environmental Restoration Program has addressed contamination issues resulting from the past 45 years of operations at the site. Environmental restoration includes two major program elements: (a) remediation and (b) decontamination and decommissioning.

2.2.6.1 Remediation. Remediation is the process of assessing and cleaning up releases and threatened releases of hazardous substances, including radioactive substances at the INEL. The remediation program at the INEL is conducted under the Federal Facility Agreement and Consent Order, entered into by DOE, the U. S. Environmental Protection Agency, and the State of Idaho pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The INEL follows the remedial action process (Figure 2.2-4) established under CERCLA and its implementing regulation, the National Contingency Plan. Under CERCLA, the INEL entered into the Federal Facility Agreement and Consent Order, which provides site-specific direction for the remedial action process. This process directs both the assessment and cleanup of release sites and is designed to support an informed risk management decision regarding which remedy is most appropriate for a given site. The process is flexible enough to be tailored to the specific circumstances of individual potential release sites.

Flexibility in the process is allowed by following different assessment tracks. Track 1 studies are for sites that will not likely require any cleanup action and can be assessed with existing available information. Track 2 studies are for sites or operable units that require field data collection to make a determination as to the potential risk. Both Track 1 and 2 studies are considered preliminary scoping studies. A Remedial Investigation/Feasibility Study is a more rigorous study for sites where more extensive characterization of contamination, assessment of risk, and evaluation of cleanup alternatives are required to reach a final cleanup decision.

If at any time it is determined that a threat exists and there is greater urgency to reach the cleanup phase, an interim action may be implemented. Removal actions may also be implemented for small sites with relatively simple cleanups that will achieve progress toward the long-term remedial action.

Once a study is complete and an interim or final action is identified, a proposed plan is issued for public comment. The proposed plan summarizes the investigation and risk assessment and identifies the preferred cleanup alternative. When all comments have been considered, a CERCLA Record of Decision is issued that selects the cleanup alternative. This Record of Decision also establishes the cleanup objectives and criteria that will be met to adequately protect human health and the environment. The Remedial Design/Remedial Action phase occurs after the cleanup is authorized by this Record of Decision. Remedial action is successfully completed when DOE-ID and the regulatory agencies agree that all the requirements established in the Record of Decision have been met.

DOE has identified and currently is implementing the remediation process on areas at the INEL site where hazardous substances have been or are suspected of having been released to the

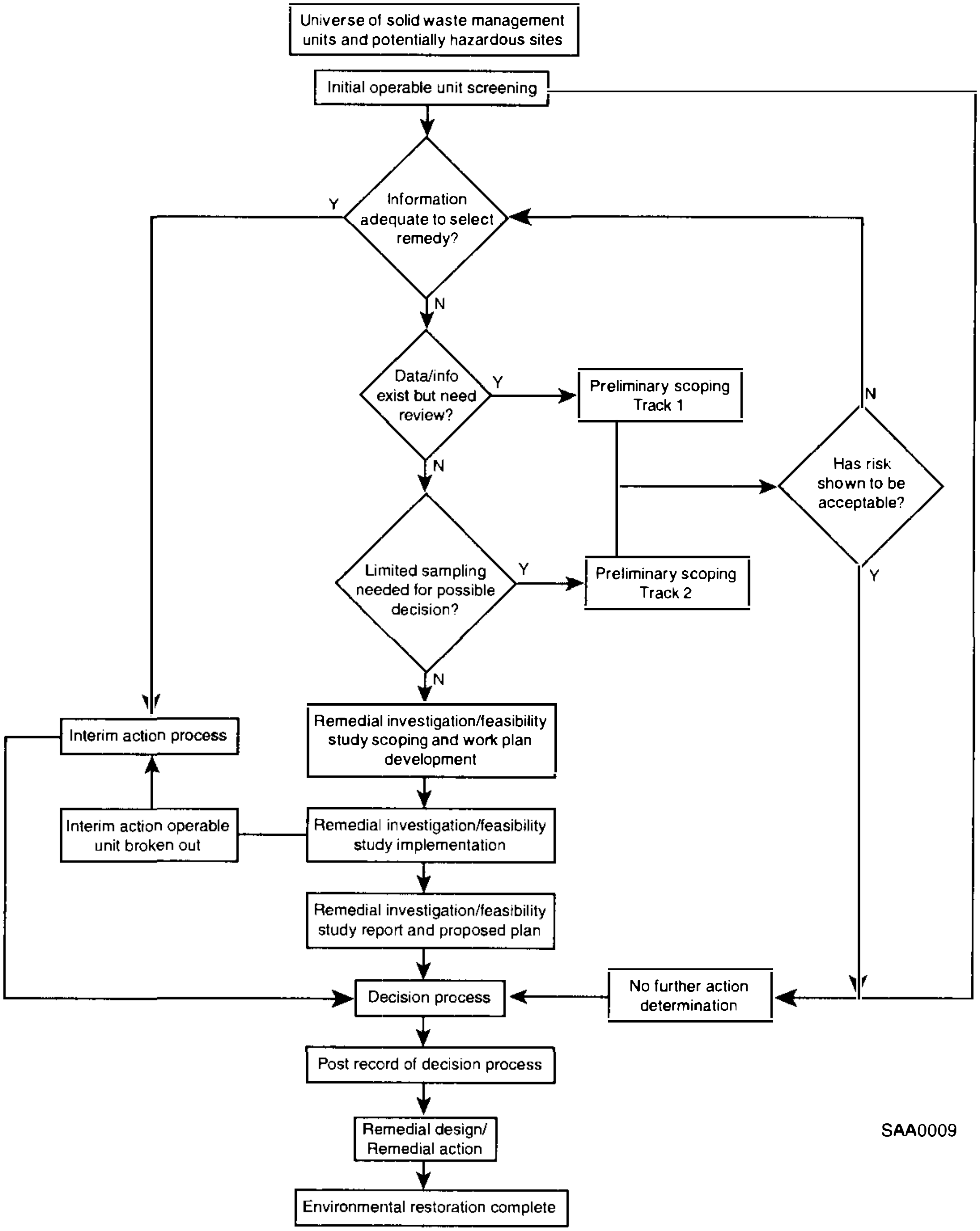


Figure 2.2-4. Flow chart of remedial action process at the Idaho National Engineering Laboratory.

environment. Since 1986, about 500 suspected release sites have been identified at the INEL site for investigation. As of June 1994, over 270 of the suspected release sites had been proposed or designated as requiring no further action.

Release sites with similar contamination problems are grouped together into operable units to promote management and cleanup efficiency. Operable units are, in turn, grouped into 10 location areas called Waste Area Groups (WAGs), for efficiency in managing the assessment and cleanup process. Nine of these Waste Area Groups are roughly equivalent to the major facility areas identified in Section 2.2.4, Major Facility Areas (see Figure 2.2-2). 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.

Sources of contamination at the INEL include spills, abandoned tanks, septic systems, percolation ponds, landfills, and injection wells. Contaminated sites range from large facilities, such as the Subsurface Disposal Area (pits and trenches) at the Radioactive Waste Management Complex (WAG 7), to small areas in various locations where minor spills may have occurred. Table 2.2-2 summarizes current information on wastes and contaminants for each Waste Area Group.

Numerous proven technologies are suitable for cleanup of the potential release sites identified at the INEL. These technologies include containment (capping, vertical barriers, and subsurface horizontal barriers), immobilization (solidification and stabilization), physical processes (separation, soil washing, vacuum extraction, air stripping, filtration, ion exchange, and membrane separation), thermal processes (incineration, pyrolysis, wet oxidation, or in situ vitrification), chemical processes (reduction/oxidation, neutralization, precipitation, and dechlorination), and biological processes (aerobic and anaerobic digestion and biodegradation).

2.2.6.2 Decontamination and Decommissioning. Decontamination and decommissioning activities are concerned with safely managing contaminated surplus nuclear facilities until they are decontaminated for reuse or decommissioned. A long-term goal for DOE is to decontaminate and decommission all contaminated surplus facilities as funds become available to ensure that human health and the environment are protected.

Table 2.2-2. Waste types and contaminants located at Waste Area Groups at the Idabo National Engineering Laboratory.

Waste Area Group	Location	Waste site	Main contaminants of concern	Types of waste
1	Test Area North	Underground storage tanks, pits, ponds, railroad turntable	Acids, petroleum products, asbestos, fission products, organic wastes, heavy metals	Hazardous, mixed, radioactive
2	Test Reactor Area	Leaching pond, underground storage tank, rubble piles, cooling towers, injection well, french drains, spills	Organic wastes, petroleum products, fission products, heavy metals	Hazardous, mixed, radioactive
3	Idaho Chemical Processing Plant	Septic tanks, cesspools, seepage pits, spills, fly ash pit, injection well, sewage treatment plant, gravel pits, french drains	Organic wastes, petroleum products, fission products, transuranic radionuclides, asbestos, acid salts, heavy metals	Hazardous, mixed, radioactive
4	Central Facilities Area	Spills, underground tanks, landfill, leach fields	Ordnance, salts of acids, petroleum products, heavy metals, fission products, asbestos, organic wastes	Hazardous, mixed, radioactive
5	Power Burst Facility/ Auxiliary Reactor Area	Evaporation ponds, sanitary sewer, waste sumps, storage pads	Fission products, petroleum products, heavy metals, organic wastes	Hazardous, mixed, radioactive
6	Experimental Breeder Reactor-I/ Boiling Water Reactor Experiment	Reactor burial site, trash dump, fuel oil tanks, septic tanks, leach pond, spills	Heavy metals, organics, fission products, petroleum products	Hazardous, mixed, radioactive, solid
7	Radioactive Waste Management Complex	Soil vaults, acid pit, waste pits and trenches, septic tank	Fission products, transuranic radionuclides, organic wastes, salts of acids, ordnance, heavy metals	Radioactive, hazardous, mixed
8	Naval Reactors Facility	Landfills, spill sites, wastewater disposal systems, storage areas	Heavy metals, organics, petroleum products, radionuclides	Hazardous, radioactive
9	Argonne National Laboratory-West	Tanks, wastewater handling/disposal systems, pits, ditches, ponds, drains	Heavy metals, fission products, petroleum products, dioxins/furans	Hazardous, mixed, radioactive
10	Miscellaneous (including Snake River Plain Aquifer)	Organic Moderated Reactor Experiment, ordnance areas, liquid corrosive chemical disposal area, leach pond	Salts of acids, fission products, organic wastes, ordnance	Hazardous, mixed, radioactive

After a facility ceases operations, but prior to its being accepted into the Decontamination and Decommissioning Program, it enters the Facility Transition Program. The purpose of this program is to provide a consistent approach to determine whether a facility is available for reuse or a candidate for decontamination and decommissioning. This phase consists of (a) termination of facility operations; (b) placement of the facility on the Surplus Facilities List, if no other mission is identified; (c) establishment of a surveillance and maintenance program to monitor the remaining known hazards and to maintain the facility in a safe condition; (d) achievement of safe shutdown/deactivation; and (e) transfer of the facility to the DOE Office of Environmental Restoration.

The Surplus Facilities List can be found in the INEL D&D Long-Range Plan (Buckland et al. 1993). Some of the larger surplus facilities on this list are Auxiliary Reactor Area-II, Boiling Water Reactor Experiment-V, Engineering Test Reactor facilities, Materials Test Reactor facilities, Fuel Processing Complex, Fuel Receipt/Storage Facility, Headend Processing Plant, and the Waste Calcine Facility.

After a facility has been accepted into the Decontamination and Decommissioning Program, a long-term surveillance and maintenance program is established and shutdown and deactivation is advised. Typical activities for safe shutdown include

- Removing special nuclear material, hazardous chemicals, combustible materials, and sources of radioactivity

- Ensuring that the minimum necessary confinement systems (both structures and heating and ventilating) are working

- Controlling access of personnel.

Surveillance and maintenance activities are performed, which include monitoring remaining known hazards and maintaining the facility in a safe condition until it is ready for decontamination and decommissioning.

Next, a project plan is written. The project plan identifies the preferred decontamination and decommissioning options, DOE's proposed strategy for compliance with the National Environmental Policy Act, and the relationship to the Comprehensive Environmental Response, Compensation, and Liability Act. The options that can be considered under the decontamination and decommissioning program vary depending on the condition of the facilities, but generally fall under one of four categories: safe storage, in-place stabilization (such as entombment), decontamination for reuse, and dismantlement. Various types of radioactive waste (for example, low-level, mixed low-level, high-level, transuranic) in varied quantities could potentially result from decontamination and decommissioning activities, depending on the previous use of a particular facility.

The next step is to complete an environmental review with the preparation of a safety analysis and risk assessment and then reach a documented decision defining the proposed scope and end condition of the project.

Next, a decommissioning plan is prepared, the surveillance and maintenance program is phased out, a contractor is selected, and the plan is executed. After the completion of the decommissioning plan, the closeout documentation is prepared and an independent verification is conducted to ensure the plan has been met.

Postoperations activities, where appropriate, consist of long-term surveillance and maintenance or other controls to carry out the final disposition of the project. These activities would continue to ensure protection of human health and the environment.

2.2.7 Waste Management

Waste management activities under the ER&WM Program include minimization, characterization, treatment, storage, and disposal of wastes generated from ongoing INEL activities and from other major sources, such as environmental restoration and decontamination and decommissioning activities. The Waste Management Program ensures that current and future waste management practices minimize any additional adverse environmental impacts. During the past four decades, hazardous and radioactive waste has been produced, stored, treated, and/or disposed of at the INEL site. In addition, every operating facility produces waste that must be managed. Several general types of wastes are managed at the INEL. These waste types are defined in Appendix E, Glossary, and discussed in the following sections. Because mixed low-level waste represents the great majority of mixed waste, it is discussed separately in Section 2.2.7.1.4. Mixed high-level waste and mixed transuranic waste are discussed under the high-level waste and transuranic waste sections, 2.2.7.1.1 and 2.2.7.1.2, respectively.

2.2.7.1 Radioactive Waste. Radioactive waste is grouped into several categories, depending on the amount and types of radioactivity it contains (for example, low-level waste) or the source of the waste (for example, high-level waste). The definitions for radioactive waste come from limits established primarily by the Atomic Energy Act and DOE orders. (More information on radioactivity is given in Appendix A, Primer on Radioactivity and Toxicology.) Presently, there are four radioactive waste streams managed at the INEL: high-level, transuranic, low-level, and mixed low-level.

2.2.7.1.1 High-Level Waste—The term high-level radioactive waste means (a) the highly radioactive material resulting from reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and (b) other highly radioactive material that the U. S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation. Radioactive sodium-bearing liquid (produced by decontamination activities) is also managed as high-level liquid waste (see Appendix E, Glossary, for a definition of sodium-bearing waste). The current INEL high-level waste management program, as depicted in Figure 2.2-5, is conducted at the Idaho Chemical Processing Plant.

From 1953 to 1992, high-level liquid waste at the INEL resulted from reprocessing spent nuclear fuel; however, reprocessing was phased out in 1992. Certain other processes generate waste handled as high-level liquid waste. For example, the process equipment waste evaporator, which concentrates low-level waste, and the Liquid Effluent Treatment and Disposal Facility, which processes evaporator vapors, both generate such waste. Also, the calcined bed from the New Waste Calcining Facility (described below) is periodically dissolved and stored as high-level waste. These sources generated about 560 cubic meters (730 cubic yards) of liquid high-level waste in 1993.

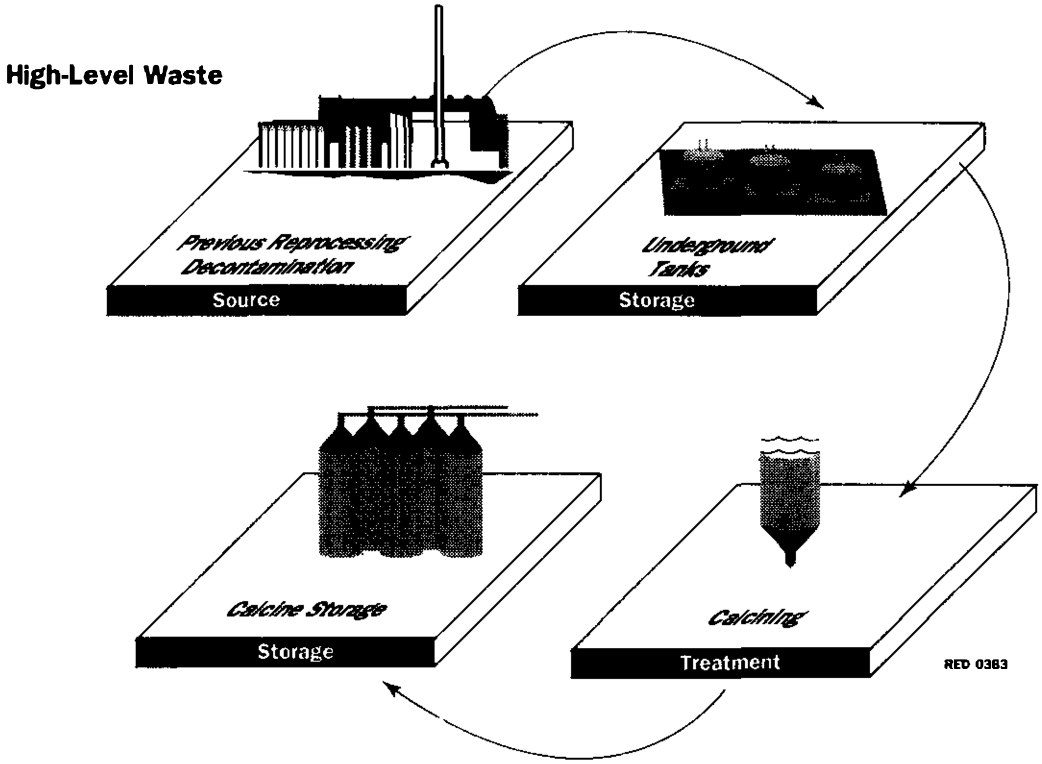


Figure 2.2-5. Current high-level waste management program at the Idaho National Engineering Laboratory.

Liquid waste is temporarily stored in eleven 1,100-cubic-meter (300,000-gallon) stainless steel tanks contained in concrete vaults at the Idaho Chemical Processing Plant. Only one tank contains high-level waste from previous reprocessing. Most of the remaining liquid waste is sodium-bearing, which is stored separately in some of the 11 tanks. A project to upgrade the piping associated with all the tanks is in progress.

These tanks are required to be taken out of service in the next two decades (some in 2009, the rest in 2015). They were built to the standards existing at the time of construction (1950 to 1965) but do not meet all current standards. A project was in progress to replace these aging tanks; however, once fuel reprocessing was phased out in 1992 at the Idaho Chemical Processing Plant, it was not clear that the new tanks would be required. DOE commissioned a study to evaluate all feasible options for emptying the existing tank farm and to determine the need for replacement tanks (Palmer et al. 1994). Options from that study form the basis for the alternatives described in Chapter 3 of Volume 2 of this EIS.

High-level liquid waste has been blended routinely with sodium-bearing liquid and solidified (calcined) at the New Waste Calcining Facility. Calcining transforms the waste into dry, noncorrosive granules. For calcination, sodium-bearing wastes have also been blended with purchased chemicals (aluminum nitrate) because the sodium-bearing waste cannot be directly calcined. The calcining process is not scheduled to resume until 1996. Equipment to concentrate the sodium-bearing waste by evaporation is being installed during the current shutdown of the New Waste Calcining Facility.

The calcined waste is stored at the Idaho Chemical Processing Plant in stainless steel closed bins inside near-surface concrete vaults. Seven sets of bins have been built: five sets are full; the sixth set is partially full.

Because the calcined waste remains a Resource Conservation and Recovery Act (RCRA) hazardous waste, it is regulated under RCRA and is subject to land disposal restrictions. Ultimately, DOE envisions that the calcined waste would be converted to an immobilized form and disposed of at a geologic repository.

2.2.7.1.2 Transuranic Waste—Transuranic waste is defined as radioactive waste having concentrations greater than 100 nanocuries per gram of transuranic elements (elements which have an atomic number greater than 92) with half-lives greater than 20 years. The radioactive nuclides in transuranic waste emit alpha radiation, which requires minimal shielding when outside the body but can severely damage lung tissue if inhaled. Transuranic wastes require long-term isolation from the environment.

Transuranic waste disposed or stored at the INEL has been generated primarily by national defense activities located offsite. Small volumes of transuranic waste have been generated at the INEL, primarily from fuel examination activities. Additional waste may be generated by spent nuclear fuel processing. Some transuranic waste [about 0.15 percent of INEL stored waste

(DOE 1992)] contains high levels of radioactivity and may require more than minimal shielding and remote handling. Figure 2.2-6 depicts the current INEL transuranic waste management program.

In the early 1980s, the definition of transuranic waste was revised from greater than 10 to greater than 100 nanocuries per gram. As a result, nearly half of the waste now in storage at the Transuranic Storage Area of the Radioactive Waste Management Complex is expected to fall below the limit (Pole 1993). The waste falling between the 10-and-100-nanocuries-per-gram limit is now called alpha low-level waste. Although this waste is technically considered low-level waste rather than transuranic waste, it cannot be disposed of at the INEL because it does not meet all INEL low-level waste acceptance criteria (DOE-ID 1994). Alpha low-level waste and transuranic waste are

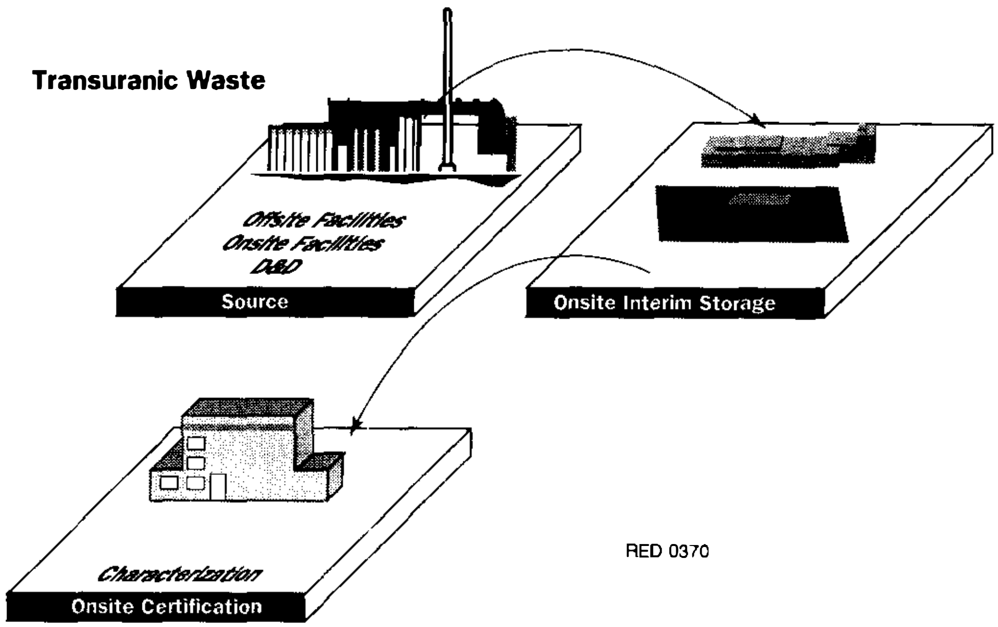


Figure 2.2-6. Current transuranic waste management program at the Idaho National Engineering Laboratory.

often mixed with other hazardous wastes. Alpha low-level wastes and alpha mixed low-level wastes are managed together at the INEL site. Both of these waste types are managed as a part of the transuranic waste stream.

Since 1954, the INEL site has received transuranic waste from both offsite and onsite waste generators for disposal or interim storage. When transuranic waste was first accepted at the Radioactive Waste Management Complex, it was disposed of in pits and trenches. This waste was often intermixed with low-level waste. After 1964, transuranic waste was placed into pits and trenches separate from low-level waste. In 1970, national policy mandated that newly generated transuranic waste be placed into retrievable storage pending permanent disposition at some other facility. The Transuranic Storage Area was established at the Radioactive Waste Management Complex to provide this interim storage. The transuranic waste stored at the Radioactive Waste Management Complex represents over half the retrievable transuranic waste in the entire DOE complex.

Although there is still no facility for disposal of transuranic waste, it is managed assuming that it will be retrieved from storage, repackaged, certified to meet disposition facility requirements, and transported to the Waste Isolation Pilot Plant for final disposition. A strategy for disposing of alpha low-level and alpha mixed low-level waste has yet to be established. Challenges to overcome include

- Storage space for transuranic waste at the INEL site is limited.

- Disposal facilities are not currently available at INEL site for alpha low-level waste.

- Certification or licensed transportation systems do not exist for remote-handled transuranic waste.

- Some stored transuranic waste at the INEL site is incompatible with the U. S. Nuclear Regulatory Commission-licensed shipping container (TRUPACT II).

- Waste Isolation Pilot Plant uncertainties:

- Final waste acceptance criteria unknown

  -- Need to treat waste for compliance to Resource Conservation and Recovery Act and/or 40 CFR 191

  -- Extent of needed waste characterization

  -- Schedule for initiating disposal operations (currently scheduled for 1998)

  -- Whether to accept pre-1970 transuranic waste for disposal.

A small amount of transuranic waste is being generated onsite (Pole 1993). Transuranic waste generated at the Test Reactor Area is stored at the Radioactive Waste Management Complex. Through an agreement with the State of Idaho, Argonne National Laboratory-East transports to the INEL site a small amount of transuranic waste generated as a result of INEL-related activities. Transuranic waste is also generated from environmental remediation and decontamination and decommissioning projects. Shipments of transuranic waste may also be accepted on a case-by-case basis from other DOE sites.

Approximately 65,000 cubic meters (85,000 cubic yards) of transuranic and alpha low-level waste are retrievably stored on above ground asphalt pads covered with plywood, plastic, and soil and in air support buildings at the Transuranic Storage Area of the Radioactive Waste Management Complex. New storage facilities, which meet State and U. S. Environmental Protection Agency Resource Conservation and Recovery Act requirements for hazardous waste storage, are being constructed to replace these older facilities. Waste is being removed from the older storage facilities and placed into new storage as these structures are completed. Waste received from offsite is placed into storage pending characterization. Small quantities of transuranic waste generated by current operations are also being placed into storage. Some transuranic waste is also stored at the Radioactive Scrap and Waste Facility at Argonne National Laboratory-West.

Another 62,000 cubic meters (81,000 cubic yards) of transuranic and alpha low-level waste (Morton and Hendrickson 1995) have been disposed of by burial in pits, trenches, and soil vaults at the Subsurface Disposal Area at the Radioactive Waste Management Complex prior to 1970.

DOE expects that much of the transuranic waste stored at the INEL site will have to be repacked and/or treated to meet the waste acceptance criteria for the Waste Isolation Pilot Plant. Activities are underway at the INEL to prepare to transport stored certified transuranic waste to the Waste Isolation Pilot Plant for disposition. The Stored Waste Examination Pilot Plant, which would support the retrieval and certification of transuranic waste for transport to the Waste Isolation Pilot Plant, is on operational standby. A new waste characterization facility is planned to provide required analyses of a representative sample of wastes before transport.

DOE is investigating the feasibility of constructing a facility (the Idaho Waste Processing Facility) that could be used to treat alpha mixed low-level waste. The facility would first be used to treat alpha mixed low-level waste and later to repackage or treat transuranic waste that could be certified to meet both transportation criteria and the Waste Isolation Pilot Plant waste acceptance criteria. DOE is also investigating the possibility of offsite commercial treatment of transuranic and alpha mixed low-level waste.

2.2.7.1.3 Low-Level Waste—Low-level waste is best defined in terms of what it is not. Low-level waste is radioactive waste that is not high-level, transuranic, or by-product material containing uranium or thorium from processed ore. Most low-level waste contains short-lived radionuclides and generally can be handled without additional shielding or remote handling equipment. The current INEL low-level waste management program is depicted in Figure 2.2-7.

Low-level waste is generated at the Test Reactor Area, Idaho Chemical Processing Plant, Central Facilities Area, Power Burst Facility, Radioactive Waste Management Complex, Naval Reactors Facility, Test Area North, and Argonne National Laboratory-West. About 60 percent of the waste generated is treated to reduce volume and stabilize it before disposal. The waste has been treated through incineration, either onsite at the Waste Experimental Reduction Facility located at the Power Burst Facility or at an offsite commercial facility. Currently, the waste is treated through compaction or size reduction at the Waste Experimental Reduction Facility. Operation of the Waste

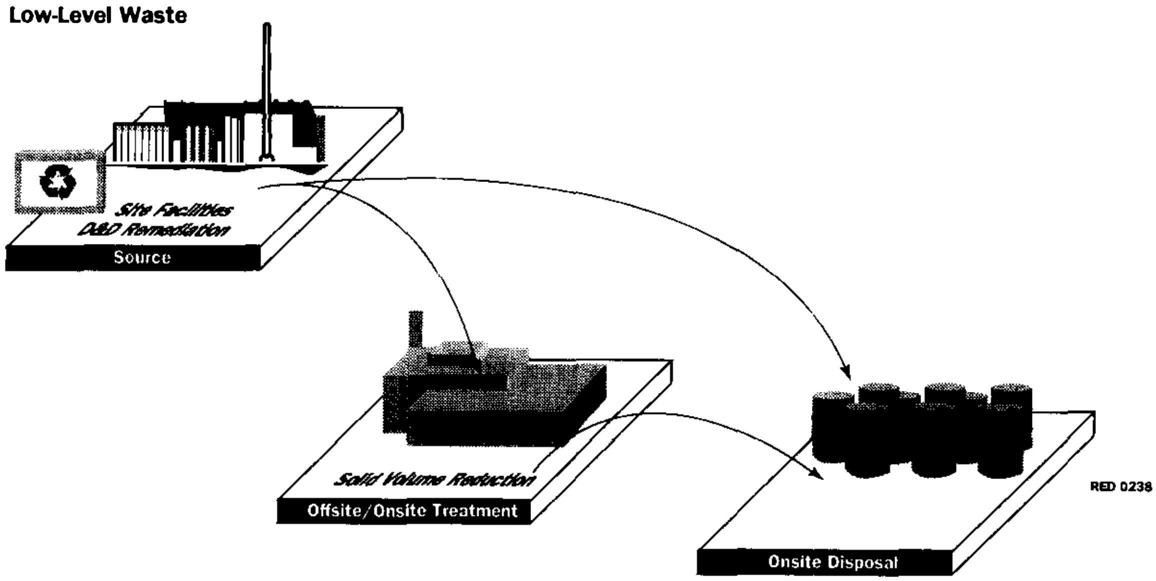


Figure 2.2-7. Current low-level waste management program at the Idaho National Engineering Laboratory.

Experimental Reduction Facility was suspended during 1991 through 1993 to upgrade the facility. During the shutdown, an environment assessment (DOE 1994d) was prepared. Based on this environmental assessment and a Finding of No Significant Impact issued in June 1994, DOE is undertaking supplemental volume reduction activities at the Waste Experimental Reduction Facility with offsite incineration at commercial facilities. This offsite incineration includes shipping the waste from the INEL site and accepting the resulting ash at the INEL site for disposal at the Radioactive Waste Management Complex.

Waste incineration is a process by which combustible waste materials are burned, producing combustion gases, noncombustible residue, and ash. Incineration also reduces the mass and volume of the waste. Reductions in volume of 200 to 1 if ash is not stabilized, or 70 to 1 if ash is stabilized in cement, are typical.

Solid low-level waste is disposed of through shallow land burial at the Radioactive Waste Management Complex in pits and concrete-lined soil vaults in the Subsurface Disposal Area. The Subsurface Disposal Area occupies approximately 35 hectares (88 acres). As of 1991, the total available capacity for low-level waste disposal in the area was 37,000 cubic meters (48,000 cubic yards). An additional 67,000 cubic meters (88,000 cubic yards) of expansion capacity is potentially available. About 40 percent of solid low-level waste generated onsite is sent directly to the Radioactive Waste Management Complex without treatment.

Most liquid low-level waste is concentrated at the Idaho Chemical Processing Plant. The condensed vapor (condensate) from the Idaho Chemical Processing Plant process equipment waste evaporator is then processed by the Liquid Effluent Treatment and Disposal Facility and the gaseous effluent vented out the high-efficiency particulate air filtered stack. The material remaining after evaporation is then pumped to the Idaho Chemical Processing Plant tank farm. Some small volumes of radioactive liquids are also solidified at the Waste Experimental Reduction Facility and disposed of at the Radioactive Waste Management Complex. All of Argonne National Laboratory-West's low-level (aqueous) liquid waste is processed at that facility's Radioactive Liquid Waste Treatment Facility. It is volume-reduced to a sludge and then transported to the Radioactive Waste Management Complex. Small volumes are discharged to the double-lined pond at the Test Reactor Area. Potential low-level waste from storm runoff at Test Area North is handled through an ion exchange system.

2.2.7.1.4 Mixed Low-Level Waste—Mixed low-level waste contains Resource Conservation and Recovery Act (RCRA)-controlled substances and is radioactive. It is managed according to RCRA requirements because of its RCRA hazardous waste characteristics and according to the Atomic Energy Act because of its radioactive components. The current INEL mixed low-level waste management program is depicted in Figure 2.2-8.

Mixed low-level waste is further divided into two categories for management purposes: alpha mixed low-level waste and beta-gamma mixed low-level waste. The difference between the categories is the quantity of transuranic radionuclides in the mixed waste. Most of the alpha mixed low-level waste stored at the INEL site is waste that has been reclassified from mixed transuranic waste. Most

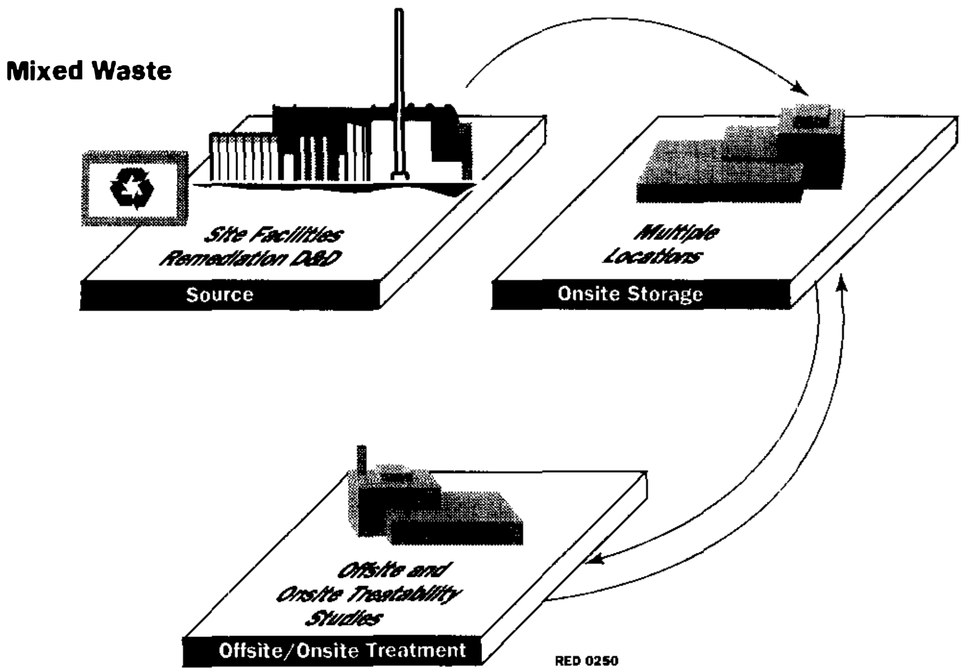


Figure 2.2-8. Current mixed low-level waste management program at the Idaho National Engineering Laboratory.

of the mixed low-level waste currently stored at the INEL site is alpha mixed low-level waste transported to the INEL for storage and treatment from offsite generators. This alpha mixed low-level waste is managed as part of the transuranic waste stream and is described more fully in Section 2.2.7.1.2, Transuranic Waste. The remainder of this section relates only to beta-gamma mixed low-level waste.

Under U. S. Environmental Protection Agency regulations, mixed low-level waste must be treated before land disposal, and disposal facilities must meet RCRA minimum technology requirements. The RCRA hazardous waste portion of mixed low-level waste is subject to the land disposal restrictions of the Act. Land disposal restrictions prohibit the disposal of any

RCRA-controlled waste generated after waste-specific prohibitions are in effect. Storage of restricted wastes is prohibited unless the wastes are being stored for the purpose of accumulating sufficient quantities for treatment. As a general rule, if no treatment technologies are available for such wastes, storage is prohibited. As discussed in Sections 7.2.1.8 and 7.2.5.9, Federal Facility Compliance Act, mixed waste treatment plans are currently under development. The potential activities and methods identified in the plans are reflected in the alternatives described in Chapter 3, Alternatives, and analyzed in Chapter 5, Environmental Consequences.

Mixed low-level waste is generated at Test Area North, Test Reactor Area, Idaho Chemical Processing Plant, Central Facilities Area, Power Burst Facility, Radioactive Waste Management Complex, Naval Reactors Facility, Argonne National Laboratory-West, and the Idaho Falls facilities. Sources include environmental restoration, decontamination and decommissioning, production operations, laboratory activities, construction, maintenance, and research and development activities.

Waste minimization is also being used at the INEL to eliminate potential sources of mixed low-level waste before generation. These efforts include using improved operating practices, technology changes, raw material changes, product changes, waste avoidance through recycling, and other actions.

Eleven hundred cubic meters (1,400 cubic yards) of mixed low-level waste are currently onsite and stored in permitted (or interim status) storage facilities onsite. Existing permitted storage capacity is 1,800 cubic meters (2,300 cubic yards).

Mixed low-level waste at the INEL is stored at the Mixed Waste Storage Facility (or Waste Experimental Reduction Facility Waste Storage Building) and portable storage units at the Power Burst Facility area. In addition, smaller quantities of mixed low-level waste are stored in various facilities at the INEL including the Hazardous Chemical/Radioactive Waste Facility at the Idaho Chemical Processing Plant, the Radioactive Sodium Storage Facility, Building 703, and the Radioactive Scrap and Waste Facility at Argonne National Laboratory-West. The majority of mixed low-level waste at the INEL is waiting treatment and disposal; a small amount is being treated through ongoing treatability studies both onsite and offsite.

As part of the site treatment plans required by the Federal Facility Compliance Act, preferred treatment options have been identified to eliminate the hazardous waste component for many types of mixed low-level waste (DOE-ID 1993b). Existing treatment facilities include the Waste Experimental Reduction Facility incinerator and stabilization system and the Waste Engineering Development Facility stabilization system, all of which are currently on operational standby. Additional facilities include a portable water treatment unit, debris treatment at the Idaho Chemical Processing Plant, and the high-efficiency particulate air filter leach system at the Idaho Chemical Processing Plant. Commercial treatment options are being considered for mixed low-level waste.

In addition, some of the mixed low-level waste streams require new forms of treatment. These wastes include contaminated lead, one-of-a-kind wastes, and contaminated polychlorinated biphenyls. (Polychlorinated biphenyls are hazardous substances managed under the Toxic Substances Control Act.) DOE is conducting treatability studies and research onsite and at university and commercial facilities in order to identify new forms of treatment for disposal at onsite and offsite DOE or commercial facilities.

Ultimately, mixed wastes will be treated and disposed of in accordance with applicable regulations. All RCRA-controlled wastes generated at the INEL are evaluated to certify that they are not radioactively contaminated. If this certification cannot be made, then the wastes are managed as mixed low-level waste. If analyses verify that treated characteristic mixed low-level waste no longer exhibits the characteristic and therefore is no longer hazardous, and if the treated waste meets Radioactive Waste Management Complex radioactive waste acceptance criteria, it is reclassified as low-level waste and sent to the Radioactive Waste Management Complex for disposal. Waste that does not meet the Radioactive Waste Management Complex waste acceptance criteria will be stored until a suitable facility is available. DOE requirements, as outlined in DOE orders, require all DOE-generated radioactive waste to be disposed of on a DOE site. Mixed waste, treated to meet Land Disposal Restrictions, must be disposed of at a DOE facility. Commercial disposal may be used on a case-by-case basis.

Liquid low-level mixed waste is concentrated at the Idaho Chemical Processing Plant. The condensed vapor (condensate) from the Idaho Chemical Processing Plant process equipment waste evaporator is then processed by the Liquid Effluent Treatment and Disposal Facility and the vapor vented out the high-efficiency particulate air filtered stack. The material remaining after evaporation (which is mixed waste) is then pumped to the Idaho Chemical Processing Plant tank farm.

2.2.7.1.5 Greater-Than-Class-C Low-Level Waste—Greater-than-Class-C waste exceeds U. S. Nuclear Regulatory Commission concentration limits for Class-C low-level waste specified in 10 CFR 61 and thus exceeds limits for shallow land burial. The Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240) requires DOE to ensure safe disposal of this waste. In May 1989, the U. S. Nuclear Regulatory Commission (NRC) promulgated a rule that requires greater-than-Class-C waste to be disposed of in a deep geologic repository, unless the NRC approves disposal elsewhere.

Under the Low-Level Radioactive Waste Policy Amendments Act of 1985, the Federal government is responsible for the disposal of greater-than-Class-C low-level waste generated by licensees of the NRC and Agreement States. DOE was identified as the Federal agency responsible for this effort. In February 1989, a report to Congress from DOE (DOE 1989) stated that it plans to accept and manage limited quantities of greater-than-Class-C low-level waste until a disposal facility is developed. DOE has assigned management responsibility for this effort to the INEL. The Radioactive Waste Management Complex currently stores a total of about 25 cubic meters (33 cubic yards) of greater-than-Class-C waste. This waste was received in 1987 and 1988 from two offsite commercial generators.

2.2.7.1.6 Special-Case Waste—Special-case waste is defined as a radioactive waste owned or generated by DOE that does not fit into typical management plans developed for the major radioactive waste types such as high-level waste, low-level waste, or transuranic waste. The special-case waste at the INEL has been classified by a categorization process described in Winberg and Allred (1993). Special-case waste comprises five types of waste based on disposal requirements:

- Containers of waste with unknown contents

- Spent nuclear fuel and fuel debris (originally used in research and development applications) in configurations unlike normal commercial fuel elements, and therefore incompatible with the anticipated high-level waste repository waste acceptance criteria

- DOE wastes that do not meet the disposal requirements of the Radioactive Waste Management Complex waste acceptance criteria

- DOE wastes that are generated by Energy Research Programs, Nuclear Energy Programs, or U. S. Nuclear Regulatory Commission licensees and that have concentrations of transuranic constituents exceeding the Class C limits specified in 10 CFR 61.55

- DOE wastes generated by Defense Programs that do not meet the waste acceptance criteria for the Waste Isolation Pilot Plant.

Special-case waste at the INEL is stored in various major facility areas, including Argonne National Laboratory-West, the Advanced Test Reactor at the Test Reactor Area, the Naval Reactors Facility, the Power Burst Facility, Test Area North, and the Radioactive Waste Management Complex. Some special-case waste, such as activated metals from reactor cores, will be generated as long as reactor operations continue. Because of this continuing generation, new storage facilities or additional disposal capability may need to be provided. In addition to alpha low-level waste, some of the existing special-case waste may be reclassified to one of the major radioactive waste types. Until the waste is characterized, it is managed as special-case waste. Actions associated with this special-case waste are evaluated on a case-by-case basis, and therefore the EIS does not specifically assess impacts related to such actions.

Two hundred cubic meters (260 cubic yards) of special-case waste consists of performance-assessment-limited low-level waste and nondefense transuranic waste located at various INEL facilities. These data do not include the potential special-case waste that may be generated by the Environmental Restoration Program and other programs.

As with the transuranic waste, when characterization, treatment, or disposal options for these wastes are identified, they will be implemented.

2.2.7.2 Hazardous Waste. A hazardous waste is any solid waste, not otherwise precluded from regulation under the Resource Conservation and Recovery Act (RCRA), that exhibits the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined by RCRA, or which has been otherwise determined to pose a hazard and which has been designated by the RCRA as a listed hazardous waste. Examples of hazardous wastes include paint thinner, lead, and chromium wastes. The U. S. Environmental Protection Agency has also established requirements for the management of these materials. The hazardous waste program at the INEL also manages substances regulated by the Toxic Substances Control Act, such as polychlorinated biphenyls. The current INEL hazardous waste management program is depicted in Figure 2.2-9.

Hazardous waste at the INEL is currently generated at the Radioactive Waste Management Complex, Central Facilities Area, Power Burst Facility, Naval Reactors Facility, Test Area North, Test Reactor Area, Argonne National Laboratory-West, Idaho Chemical Processing Plant, and Idaho Falls facilities. Decontamination and decommissioning and remediation activities also generate hazardous waste. About 1 percent of the total waste generated at the INEL is hazardous waste.

To reduce the quantity of hazardous waste, waste generated at the INEL is recycled, reused, or reprocessed where possible. Also, some hazardous substances used at the INEL may be replaced by nonhazardous substances. Recyclable hazardous waste at the INEL includes metals (such as bulk lead, mercury, chromium), solvents, fuel, and other waste materials. Recyclable materials are transported periodically as sufficient quantities are accumulated or as negotiated with recycling shippers and vendors. The total volume of recyclable hazardous waste from the INEL in 1992 was 760 cubic meters (980 cubic yards).

Under RCRA, hazardous waste generated at the INEL may remain for less than 90 days at designated accumulation points. The waste is then transported to a RCRA interim status or permitted status storage facility. The Hazardous Waste Storage Facility at the Central Facilities Area is the major onsite RCRA Part B-permitted storage facility. The facility is designed primarily to prepare the waste for transported to an offsite RCRA-permitted treatment facility prior to offsite disposal. The majority of the hazardous waste generated annually at the INEL is transported offsite for treatment and disposal.

Hazardous waste generated in a radioactively controlled area or suspected of being radioactive cannot be transported offsite until it is surveyed for radioactivity. If the waste is radioactively contaminated, it is classified and managed as mixed waste (see Section 2.2.7.1.4, Mixed Low-Level

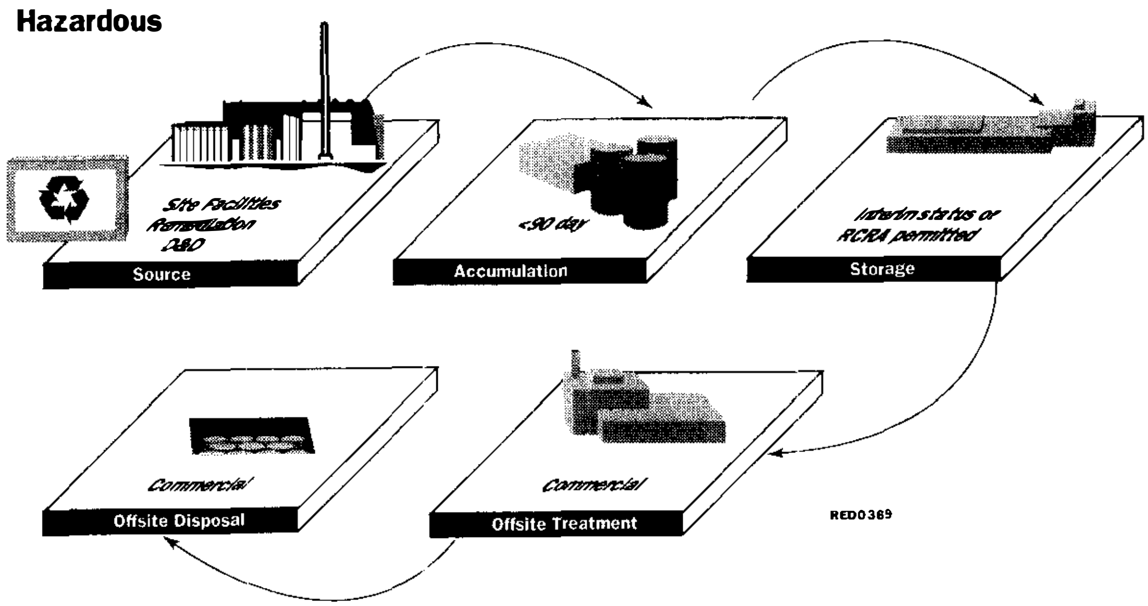


Figure 2.2-9. Current hazardous waste management program at the Idaho National Engineering Laboratory.

Waste). Highly reactive or unstable materials, such as waste explosives, are addressed on a case-by-case basis and are either stored, burned, or detonated at the Reactive Storage and Treatment Area near the Auxiliary Reactor Area. (More detailed information on toxic substances is given in Appendix A, Primer on Radioactivity and Toxicology.)

2.2.7.3 INEL Industrial Waste. INEL industrial wastes are nonhazardous materials. The current INEL industrial waste management program is depicted in Figure 2.2-10.

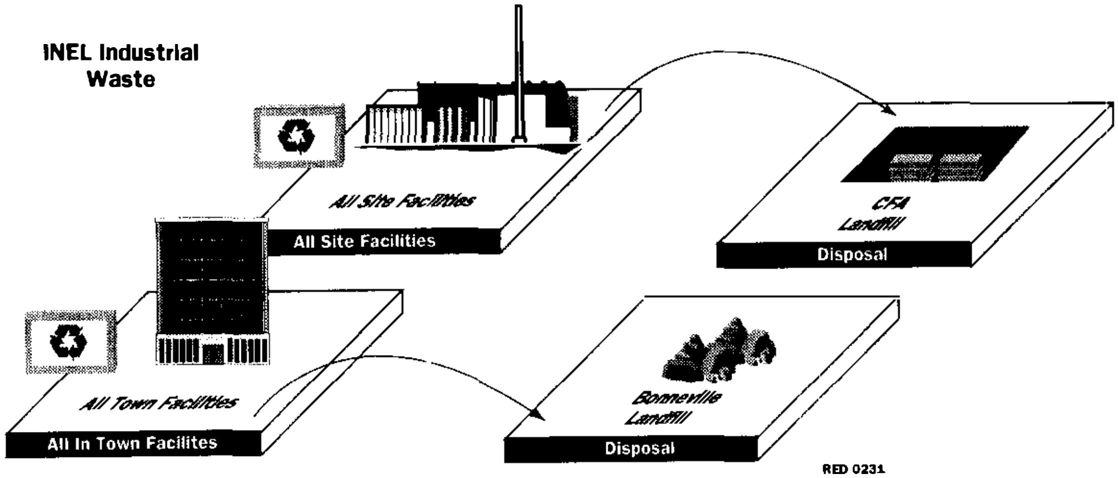


Figure 2.2-10. Current INEL industrial waste management program at the Idaho National Engineering Laboratory.

Industrial waste is nonhazardous waste generated during manufacturing or industrial processes. At the INEL, this is categorized as INEL industrial waste. Also at the INEL, sanitary waste is included in this category. (See Appendix E, Glossary, for a definition of sanitary waste.) Over 94 percent of the waste generated at the INEL is classified as INEL industrial waste (DOE-ID 1993c) and disposed of at the Central Facilities Area Landfill (site) and the Bonneville County Landfill (Idaho Falls facilities).

The portion of the INEL Landfill Complex targeted for landfill use is approximately 90 hectares (220 acres), which is estimated to be adequate capacity for 30 to 50 years. Landfills I and II are closed; Landfill III comprises two separate areas: the INEL industrial waste disposal area (not in use) and the currently used disposal area. The current disposal area is located in a 4.8-hectare (12-acre) gravel pit north of Landfill II. Although nearly filled, part of the INEL industrial area of Landfill III is still used to dispose of waste containing asbestos.

Waste types disposed of at the INEL Landfill Complex include asbestos, asphalt, cafeteria garbage, dirt and gravel, masonry and concrete, scrap metal, trash, sweepings, wood and scrap lumber, weeds, grass, and trees.

An active recycling program has been started to reduce the amount of INEL industrial waste. This recycling program is coupled with a concerted effort to ensure that waste materials are properly segregated. In addition, a materials exchange program has been initiated; this program arranges for unused materials stored at one INEL facility to be reused at other facilities. Through 1991, 320,000 kilograms (700,000 pounds) of office waste and 3,100 kilograms (6,800 pounds) of scrap metal were recycled at the INEL. Efforts are underway to expand the recycling program to include asphalt and metals and to convert scrap wood into mulch.

DOE's long-term goal is to greatly reduce the amount of industrial commercial waste (including INEL industrial waste) generated through an intensive program of waste avoidance, recycling, and segregation.

2.2.8 Infrastructure

DOE is responsible for ensuring the continued safe operation of INEL facilities. One aspect of this activity is infrastructure support. The current program of infrastructure support at the INEL includes general plant projects to maintain and upgrade the current facilities, buildings, roads, and utilities that support operations. Other aspects of DOE's responsibility involves upgrading facilities, replacing equipment, maintaining facilities and equipment, providing environmental monitoring, and ensuring that quality control and quality assurance programs are in place.

Present infrastructure upgrades include general plant projects for utility and facility upgrades and maintenance, as well as larger line item projects. Near-term projects include the replacement of the Radiological and Environmental Sciences Laboratory and a new Health Physics Instrument Laboratory.

A major support service for the ER&WM Program is the INEL environmental monitoring program. This monitoring program is designed to determine if waste management practices are adversely affecting the environment and, if so, how these practices need to be changed to decrease or eliminate the effects (DOE-ID 1992). The monitoring program includes air, surface water, drinking water, nonradiological discharges, ambient (surrounding) radiation levels, and plants and animals. Various locations within and outside the perimeter of all facilities and the INEL site as a whole are monitored. The State of Idaho has also established an independent program to monitor INEL operations. The U. S. Environmental Protection Agency and the State of Idaho each have regulatory authority for different aspects of environmental compliance at the site.

The long-term goal is to provide the necessary support required for ER&WM projects and to continue to ensure that operations are conducted as safely as possible, including minimum radiation exposure and minimum risk to personnel, facilities, the public, and the environment.

2.2.9 Technology Development

Technology development supports ER&WM by designing and testing potential technical solutions to specific problems related to ER&WM. Broad program areas under technology development include research, development, demonstration, testing, and evaluation; technology integration; infrastructure support for developing and improving safe and efficient packaging systems; emergency response management; education; and laboratory analysis. Types of current technology development activities at the INEL include developing waste minimization; testing remediation technologies; evaluating and testing methods to treat calcined high-level, sodium-bearing, and other waste types; and designing sensors and other environmental monitoring equipment and systems.

In 1992, DOE had proposed to engage in research and development activities for technology development and demonstration required to assure that spent nuclear fuel could be appropriately prepared for disposition in a geologic repository. Any such repository is not expected to be available until after the year 2010. DOE has therefore adopted a systems approach to plan the development of technologies and facility resources to ensure safe and effective management of spent nuclear fuel in the interim. The Spent Fuel Program Systems Engineering process is a formal structured methodology to ensure that all factors and necessary interfaces are identified and satisfied, and that technical requirements and constraints and stakeholder values are accommodated in decisions related to the interim management of spent nuclear fuel. In addition to identifying and integrating fuel management requirements, the systems engineering process implements a formal method for selecting best alternatives for stabilizing, conditioning, packaging, transporting, and storing the spent nuclear fuel.

2.2.10 Activities Not Directly Related to Spent Nuclear Fuel or Environmental Restoration and Waste Management

Many activities at the INEL are identified in Section 2.2.4, Major Facility Areas. Some of these activities, for example, the operation of nuclear reactors, fall outside the scope of this document. Chapter 5, Environmental Consequences, of Volume 2 evaluates impacts if they are associated with environmental restoration, waste management, and spent nuclear fuel operations at the INEL. However, Chapter 5 also evaluates cumulative impacts of activities at the INEL not directly related to spent nuclear fuel or ER&WM. Hazardous materials are included in this section due to their potential impact on human health, safety, and the environment.

2.2.10.1 Hazardous Materials. Hazardous materials are broadly defined as hazardous substances, hazardous chemicals, or toxic substances. The Emergency Planning and Community Right-to-Know Act, Section 312, requires an annual inventory of hazardous chemicals at the INEL. Hazardous chemicals are managed at the INEL to prevent harmful impacts to human health and safety and the environment.

The 1992 hazardous chemicals inventory lists 774 hazardous chemicals used at the INEL in quantities of 0.5 kilogram (1 pound) or greater. Volumes range from 0.5 kilogram (1 pound) of numerous chemicals to a maximum single volume of approximately 1,100,000 kilograms (2,400,000 pounds) of fuel oil (Priestly 1992, Slaughterbeck 1993).

The number of hazardous chemicals and the total weight of any chemicals routinely used at the INEL changes from day to day and from facility to facility. Year-to-year inventories are maintained and accounted for through the annual Emergency Planning and Community Right-to-Know Act reports for INEL facilities. The percentage of hazardous materials used onsite that become hazardous waste or part of a hazardous waste cannot be determined.

2.2.10.2 *Support Services*. DOE provides safety services, security and safeguards, utilities and plant services, environmental compliance, and emergency preparedness. A program of emergency preparedness for site areas and facilities has been developed based on prevention, planning, response, and recovery (DOE-ID 1993d).

2.2.11 Regulatory Framework for Environmental Restoration and Waste Management

Various laws and regulations govern environmental restoration and waste management at the INEL. These regulations affect choices in treatment, storage, and disposal; drive cleanup schedules; and provide standards against which the impacts of the alternatives are measured. Agreements between DOE-ID, regulatory agencies, and governmental agencies have been signed to provide guidance on the implementation of these laws. In addition, DOE Headquarters and DOE-ID issue orders and supplemental directives that implement laws, regulations, and requirements; give specific responsibilities; and describe implementation processes and procedures. Additional information on environmental regulations, compliance, and DOE-ID's compliance status can be found in Chapter 7, Consultations and Environmental Requirements.

3. ALTERNATIVES

> **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 INEL waste streams and spent nuclear fuel, prepare waste for ultimate disposal, and develop technologies for fuel disposition.
>
> **C (Minimum Treatment, Storage, and Disposal)**
> Minimize treatment, storage, and disposal activities at the INEL 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 INEL to accommodate waste and spent nuclear fuel from the DOE complex. Conduct maximum cleanup and decontamination and decommissioning.

For this EIS, the DOE evaluated four alternatives for the Spent Nuclear Fuel Program and the Environmental Restoration and Waste Management Program that represent a broad range of possible actions at the INEL over the next ten years.

These alternatives were developed during the public scoping process. DOE initially proposed the No Action and Ten-Year Plan alternatives. These alternatives were modified, and two other alternatives were added in response to comments received during the scoping process. The intent of these two added alternatives was to provide the extremes of minimum and maximum impacts at the INEL during the 1995-to-2005 time period. Thus, these alternatives would bound any reasonably foreseeable alternatives that would be selected as a result of this EIS. Each alternative includes components for remediation, decontamination and decommissioning, waste management, and spent nuclear fuel management. Infrastructure, technology development, and transportation requirements were also considered for each alternative.

Alternative A (No Action) must be considered under the National Environmental Policy Act. It serves as a benchmark for comparing potential effects of the other alternatives. In addition, three proposed action alternatives are considered in this EIS: Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal). As illustrated in Figure 3.0-1 the proposed action alternatives for waste and spent nuclear fuel were shaped by management decisions involving sources, disposition options, and location

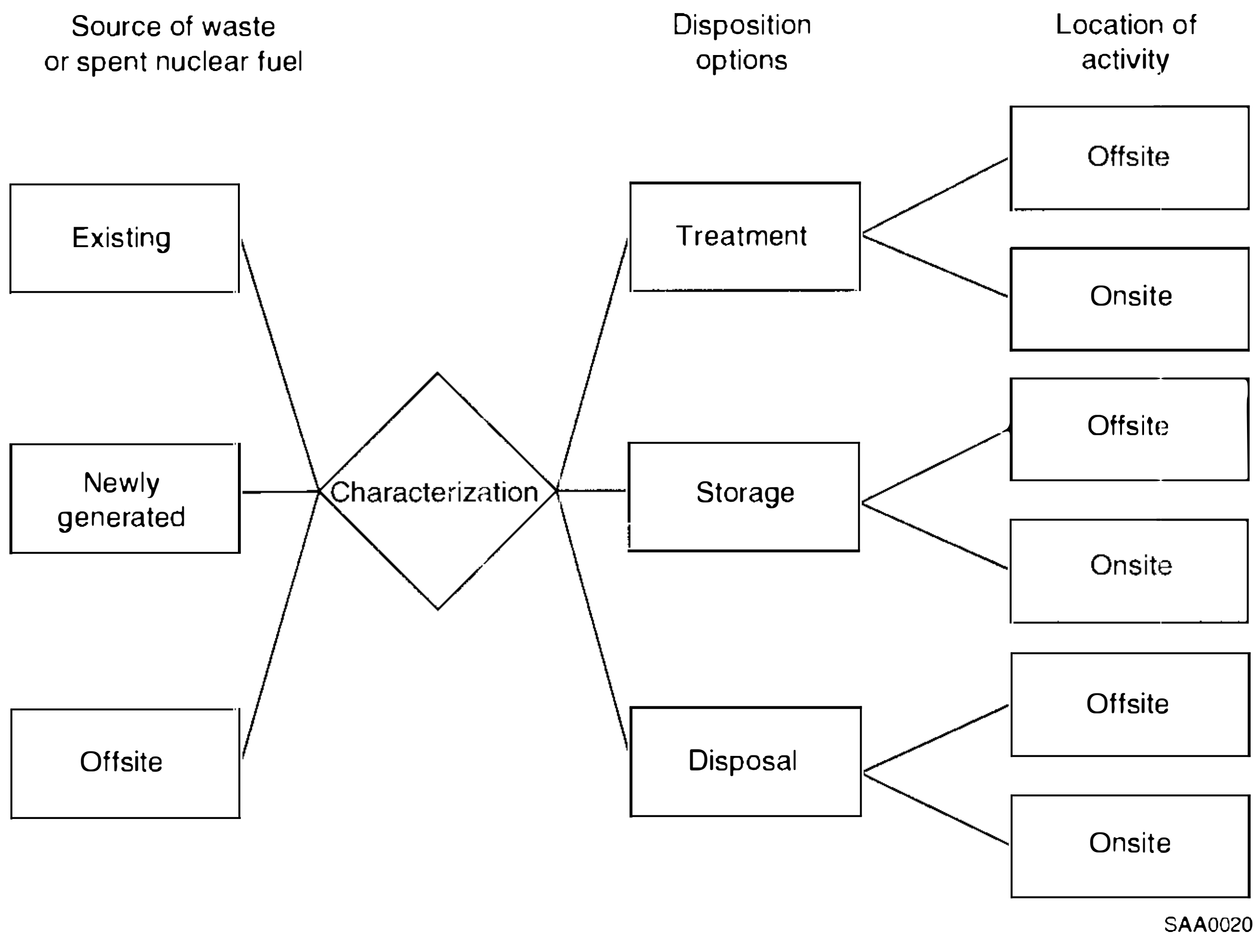


Figure 3.0-1. The basic management decisions for spent nuclear fuel and waste.

options. The options for sources of spent nuclear fuel or waste are (a) that existing at the INEL site by June 1, 1995; (b) that generated at the INEL site between 1995 and 2005; and (c) that transported to the INEL site from other sites. The general handling options for spent nuclear fuel or waste would include characterization, treatment (processing for spent nuclear fuel), storage, disposition, or stabilization. Location options for handling activities would be either on the INEL or off the INEL.

Specific components of the alternatives were identified from a list of potential INEL projects and activities for the next ten years (through 2005), as reported by DOE planning documents and program managers. Relevant projects for which documentation under the National Environmental Policy Act was expected to be complete before June 1, 1995, were considered as part of Alternative A (No Action). Other potential projects were candidates for inclusion in the various action alternatives, along with reasonable alternative actions. Section 3.1 describes the alternatives, and Appendix C, Information Supporting the Alternatives, gives detailed descriptions of the projects.

The alternatives represent different ways of accomplishing the following at the INEL:

a. Implementing reasonably foreseeable DOE-wide programmatic decisions for spent nuclear fuel, environmental restoration, and waste management

b. Continuing existing research and development missions

c. Fulfilling [except for Alternative A (No Action)] DOE and national requirements governing spent nuclear fuel, environmental restoration, and waste management.

The range of alternatives in the EIS was developed to be inclusive, in accordance with the philosophy of considering a full range of reasonable alternatives as required by the National Environmental Policy Act and Council on Environmental Quality regulations. The alternatives analyzed in the EIS ranged from the No Action alternative and minimum environmental restoration and waste management activities to an alternative maximizing environmental restoration and waste management activities at the INEL. These alternatives thus bound all reasonably foreseeable alternative actions.

3.1 Description of Alternatives

This section summarizes each of the four alternatives first at a general level, emphasizing management decisions. Starting with Section 3.1.1, the description is more specific, comparing and contrasting how spent nuclear fuel, environmental restoration, and each waste stream (such as high-level waste, hazardous waste, or mixed low-level waste) would be managed under the various alternatives. The discussion identifies functions, activities, projects, amounts of waste, and technology development associated with each alternative for each waste stream. The proposed projects associated with all four alternatives are presented in Table 3.1-1, and their locations are shown on Figure 3.1-1.

Alternative A (No Action)

Under Alternative A (No Action), existing environmental restoration and waste management operations, facilities, and projects would continue to be managed. This includes continuing existing environmental restoration, waste management, decontamination and decommissioning, research and development, and infrastructure facilities and projects that support the Environmental Restoration and Waste Management Program at the INEL. There would be no shipments of spent nuclear fuel to the INEL, with the exception of shipments of naval spent nuclear fuel during an approximately three-year transition period. Existing inventories of spent nuclear fuel stored at the INEL would remain. Activities and projects include those that may be initiated after June 1, 1995, but that were proposed to have been evaluated under the National Environmental Policy Act regulations by June 1, 1995. New activities would be limited to minor environmental safety and health activities needed to maintain safe operation. No new major upgrades would be undertaken. Implementation of this alternative would not fully meet all negotiated agreements and commitments (that is, the Federal Facility Agreement and other consent orders). This includes any obligations to receive university, Fort St. Vrain, and West Valley Demonstration Project spent nuclear fuel.

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. Besides existing facilities and projects, currently proposed projects for 1995 through 2005 would be implemented. These projects

Table 3.1-1. Projects at the Idaho National Engineering Laboratory associated with the proposed alternatives.

Project name	Alternative[a]
Expended Core Facility Dry Cell Project	B,D
Increased Rack Capacity for CPP-666	B,D
Additional Increased Rack Capacity (CPP-666)	B,D
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping	B, C, D[b]
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	B, D
Spent Fuel Processing	D
Experimental Breeder Reactor-II Blanket Treatment	B, D
Electrometallurgical Process Demonstration (formerly known as Actinide Recycle Project)	B, C, D
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)	B, D
Engineering Test Reactor D&D	B, D
Materials Test Reactor D&D	B, D
Fuel Processing Complex (CPP-601) D&D	B, D
Fuel Receipt and Storage Facility (CPP-603) D&D	B, D
Headend Processing Plant (CPP-640) D&D	B, D
Waste Calcine Facility (CPP-633) D&D	B, D
Tank Farm Heel Removal Project	B, C, D
Waste Immobilization Facility[c]	B, C, D
High-Level Tank Farm New Tanks	C, D
New Calcine Storage	D
Radioactive Scrap/Waste Facility	B, C, D
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	B, D
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	B, D
Idaho Waste Processing Facility	B, D[b]
Shipping/Transfer Station	C
Waste Experimental Reduction Facility Incineration	B, D
Mixed/Low-Level Waste Treatment Facility	D
Mixed/Low-Level Waste Disposal Facility	B, D[b]

Table 3.1-1. (continued).

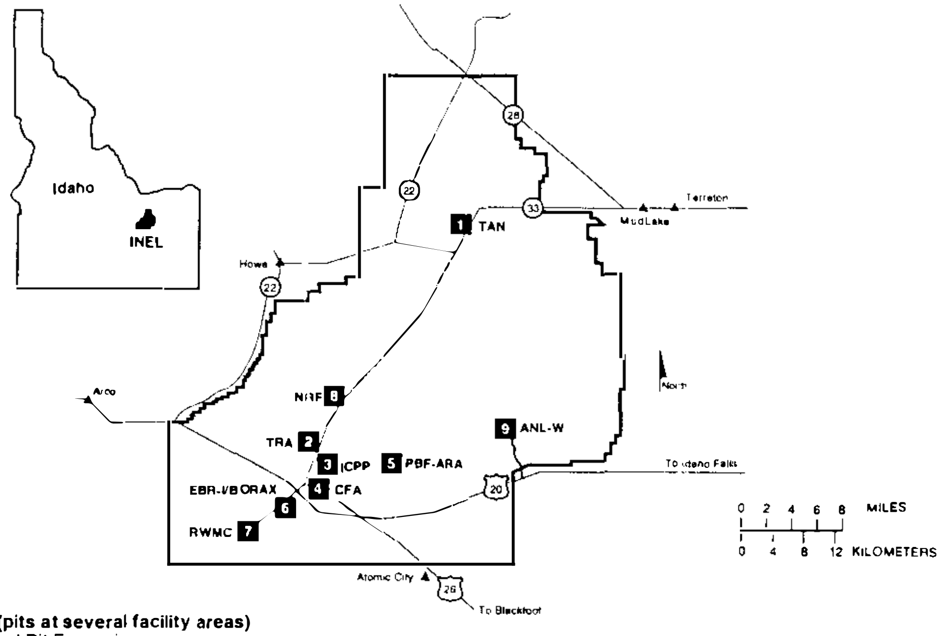
Project name	Alternative[a]
Nonincinerable Mixed Waste Treatment	B, D[b]
Remote Mixed Waste Treatment Facility	B, D
Sodium Processing Project	B, D
Greater-Than-Class-C Dedicated Storage	B, D
Hazardous Waste Treatment, Storage, and Disposal Facilities	D
Industrial/Commercial Landfill Expansion	B, C, D
Gravel Pit Expansions	B, D[b]
Central Facilities Area Clean Laundry and Respirator Facility	B, D
Calcine Transfer Project (Bin Set #1)	B, C, D
Plasma Hearth Process Project	B, D
Test Area North Pool Fuel Transfer[d]	A, B, D
Remediation of Groundwater Contamination[d]	A, B, C, D
Pit 9 Retrieval[d]	A, B, C, D
Vadose Zone Remediation[d]	A, B, C, D
Auxiliary Reactor Area (ARA)-II D&D[d]	A, B, C, D
Boiling Water Reactor Experiment (BORAX)-V D&D[d]	A, B, C, D
High-Level Tank Farm Replacement (upgrade phase)[d]	A, B, C, D
Transuranic Storage Area Enclosure and Storage Project[d]	A, B, C, D
Waste Characterization Facility[d]	A, B, C, D
Waste Handling Facility[d]	A, B, C, D
Health Physics Instrument Laboratory[d]	A, B, C, D
Radiological and Environmental Sciences Laboratory Replacement[d]	A, B, C, D

a. Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), Alternative D (Maximum Treatment, Storage, and Disposal).

b. These projects would be expanded for Alternative D (Maximum Treatment, Storage, and Disposal).

c. Sodium-bearing and calcine waste treatment technology selection would be implemented through this facility.

d. These ongoing projects have been included in the environmental analysis represented in this Environmental Impact Statement (EIS). At the time the analysis was performed, National Environmental Policy Act documentation was planned to be completed by June 1995.



INEL (pits at several facility areas)
- Gravel Pit Expansions

1 Test Area North (TAN)
- TAN Pool Fuel Transfer
- Remediation of Groundwater Contamination [Environmental Remediation (ER)]

2 Test Reactor Area (TRA)
- Engineering Test Reactor Decontamination and Decomissioning (D&D)
- Materials Test Reactor D&D

Test Area North or Test Reactor Area
- Greater-Than-Class-C Dedicated Storage

3 Idaho Chemical Processing Plant (ICPP)
- New Calcine Storage
- Tank Farm Heel Removal Project
- High-Level Tank Farm New Tanks
- High Level Tank Farm Replacement (upgrade phase)
- Calcine Transfer Project (Bin Set #1)
- Waste Immobilization Facility
- Additional Increased Rack Capacity (CPP-666)
- Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping
- Fort St. Vrain Spent Nuclear Fuel Receipt and Storage
- Increased Rack Capacity for CPP-666
- Spent Fuel Processing
- Fuel Processing Complex (CPP-601) D&D
- Fuel Receipt and Storage Facility (CPP-603) D&D
- Headend Processing Plant (CPP-640) D&D
- Waste Calcine Facility (CPP-633) D&D

4 Central Facilities Area (CFA)
- Industrial/Commercial Landfill Expansion
- Health Physics Instrument Laboratory
- Radiological Environmental Sciences Laboratory Replacement
- CFA Clean Laundry and Respirator Facility

5 Power Burst Facility (PBF)/Auxiliary Reactor Area (ARA)
- Nonincinerable Mixed Waste Treatment
- Waste Experimental Reduction Facility Incineration
- ARA-II D&D

6 Experimental Breeder Reactor (EBR)-I/ Boiling Water Reactor Experiment (BORAX)
- BORAX-V D&D

7 Radioactive Waste Management Complex (RWMC)
- Shipping/Transfer Station
- RWMC Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste
- Waste Characterization Facility
- Transuranic Storage Area Enclosure and Storage Project
- Pit 9 Retrieval (ER)
- Vadose Zone Remediation (ER)

2.5 miles east of RWMC (for analysis purposes)
- Idaho Waste Processing Facility
- Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment
- Hazardous Waste Treatment, Storage, and Disposal Facilities
- Mixed/Low-Level Waste Treatment Facility
- Mixed/Low-Level Waste Disposal Facility

8 Naval Reactors Facility (NRF)
- Expended Core Facility Dry Cell Project

9 Argonne National Laboratory-West (ANL-W)
- Remote Mixed Waste Treatment Facility
- Radioactive Scrap/Waste Facility
- Central Liquid Waste Processing Facility D&D
- EBR-II Blanket Treatment
- Plasma Hearth Process Project
- Electrometallurgical Process Demonstration
- Sodium Processing Project
- Waste Handling Facility

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Figure 3.1-1. The Idaho National Engineering Laboratory location of projects associated with alternatives.

would be implemented to continue to meet INEL's historic role and to assist in ensuring regulatory compliance. Implementation of this alternative would meet negotiated agreements and commitments (that is, the Federal Facility Agreement and other consent orders).

Under Alternative B (Ten-Year Plan), spent nuclear fuel and 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. New waste generation would increase (reflecting regulatory requirements and increased environmental restoration activities). Spent nuclear fuel and selected waste would be received from other sites. Onsite management would emphasize greater treatment and disposal capabilities compared with Alternative A (No Action). Additional remediation and decommissioning and decontamination projects would be conducted under this alternative compared with Alternative A (No Action). Environmental restoration activities would be conducted in accordance with the Federal Facility Agreement and Consent Order and Action Plan. Also, some spent nuclear fuel and more waste management activities would be directed to the INEL from other DOE sites.

Alternative C (Minimum Treatment, Storage, and Disposal)

To the extent possible, under Alternative C (Minimum Treatment, Storage, and Disposal) ongoing INEL spent nuclear fuel, waste management activities, and materials and waste would be transferred to other locations. Possible locations include DOE facilities, other government sites, or private sector locations. Minimal treatment, storage, and disposal activities would be located at the INEL site under this alternative. All these elements are consistent with the Alternative C objective of encompassing the lower level of impacts at the INEL associated with the activities covered by this EIS for the 1995-to-2005 time period.

Under Alternative C (Minimum Treatment, Storage, and Disposal), neither waste nor spent nuclear fuel would be received from other sites for management. Whenever feasible, wastes generated from environmental restoration activities would be minimized by emphasizing institutional controls over treatment options. Also, many of the spent nuclear fuel and waste management activities currently occurring or proposed under Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal) would be transferred to other sites. 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)

To the extent possible, under Alternative D (Maximum Treatment, Storage, and Disposal) spent nuclear fuel and waste would be transferred from other DOE facilities to the INEL site for management. Environmental restoration activities would include the maximum planned decontamination and decommissioning projects and would emphasize residential use as the preferred end land use, which potentially would result in maximum waste generation. Implementing this alternative would result in the need for additional projects not yet defined or for the expansion of identified projects compared with those identified in Alternative B (Ten-Year Plan). All alternative elements are consistent with the Alternative D objective of encompassing the upper level of impacts at the INEL associated with the activities covered by this EIS for the 1995-to-2005 time period.

Under Alternative D (Maximum Treatment, Storage, and Disposal), acceptance of waste or spent nuclear fuel from other sites would be maximized. Compared with other alternatives, wastes generated from environmental restoration and waste management activities potentially would be greater. Spent nuclear fuel and environmental restoration and waste management activities at the INEL 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. New waste generation would increase to a maximum possible level (reflecting regulatory requirements and increased environmental restoration activities). Onsite management would emphasize greater treatment and disposal capabilities compared with Alternative A (No Action). In addition, the capabilities required would be greater compared with Alternative B (Ten-Year Plan) because of the additional waste (a) accepted from other sites or (b) generated because of proposed spent nuclear fuel processing, environmental restoration, and waste management treatment activities. Additional decommissioning and decontamination projects would be conducted under this alternative compared with Alternative A (No Action).

3.1.1 Alternatives for Management of Spent Nuclear Fuel

Spent Nuclear Fuel	
Alternative A	• Phase out examination of naval spent nuclear fuel after an approximate three-year transition period • No other spent nuclear fuel would be received • Phase out storage pools at Building 603 at the Idaho Chemical Processing Plant
Alternative B	• Examine and store naval spent nuclear fuel • Receive additional offsite spent nuclear fuel • Complete Expended Core Facility Dry Cell Project • Transfer aluminum-clad spent nuclear fuel to the Savannah River Site • Phase out CPP-603 storage pools • Expand storage capacity in existing CPP-666 pools • Phase in dry storage • Demonstrate electrometallurgical process
Alternative C	• Phase out examination of naval spent nuclear fuel during approximate three-year transition period. Expended Core Facility would close • Transport all spent nuclear fuel to another U. S. Department of Energy (DOE) site • Phase out spent nuclear fuel handling facilities • Demonstrate electrometallurgical process
Alternative D	• Examine and store naval spent nuclear fuel • Receive DOE complex-wide spent nuclear fuel • Phase out CPP-603 storage pools • Expand storage capacity in existing CPP-666 pools • Phase in expanded dry storage • Demonstrate electrometallurgical process • Phase in spent nuclear fuel stabilization

The goal for the alternatives to manage spent nuclear fuel at the INEL is to provide safe and environmentally responsible interim storage until a suitable geologic repository is available. Under all alternatives, corrective actions to resolve outstanding spent nuclear fuel management deficiencies identified and prioritized per the Defense Nuclear Facilities Safety Board Recommendation 94-1 Implementation Plan (DOE 1995) would be implemented as appropriate. The Recommendation 94-1 Implementation Plan will be balanced with other factors such as budgetary constraints and public comments as the spent nuclear fuel management path forward is designed by the DOE in the Record of Decision. The basic potential and existing activities and facilities to manage spent nuclear fuel are

Table 3.1-2. Spent nuclear fuel: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.

Alternative	Transportation	Stabilization	Storage	Research and development	Naval fuel examination
A (No Action)	Naval spent nuclear fuel shipped to INEL site during 3-year transition period No other spent nuclear fuel shipments to INEL site Onsite spent nuclear fuel transfer in existing casks for consolidation	Minimum actions required to safely store spent nuclear fuel Continue canning/characterization of spent nuclear fuel including fuel removed from CPP-603	Onsite consolidation at various existing INEL facilities • Test Area North Pool Fuel Transfer Phase out CPP-603 wet storage	Continue existing research and development activities	Phase out examination and Expended Core Facility after 3-year transition period
B (Ten-Year Plan)	Additional receipts of non-Department of Energy (DOE) domestic research spent nuclear fuel, plus spent nuclear fuel from Fort St. Vrain, West Valley, and some foreign research reactors Naval spent nuclear fuel from defueling points received plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation	Current INEL spent nuclear fuel inventory stabilized as planned Offsite receipts stabilized as needed (beyond stabilization provided by originating site for transportation) • Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	Onsite consolidation plus upgrading and expansion of storage to accommodate offsite receipts • Test Area North Pool Fuel Transfer • Increased Rack Capacity for CPP-666 • Additional Increased Rack Capacity (CPP-666) • Fort St. Vrain Spent Nuclear Fuel Receipt and Storage Phase out miscellaneous storage facilities and CPP-603 wet storage Phase in dry storage • Dry Fuel Storage Facility; Fuel Receiving, Canning/ Characterization, and Shipping	Research and development activities expanded as planned • Experimental Breeder Reactor-II Blanket Treatment •Electrometallurgical Process Demonstration	Examination at existing Expended Core Facility • Expended Core Facility Dry Cell Project

Table 3.1-2. (continued).

Alternative	Transportation	Stabilization	Storage	Research and development	Naval fuel examination
C (Minimum Treatment, Storage, and Disposal)	Current (1995) INEL spent nuclear fuel inventory shipped offsite to selected DOE site Onsite spent nuclear fuel transfer for stabilization before offsite shipment Naval spent nuclear fuel to INEL site during 3-year transition period Casks for offsite shipments obtained commercially or supplied by others	Adequate stabilization for safe offsite shipment • Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping (no storage)	Phase out all spent nuclear fuel storage facilities at Idaho Chemical Processing Plant, Test Area North, and miscellaneous locations, except Advanced Test Reactor canal	Phase out of all spent nuclear fuel research and development activities at INEL • Electrometallurgical Process Demonstration Discontinue spent nuclear fuel function of technology development activity	Phase out Expended Core Facility after 3-year transition
D (Maximum Treatment, Storage and Disposal)	Shipment of all spent nuclear fuel in DOE complex to INEL site Naval spent nuclear fuel from defueling points plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation	Current (1995) INEL spent nuclear fuel inventory stabilized as planned Offsite receipts stabilized as needed • Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Fuel processing as bounding case • Spent Fuel Processing	Onsite consolidation at various existing INEL facilities, plus upgrading and additional expansion of storage to accommodate offsite receipts • Test Area North Pool Fuel Transfer • Increased Rack Capacity for CPP-666 • Additional Increased Rack Capacity (CPP-666) • Fort St. Vrain Spent Nuclear Fuel Receipt and Storage Phase out miscellaneous storage facilities and CPP-603 wet storage Phase in expanded dry storage • Dry Fuel Storage Facility; Fuel Receiving, Canning/ Characterization, and Storage	Research and development activities expanded as planned plus demonstration of spent nuclear fuel processing technologies • Experimental Breeder Reactor-II Blanket Treatment • Electrometallurgical Process Demonstration	Examination at existing Expended Core Facility • Expended Core Facility Dry Cell Project

illustrated in figures associated with each alternative description, and details are given by alternative in Table 3.1-2. The locations of the projects associated with spent nuclear fuel alternatives are shown on Figure 3.1-2. The activities and facilities are organized by options available for the management decision on how to handle spent nuclear fuel. Each alternative emphasizes various options that implement the three basic management decisions on sources, handling, and locations discussed earlier (Figure 3.0-1). Except for the required No-Action alternative, the combination of technologies, facilities, and projects that implement the options for each alternative were selected to meet the basic goals of the spent nuclear fuel program.

The spent nuclear fuel alternatives in this volume would implement, at the INEL, the alternatives analyzed in Volume 1 of this EIS. Alternative A (No Action) in Volume 2 corresponds to the No-Action alternative (Alternative 1) in Volume 1.

Alternative B (Ten-Year Plan) in Volume 2 encompasses the following Volume 1 alternatives: Decentralization (Alternative 2), 1992/1993 Planning Basis (Alternative 3), and Regionalization by fuel type (Alternative 4A). The Volume 1 Regionalization 4A alternative was used to analyze potential consequences from implementing Alternative B (Ten-Year Plan) of Volume 2. This is

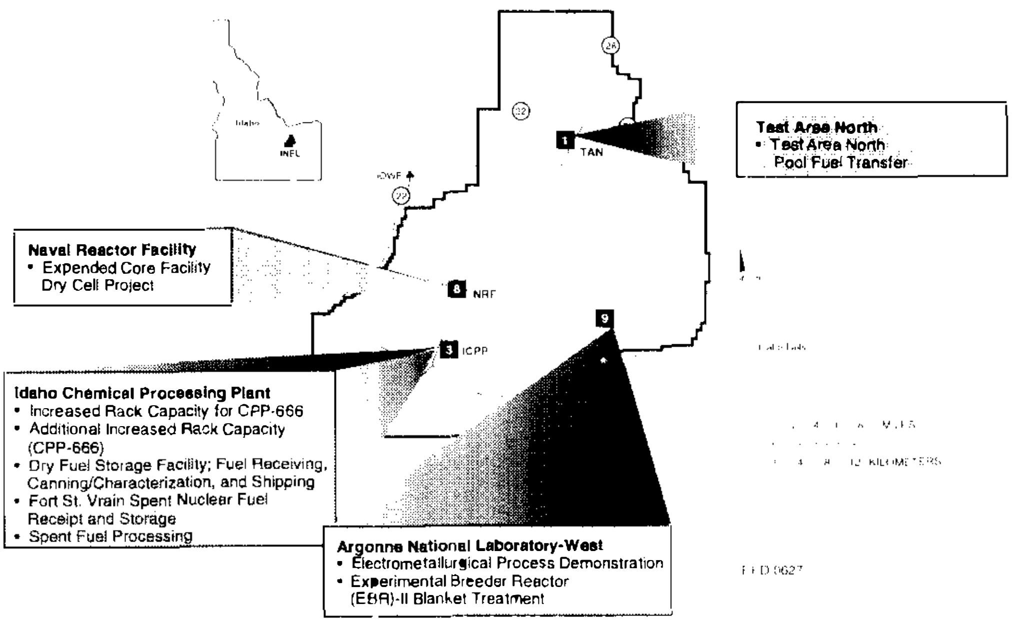


Figure 3.1-2. Spent nuclear fuel: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

because the Regionalization 4A alternative would handle the largest quantities of spent nuclear fuel and have the most activities compared with the other two Volume 1 alternatives. Therefore, the potential consequences of the Regionalization 4A alternative would bound the potential consequences of Decentralization and the 1992/1993 Planning Basis alternatives, if either were implemented at the INEL.

Alternative C (Minimum Treatment, Storage, and Disposal) of Volume 2 corresponds to the Volume I Regionalization 4B alternative (regionalization of spent nuclear fuel is not at the INEL) and Centralization alternative 5A (centralization is not at the INEL). This would result in the transport of spent nuclear fuel from the INEL site to the regional or central facility, respectively.

Under Alternative D (Maximum Treatment, Storage, and Disposal) of Volume 2, the INEL site would accept the maximum amount of spent nuclear fuel. This alternative would correspond to the Volume 1 Regionalization 4B(I) alternative (INEL is the western regional facility for spent nuclear fuel) and the Centralization 5B alternative (INEL is the central facility for spent nuclear fuel). The two Volume 1 alternatives are similar, except that a slightly lower quantity of spent nuclear fuel would be accepted at the INEL under the Regionalization 4B(1) alternative.

Alternative A (No Action) in Volume 2 corresponds to the No-Action alternative in Volume 1 of this EIS. Alternative A (No Action) generally would continue existing operations and handling of spent nuclear fuel (Table 3.1-2, Figure 3.1-3). There would be no shipments of spent nuclear fuel to the INEL site, with the exception of shipments of naval spent nuclear fuel during an approximately three-year transition period. During that transition period, naval spent nuclear fuel would be examined at the Expended Core Facility at the Naval Reactors Facility and then transported to the Idaho Chemical Processing Plant for storage. The Expended Core Facility would close after the transition period. Some consolidation of some onsite storage activities would continue. Older storage pools (in Building CPP-603) would be phased out, and the spent nuclear fuel would be canned, as needed, and stored using dry storage methods.

Under Alternative B (Ten-Year Plan), offsite spent nuclear fuel would be received, primarily naval but including Fort St. Vrain, West Valley, and other spent nuclear fuel from some university

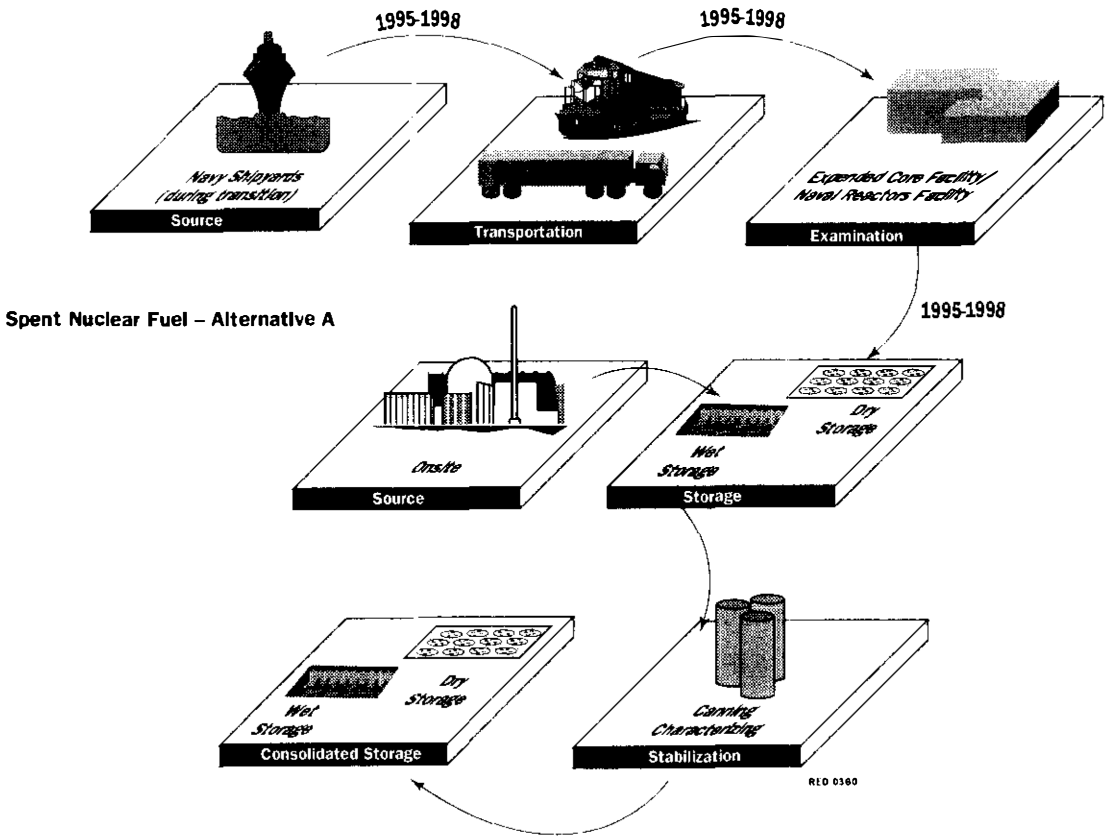


Figure 3.1-3. Management of spent nuclear fuel at the Idaho National Engineering Laboratory under the proposed Alternative A (No Action).

and foreign research reactors (Figure 3.1-4). Aluminum-clad spent nuclear fuel would be transferred to the Savannah River Site. Naval spent nuclear fuel would be examined at the Expended Core Facility at the Naval Reactors Facility and then stored at the Idaho Chemical Processing Plant. The Expended Core Facility Dry Cell Project would be executed, as described in Appendix C, Information Supporting the Alternatives. Additional storage would be gained by installing additional racks in the storage pools at the Idaho Chemical Processing Plant (Building CPP-666). Dry storage would be phased in. Consolidation of spent nuclear fuel would occur. This alternative would also allow a demonstration of Experimental Breeder Reactor-II Blanket Treatment and the Electrometallurgical Process Demonstration at Argonne National Laboratory-West.

One important project that would be implemented under both Alternatives B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal) is the Increased Rack Capacity for the storage pools in Building CPP-666 of the Idaho Chemical Processing Plant. This project would

Spent Nuclear Fuel – Alternatives B & D

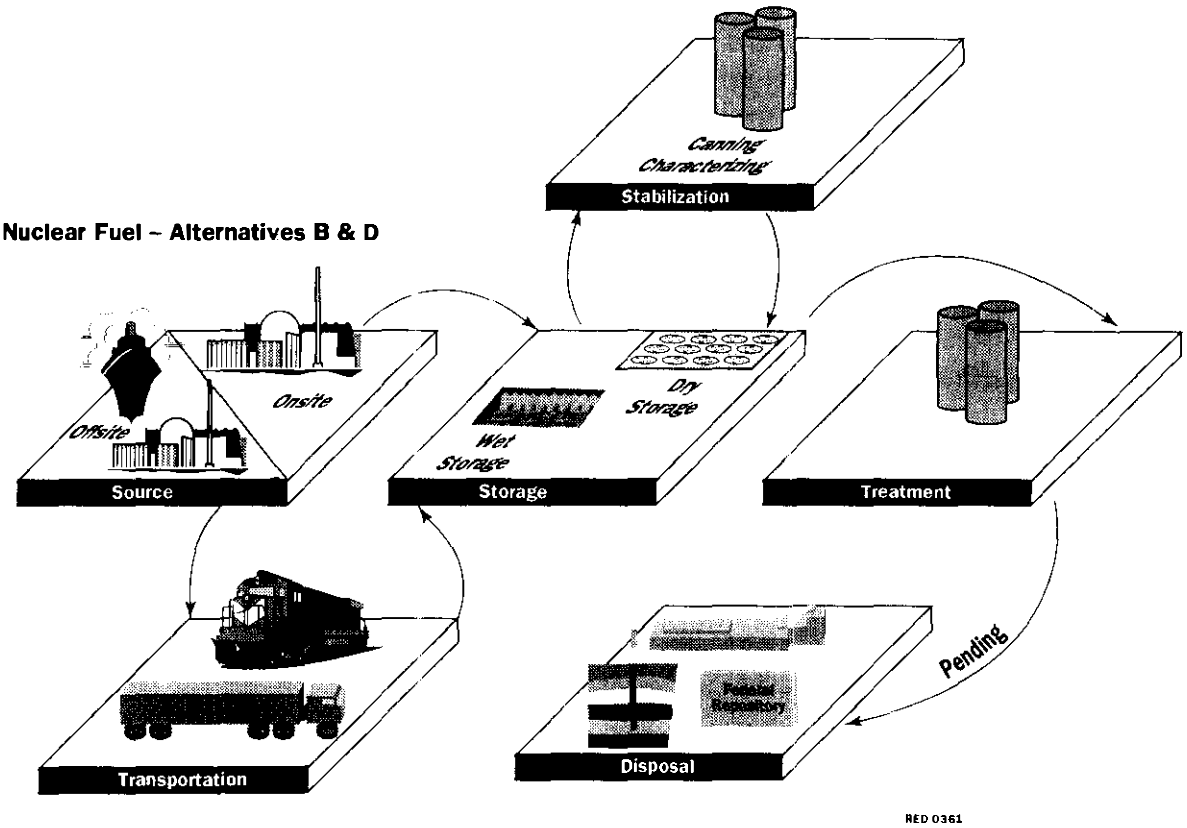


Figure 3.1-4. Management of spent nuclear fuel at the Idaho National Engineering Laboratory under the proposed Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal.).

involve replacing and rearranging (commonly called reracking) existing fuel storage racks in three of the six fuel storage area pools located in the Fluorinel Dissolution Process and Fuel Storage (FAST) Facility (Building CPP-666). A second potential project (Additional Increased Rack Capacity in CPP-666) would involve reracking existing fuel storage in at least two other pools in CPP-666. More complete details on the reracking projects are given in Appendix C, Information Supporting the Alternatives.

For Alternative B, the implementation in 1997 of the Increased Rack Capacity Project (as currently described and scheduled in the Project Summaries in Appendix C) would allow CPP-666 to accept all the projected spent nuclear fuel receipts (Heiselmann 1995) until the Additional Rerack Project is implemented in 2001. The implementation would, however, have to be coupled with stringent Fuel Storage Area fuel management and, if necessary, temporary storage of some aluminum clad fuel in stainless steel racks. The further addition of the Additional Increased Rack Capacity Project would allow CPP-666 to accept the projected spent nuclear fuel receipts (Heiselmann 1995) until the Dry Fuels Storage Facility Project comes on line in 2005.

To fully accommodate the projected spent nuclear fuel receipts for Alternative D (Heiselmann 1995), schedules may have to be accelerated compared with Alternative B for the Increased Rack Capacity Project, the Additional Increased Rack Capacity Project, and the Expanded Dry Fuels Storage Project (described in Appendix C). For example, the Increased Rack Capacity Project may have to begin operation in late 1996, the Additional Increased Rack Capacity Project in late 1998, and the Expanded Dry Fuels Storage Project in 2002. If the Expanded Dry Fuels Storage Project were to come on line even earlier, with adequate capacity, it could eliminate the need for the Additional Increased Rack Capacity Project. If these schedules could not be met, then other fuel management strategies would have to be pursued, such as proceeding beyond the point in time when reracking would be feasible, expediting the characterizing/canning of CPP-666 fuel and obtaining dry fuel storage modules on a temporary basis, delaying incoming shipments where possible, and/or using existing storage capacities at facilities other than CPP-666.

Under Alternative C (Minimum Treatment, Storage, and Disposal), the current INEL spent nuclear fuel inventory would be transported to another DOE site (Figure 3.1-5). Current practices for managing naval spent nuclear fuel at the Idaho Chemical Processing Plant would continue until fuels are removed from the INEL site. Wet storage at Building CPP-603 at the Idaho Chemical Processing Plant would be phased out. The Electrometallurgical Process Demonstration project at Argonne National Laboratory-West would proceed. Table 3.1-2 provides additional information on other activities that would be conducted under this alternative. Under Alternative C, less spent nuclear fuel would remain at the INEL site in 2005, and no fuel would be present by 2035.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the INEL site would receive virtually all spent nuclear fuel for which DOE is responsible. Therefore, the quantity of fuel handled at the INEL site would increase from less than 500 metric tons of heavy metal under the other alternatives to nearly 1,000 metric tons of heavy metal by the year 2005. Activities required to handle this volume of fuel would include the Expended Core Facility Dry Cell Project, adding additional storage racks to increase spent nuclear fuel storage in pools at the Idaho Chemical Processing Plant (Building CPP-666), and phasing in expanded dry storage (Table 3.1-2). Older

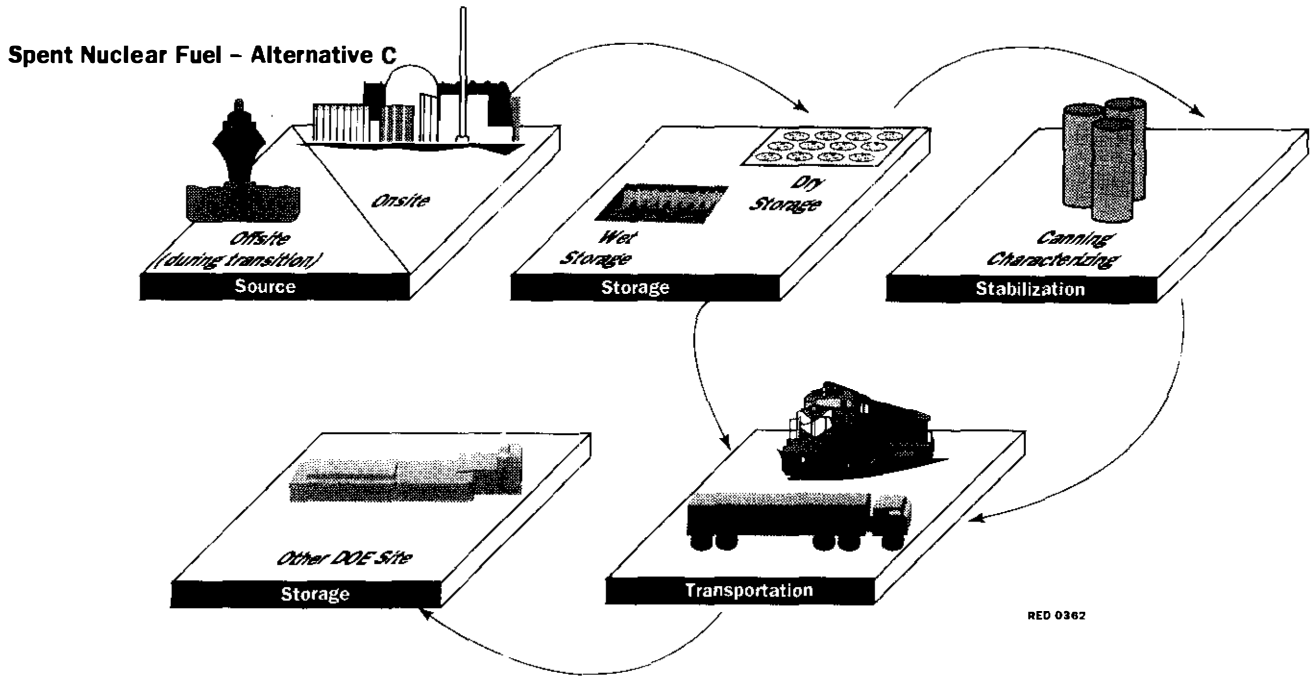


Figure 3.1-5. Management of spent nuclear fuel at the Idaho National Engineering Laboratory under the proposed Alternative C (Minimum Treatment, Storage, and Disposal).

storage pools (in Building CPP-603) would be phased out and the spent nuclear fuel canned and stored using dry storage methods. Consolidation of spent nuclear fuel would occur under this alternative. In addition, the demonstration of the Experimental Breeder Reactor-II Blanket Treatment and the Electrometallurgical Process Demonstration project at Argonne National Laboratory-West would be implemented.

Aqueous processing of spent nuclear fuel to stabilize it for disposition would be considered under Alternative D (Maximum Treatment, Storage, and Disposal). This processing would be implemented by the Spent Fuel Processing project described in Appendix C, Information Supporting the Alternatives. This project would be initiated at the Idaho Chemical Processing Plant. The existing fluorinel dissolution process, aluminum dissolution, and the solvent extraction system would be upgraded and restarted. In addition, the partially constructed Fuel Process Restoration Facility would be completed.

The quantities of spent nuclear fuel stored at the INEL in 2005 and 2035 (as shown in Figure 3.1-6) reflect the management decisions made for the four alternatives. The year 2035

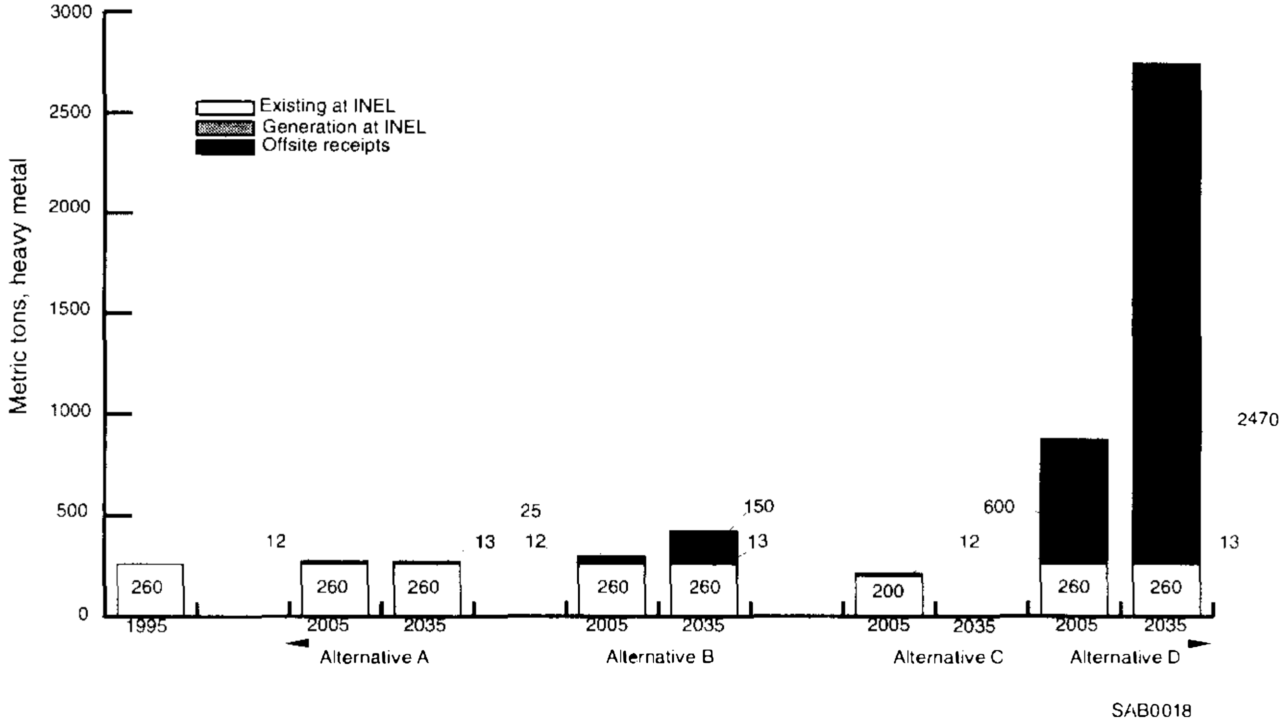


Figure 3.1-6. Spent nuclear fuel volumes at the Idaho National Engineering Laboratory for 1994, 2005, and 2035 under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal).

quantities are consistent with the corresponding Volume 1 alternatives. They result from three sources: (a) 1995 quantities already at the INEL site from sources described in Section 2.2.5, Spent Nuclear Fuel, (b) generation by operating reactors at the INEL site (see also Section 2.2.5), and (c) receipts from offsite.

The 2005 spent nuclear fuel inventory values reported in Figure 3.1-6 are conservative interpolations between the 1995 basis and the 2035 values. Assumptions that make the 2005 values conservatively high include the following:

- Under Alternative C (Minimum Treatment, Storage, and Disposal), offsite facilities are assumed not to be ready to receive most of the 1995 INEL inventory.

- Under Alternative D (Maximum Treatment, Storage, and Disposal), by 2005, the INEL site would accept about one-fourth of the DOE complex-wide spent nuclear fuel by placing the fuel in temporary dry storage.

3.1.2 Alternatives for Environmental Restoration

The environmental restoration alternatives are described separately for remediation and decontamination and decommissioning. The alternatives for these elements of the Environmental Restoration Program follow the basic alternative definitions described in the introduction to Section 3.1. The inclusion (or noninclusion) of proposed projects and the different end land use preferences are the primary attributes that differentiate the alternatives.

3.1.2.1 Remediation. The Federal Facility Agreement and Consent Order Action Plan would be followed under each alternative except Alternative A (No Action). In addition, three projects that would be authorized before June 1, 1995, under the Comprehensive Environmental Response, Compensation, and Liability Act would be completed under all four alternatives (Figure 3.1-7). The projects enumerated below are described in detail in Appendix C, Information Supporting the Alternatives, and their locations are shown in Figure 3.1-8:

- Retrieval and treatment of radioactive and hazardous wastes from Pit 9 at the Radioactive Waste Management Complex

- Remediation of groundwater contamination by removing contaminated groundwater from the aquifer in the vicinity of an injection well at Test Area North

- Remediation of the unsaturated hydrogeologic (vadose) zone by removing volatile organic contamination in the area of the Subsurface Disposal Area at the Radioactive Waste Management Complex.

Table 3.1-3 identifies the proposed projects and management functions at INEL by alternative. Most environmental restoration projects would be carried through all the alternatives. The primary difference between the projects in each alternative would be in the preferred end land use. Alternative B (Ten-Year Plan) activities would be conducted to result in industrial land use. For Alternative C (Minimum Treatment, Storage, and Disposal), environmental restoration would be minimized by emphasizing institutional controls. Alternative D (Maximum Treatment, Storage, and Disposal) would emphasize residential use as the preferred end land use. New remedial design and remedial actions may be implemented, independent of this EIS, as determined by the Record of

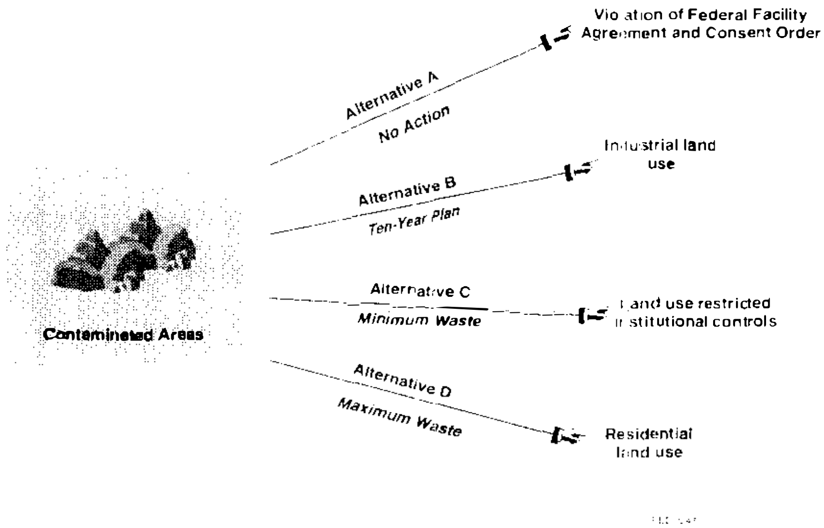


Figure 3.1-7. Management of remediation activities at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal).

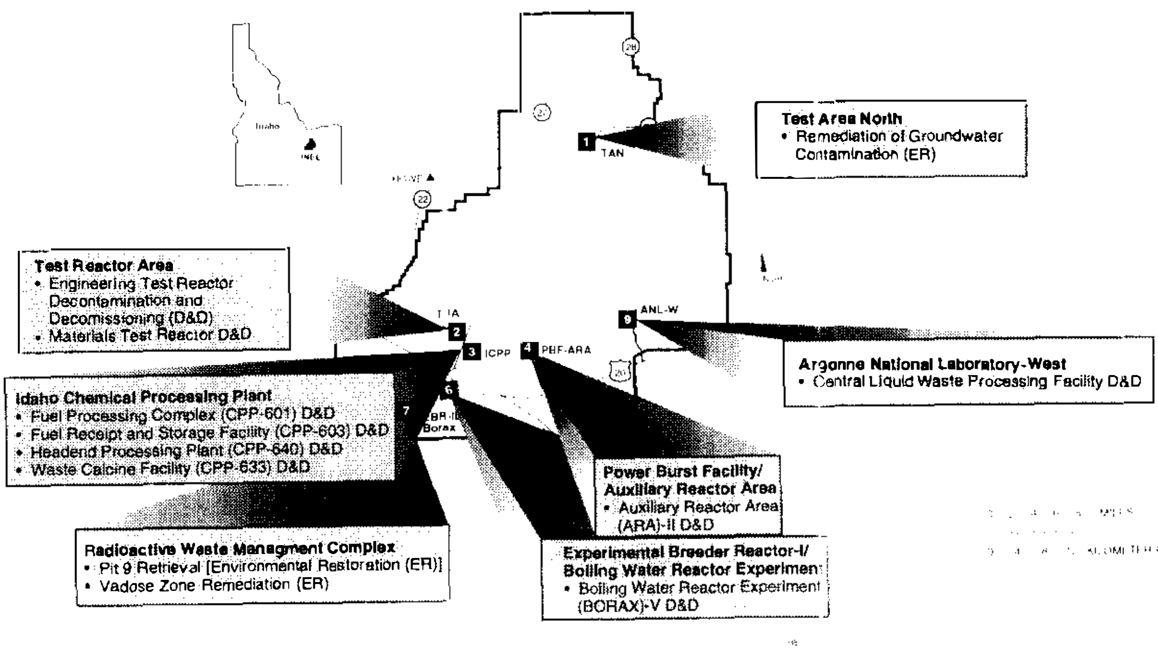


Figure 3.1-8. Environmental restoration: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

Table 3.1-3. Environmental restoration: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.[a]

A (No Action)	B (Ten-Year Plan)	C (Minimum Treatment, Storage, and Disposal)	D (Maximum Treatment, Storage and Disposal)
Conduct no activities other than already approved projects under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process FFA/CO would be violated Waste generation would be minimal compared to other alternatives <u>D&D Projects</u> • ARA-II • BORAX-V <u>Remediation Projects</u> • Remediation of Groundwater Contamination • Pit 9 Retrieval • Vadose Zone Remediation • Ongoing RI/FS.	Conduct projects in accordance with FFA/CO and Action Plan Waste generation quantity and increase similar to current quantities planned Reuse and partial dismantlement of D&D projects <u>D&D Projects</u> • ARA-II • BORAX-V • Engineering Test Reactor • Materials Test Reactor • Fuel Processing Complex (CPP-601) • Fuel Receipt and Storage Facility (CPP-603) • Headend Processing Plant (CPP-640) • Waste Calcine Facility (CPP-633) • Central Liquid Waste Processing Facility <u>Remediation Projects</u> • Remediation of Groundwater Contamination • Pit 9 Retrieval • Vadose Zone Remediation • Complete all RI/FS scheduled under FFA/CO, including comprehensive RI/FS for WAGs 1 through 10 • RI/FS-RD/RA for spills, contaminated soil, tanks, sewage lagoons, etc.	Conduct projects in accordance with FFA/CO and Action Plan Seek minimal waste generation Surveillance and maintenance of D&D projects <u>D&D Projects</u> • ARA-II • BORAX-V Focus on institutional controls to the extent possible for remediation projects <u>Remediation Projects</u> • Remediation of Groundwater Contamination • Pit 9 Retrieval • Vadose Zone Remediation • Complete all RI/FS scheduled under FFA/CO, including comprehensive RI/FS for WAGs 1 through 10 • RI/FS-RD/RA for spills, contaminated soil, tanks, sewage lagoons, etc.	Conduct projects in accordance with FFA/CO and Action Plan Assume maximum waste generation Complete dismantlement of D&D projects <u>D&D Projects</u> • ARA-II • BORAX-V • Engineering Test Reactor • Materials Test Reactor • Fuel Processing Complex (CPP-601) • Fuel Receipt and Storage Facility (CPP-603) • Headend Processing Plant (CPP-640) • Waste Calcine Facility (CPP-633) • Central Liquid Waste Processing Facility Focus on residential future land use to the extent possible for remediation projects <u>Remediation Projects</u> • Remediation of Groundwater Contamination • Pit 9 Retrieval • Vadose Zone Remediation • Complete all RI/FS scheduled under FFA/CO, including comprehensive RI/FS for WAGs 1 through 10 • RI/FS-RD/RA for spills, contaminated soil, tanks, sewage lagoons, etc.

a. ARA-Auxiliary Reactor Area; BORAX-Boiling Water Reactor Experiment; D&D-Decontamination and Decommissioning; FFA/CO - Federal Facility Agreement and Consent Order; RD/RA-remedial design/remedial action; RI/FS-remedial investigation/ feasibility study; SDA - subsurface disposal area, WAGs-Waste Area Groups: 1- Test Area North, 2-Test Reactor Area, 3-Idaho Chemical Processing Plant (ICPP), 4-Central Facilities Area, 5-Power Burst Facility/Auxiliary Reactor Area, 6-Experimental Breeder Reactor-I/Boiling Water Reactor Experiment, 7-Radioactive Waste Management Complex (RWMC), 8-Naval Reactors Facility, 9-Argonne National Laboratory-West, 10-Snake River Aquifer and other areas.

Decision from the Comprehensive Environmental Response, Compensation, and Liability Act process for each remedial investigation and feasibility study completed.

Under Alternative A (No Action), only existing and ongoing remediation activities would be permitted. These ongoing activities include the three projects described above and initiated remedial investigations and feasibility studies at each waste area group (Table 3.1-3). No additional remedial design and remedial actions would be implemented under this alternative. No end land use would be preferred.

Under Alternative B (Ten-Year Plan), all currently planned and new remedial investigations and feasibility studies would be implemented at each waste area group, leading to a comprehensive remedial investigation/feasibility study for all waste area groups. The three ongoing projects would continue. In addition, new remedial design and remedial actions would be implemented under this alternative, if remedial action is determined necessary by the Record of Decision determined under the Comprehensive Environmental Response, Compensation, and Liability Act process and the Federal Facility Agreement and Consent Order for each interim action or remedial investigation and feasibility study completed.

Under Alternative C (Minimum Treatment, Storage, and Disposal), remediation activities would be the same as identified under Alternative B (Ten-Year Plan). The emphasis of remedial designs and implementation of remedial actions to clean up sites, however, may be less extensive than under Alternative B. This is because the assumed end land use would be to restrict access and use by relying on institutional controls when allowed under the Record of Decision determined under the Comprehensive Environmental Response, Compensation, and Liability Act process and the Federal Facility Agreement and Consent Order. This potentially would result in less waste generated that would be transferred to the Waste Management Program.

Under Alternative D (Maximum Treatment, Storage, and Disposal), remediation activities would be the same as identified under Alternative B (Ten-Year Plan) The emphasis of remedial designs and implementation of remedial actions to clean up sites, however, may be more extensive than under Alternative B. This is because the assumed end land use would be residential when allowed under the Record of Decision determined under the Comprehensive Environmental Response, Compensation, and Liability Act process and the Federal Facility Agreement and Consent Order.

This potentially would result in more waste generated that would be transferred to the Waste Management Program.

3.1.2.2 Decontamination and Decommissioning. The decontamination and decommissioning process at the INEL is one of the functions of the Environmental Restoration Program where surplus contaminated facilities are either decontaminated and reused or decommissioned. The details of the process are described in Section 2.2.6.2. The projects under each alternative are listed in Table 3.1-3 and their locations are shown in Figure 3.1-8.

The alternatives and related decontamination and decommissioning actions considered in this EIS are Alternative A (No Action), continuing with ongoing projects and not beginning any new ones; Alternative B (Ten-Year Plan), continuing with ongoing projects and, in accordance with the established priorities, completing new ones to a level consistent with overall risk reduction and reuse capabilities; Alternative C (Minimum Treatment, Storage, and Disposal), providing primarily surveillance and maintenance with as little decontamination and dismantlement as possible; and Alternative D (Maximum Treatment, Storage, and Disposal), more completely removing the facility when it is not going to be reused (Figure 3.1-9).

3.1.2.2.1 Alternative A (No Action)—The two ongoing decontamination and decommissioning projects, Auxiliary Reactor Area-II facilities and the Boiling Water Reactor Experiment (BORAX)-V reactor building, would be completed by 1998 and the wastes (low-level, mixed low-level, hazardous, and industrial) generated would be dispositioned to existing waste handling facilities onsite. For this alternative, the approximate total quantities for all the decontamination and decommissioning projects are estimated to be 1,500 cubic meters (2,000 cubic yards) of low-level waste, 4 cubic meters (5 cubic yards) of mixed low-level waste, 5 cubic meters (6.5 cubic yards) of hazardous waste, and 350 cubic meters (450 cubic yards) of INEL industrial waste. Approximately 3 hectares (7 acres) would be restored for reuse. Under Alternative A (No Action), no other facilities would be decontaminated and decommissioned

3.1.2.2.2 Alternative B (Ten-Year Plan)—All the facilities currently on the Surplus Facilities List scheduled for decontamination and decommissioning at the INEL would be decontaminated and decommissioned under this alternative. Besides the two facilities identified under Alternative A (No Action), seven other projects would be initiated, as shown on Table 3.1-3 and

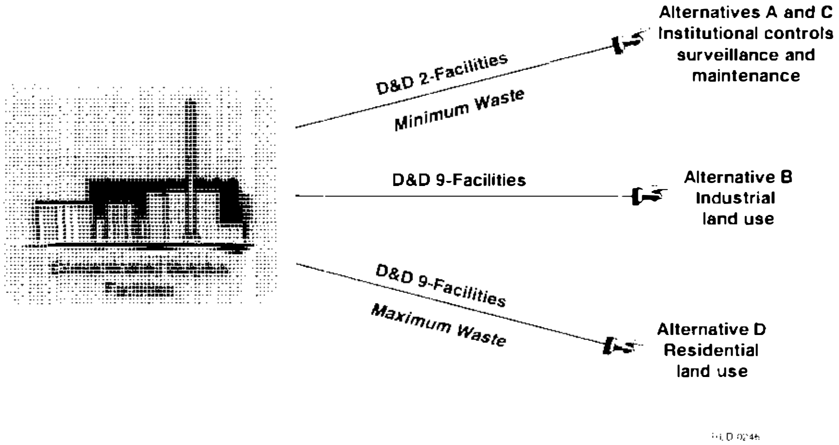


Figure 3.1-9. Management of decontamination and decommissioning (D&D) activities at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B ((Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal).

Figure 3.1-8. Alternative B (Ten-Year Plan) would emphasize, when possible, reuse or partial dismantlement of the facility.

Current estimates of wastes generated for each project are given in the applicable project summaries in Appendix C, Information Supporting the Alternatives. For this alternative, the approximate total quantities for all the decontamination and decommissioning projects are estimated to be 26,000 cubic meters (34,000 cubic yards) of low-level waste, 10 cubic meters (13 cubic yards) of transuranic wastes, 60 cubic meters (79 cubic yards) of mixed low-level waste, 6 cubic meters (8 cubic yards) of hazardous waste, and 31,000 cubic meters (41,000 cubic yards) of INEL industrial waste. Approximately 7 hectares (17 acres) would be restored for reuse.

3.1.2.2.3 Alternative C (Minimum Treatment, Storage, and Disposal)—Decontamination and decommissioning activities under Alternative C (Minimum Treatment, Storage, and Disposal) would be similar to those described under Alternative A (No Action). Under Alternative C (Minimum Treatment, Storage, and Disposal), the use of surveillance and maintenance methods would be preferred over dismantlement if human health and the environment would be adequately protected. The two ongoing projects would continue and the other candidate facilities would be kept in a safe storage status, that is, with a formal surveillance and maintenance program that would keep the facilities in repair and the contents safe and secure. Since this alternative would create several potentially surplus facilities, the surveillance and maintenance program would, if a new mission is not identified for these facilities, be significantly enlarged over the other alternatives.

3.1.2.2.4 Alternative D (Maximum Treatment, Storage, and Disposal)—The decontamination and decommissioning projects under this alternative would be the same ones as those identified under Alternative B (Ten-Year Plan). Alternative D (Maximum Treatment, Storage, and Disposal) would emphasize, when possible, complete dismantlement and restoration of the site. Under Alternative D (Maximum Treatment, Storage, and Disposal), the volume of wastes generated would be significantly greater than under Alternative B (Ten-Year Plan). Most of these increases would be for low-level waste and INEL industrial waste because the major effect of this activity would be the removal of structures such as wood, metal, and concrete that generally are in these categories.

3.1.3 Alternatives for Waste Management

The following discusses the alternatives for waste management activities under the Environmental Restoration and Waste Management Program. The same three basic management decisions and options discussed earlier are applicable for all waste streams (Figure 3.0-1 and Table 3.1-4). The implementation and emphasis for each management decision option that differentiates each alternative may vary in detail for each waste stream. This is because of the number of waste types that must be managed and several complicating factors:

- **Interrelationship between waste management, spent nuclear fuel management, and environmental restoration.** The interrelation for waste volumes presented in this chapter are given in Pole et al. (1993), as modified and supplemented by Heiselmann (1995), Freund (1995), and Morton and Hendrickson (1995). Together these documents provide waste stream data accurate when the documents were generated. Volume estimates in these documents include waste generated from spent nuclear fuel and environmental restoration activities.

Table 3.1-4. Summary of proposed waste management activities at the Idaho National Engineering Laboratory (INEL) by alternative.

A (No Action)	B (Ten-Year Plan)	C (Minimum Treatment, Storage, and Disposal)	D (Maximum Treatment, Storage, and Disposal)
Continue managing existing operations and existing waste management, research and development, and infrastructure facilities and projects Initiate no new activities with the exception of minor environmental safety and health activities that are necessary for maintaining safe operation Start no new major upgrades or facilities	Continue managing existing activities Plan, manage, and implement currently proposed projects for 1995 through 2005 to continue to meet the historic INEL role; ensure regulatory compliance; and meet commitments to the State of Idaho May include use of private sector	Manage waste management activities by transferring ongoing activities and waste to other Department of Energy (DOE) facilities or other government or private sector locations, resulting in minimal treatment, storage, and disposal activities on the INEL site Receive a minimum amount of waste from the DOE complex for purposes of treatment, storage, or disposal	To the maximum extent possible, other DOE facilities would transfer ongoing activities and waste to INEL site, resulting in maximum treatment, storage, and disposal activities on the INEL site Besides existing facilities and projects and currently planned projects for 1995 through 2005, manage additional projects not defined or defined on a smaller scale in Alternative B (Ten-Year Plan)

- **Interrelationships among waste types**. Distinctions between waste types are not sharp. Treatment may convert one waste type to another. Facilities may be shared among waste types.

- **Technical limitations** For some waste types there is currently no means of transport from one location to another. Disposal criteria have not been confirmed and disposal facilities, such as the Waste Isolation Pilot Plant, have not been permitted to accept waste.

- **Privatization**. Some of the management (treatment, storage, and disposal) activities are already being carried out in private/commercial facilities. DOE could consider expansion of commercial treatment, storage, and disposal.

The alternative descriptions for each waste stream identify the specific facilities and activities that would be required under each alternative to disposition the potential waste quantities. This presentation also allows for a clearer understanding of the differences among alternatives.

The basic steps in managing the wastes involve determining what wastes would be accepted for management and how and where they would be managed. The sources of wastes would be identified as (a) existing onsite, (b) newly generated onsite on a continuing basis, or (c) transported in from offsite. Volumes of waste expected to result from these sources would be estimated. Individual batches of waste would be characterized by sampling and analyses to confirm the waste type. Characterization might also be used to determine whether the waste meets, or could potentially meet, the acceptance criteria of existing or proposed facilities for treatment, storage, or disposal. The decision to treat, store pending treatment, and/or dispose would be made, and the location of these waste management steps would be selected.

3.1.3.1 High-Level Waste. The management of high-level waste under the four alternatives is illustrated in the flow diagrams associated with the descriptions of the four alternatives. The alternatives represent various strategies for completing the process, including various functions and projects, as detailed in Table 3.1-5. Under all four alternatives, storage of liquid in underground

High-Level Waste

Alternative A	• Convert liquid to solid calcine
Alternative B	• Convert liquid to calcine (solid) • Construct facility to immobilize both liquid and calcine for operation in 2008
Alternative C	• Construct replacement liquid storage tanks • Develop treatment that minimizes volume of high-activity waste • Select technology and plan immobilization facility to start operation in 2015
Alternative D	• Construct replacement liquid storage tanks • Convert liquid to calcine • Develop treatment that minimizes volume of high-activity waste • Select technology and plan immobilization facility to start operation in 2015

Table 3.1-5. High-level waste: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.

Alternative	Generate	Retrieve	Receive	Characterize	Store	Treat	Transport	Dispose
A (No Action)	From low-level waste stream via Process Equipment Waste evaporator	Not applicable	Not applicable	Not applicable	Continue storing liquid in underground tanks. • High-Level Tank Farm Replacement (upgrade phase) Continue storing solids in existing bins in concrete vaults	Continue converting liquid to calcine (solid)	Not applicable	Not at INEL
B (Ten-Year Plan)	From low-level waste stream via Process Equipment Waste Evaporator Some sodium-bearing waste from decontamination and decommissioning (D&D) projects at the Idaho Chemical Processing Plant	Demonstrate calcine retrieval from early bin set [see Section 3.1.4 for discussion of Calcine Transfer Project (Bin Set # 1)]	Not applicable	Develop acceptance criteria for disposal in geologic repository	Continue storing liquid in underground tanks. • High-Level Tank Farm Replacement (upgrade phase) Prepare existing tanks to phase out use • Tank Farm Heel Removal Project Continue storing solids in existing bins in concrete vaults. Expand high-level waste storage at Argonne National Laboratory-West (ANL-W) • Radioactive Scrap/Waste Facility (ANL-W)	Continue converting liquid to calcine (solid) Convert liquid and calcine to glass or ceramic for ultimate disposal • Waste Immobilization Facility (vitrification only)	Not until further disposition decisions are made	Not at INEL

Table 3.1-5. (continued).

Alternative	Generate	Retrieve	Receive	Characterize	Store	Treat	Transport	Dispose
C (Minimum Treatment, Storage, and Disposal)	From low-level waste stream via Process Equipment Waste Evaporator	Not applicable	Not applicable	Develop acceptance criteria for disposal in geologic repository	Continue storing liquid in underground tanks. • High-Level Tank Farm Replacement (upgrade phase) Prepare existing tanks for cease use • Tank Farm Heel Removal Project Replace existing liquid storage tanks • High-Level Tank Farm New Tanks Continue storing solids in existing bins in concrete vaults Expand high-level waste storage at Argonne National Laboratory-West • Radioactive Scrap/Waste Facility	Convert liquid and calcine to glass or ceramic for ultimate disposal • Waste Immobilization Facility (vitrification with separations)	Not until further disposition decisions are made	Dispose low-activity fraction from separations offsite or at INEL
D (Maximum Treatment, Storage and Disposal)	From low-level waste stream via Process Equipment Waste Evaporator Sodium-bearing waste as from D&D as in Alternative B Also potentially from processing spent nuclear fuel	Demonstrate calcine retrieval from early bin set [see Section 3.1.4 for discussion of Calcine Transfer Project (Bin Set # 1)]	Not applicable	Develop acceptance criteria for disposal in geologic repository	Continue storing liquid in underground tanks. • High-Level Tank Farm Replacement (upgrade phase) Prepare existing tanks for cease use • Tank Farm Heel Removal Project Replace existing liquid storage tanks • High-Level Tank Farm New Tanks Continue storing solids in existing bins in concrete vaults and add new bin set • New Calcine Storage Expand high-level waste storage at Argonne National Laboratory-West • Radioactive Scrap/Waste Facility	Convert liquid and calcine to glass or ceramic for ultimate disposal • Waste Immobilization Facility (vitrification with separations)	Not until further disposition decisions are made	Dispose low-activity fraction from separations offsite or at INEL

tanks and of solid (calcine) in near-surface bins would continue and the upgrade project for storage tank piping (identified in Chapter 2) would be completed. The high-level waste volumes, treatment rates, and volume reduction effects are documented in Freund (1995). This project and other proposed projects to implement the alternatives would be located at the Idaho Chemical Processing Plant, except for the expansion of high-level waste storage at Argonne National Laboratory-West (see Figure 3.1-10)

As of 1995, the generation and management activities for high-level waste, as described in Chapter 2, Background, would have resulted in both liquid waste and calcine (see Figure 3.1-11). About 15 percent of the liquid waste is high-level resulting from previous reprocessing. This waste is required to be calcined before January 1, 1998.

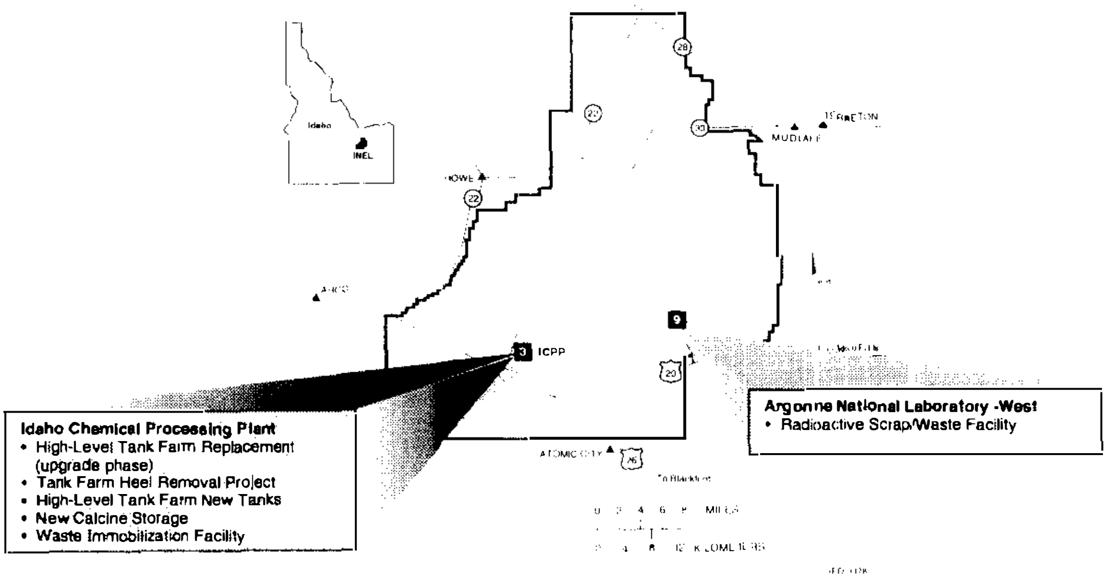


Figure 3.1-10. High-level waste: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

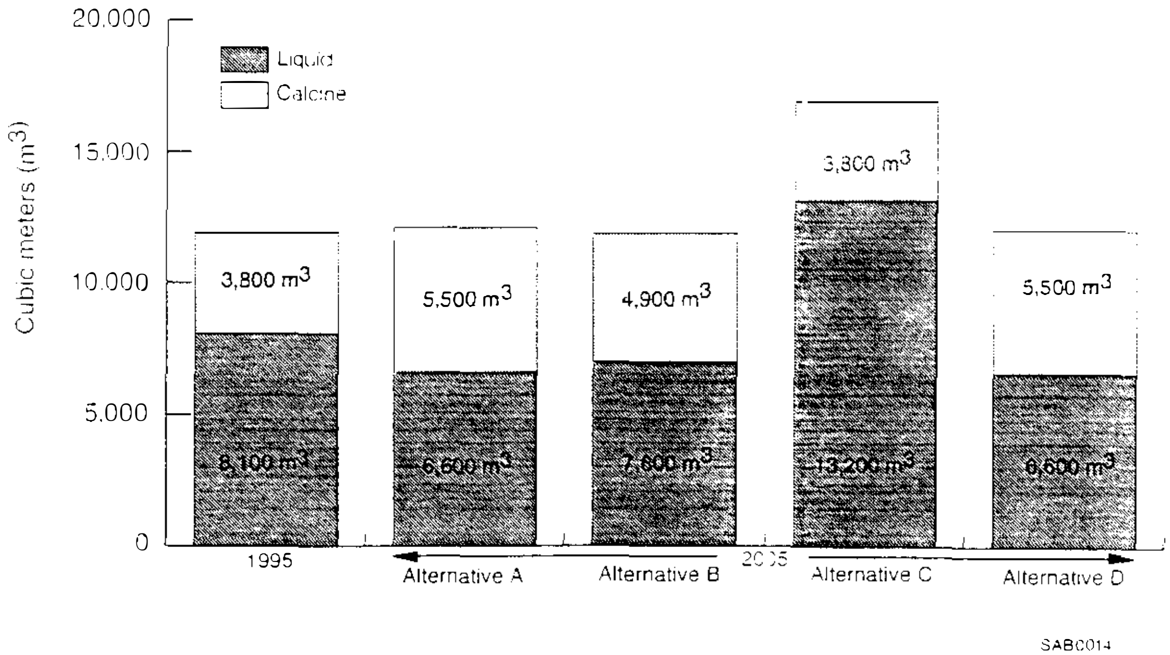


Figure 3.1-11. High-level waste volumes at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal).

3.1.3.1.1 Alternative A (No Action)—Under Alternative A (No Action), liquid waste from other sources and handled as high-level would continue to be generated (Figure 3.1-12). Waste would continue to be stored in existing tanks. Periodic operation to convert liquid waste to calcine in the New Waste Calcining Facility would continue in three 18-month intervals starting in 1996. Since no other projects are authorized under Alternative A (No Action), this alternative would not lead toward eliminating storage in the existing liquid storage tanks by 2015 (as required by current agreement).

3.1.3.1.2 Alternative B (Ten-Year Plan)—Under Alternative B (Ten-Year Plan), the New Waste Calcining Facility would be operated for a total of three years, in two 18-month intervals starting in 1996 (Figure 3.1-13). In the first interval, high-level waste from previous reprocessing would be calcined (as described in Chapter 2, Background) to meet the January 1, 1998, deadline for completing calcining this waste. Then, additional sodium-bearing waste would be

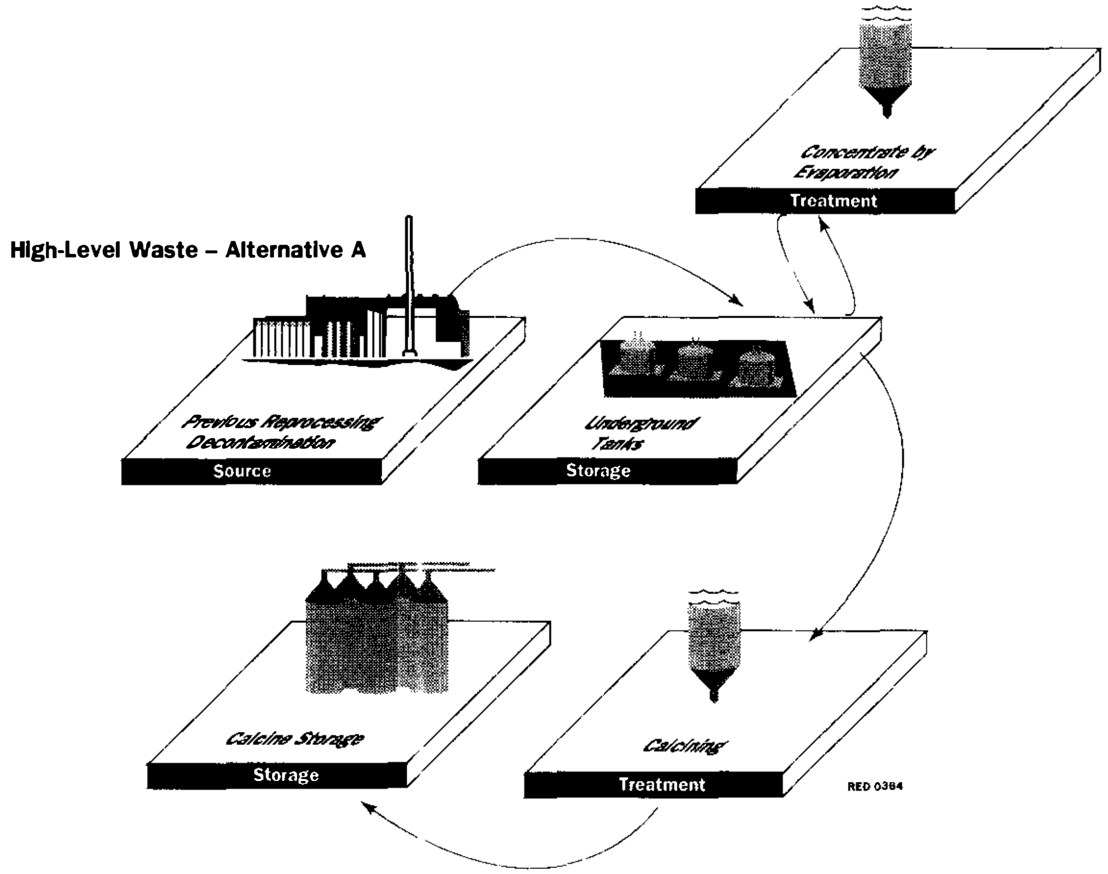


Figure 3.1-12. Management of high-level waste at the Idaho National Engineering Laboratory under the proposed Alternative A (No Action).

calcined, as also described in Chapter 2. The calcine thus generated (see Figure 3.1-11) would fit into existing bin storage. When calcining is not in process, the liquid waste evaporator, currently being installed in the New Waste Calcining Facility, would operate intermittently to concentrate the sodium-bearing liquid waste.

Design and construction would be started on the Waste Immobilization Facility, described further in Appendix C, Information Supporting the Alternatives. This facility, assumed for analysis purposes to be ready to operate in 2008, would be capable of treating both the liquid waste (including sodium-bearing waste) and the calcine into a form (either glass or glass ceramic) that is potentially acceptable for ultimate disposal into a geologic repository. Under Alternative B (Ten-Year Plan), the

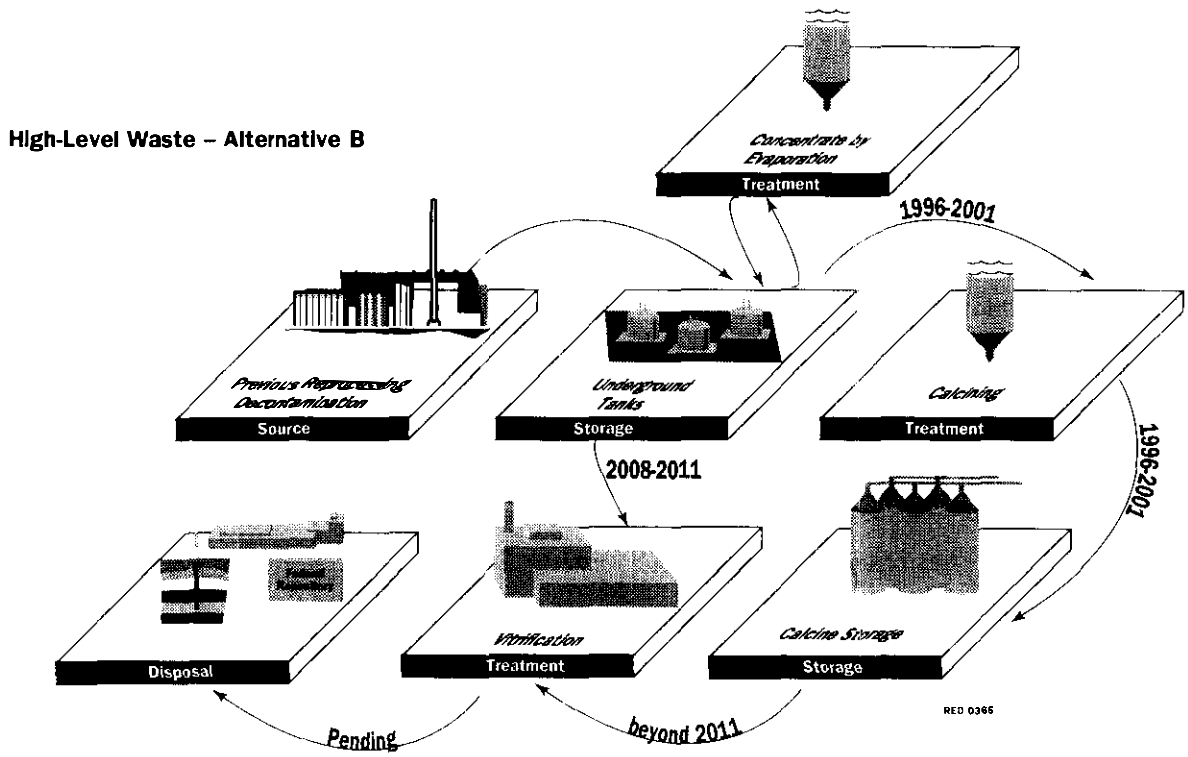


Figure 3.1-13. Management of high-level waste at the Idaho National Engineering Laboratory under the proposed Alternative B (Ten-Year Plan).

Waste Immobilization Facility would involve direct vitrification (with only minimum pretreatment) of sodium-bearing liquids and calcined solids.

Without more extensive pretreatment, direct vitrification would produce a comparatively large amount of vitrified, disposable, high-activity solid waste [up to 19,000 cubic meters (25,000 cubic yards)]. The Waste Immobilization Facility would potentially include enough storage capacity for the immobilized solid until a repository is available.

Operation of the liquid waste evaporator and the New Waste Calcining Facility, if combined with waste minimization, should allow DOE to meet the Notice of Noncompliance Consent Order requirement to cease use of some Tank Farm tanks by 2009. Operation of the Waste Immobilization Facility (assumed to begin in 2008 with liquid waste as the feed) should allow DOE to meet the Notice of Noncompliance Consent Order requirement to cease use of the remaining Tank Farm tanks by 2015.

The activities necessary to take these storage tanks out of service include the Tank Heel Removal Project (see Appendix C for details). The remaining few thousand gallons of liquid would be removed from these tanks by new equipment because the "heel" (remaining liquid) is not removable with the existing transfer lines witbin the tanks.

3.1.3.1.3 Alternative C (Minimum Treatment, Storage, and Disposal)—Under Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-14), newly generated waste is comparable to Alternative A (No Action). Activities consistent with the minimum treatment aspect of the alternative would be implemented. Thus, the projects and activities would include building new tanks for liquid waste storage. New tanks would be needed because the New Waste Calcining Facility would not be used to calcine liquid waste or to concentrate sodium-bearing waste. With neither of these processes operating, more liquid waste would exist under Alternative C (Minimum Treatment, Storage, and Disposal) in 2005 than under any other proposed alternative. (Even under this alternative, calcining would be required to meet the court-mandated deadline of having all

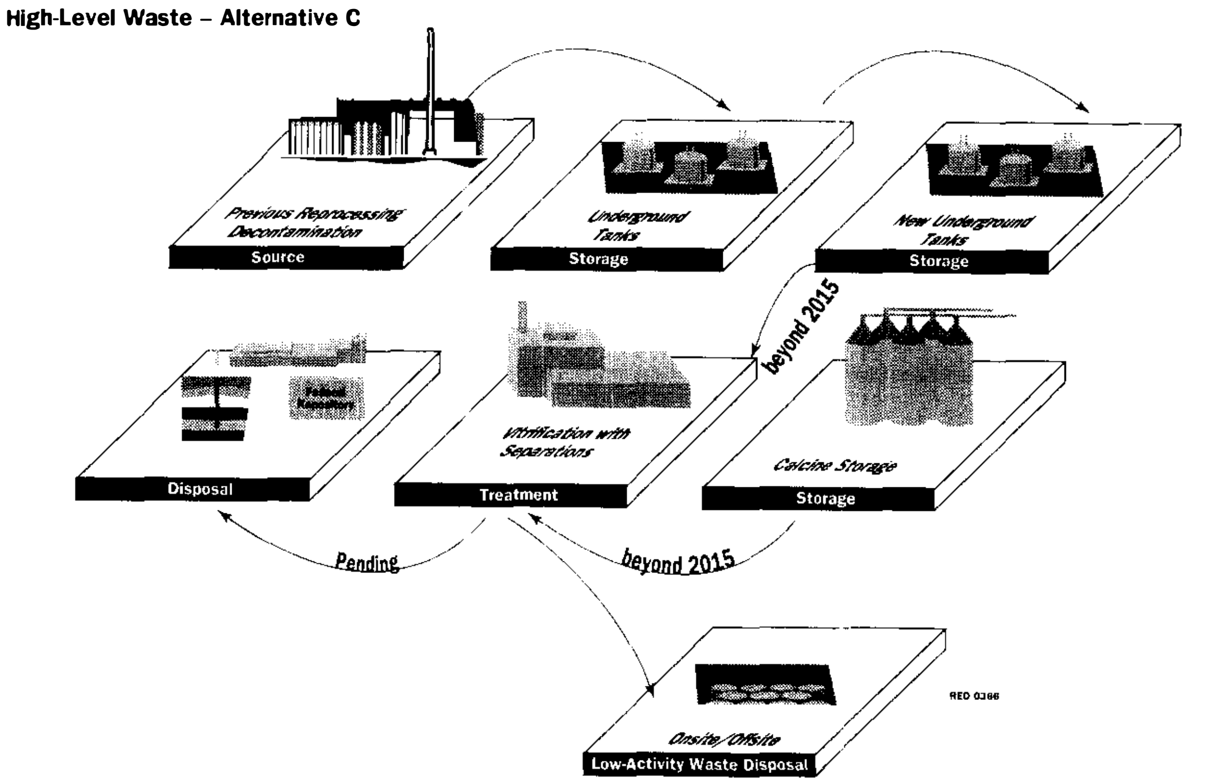


Figure 3.1-14. Management of high-level waste at the Idaho National Engineering Laboratory under the proposed Alternative C (Minimum Treatment, Storage, and Disposal).

high-level waste calcined before January 1, 1998. Calcining was not, however, included in the impact analysis for this alternative.) Because the existing liquid waste storage tanks would still be needed to be taken out of service, the Tank Farm Heel Removal Project would proceed under Alternative C (Minimum Treatment, Storage, and Disposal).

Design and construction of the Waste Immobilization Facility would be delayed beyond 2005, and its operation was assumed for analysis purposes to begin in 2015 under this alternative. The Waste Immobilization Facility (described in Appendix C, Information Supporting the Alternatives) would include a separations step for liquid waste before vitrification. Existing calcine would need to be dissolved in an additional pretreatment step before the separation step. The separation options for both sodium-bearing liquid waste and calcine would include precipitation and radionuclide partitioning. Sodium-bearing liquid waste could also be separated by freeze crystallization.

Pretreatment would produce a high-activity waste form suitable for placement in a geologic repository and a low-activity waste form that could be delisted or disposed of in a Resource Conservation Recovery Act-approved waste disposal site. The high-activity waste form would be glass or glass ceramic, and the low-activity waste form would be grout, glass, or glass-ceramic. The high-activity waste volume would possibly be only a few percent of that from direct vitrification.

3.1.3.1.4 Alternative D (Maximum Treatment, Storage, and Disposal)—Under Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-15), the newly generated waste would be greater than any other alternative (because of processing of spent nuclear fuel), but no estimate of generation is included in this alternative. The maximum number of projects and activities potentially needed to manage high-level waste between 1995 and 2005 is included. New projects would be (a) new tanks to store liquid waste, (b) the Tank Farm Heel Removal project, and (c) another bin set to store calcine.

As in Alternative A (No Action), the New Waste Calcining Facility was assumed to operate periodically to the maximum extent permitted between 1995 and 2005 and would produce the same amount of new calcine (see Figure 3.1-11). (Even with the full operation of the New Waste Calcining Facility, new calcine storage would not likely to be needed until well after 2005.) As in Alternative C (Minimum Treatment, Storage, and Disposal), the design and construction of the Waste Immobilization Facility was assumed to begin after 2005; and operation, including separation and

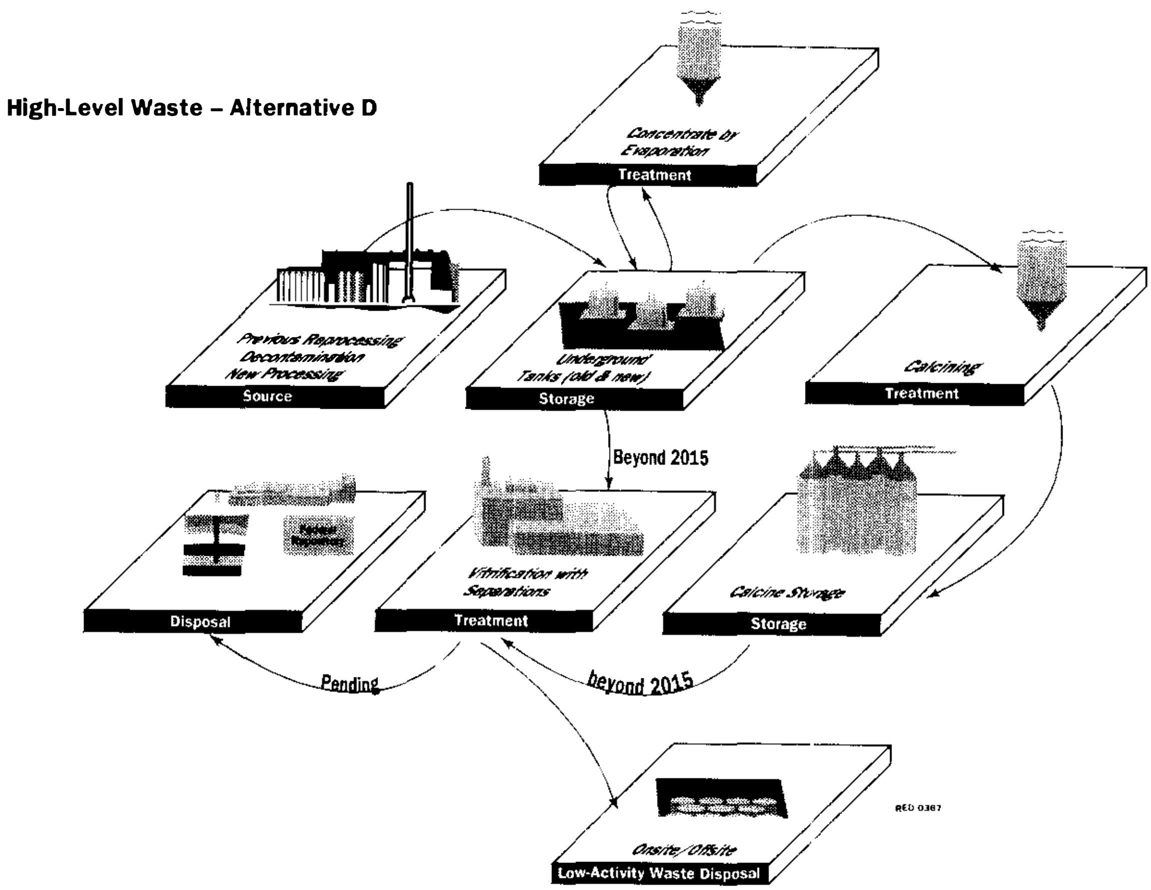


Figure 3.1-15. Management of high-level waste at the Idaho National Engineering Laboratory under the proposed Alternative D (Maximum Treatment, Storage, and Disposal).

vitrification, was assumed for analysis purposes to begin in 2015. The products of the Waste Immobilization Facility, and corresponding disposition options, would be the same as for Alternative C (Minimum Treatment, Storage, and Disposal).

By including both new liquid storage tanks and continued calcining, Alternative D (Maximum Treatment, Storage, and Disposal) would bound the impact on high-level waste management activities of any decision to process spent nuclear fuel under Alternative D. (See Section 3.1.1 and the Spent Nuclear Fuel Processing Project description in Appendix C, Information Supporting the Alternatives.)

3.1.3.1.5 Summary—Major differences and similarities among the four alternatives for high-level waste can be summarized as follows:

- Inventories of liquid waste to be treated would be essentially the same for Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). Some small amount of additional sodium-bearing waste would result from decontamination and decommissioning projects at the Idaho Chemical Processing Plant under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). In addition, more liquid waste would be generated under Alternative D (Maximum Treatment, Storage, and Disposal) if spent nuclear fuel were processed before ultimate disposal.

- All alternatives except Alternative A (No Action) would lead to phaseout of existing liquid storage tanks, consistent with previous agreements. New tanks would need to be built under Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal) to meet this phase-out schedule.

- Under all alternatives, liquid would continue to be converted to calcine (an interim solid), but calcining is not analyzed under Alternative C (Minimum Treatment, Storage, and Disposal). None of the alternatives, however, would result in the majority of the existing liquid being converted by the year 2005.

- Existing storage capacity for calcine would be sufficient for all alternatives.

- Planning for conversion of both liquid and calcine to a final disposable solid (glass or ceramic) would proceed under all alternatives except Alternative A (No Action). Under Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal), the process would be delayed to allow for developing separations methods that reduce the quantity of high-activity waste to be disposed.

- Alternatives B (Ten-Year Plan), D (Maximum Treatment, Storage, and Disposal), and, with calcining, C (Minimum Treatment, Storage, and Disposal) would meet the intent of previous consent orders and of compliance with regulations. Without calcining, Alternative C (Minimum Treatment, Storage, and Disposal) would fail to meet one mandated date in the modified court order but would result in less high-activity waste having to be disposed in a Federal repository than Alternative B (Ten-Year Plan).

3.1.3.1.6 Technology Selection—DOE has identified reasonable technology alternatives to process sodium-bearing liquid wastes and calcine and is currently evaluating and conducting tests to determine the viability of the competing technologies. In the Record of Decision for this EIS, DOE will select a technology for calcining or processing sodium-bearing liquid waste. In addition, in the Record of Decision for this EIS, DOE will select a technology for converting calcined wastes into an appropriate form for disposal.

Decisions on these treatment technologies will be made in conjunction with efforts currently being undertaken with the State of Idaho under the Federal Facility Compliance Act. These efforts include identification of potential treatment technologies for mixed wastes and the development of a Site Treatment Plan, which will provide a schedule for the development and implementation of these treatment technologies. A discussion of the evaluation and analyses for these treatment technology alternatives for sodium-bearing wastes and calcine is provided in the Project Summary for the Waste Immobilization Facility given in Appendix C, Information Supporting the Alternatives.

DOE has identified two primary treatment technology alternatives for evaluation: (a) vitrification and (b) separation, followed by vitrification and grouting. Within the separation technology alternative, three options were identified: (a) radionuclide partitioning, (b) precipitation, or (c) freeze crystallization. Either of these two primary technology alternatives could be implemented through the Waste Immobilization Facility. The emissions, effluents. and final waste forms from processes within the Waste Immobilization Facility would depend on the treatment technology alternative selected. This EIS provides a preliminary analysis of the impacts of construction and operation of the Waste Immobilization Facility, including storage of the final waste form, for each of the treatment technology alternatives. The analyses performed for the Waste Immobilization Facility bound the impacts for each of the treatment technology alternatives and also any of the options within the primary treatment technology alternatives identified. Before a decision is made on whether to proceed with construction of the Waste Immobilization Facility, further National Environmental Policy Act review will be conducted, as appropriate.

Transuranic Waste

Alternative A	• Accept offsite waste for storage on case-by-case basis • Retrieve/move transuranic and alpha low-level waste to new storage • Transport transuranic waste offsite for disposal
Alternative B	• Accept transuranic waste from offsite for treatment • 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
Alternative C	• 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
Alternative D	• Accept offsite 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 • Dispose of alpha low-level waste at new onsite facility

3.1.3.2 Transuranic Waste. The management of transuranic waste and alpha low-level waste would involve completing the storage, characterization, treatment, and disposal process illustrated in the flow diagrams associated with the descriptions of the alternatives. The four alternatives, as detailed in Table 3.1-6 and described below, represent various strategies leading to such completion. The transuranic and alpha low-level waste volumes, treatment rates, and volume reduction effects are documented in Section 2 of Morton and Hendrickson (1995).

For analysis under each of the four alternatives, a bounding case was assumed that the INEL would transport 12,500 cubic meters (16,500 cubic yards) of transuranic waste to the national repository over a period of five years beginning in 1998. Each of the alternatives also calls for approximately 47,000 cubic meters (61,000 cubic yards) of transuranic and alpha low-level waste to be retrieved from covered storage and placed into new storage modules at the Transuranic Storage

Table 3.1-6. Transuranic waste: Summary of proposed management function and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.[a,b,c]

Alternative	Generate	Retrieve/Handle	Receive	Characterize	Store	Treat	Transport	Dispose
A (No Action)	Generate minimal amount of waste (50 m^3)	Retrieve up to 10,400 m^3/yr TRU and alpha low-level waste and place in storage • TSA Enclosure and Storage Project	Accept waste on a case-by-case basis	Characterize a representative sample of retrieved waste • Waste Characterization Facility	Store received, retrieved, and newly generated waste, pending offsite shipment • TSA Enclosure and Storage Project	Pit 9 Retrieval Project	Transport 2500 m^3/yr certified waste to WIPP starting in 1998	No onsite disposal
B (Ten-Year Plan)	Generate small amount of waste from proposed onsite activities ($\approx$300 m^3)	Retrieve up to 10,400 m^3/yr TRU and alpha low-level waste and place in storage • TSA Enclosure and Storage Project	Receive $\approx$6,000 m^3 from Rocky Flats and ANL-E	Characterize a representative sample of retrieved waste • Waste Characterization Facility	Store received, retrieved, and newly generated waste before and after treatment pending availability of disposal • TSA Enclosure and Storage Project	Treat to meet disposal requirements • Idaho Waste Processing Facility • Private Sector Alpha-Contaminated MLLW Treatment •Pit 9 Retrieval Project • Plasma Hearth Process (see Section 3.1.4, Technology Development)	Transport 2,500 m^3/yr certified waste to WIPP starting in 1998 Transport waste to commercial treatment • RWMC Modifications to Support Private Sector Treatment of Alpha-Contaminated MLLW	No onsite disposal
C (Minimum Treatment, Storage, and Disposal)	Generate small amount of waste from proposed onsite activities ($\approx$300 m^3)	Retrieve up to 10,400 m^3/yr TRU and alpha low-level waste and place in storage • TSA Enclosure and Storage Project	No waste received	Characterize a representative sample of retrieved waste • Waste Characterization Facility	Store received, retrieved, and newly generated waste before and after treatment pending availability of disposal • TSA Enclosure and Storage Project	•Pit 9 Retrieval Project	Transport 2500 m^3/yr certified waste to WIPP starting in 1998 Transport waste offsite for treatment, storage, and disposal • Shipping/Transfer Station	No onsite disposal

Table 3.1-6. (continued).

Alternative	Generate	Retrieve/Handle	Receive	Characterize	Store	Treat	Transport	Dispose
D (Maximum Treatment, Storage, and Disposal)	Generate small amount of waste from proposed onsite activities (≈350 m^3)	Retrieve up to 10,400 m^3/yr TRU and alpha low-level waste and place in storage • TSA Enclosure and Storage Project	Receive ≈20,000 m^3 from Rocky Flats, ANL-E, and Los Alamos National Laboratory	Characterize a representative sample of retrieved waste • Waste Characterization Facility	Store received, retrieved, and newly generated waste before and after treatment pending availability of disposal • TSA Enclosure and Storage Project	Treat to meet disposal requirements • Idaho Waste Processing Facility • Private Sector Alpha-Contaminated MLLW treatment •Pit 9 Retrieval Project • Plasma Hearth Process (see Section 3.1.4, Technology Development)	Transport 2500 m^3/yr certified waste to WIPP starting in 1998 (for 5 years) Transport waste to commercial treatment • RWMC Modifications to Support Private Sector Treatment of Alpha-Contaminated MLLW	No onsite disposal of TRU Potential alpha-MLLW disposal

a. Source: Morton and Hendrickson (1995)

b. ANL-E = Argonne National Laboratory-East; MLLW =mixed low-level waste; RWMC = Radioactive Waste Management Complex; TRU = transuranic waste; TSA = Transuranic Storage Area; WIPP = Waste Isolation Pilot Plant.

c. To convert cubic meters to cubic yards, divide by 0.76455.

Area during the period 1995 through 2000. This retrieval would continue several more years until the entire 52,000 cubic meters (68,000 cubic yards) of covered stored transuranic waste is retrieved. Approximately 13,000 cubic meters (17,000 cubic yards) of transuranic and alpha low-level waste in storage in the Air Support Buildings would also be moved into new storage in all alternatives. The locations of this and other projects for transuranic waste associated with all the alternatives are shown in Figure 3.1-16. The inventory of transuranic waste onsite in 2005 for all alternatives is shown in Figure 3.1-17.

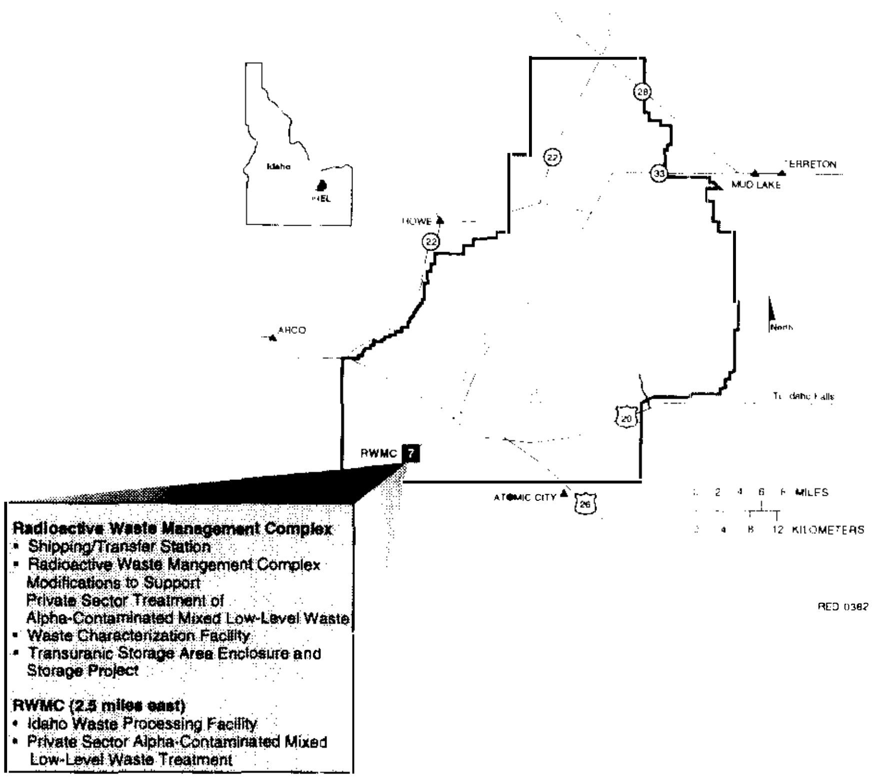


Figure 3.1-16. Transuranic waste: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

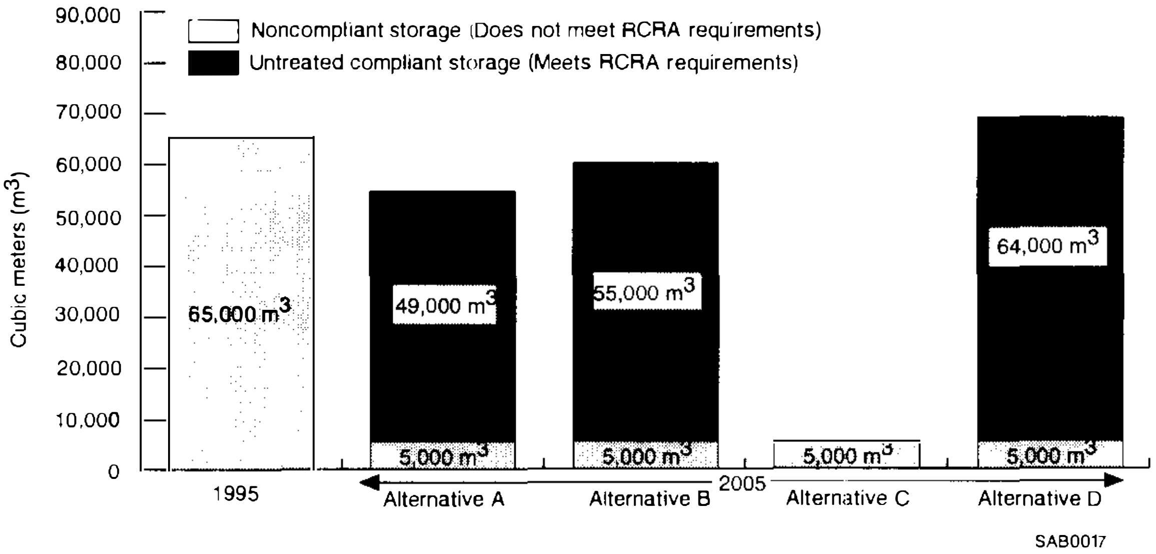


Figure 3.1-17. Transuranic waste volumes at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal). Alternatives B and D assume that the Idaho Waste Processing Facility is selected as the waste treatment facility.

3.1.3.2.1 Alternative A (No Action)—Alternative A (No Action) would continue the current program of transuranic waste management in operation at the INEL (Figure 3.1-18). Small additional quantities of waste would continue to be generated from onsite operations, environmental restoration, and decontamination and decommissioning activities. Nominal additional volumes of waste would be received from offsite generators, including Argonne National Laboratory-East and Rocky Flats. New shipments of transuranic waste would continue to be received from offsite sources on a case-by-case basis when approved by the State of Idaho.

Existing transuranic and alpha low-level waste storage facilities on the asphalt pads at the Transuranic Storage Area and in the Air Support Buildings would continue to be used until the waste was retrieved and placed into new storage modules. The program of examination, certification, and preparation for disposal of transuranic waste in a national repository would also continue. The Stored Waste Examination Pilot Plant for certifying transuranic waste would continue to operate; and retrieved stored waste would be examined, characterized, sorted, reclassified, and repackaged, as necessary at the Stored Waste Examination Pilot Plant and the new Waste Characterization Facility located at the Radioactive Waste Management Complex.

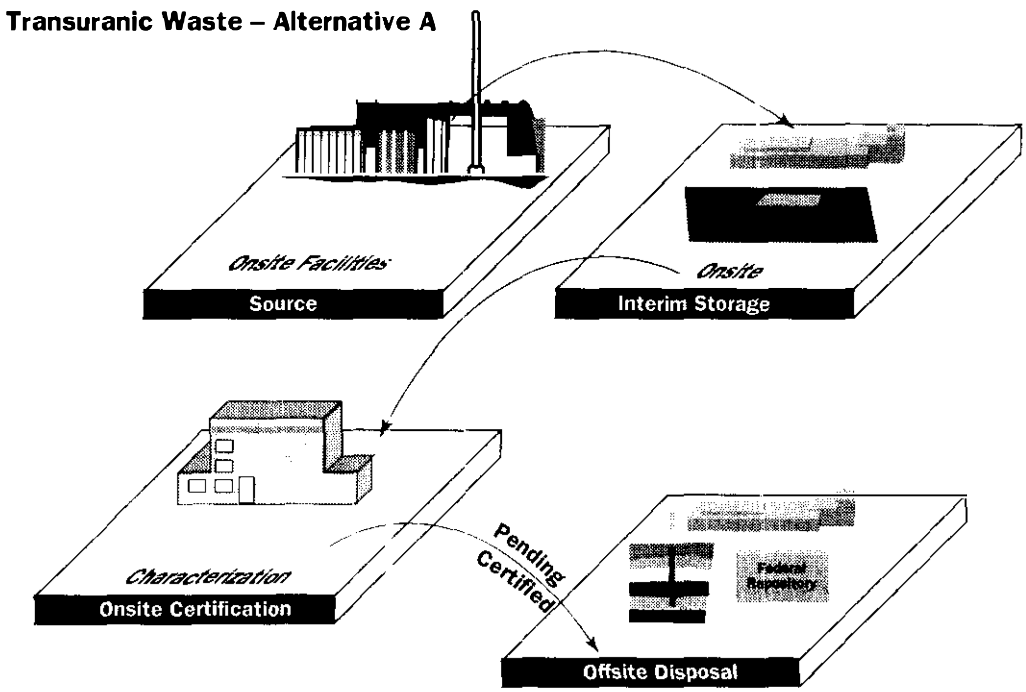


Figure 3.1-18. Management of transuranic waste at the Idaho National Engineering Laboratory under the proposed Alternative A (No Action).

3.1.3.2.2 Alternative B (Ten-Year Plan)—Alternative B (Ten-Year Plan) would supplement the current program of transuranic waste management at the INEL described in Alternative A (No Action) by implementing transuranic and alpha low-level waste treatment projects (Figure 3.1-19). The ultimate aim of these projects would be to prepare transuranic waste for disposal in a national repository. Alpha low-level waste and transuranic waste that could not be certified for disposal would be treated and left in indefinite storage. Waste storage and characterization activities would continue as described in Alternative A (No Action).

Under this alternative, approximately 6,000 cubic meters (8,000 cubic yards) of transuranic waste would be received from Rocky Flats and Argonne National Laboratory-East.

Under Alternative B (Ten-Year Plan), DOE would add transuranic and alpha low-level waste treatment capabilities before 2005. Technologies for treating transuranic and alpha low-level waste and preferred modes of making the technologies available, whether through the private sector (on or off the site) or through INEL facilities, would be chosen first. Then new waste treatment facilities

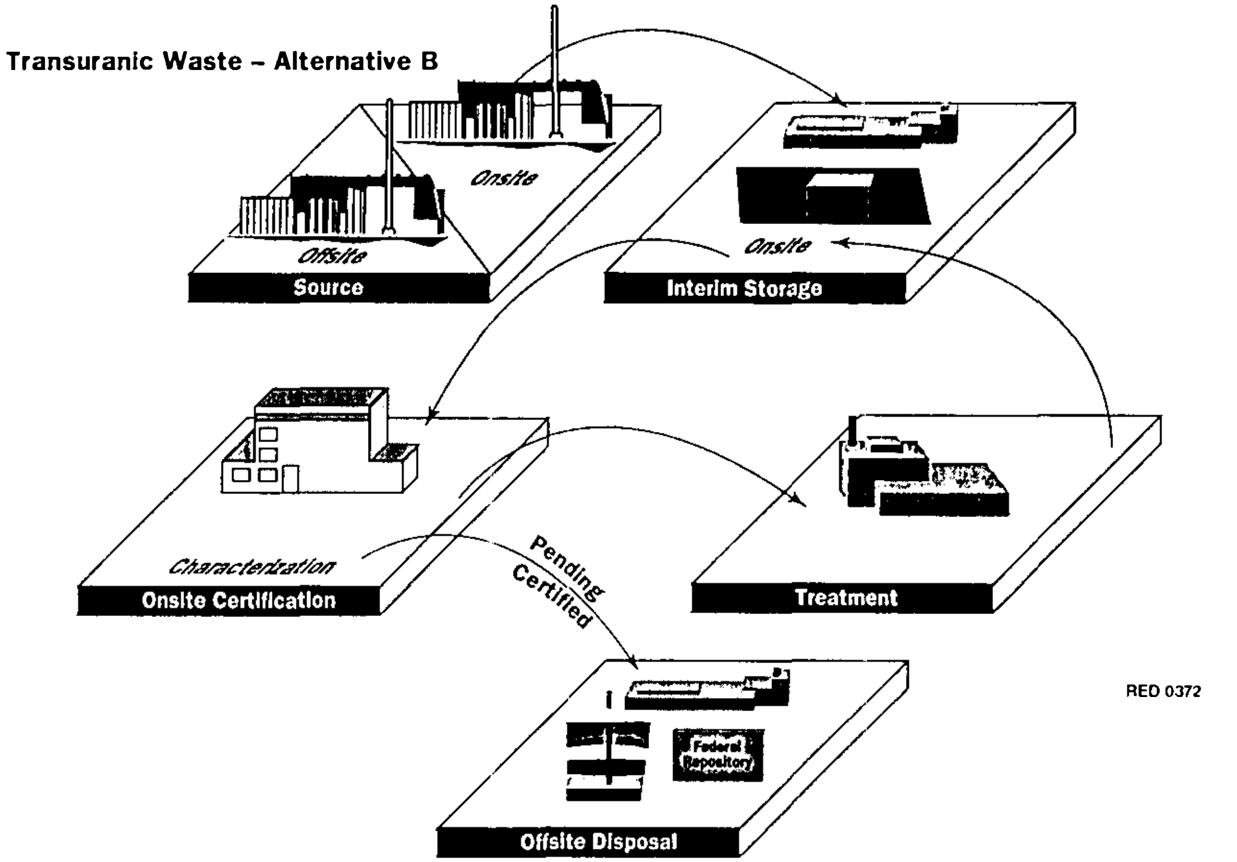


Figure 3.1-19. Management of transuranic waste at the Idaho National Engineering Laboratory under the proposed Alternative B (Ten-Year Plan).

would be constructed in two phases—the first to treat alpha-contaminated waste and the second to treat transuranic waste.

If the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility is selected, approximately 10,000 cubic meters (13,000 cubic yards) of alpha low-level waste would be treated at this facility within the ten-year window of this EIS. If the Idaho Waste Processing Facility is selected, treatment of transuranic waste and alpha low-level waste would start after 2005. Radioactive Waste Management Complex modifications would be performed to support shipment if the facility is off the site. Additional volumes of transuranic and alpha low-level waste would be treated at this facility sometime after 2005. Alpha low-level waste treatment residuals from the treatment facility would be stored for eventual disposal.

3.1.3.2.3 Alternative C (Minimum Treatment, Storage, and Disposal)—Alternative C (Minimum Treatment, Storage, and Disposal) would shut down, phase out, or minimize treatment, storage, and disposal activities at the INEL site (Figure 3.1-20). Therefore, to the maximum extent possible, transuranic and alpha low-level waste would be transported to another facility for management. Under this alternative, no transuranic waste would be received from offsite generators. Onsite management of wastes would be scaled down to the minimum required by regulations. This alternative would end all technology development and privatization initiatives for transuranic and alpha low-level waste treatment at the INEL site. Selecting this alternative would not, however, end the waste storage and characterization activities, described under Alternative A (No Action), that are required to send waste to a national transuranic waste repository.

Additional storage facilities would also be required to support the retrieval of stored waste and to provide interim storage and staging of waste before shipment.

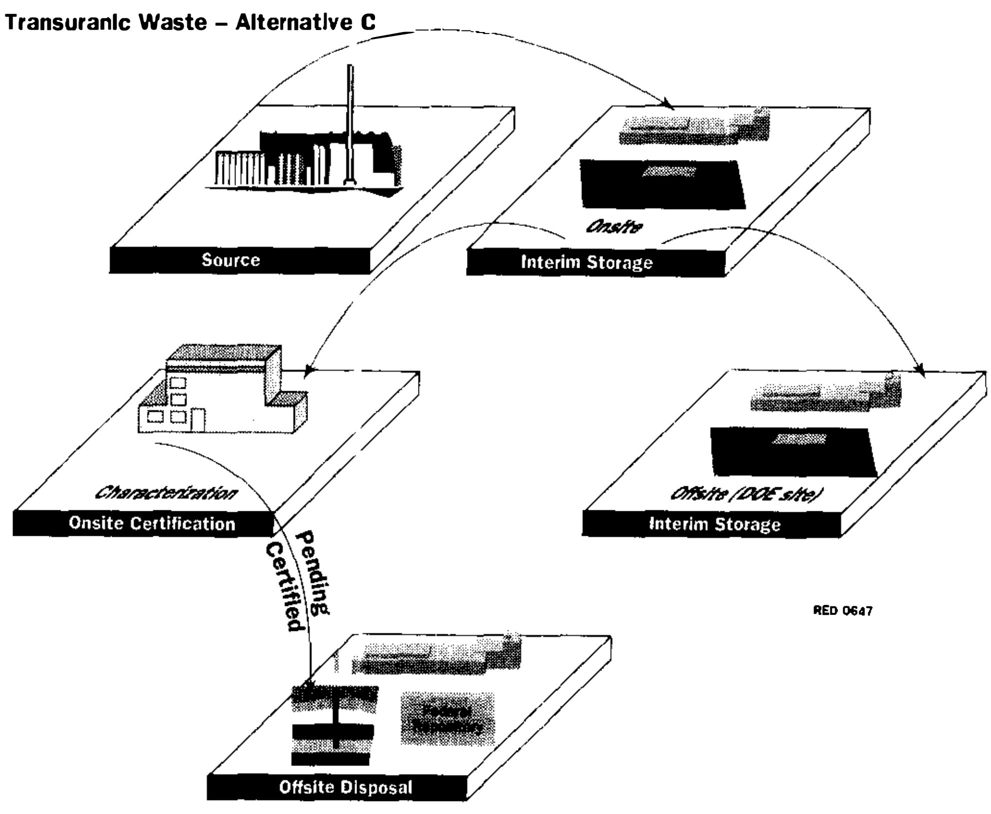


Figure 3.1-20. Management of transuranic waste at the Idaho National Engineering Laboratory under the proposed Alternative C (Minimum Treatment, Storage, and Disposal).

Transporting all the transuranic and alpha low-level waste stored at the INEL offsite would require expanding transportation and characterization capabilities. The Shipping/Transfer Facility, which is an expansion of the Stored Waste Examination Pilot Plant, would be constructed.

3.1.3.2.4 Alternative D (Maximum Treatment, Storage, and Disposal)—Alternative D (Maximum Treatment, Storage, and Disposal) would increase onsite management of transuranic and alpha low-level waste to accommodate increased waste management support to offsite facilities in the DOE complex (Figure 3.1-21). Under Alternative D (Maximum Treatment, Storage, and Disposal), 20,000 cubic meters (26,000 cubic yards) of transuranic waste would be accepted from offsite generators. A low-level waste disposal facility for alpha low-level waste would also be constructed in the vicinity of the Radioactive Waste Management Complex so that this waste could be finally disposed of.

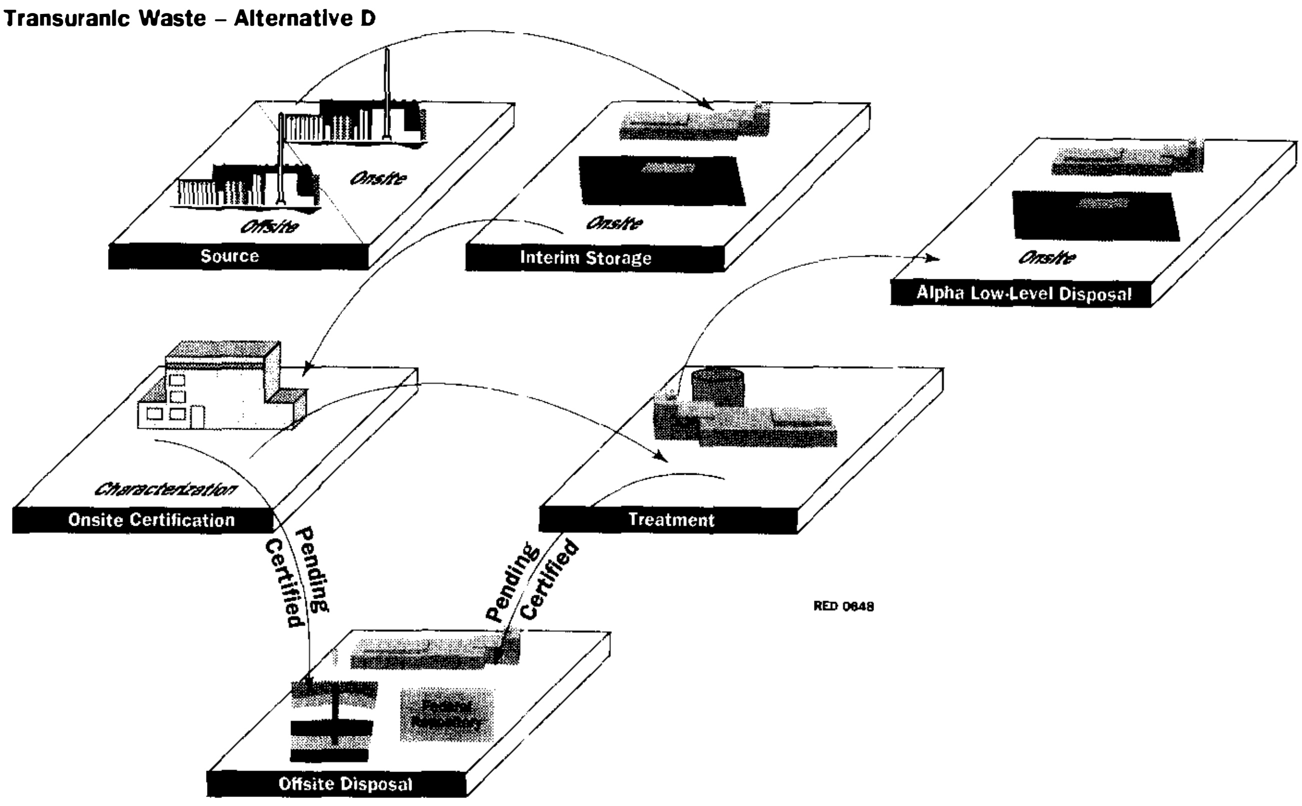


Figure 3.1-21. Management of transuranic waste at the Idaho National Engineering Laboratory under the proposed Alternative D (Maximum Treatment, Storage, and Disposal).

Implementing this alternative would require accepting additional volumes of waste from offsite facilities for interim storage and building additional new storage. A maximum of approximately 64,000 cubic meters (84,000 cubic yards) of transuranic and alpha low-level waste would be in storage in 2005.

3.1.3.2.5 Summary—The major differences and similarities among the four alternatives for transuranic waste can he summarized as follows:

- Retrieval and transfer of transuranic waste would occur under all alternatives. Transuranic and alpha low-level waste would be retrieved from covered storage and placed into new storage modules. The retrieval would continue until the entire amount of waste in covered storage was retrieved. Waste would also be moved from storage in the Air Support Buildings to new storage.

- Receipt of offsite shipments of transuranic waste would continue under all alternatives except Alternative C (Minimum Treatment, Storage, and Disposal). Under Alternative C (Minimum Treatment, Storage, and Disposal), these shipments would be stopped. Under Alternative A (No Action), these shipments would proceed as approved on a case-by-case basis. Under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal), volumes of received waste would be increased.

- Under all the alternatives, over a period of five years, 12,500 cubic meters (16,400 cubic yards) of transuranic waste would be transported from the INEL to the repository. A facility to provide additional capahilities for waste characterization would be built under each alternative.

- Under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal), waste treatment technologies would be developed and a transuranic waste treatment facility would be constructed to meet current requirements of the U. S. Environmental Protection Agency regulations for land disposal of wastes and reasonably foreseeable waste certification requirements of the Federal repository. Alternative D (Maximum Treatment, Storage, and Disposal) would provide for final disposal of alpha low-level waste.

	Low-Level waste
Alternative A	• Treat onsite and offsite • Dispose onsite in existing facility
Alternative B	• Treat onsite and offsite • Construct and operate additional treatment and disposal facilities onsite
Alternative C	• Transport waste to other Department of Energy facilities for treatment, storage, and disposal
Alternative D	• Receive offsite waste • Treat waste onsite • Construct and operate additional treatment and disposal facilities onsite

3.1.3.3 Low-Level Waste. As explained in Section 2.2.7.1.3, the overall process for low-level waste management is minimization before and during generation, storage pending availability of treatment and disposal, treatment as appropriate, and disposal. The four alternatives, as detailed in Table 3.1-7 and depicted in figures associated with the descriptions below, represent various strategies for handling newly generated waste. For analysis purposes, all low-level waste generated before June 1995 was assumed to have been treated and disposed. The low-level waste volumes, treatment rates, and volume reduction effects are documented in Section 3 of Morton and Hendrickson (1995). In all the alternatives, a Waste Handling Facility would be constructed at Argonne National Laboratory-West to help handle and stage its wastes. Figure 3.1-22 depicts the location of this and all new facilities for the handling of low-level waste, and Appendix C, Information Supporting the Alternatives, provides detailed descriptions of the projects.

3.1.3.3.1 Alternative A (No Action)—For Alternative A (No Action) (Figure 3.1-23), the INEL site would handle low-level waste of approximately 46,000 cubic meters (60,000 cubic yards) generated onsite from continuing activities over the ten years. Activities would be similar to those described in Chapter 2. In addition to volume reduction by compaction and sizing at the Waste Experimental Reduction Facility and disposal onsite at the Radioactive Waste Management Complex, low-level waste would be incinerated at an existing offsite commercial facility.

Table 3.1-7. Low-level waste: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.[a,b]

Alternative	Generate	Receive	Store	Treat	Transport	Dispose
A (No Action)	Generate 46,000 m^3 Upgrade waste handling • Waste Handling Facility	No offsite waste received	Store waste pending treatment and disposal	Nonincineration treatment at the existing Waste Experimental Reduction Facility Incinerable waste treated offsite	Transport 17,500 m^3 of waste to commercial treatment and to INEL site for disposal	Dispose 21,000 m^3 treated and untreated waste at the existing Radioactive Waste Management Complex
B (Ten-Year Plan)	Generate 72,000 m^3 Upgrade waste handling • Waste Handling Facility	No offsite waste received	Store waste pending treatment and disposal	Nonincineration treatment at the existing Waste Experimental Reduction Facility Waste treated offsite or onsite by incineration • Waste Experimental Reduction Facility Incineration • Idaho Waste Processing Facility	Transport 26,000 m^3 of waste to commercial treatment and return to INEL site for disposal	Dispose 34,000 m^3 treated and untreated waste at the existing Radioactive Waste Management Complex Additional disposal capacity • Mixed/Low-Level Waste Disposal Facility
C (Minimum Treatment, Storage, and Disposal)	Generate 47,000 m^3 Upgrade waste handling • Waste Handling Facility	No offsite waste received	Store waste pending shipment	No onsite treatment	Transport untreated waste to offsite facilities for treatment, storage, and disposal •Shipping/Transfer Station	No onsite disposal

Table 3.1-7. (continued).

Alternative	Generate	Receive	Store	Treat	Transport	Dispose
D (Maximum Treatment, Storage, and Disposal)	Generate 73,000 m^3 Upgrade waste handling • Waste Handling Facility	770,000 m^3 offsite waste received	Untreated waste stored pending treatment and disposal	Nonincineration treatment at the existing Waste Experimental Reduction Facility Onsite incineration authorized but mixed low-level waste takes precedence • Mixed/Low-Level waste Treatment Facility • Idaho Waste Processing Facility • Waste Experimental Reduction Facility Incineration	No offsite shipments Waste activities centralized at INEL site	Dispose 66,000 m^3 waste onsite at existing Radioactive Waste Management Complex Plan for future disposal • Mixed/Low-Level Waste Disposal Facility for future use

a. Source: Morton and Hendrickson (1995).

b. To convert cubic meters to cubic yards, divide by 0.76455.

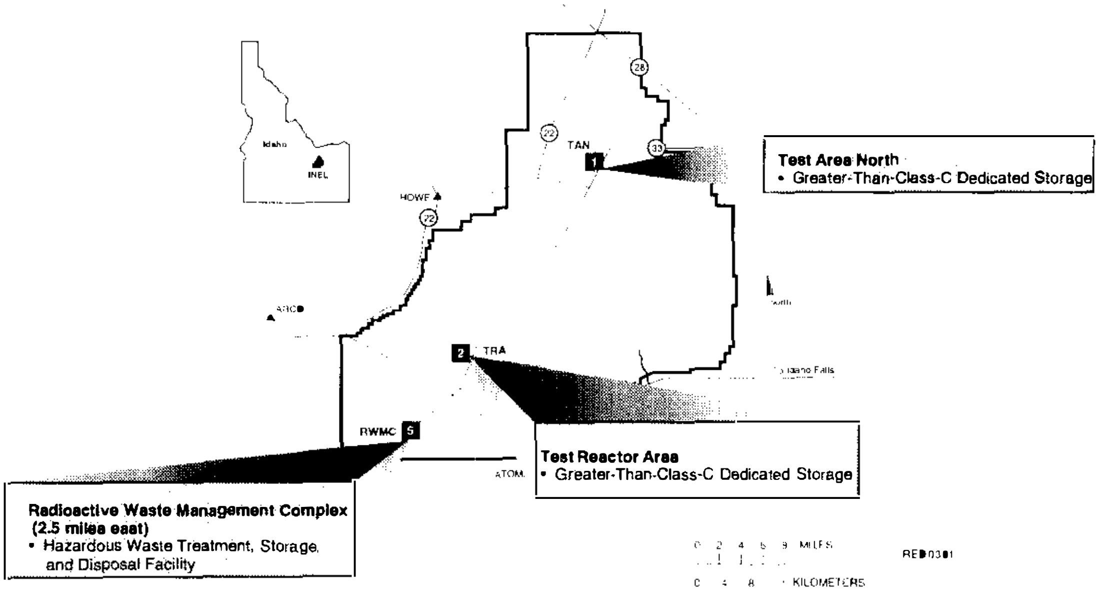


Figure 3.1-22. Low-level waste: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

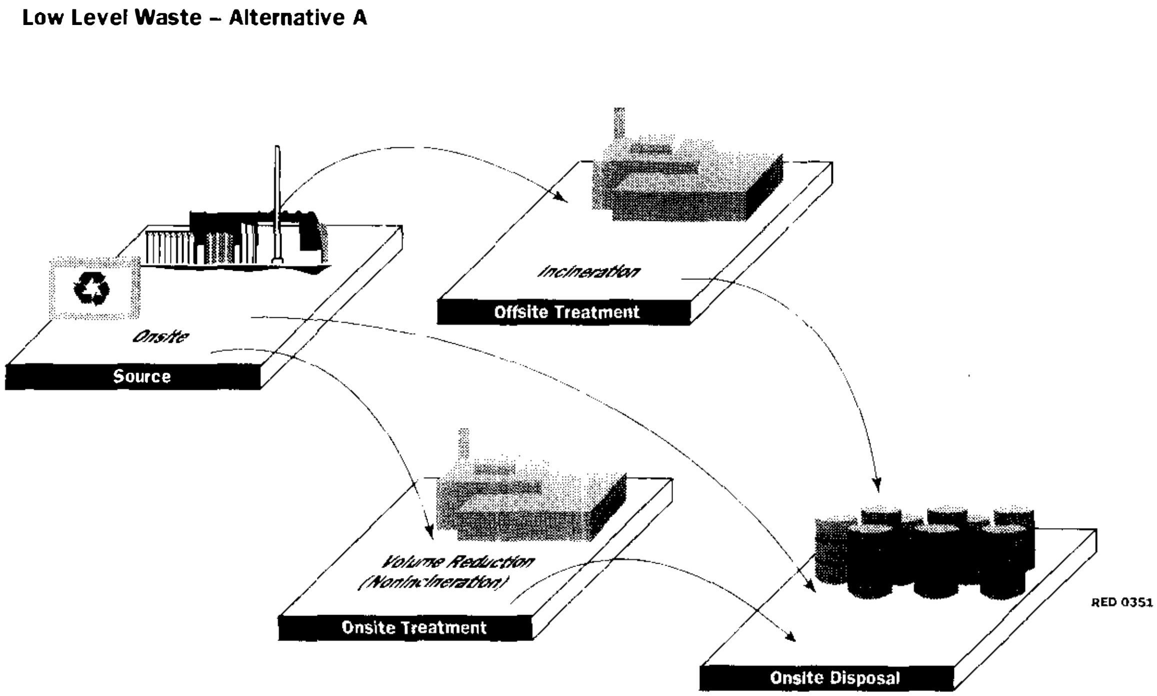


Figure 3.1-23. Management of low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative A (No Action).

3.1.3.3.2 Alternative B (Ten-Year Plan)—Under Alternative B (Ten-Year Plan) (Figure 3.1-24), approximately 72,000 cubic meters (94,000 cubic yards) of low-level waste would be generated during the ten years. This waste would be treated onsite at the Waste Experimental Reduction Facility, using both nonincineration and incineration. Offsite commercial incineration would continue. To treat all waste in a timely manner, most incinerable low-level waste would be treated offsite at a commercial facility, but the Waste Experimental Reduction Facility would also incinerate low-level and mixed low-level wastes. The Waste Experimental Reduction Facility is a Resource Conservation and Recovery Act interim status incineration facility located at the INEL site. The facility and the process are described in the Waste Experiment Reduction Facility project summary in Appendix C, Information Supporting the Alternatives. The Idabo Waste Processing Facility, planned as a stand-alone facility near the Radioactive Waste Management Complex, would be constructed for operation after 2005.

Waste remaining after onsite and offsite treatment would be disposed at the Radioactive Waste Management Complex. To facilitate future disposal of low-level waste, a Mixed/Low-level Waste Disposal Facility would be constructed for operation in 2004. For analysis purposes, this facility would be located 2.5 miles east of the Radioactive Waste Management Complex.

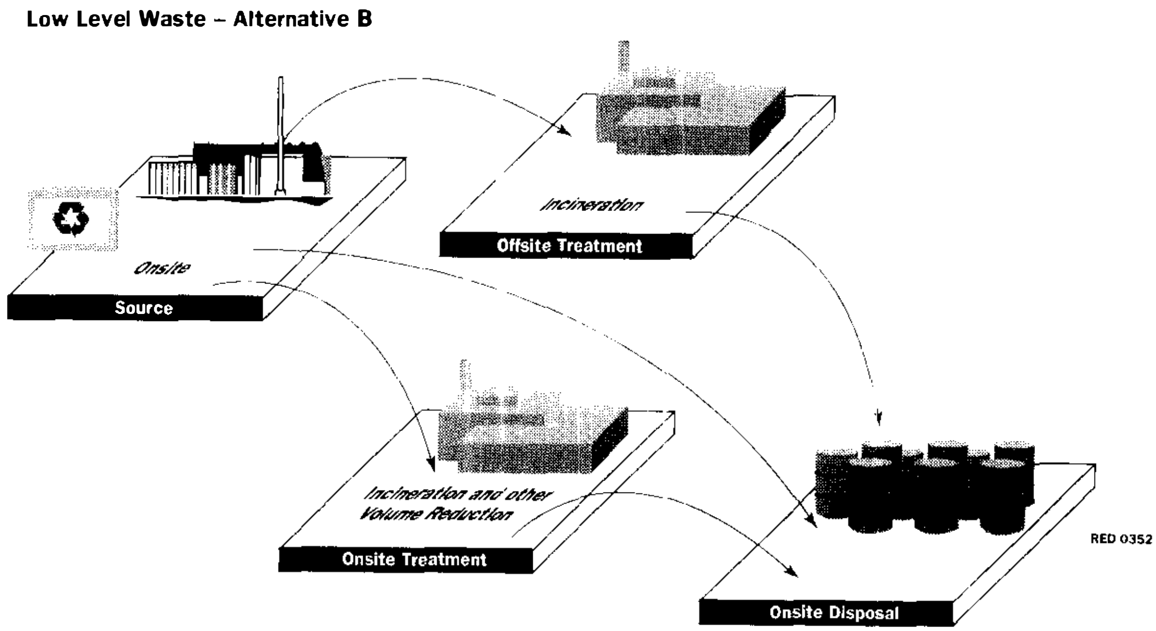


Figure 3.1-24. Management of low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative B (Ten-Year Plan).

3.1.3.3.3 Alternative C (Minimum Treatment, Storage, and Disposal)—Under Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-25), all low-level waste generated onsite, approximately 47,000 cubic meters (61,000 cubic yards), during the ten years would be transported to another DOE facility for treatment, storage, and disposal. To support transporting the larger quantities of waste, a Shipping/Transfer Station, which would be located at the Radioactive Waste Management Complex, would be constructed. The INEL would phase out the use of existing onsite treatment and disposal facilities.

3.1.3.3.4 Alternative D (Maximum Treatment, Storage, and Disposal)—Under Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-26), approximately 73,000 cubic meters (95,000 cubic yards) of low-level waste would be generated during ten years. In addition to the onsite-generated waste, about 770,000 cubic meters (1,000,000 cubic yards) of offsite waste would be accepted for treatment and disposal at the INEL. Under this alternative, the volumes of waste from environmental restoration and decontamination and decommissioning would be significantly greater than under Alternative B. Most of these increases would be for low-level waste and INEL industrial waste because the major effect of these activities would be the removal of structural materials. The volume increases due to these activities are not included in the estimates for waste management for Alternative D. All treatment, storage, and disposal would be performed onsite. The Waste Experimental Reduction Facility capacity would be used to incinerate low-level and mixed low-level wastes. Some low-level incinerable waste could be stored pending construction and operation of the Idaho Waste Processing Facility. Additional treatment capacity for many of the waste streams eligible for treatment at the Waste Experimental Reduction Facility would be available after 2005 through the operation of the Mixed/Low-Level Waste Treatment Facility. For analysis purposes, the Idaho Waste Processing Facility and the Mixed/Low-Level Waste Treatment Facility were assumed to be located 2.5 miles east of the Radioactive Waste Management Complex.

Low-level waste would be disposed in the Radioactive Waste Management Complex until the existing and expanded capacity is filled. All additional waste would be stored pending operation of the Mixed/Low-Level Waste Disposal Facility. This facility would be put into operation in 2008 and for analysis purposes was assumed to be located 2.5 miles east of the Radioactive Waste Management Complex.

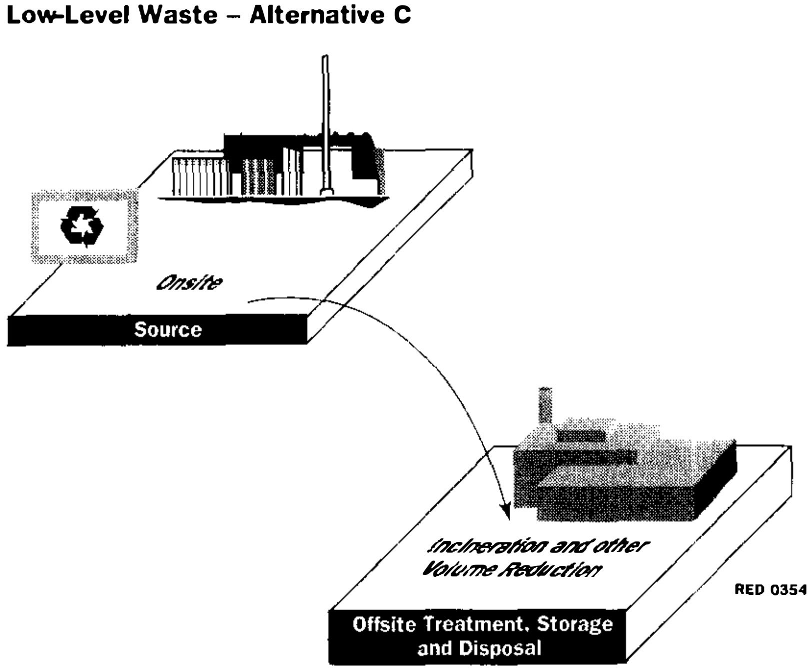


Figure 3.1-25. Management of low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative C (Minimum Treatment, Storage, and Disposal).

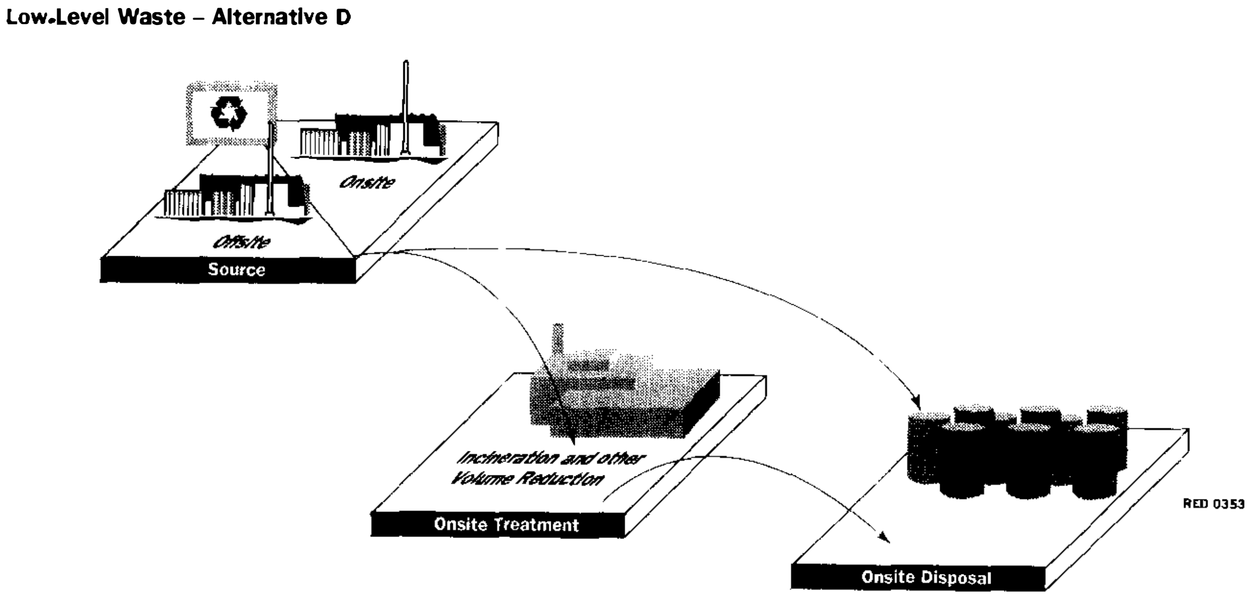


Figure 3.1-26. Management of low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative D (Maximum Treatment, Storage, and Disposal).

3.1.3.3.5 Summary—As shown in Figure 3.1-27, by the year 2005, all low-level waste onsite would have been disposed through the activities in all alternatives except Alternative D (Maximum Treatment, Storage, and Disposal). All alternatives plan to handle waste generated onsite, but Alternative D (Maximum Treatment, Storage, and Disposal) includes plans for handling of waste received from offsite, as well as the onsite waste. In Alternative D, significant amounts of waste would remain in storage pending completion of new treatment and disposal facilities onsite. As soon as these planned facilities were operational beyond 2005, they would allow the waste to be handled appropriately. Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) include facilities to treat, store, and dispose of all waste onsite. Alternative C (Minimum Treatment, Storage, and Disposal) would result in all waste being transported offsite for treatment, storage, and disposal.

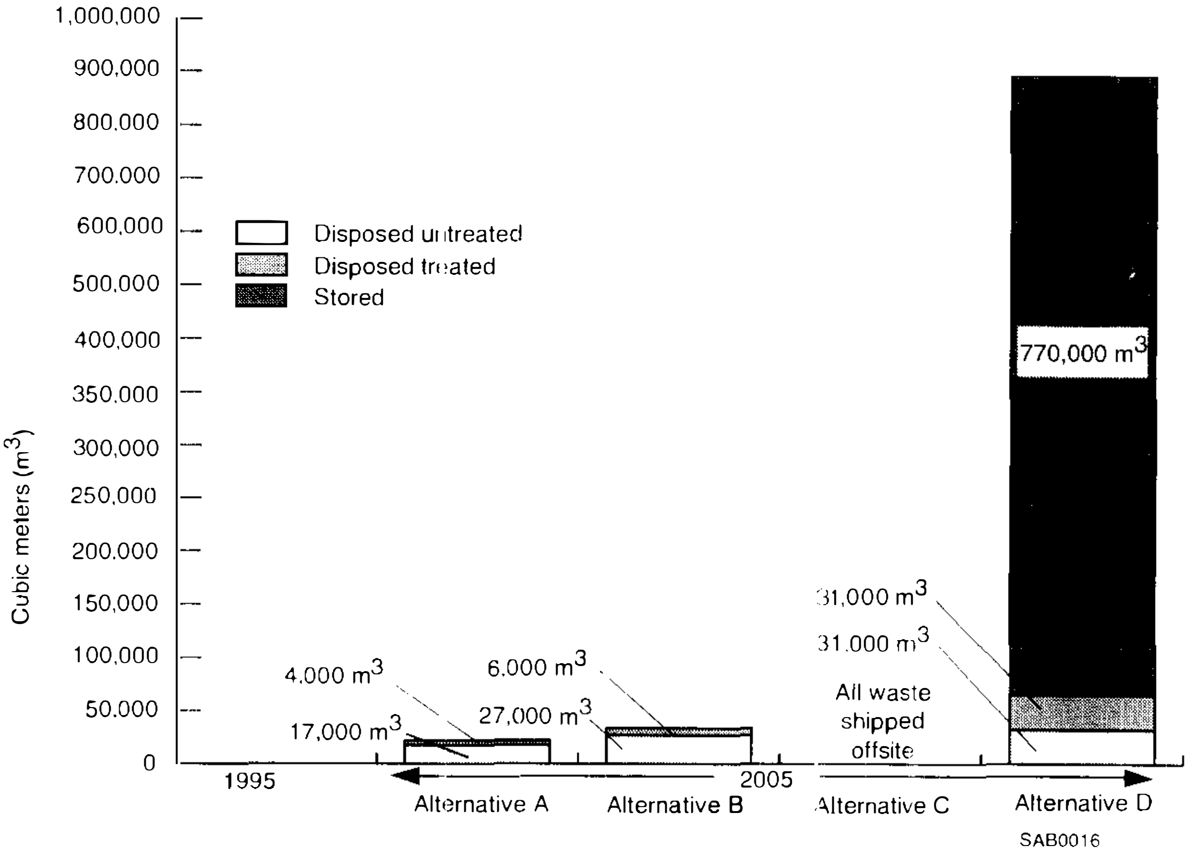


Figure 3.1-27. Low-level waste volumes at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal). (Many of these volumes are after treatment; therefore, the volumes cannot be summed to before treatment volumes.)

Mixed Low-Level Waste	
Alternative A	• Treat onsite (nonincineration)
Alternative B	• 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
Alternative C	• Transport waste offsite for treatment, storage, and disposal
Alternative D	• Receive offsite waste • Treat onsite by incineration and nonincineration • Construct and operate facilities for onsite incineration and nonincineration treatment • Construct and operate new disposal facility • Transport waste offsite for treatment and disposal

3.1.3.4 Mixed Low-Level Waste. As identified in Section 2.2.7.1.4, the current management of mixed waste is to minimize waste before and during generation, to treat, and to store the waste in permitted facilities onsite pending availability of treatment and disposal. The four alternatives, as detailed in Table 3.1-8 and described below, represent various strategies for implementing this process and dispositioning the waste. The four alternatives focus on different management options (Figure 3.0-1), including receipt of offsite waste, treatment onsite and offsite, and disposal onsite and offsite. The mixed low-level waste volumes, treatment rates, and volume reduction effects are documented in Section 4 of Morton and Hendrickson (1995). In all the alternatives, a Waste Handling Facility would be constructed for Argonne National Laboratory-West to provide an accumulation area and storage for less than 90 days. All proposed new mixed low-level waste projects are described in Appendix C, Information Supporting the Alternatives; and Figure 3.1-28 shows their locations.

Table 3.1-8. Mixed low-level waste: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.[a,b]

Alternative	Generate	Receive	Store	Treat	Transport	Dispose
A (No Action)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (15,400 m^3) Improve waste handling • Waste Handling Facility	No offsite waste received	Store non-treated waste pending treatment and treated listed waste pending disposal	Nonincineration treatment	No shipments planned	Dispose of treated characteristic waste onsite (Radioactive Waste Management Complex)
B (Ten-Year Plan)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (16,200 m^3) Improve waste handling • Waste Handling Facility	No offsite waste received	Store treated listed waste pending disposal	Offsite treatment as necessary Nonincineration and incineration treatment • Waste Experimental Reduction Facility incineration • Nonincinerable Mixed Waste Treatment • Plasma Hearth Process (see Section 3.1.4, Technology Development) Treatment of Sodium Coolant • Sodium Processing Project • Remote Mixed Waste Treatment Facility Plan for future treatment • Idaho Waste Processing Facility	Transport offsite for treatment	Dispose of treated characteristic waste onsite (Radioactive Waste Management Complex) Small quantities may be disposed offsite after treatment Mixed waste disposal • Mixed/Low-Level Waste Disposal Facility (operational 2004)
C (Minimum Treatment, Storage, and Disposal)	Generate waste from environmental restoration, decontamination and decommissioning, and operations (15,500 m^3) Improve waste handling • Waste Handling Facility	No offsite waste received	Store all waste pending shipment off-site	No onsite treatment	Transport untreated waste offsite • Shipping/ Transfer Station	No onsite disposal

Table 3.1-8. (continued).

Alternative	Generate	Receive	Store	Treat	Transport	Dispose
D (Maximum Treatment, Storage, and Disposal)	Generate waste from expanded environmental restoration, decontamination and decommissioning, and operations (16,200 m^3) Improve waste handling • Waste Handling Facility	Receive 149,000 m^3 of waste from offsite	Store non-treated waste pending treatment, store treated listed waste pending disposal.	Nonincineration and incineration treatment • Waste Experimental Reduction Facility Incineration • Nonincinerable Mixed Waste Treatment • Plasma Hearth Process (see Section 3.1.4, Technology Development) Treatment of sodium coolant • Sodium Processing Project • Remote Mixed Waste Treatment Facility Plan for future treatment • Idaho Waste Processing Facility • Mixed Low-Level Waste Treatment Facility •	No long term transport of waste (goal to treat and dispose all waste onsite)	Dispose of treated characteristic waste onsite (Radioactive Waste Management Complex) Plan for future waste disposal • Mixed/Low-Level Waste Disposal Facility (operational 2008)

a. Source: Morton and Hendrickson (1995).

b. To convert cubic meters to cubic yards, divide by 0.76455.

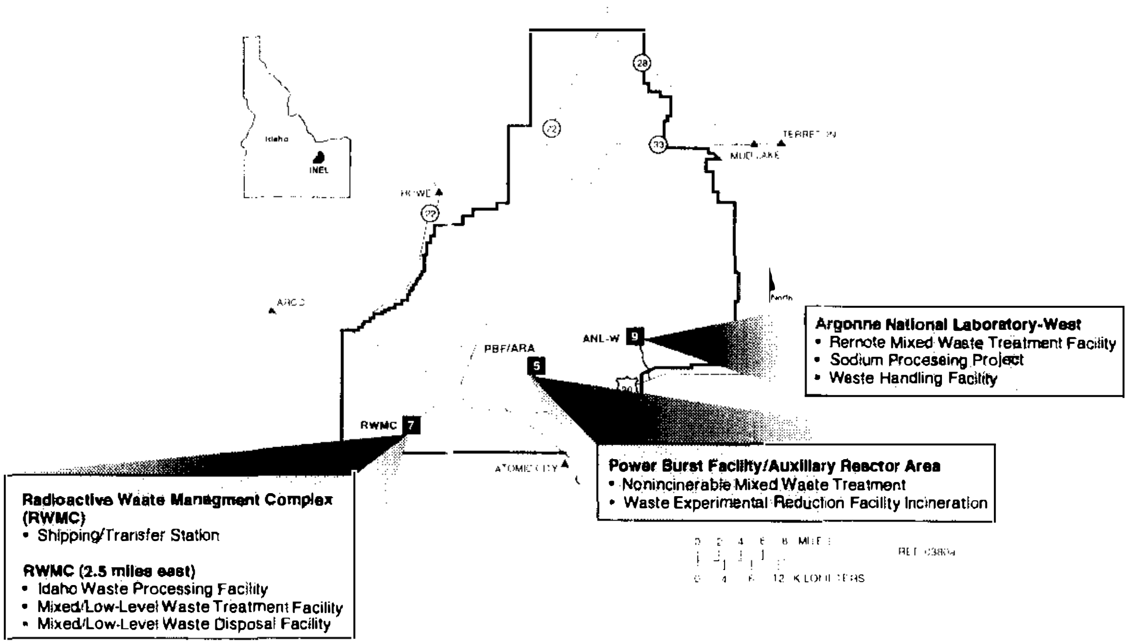


Figure 3.1-28. Mixed low-level waste: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

3.1.3.4.1 Alternative A (No Action)—In Alternative A (No Action) (Figure 3.1-29), existing [1,100 cubic meters (1,440 cubic yards)] and newly generated mixed low-level waste [15,400 cubic meters (20,000 cubic yards)] would continue to be stored in existing onsite facilities. Facilities identified in Chapter 2, Background, including those on operational standby, would operate. Onsite, nonincineration treatment (stabilization) would be performed at the Waste Experimental Reduction Facility, and waste that meets the Waste Acceptance Criteria for the Radioactive Waste Management Complex would be disposed. This alternative would provide for no change in the current handling of mixed waste.

3.1.3.4.2 Alternative B (Ten-Year Plan)—Existing and newly generated waste of approximately 17,300 cubic meters (22,600 cubic yards) would be stored in existing facilities, pending onsite incineration and nonincineration treatment and offsite treatment, as needed, under Alternative B (Ten-Year Plan) (Figure 3.1-30). Treated waste meeting the Waste Acceptance Criteria for the Radioactive Waste Management Complex would be disposed onsite. Until disposed, treated and untreated waste would be stored in existing facilities onsite. By 2005, all waste would have been treated and disposed onsite or offsite.

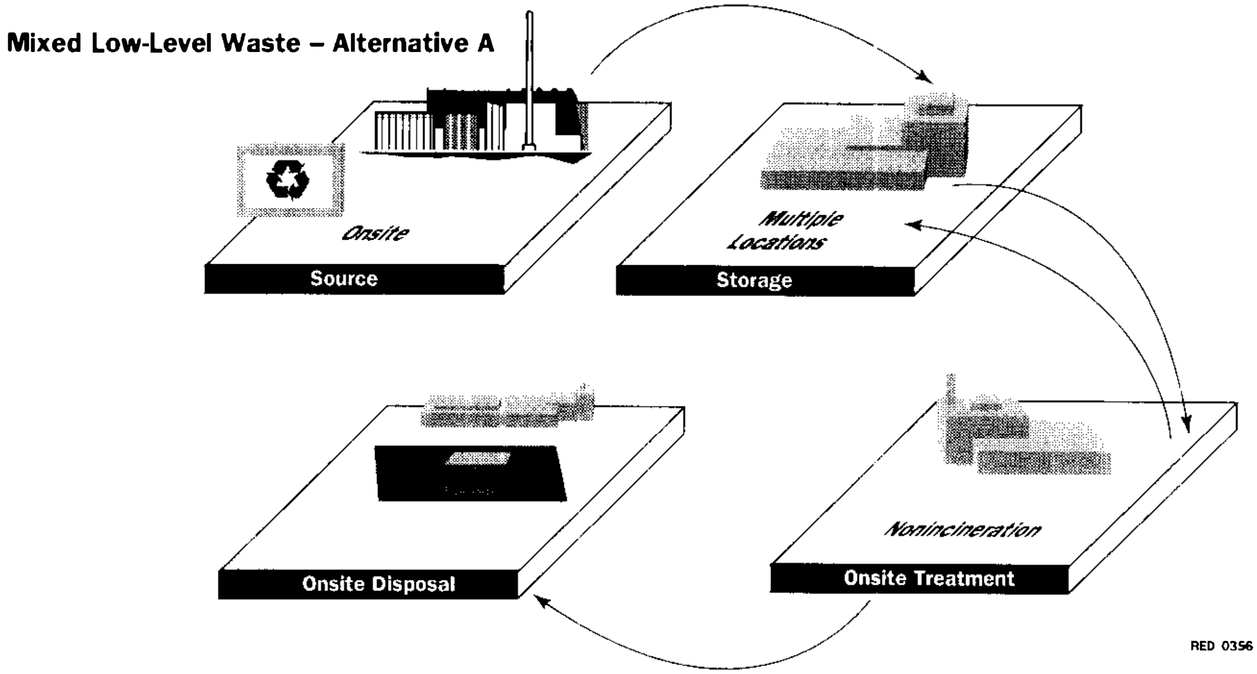


Figure 3.1-29. Management of mixed low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative A (No Action).

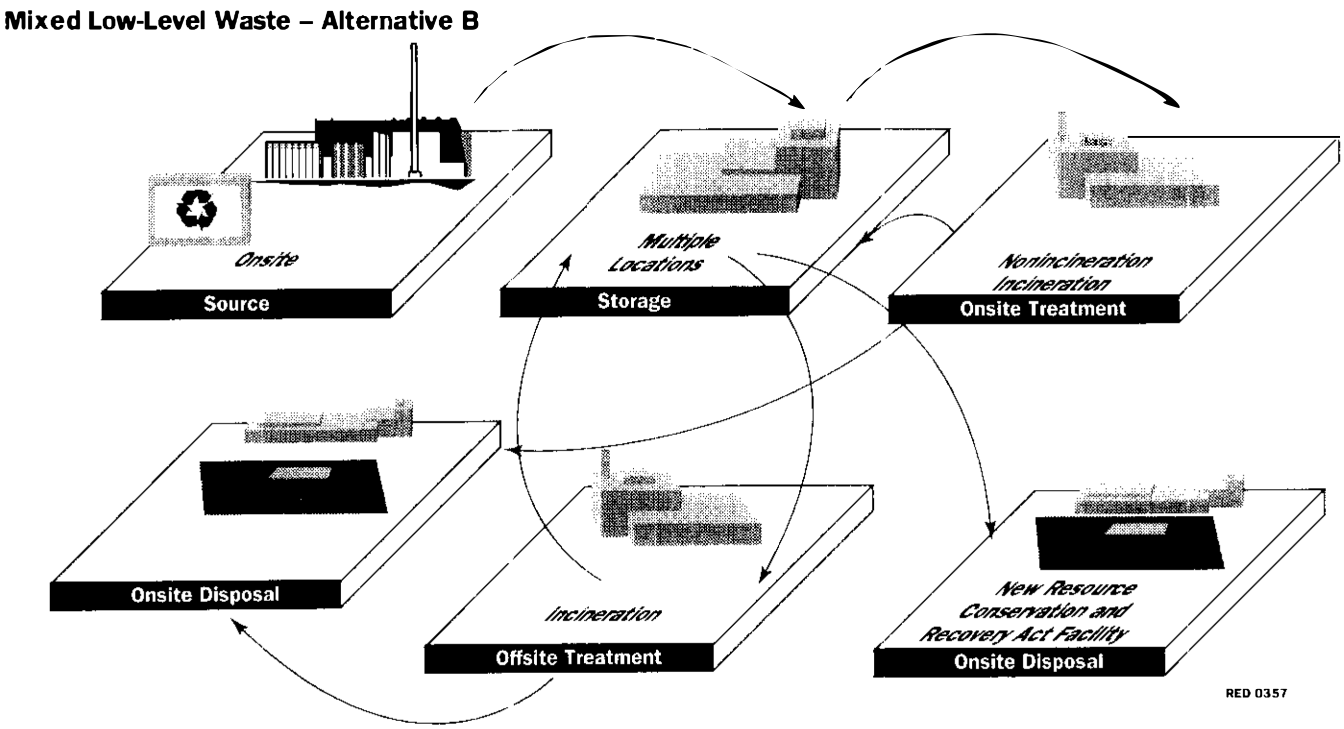


Figure 3.1-30. Management of mixed low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative B (Ten-Year Plan).

To treat and dispose of most of the mixed waste generated from activities identified as part of Alternative B (Ten-Year Plan), the Waste Experimental Reduction Facility Incineration process would operate. The Nonincinerable Mixed Waste Treatment project, to be located in the Waste Engineering Development Facility, would operate small-scale treatment processes. All mixed waste is assumed to be treated starting in 1996 when the Waste Experimental Reduction Facility and the Waste Engineering Development Facility would be operational. Waste that can be treated and reused (for example, lead) would be returned for commercial or internal laboratory use after treatment. In addition, the Sodium Processing Project and Remote Mixed Waste Treatment Facility, to be located at Argonne National Laboratory-West, would treat coolant waste from metal-cooled breeder reactors.

All mixed waste that remains after treatment cannot be disposed in the Radioactive Waste Management Complex and would be disposed in 2004 when the Mixed/Low-Level Waste Disposal Facility would become operational. For analysis purposes, the planned location for the Mixed/Low-Level Waste Disposal Facility is 2.5 miles east of the existing Radioactive Waste Management Complex.

3.1.3.4.3 Alternative C (Minimum Treatment, Storage, and Disposal)—Existing and newly generated waste of approximately 16,600 cubic meters (21,700 cubic yards) would be stored in existing onsite facilities pending shipment to offsite facilities for treatment, storage, and disposal under Alternative C (Minimum Treatment, Storage, and Disposal) (Figure 3.1-31). All existing treatment and disposal operations would be phased out. To achieve transport of all waste offsite, a Shipping/Transfer Station would be constructed at the Radioactive Waste Management Complex.

3.1.3.4.4 Alternative D (Maximum Treatment, Storage, and Disposal)—Under Alternative D (Maximum Treatment, Storage, and Disposal) (Figure 3.1-32), approximately 17,300 cubic meters (22,600 cubic yards) of existing waste and newly generated waste and approximately 149,000 cubic meters (195,000 cubic yards) of waste received from offsite would be stored in existing and expanded facilities pending onsite treatment and disposal. All activities identified in Chapter 2, Background, would continue and would be enhanced during a transition to treating, storing, and disposing all INEL generated mixed low-level waste at the INEL site.

Mixed Low-Level Waste - Alternative C

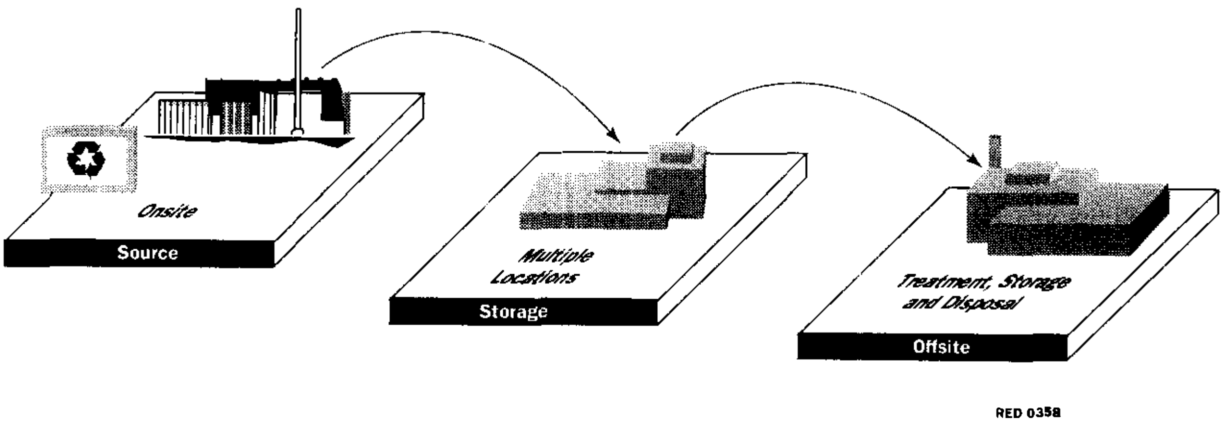


Figure 3.1-31. Management of mixed low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative C (Minimum Treatment, Storage, and Disposal).

Mixed Low-Level Waste - Alternative D

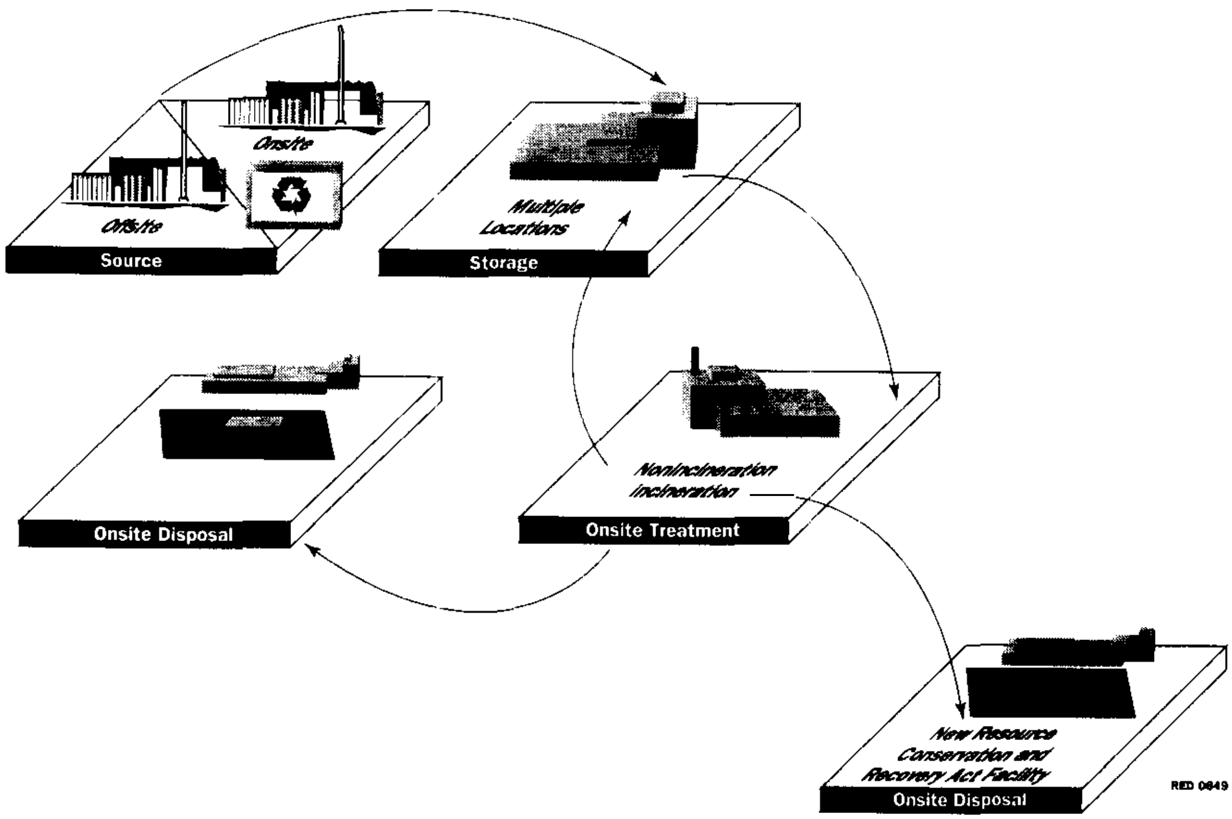


Figure 3.1-32. Management of mixed low-level waste at the Idaho National Engineering Laboratory under the proposed Alternative D (Maximum Treatment, Storage, and Disposal).

The ten-year focus for this alternative provides a transition to allow time for planning, designing, and constructing facilities. During this transition phase, offsite treatment facilities would be used for offsite-generated incinerable waste. Offsite waste would be characterized by the generator and transported directly to the commercial incinerator for treatment. Onsite waste would be incinerated in the Waste Experimental Reduction Facility and disposed or stored, as appropriate.

Waste generated both onsite and offsite requiring treatment other than incineration (for example, macroencapsulation or stabilization) would be handled by the nonincinerable mixed waste treatment processes located in the Waste Engineering Development Facility. Sodium coolant waste from sodium-cooled breeder reactors would be treated with the Sodium Processing Project and the Remote Mixed Waste Treatment Facility, to be located at Argonne National Laboratory-West. To minimize the requirement for offsite commercial treatment, onsite treatment facilities would be planned and constructed. The onsite facilities could be commercially or DOE-operated.

After treatment, all waste would be transported to the Radioactive Waste Management Complex for disposal if appropriate, or storage, pending availability of the Mixed/Low-Level Waste Disposal Facility. Additional storage might be required before availability of appropriate treatment and disposal. Additional storage modules would be procured and constructed as necessary to store mixed low-level waste in compliance with the Resource Conservation and Recovery Act, pending completion of the new facilities.

3.1.3.4.5 Summary—For mixed low-level waste, Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would achieve long-term treatment and disposal of INEL waste. Alternative C (Minimum Treatment, Storage, and Disposal) would provide for all INEL waste to be transported offsite, negating the requirement for INEL treatment and disposal facilities. Without additional storage, mixed waste would be stored in noncompliance with the Resource Conservation and Recovery Act under Alternative A (No Action). The waste inventory onsite in 2005 for all alternatives is shown in Figure 3.1-33.

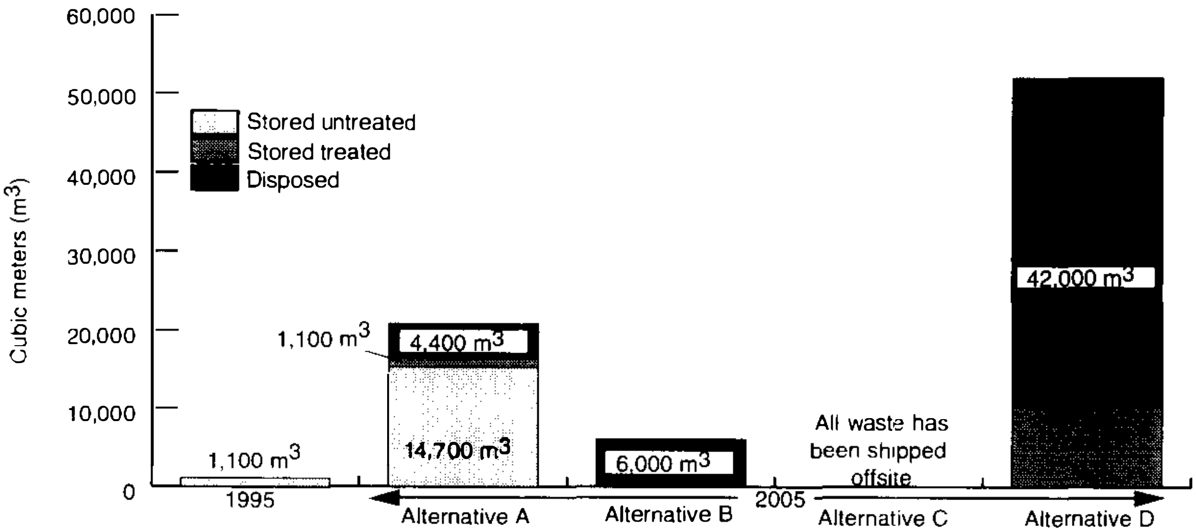


Figure 3.1-33. Mixed low-level waste volumes at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal). (Many of these volumes are after treatment; therefore, the volumes cannot be summed to the before-treatment volumes.)

Greater-Than-Class-C Low-Level Waste

Alternative A	• Continue greater-than-Class-C low-level waste management programs
Alternative B	• Receive sealed sources for recycle or storage • Construct dedicated storage facility
Alternative C	• Discontinue greater-than-Class-C management programs
Alternative D	• Receive sealed sources for recycle or storage • Construct dedicated storage facility

3.1.3.5 Greater-Than-Class-C Low-Level Waste. The INEL has been assigned responsibility for managing the greater-than-Class-C low-level waste program. The focus of the program is to determine the disposition of the greater-than-Class-C sources. Projections indicate that approximately 30,000 sealed sources/devices are held by the U. S. Nuclear Regulatory Commission and Agreement State licensees. The greater-than-Class-C low-level waste volumes, treatment rates, and volume reduction effects are documented in Section 5 of Morton and Hendrickson (1995). Under

Alternative A (No Action), the current greater-than-Class-C low-level waste management activities would continue.

Under Alternative B (Ten-Year Plan), the INEL would receive greater-than-Class-C sources to store before determining the final disposition. The U. S. Nuclear Regulatory Commission has estimated that DOE acceptance of up to 2,000 sealed sources over a five-year period could be required to ensure public health and safety. Nearly all these sealed sources would be received and managed as radioactive material suitable for recycle and reuse rather than as greater-than-Class-C low-level waste, because of their continuing functionality and value. While the INEL would attempt to recycle these sources to industry, all these may need storage or disposal over the next 30 years. This would be a baseline rate of 1,000 sources or devices per year. The sources or devices would be unwanted calibration reference sources, instrumentation sources, and radiography sources and devices. These sources or devices would typically be received as leaktight capsules containing strontium-90, cesium-137, americium/beryllium, and plutonium/beryllium. Minor amounts of other greater-than-Class-C low-level waste types may be accepted for storage on an as-needed basis.

Under Alternative C (Minimum Treatment, Storage, and Disposal), all greater-than-Class-C management activities would be transferred to another site. Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) are identical in their receipt and handling of greater-than-Class-C low-level waste. This waste would be stored in monitored, retrievable casks that are shielded, leaktight, and weather-tight until a disposal facility was developed. The Greater-Than-Class-C Dedicated Low-Level Waste Storage Facility (located at Test Area North, the Test Reactor Area, or a similar INEL location, as indicated on Figure 3.1-34) would provide for consolidated management and storage of the greater-than-Class-C low-level-waste at one centralized location under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

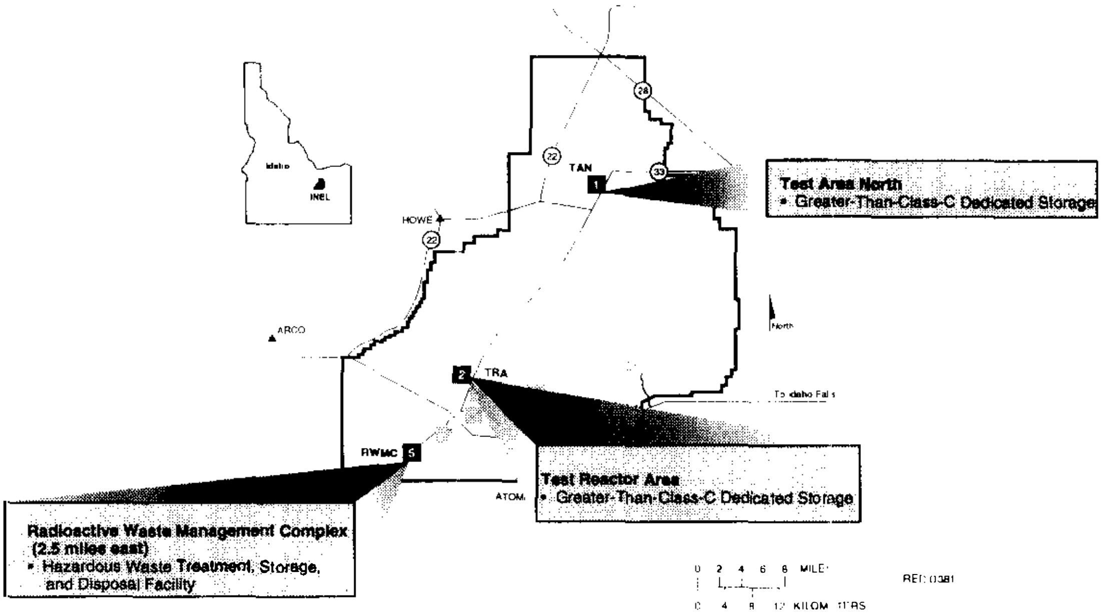


Figure 3.1-34. Greater-than-Class-C and hazardous waste: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

Hazardous Waste

Alternative A	• Transport waste offsite for treatment, storage, disposal
Alternative B	• Transport waste offsite for treatment, storage, disposal
Alternative C	• Transport waste offsite for treatment, storage, disposal
Alternative D	• Transport waste offsite for treatment, storage, disposal • Possibly construct onsite treatment, storage and disposal facility

3.1.3.6 Hazardous Waste. Management practices for hazardous waste at the INEL and throughout the DOE complex rely primarily on the private sector, as shown on Figure 3.1-35. Few changes from these practices are assumed for any alternative, as shown in Table 3.1-9. Alternatives include whether to move toward onsite treatment, storage, and disposal. The hazardous waste

Hazardous – Alternatives A, B, C, D

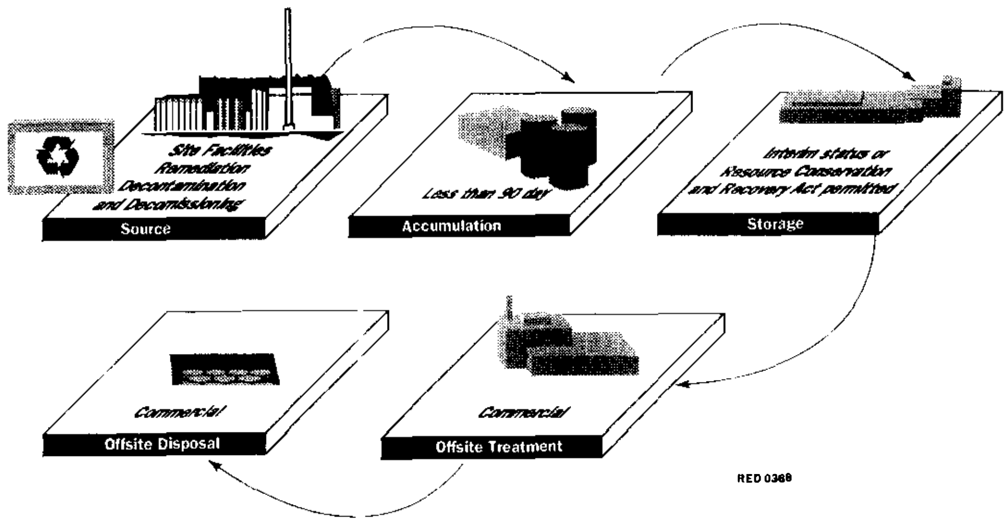


Figure 3.1-35. Management of hazardous waste at the Idaho National Engineering Laboratory under the proposed alternatives: Alternative A (No Action), Alternative B (Ten-Year Plan), Alternative C (Minimum Treatment, Storage, and Disposal), and Alternative D (Maximum Treatment, Storage, and Disposal).

volumes, treatment rates, and volume reduction effects are documented in Section 6 of Morton and Hendrickson (1995).

Under all alternatives, a new Waste Handling Facility would be placed in service as a central staging area for Argonne National Laboratory-West. This facility and the proposed Hazardous Waste Treatment, Storage, and Disposal Facility are described in Appendix C, Information Supporting the Alternatives. Figure 3.1-34 in Section 3.1.3.5 shows their locations.

All alternatives except Alternative D (Maximum Treatment, Storage, and Disposal) would continue activities identified in Chapter 2 for handling of hazardous waste generated onsite. About 12,000 cubic meters (16,000 cubic yards) would be generated under all alternatives. The majority of these wastes are generated by the planned environmental restoration activities. Onsite activities include treatment of reactives and shipment offsite for treatment and disposal of all other hazardous waste for Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). Under Alternative C (Minimum Treatment, Storage, and Disposal), hazardous waste generated at the INEL could be transported to another DOE site, rather than a commercial facility.

Table 3.1-9. Hazardous waste: Summary of proposed management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL) by alternative.

Alternative	Store	Treat	Transport	Dispose
A (No Action)	Store short-term pending offsite shipment Stage Waste • Waste Handling Facility	Treat reactives onsite	Transport waste offsite for treatment, storage, and disposal	No onsite disposal
B (Ten-Year Plan)	Store short-term pending offsite shipment Stage Waste • Waste Handling Facility	Treat reactives onsite Incineration treatment • Plasma Hearth process (see Section 3.1.4, Technology Development)	Transport waste offsite for treatment, storage, and disposal	No onsite disposal
C (Minimum Treatment, Storage, and Disposal)	Store short-term pending offsite shipment Stage Waste • Waste Handling Facility	Treat reactives onsite	Transport waste offsite for treatment, storage, and disposal	No onsite disposal
D (Maximum Treatment, Storage and Disposal)	Plan future onsite storage • Hazardous Waste Treatment, Storage and Disposal Facility Stage Waste • Waste Handling Facility	Treat reactives onsite Incineration treatment • Plasma Hearth process (see Section 3.1.4, Technology Development) Move toward 80 percent onsite treatment Plan future onsite treatment • Hazardous Waste Treatment, Storage, and Disposal Facility	Continue to transport offsite pending onsite treatment capabilities	Plan future onsite disposal • Hazardous Waste Treatment, Storage, and Disposal Facility

Under Alternative D (Maximum Treatment, Storage, and Disposal), current practices would also continue. DOE has considered consolidating the treatment of all organic hazardous waste at a couple of locations, such as the INEL. Organics constitute an estimated 80 percent of all hazardous waste throughout the DOE complex. These plans are not, however, sufficiently firm to be included in Alternative D (Maximum Treatment, Storage, and Disposal). To implement these plans, a new Hazardous Waste Treatment, Storage, and Disposal Facility would be required. This facility, if constructed, would be operational in 2008. Because this operational date is shortly after 2005, hazardous waste could be managed differently (for example, stored) under Alternative D (Maximum Treatment, Storage, and Disposal) than under the other three alternatives.

For all alternatives, all waste would be transported offsite and no inventory of hazardous waste would remain onsite in 2005.

3.1.3.7 Infrastructure. The infrastructure that exists at the INEL includes a new transportation complex. Also, the site-wide sewer system, new electrical system, and new life safety system have been upgraded. For the different alternatives, however, additional infrastructure projects would be needed. The INEL industrial waste volumes, treatment rates, and volume reduction effects are documented in Section 7 of Morton and Hendrickson (1995). Figure 3.1-36 shows the location of the proposed projects. Under all alternatives, previously approved infrastructure projects would be completed.

Infrastructure

Alternative A
- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory

Alternative B
- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory
- Industrial/Commercial Landfill
- Gravel Pit Expansions
- Central Facilities Area Clean Laundry and Respirator Facility

Alternative C
- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory
- Industrial/Commercial Landfill

Alternative D
- Radiological and Environmental Sciences Laboratory Replacement
- Health Physics Instrument Laboratory
- Expanded Industrial/Commercial Landfill
- Larger Gravel Pit Expansion project
- Central Facilities Area Clean Laundry and Respirator Facility

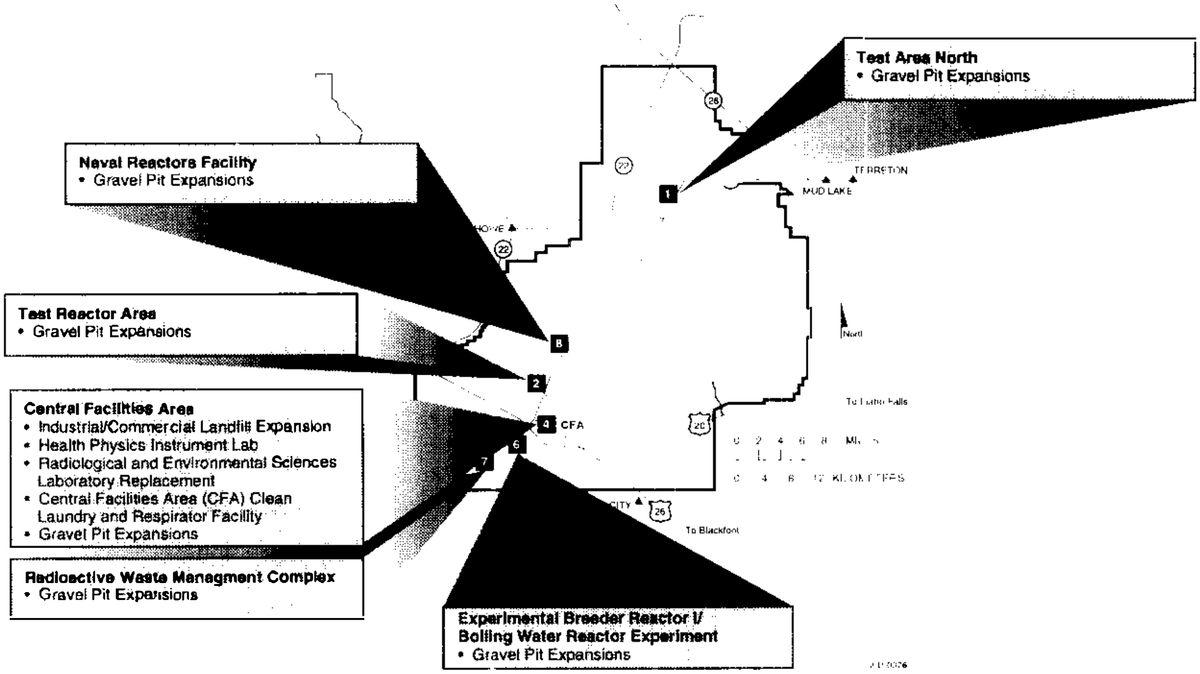


Figure 3.1-36. Infrastructure: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

Under Alternative A (No Action), those facilities not scheduled for closure would continue to be operated; minor maintenance would be performed to maintain their existing status. This effort would not correct outstanding environmental citations that may exist against some aspects of facility operations.

Under Alternative B (Ten-Year Plan), existing facilities would be upgraded to the extent practicable to comply with the current State and DOE regulations. INEL industrial landfill facilities would be increased. The gravel pits located at several locations around the INEL site would be expanded. The Clean Laundry and Respirator Facility, located at the Central Facilities Area, would be evaluated for another function.

Under Alternative C (Minimum Treatment, Storage, and Disposal), a phase-out plan (excluding those infrastructure activities necessary to support operating reactors, the shipment of spent nuclear fuel and waste offsite, and continuing high-level waste work) would be developed and implemented. The only new project would be a restricted expansion of the INEL industrial landfill to support some continued activities that are necessary under this alternative.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the planned infrastructure projects (landfill and gravel pits) identified for Alternative B (Ten-Year Plan) would be expanded. The reuse of the laundry in the Central Facilities Area would be evaluated. Construction of new (or upgraded) infrastructure support facilities could be necessary, primarily at or near the Radioactive Waste Management Complex. These facilities would consist of new or upgraded offices and the associated support necessary for the additional people who would be working with the increased waste management activities.

3.1.4 Technology Development

Under Alternative A (No Action), only ongoing research, development, demonstration, testing, and evaluation activities would be permitted. Tests on waste treatment technologies and calcined waste and sodium-bearing waste treatment technology studies would continue. Other projects would include radionuclide sensor development, fissile material detection capability, material control and accountability tests, and existing environmental analysis methodology development. Laboratory analyses and existing waste packaging development would also continue. No new technology development initiatives would be begun and existing technology studies would not be expanded.

Under Alternative B (Ten-Year Plan), existing technology development and privatization activities would continue and additional activities would be implemented. Activities discussed under Alternative A (No Action) would be expanded.

Specific examples of new initiatives include the Calcine Transfer Project Bin Set #1 and the Plasma Hearth Process project; Figure 3.1-37 shows the location of these projects. The Calcine Transfer Project Bin Set #1 would demonstrate methods to retrieve calcine from bin set #1 at the Idaho Chemical Processing Plant. The plasma hearth process is a high-temperature thermal treatment process. It uses a plasma arc torch in a refractory lined chamber to destroy organics and stabilize the residuals in a nonleaching, vitrified (glass-type) waste form. Plasma arc technology is used commercially, primarily to produce high purity alloys, and this project would adapt this existing technology.

The key elements of the plasma hearth process technology are (a) extremely high temperature operation that completely destroys organics while stabilizing inorganics; (b) acceptance of a very wide

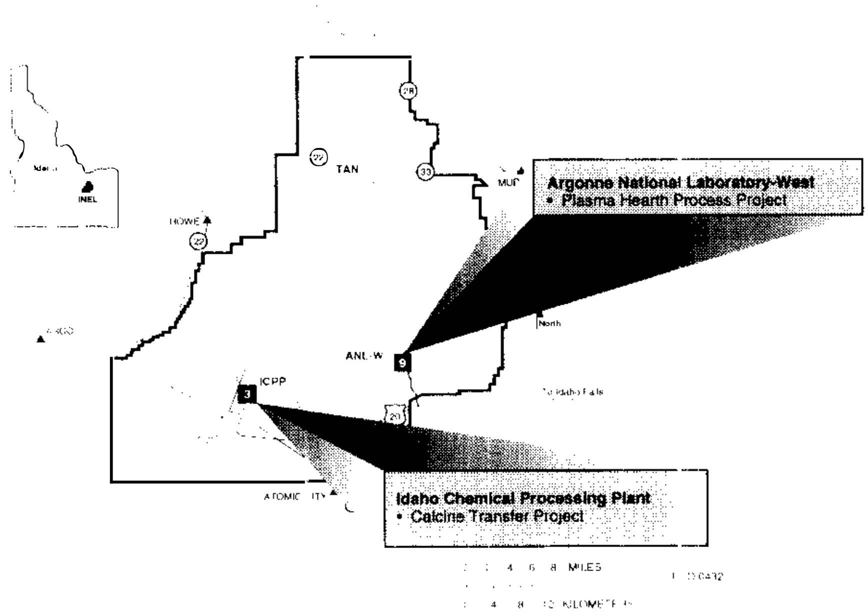


Figure 3.1-37. Technology development: Idaho National Engineering Laboratory locations of projects associated with proposed alternatives.

range of waste types without pretreatment (c) treatment of waste without removing it from the container; (d) generation of separate slag and metallic phases, allowing segregation and possible reuse of the metal; and (e) preference of many radionuclides (especially the actinides) and toxic heavy metals to migrate to the stable slag phase.

Several alternatives are being considered for the safe management of spent nuclear fuel. These range from wet or dry canning of the fuel to stabilization by oxidation or vitrification. The best alternative in any particular instance depends on the type of fuel and its current condition. DOE has adopted a systems engineering methodology to plan the development of technologies and facility resources to ensure safe and effective management of spent nuclear fuel. Systems engineering provides a formal structure methodology to ensure that all factors and necessary interfaces are identified and satisfied, and that technical requirements and constraints and stakeholder values are accommodated in decisions related to the management of spent nuclear fuel. In addition to identifying and integrating fuel management requirements, the systems engineering process implements a formal method for selecting the best technologies for stabilizing, conditioning, packaging, transporting, and storing the spent nuclear fuel.

Under Alternative C (Minimum Treatment, Storage, and Disposal), technology development projects for high-level and hazardous waste treatment would continue. Technology development and privatization activities for other wastes and spent nuclear fuel, however, would be phased out. Similarly, privatization initiatives for transuranic, low-level, and mixed low-level wastes would be discontinued. New technology development activities would be limited. These limited new initiatives would include activities to minimize waste generation or to improve the treatment of those wastes and materials treated, stored, or disposed at the INEL site.

Technology development activities proposed under Alternative D (Maximum Treatment, Storage, and Disposal) would be similar to those activities in Alternative B (Ten-Year Plan).

3.2 Alternatives Eliminated from Detailed Analysis

This section describes alternatives that were considered and subsequently eliminated from further analysis. On the basis of scientific and engineering judgment, detailed analysis of these alternatives was considered unnecessary.

3.2.1 Relocate All Idaho National Engineering Laboratory Site Activities to Another Site

This alternative was examined to evaluate relocating facilities and activities associated with the specific emphases of the INEL mission.

DOE is considering a full range of reasonable alternatives for managing spent nuclear fuel, including alternatives at the INEL site that would involve the transport, receipt, processing, and storage of spent nuclear fuel at sites other than the INEL. The relocation of all spent nuclear fuel activities from the INEL is evaluated in Volume 1 of this EIS and is also considered under Alternative C (Minimum Treatment, Storage, and Disposal) of Volume 2. However, total relocation of all spent nuclear fuel activities would not be accomplished completely at the INEL during the ten-year timeframe analyzed in detail in Volume 2. This is because many of the facilities required to handle INEL spent nuclear fuel would not be available until beyond the ten-year period.

Relocating waste management facilities to another site, however, would require transporting all waste in storage, from ongoing INEL projects (most of which is industrial waste), and from environmental restoration to another site. This alternative is not feasible because neither liquid nor calcined high-level waste can be transported without further treatment and some transuranic waste would require minimal treatment before transport. Minimal facilities would be required onsite for transporting other wastes offsite as long as other programs continue onsite. Alternative C (Minimum Treatment, Storage, and Disposal) evaluates minimum treatment, storage, and disposal facilities and activities. This alternative has been eliminated from detailed analysis.

3.2.2 Restore the Idaho National Engineering Laboratory Site

The alternative of restoring the INEL site to pristine conditions was evaluated using scientific and engineering judgment. This alternative represents an approach requiring intensive remediation activities for decontamination, removal of buildings, and restoration of disturbed areas. Restoration of sites may consider special end land uses, such as the following:

- To provide public access to productive land for agriculture, animal husbandry, recreation, or housing development. Restoring the currently used portion (8 percent) of the INEL site to pristine conditions would be impractical due to cost. However, the undisturbed portion (92 percent) of the site would be available for these land uses.

- To extend and preserve a unique or very limited land resource; for example, preagricultural grasslands of the Northern Great Plains. The areas in use on the INEL site do not represent a limited or unique land resource in the area.

- To recreate or preserve an aesthetically pleasing landform or landscape. The disturbed portion of the INEL site is small compared with the entire site area and this area does not include any unusual aesthetic features.

For whatever cost, this option would not significantly contribute to existing land use or to special end land uses cited. Only about 8 percent of the 230,000-hectare (890-square-mile) site is currently used for facilities, including highways. The industrial development at the INEL site occupies only about 2 percent of the total land area of the site. In addition, lava beds that have already been disturbed could not be restored to pristine conditions. Eliminating existing public highways is not likely to be acceptable to the public. Thus, this alternative has been eliminated from detailed analysis.

3.2.3 No Cleanup or Controls

Leaving the surplused facilities and identified remediation sites without cleanup or institutional controls would not only violate the Federal Facility Agreement and Consent Order and Comprehensive Environmental Response, Compensation, and Liability Act and DOE commitments to the public and State of Idaho, but could also pose a threat to the environment and to workers (and possibly the public). The lack of site access controls and the presence of contaminated areas of soil and industrial facilities would create a potential for exposure to hazardous materials and for accidents. Thus, this alternative has been eliminated from detailed analysis.

3.3 Comparison of Impacts

This section compares the potential environmental consequences of implementing each of the four alternatives described in Section 3.1, Description of Alternatives. Each alternative consists of projects and actions that would support a particular direction for environmental restoration, waste management, and spent nuclear fuel programs at the INEL over the next ten years. This brief comparison of impacts is presented to help decisionmakers and the public understand the potential environmental consequences of proceeding with each of the alternatives at the INEL. In its Record of Decision, DOE may also choose to combine projects and activities from more than one alternative.

The following discussion is based on the detailed information presented in Chapter 5, Environmental Consequences. The environmental impact analyses are designed to produce a reasonable projection of the upper bound for potential environmental consequences. This requires the use of appropriately conservative assumptions and analytical approaches. Further discussion of the level of conservatism and degree of uncertainty in these analyses is presented in Chapter 5. Also, Table 3.3-1 summarizes the potential impacts of each alternative for the various environmental disciplines and lists proposed measures that could reduce or eliminate these impacts.

3.3.1 Land Use

In terms of land use (Section 5.2), implementing each of the alternatives would disturb different amounts of acreage—40 acres for Alternative A (No Action), 823 acres for Alternative B (Ten-Year Plan), approximately 355 acres for Alternative C (Minimum Treatment, Storage, and Disposal), and approximately 1,339 acres for Alternative D (Maximum Treatment, Storage, and Disposal). Some of this acreage has been previously disturbed by INEL site activities (88 percent for Alternative A, 30 percent for Alternative B, 66 percent for Alternative C, and 21 percent for Alternative D). The remaining acreage is open space. (Calculations of acreage disturbed by proposed projects are based on individual project data sheets in Volume 2, Appendix C.) Regardless of the alternative, the total amount of acreage that would be disturbed would represent less than one percent of all land within the INEL site boundary.

Proposed activities at the INEL site would be consistent with existing DOE plans for continued operations, environmental restoration, and waste management and would be similar to uses

Table 3.3-1. Comparison of projected environmental consequences at the Idaho National Engineering Laboratory by alternative.

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
Land use[a]	About 40 total acres would be disturbed; 5 acres newly disturbed. Consistent with existing DOE plans and policies. No effect on surrounding land uses or local plans. Minimal impacts expected. Mitigations: None proposed.	About 823 total acres would be disturbed; 577 acres newly disturbed. Consistent with existing DOE plans and policies. No effect on surrounding land uses or local plans. Minimal impacts expected. Mitigations: None proposed.	About 355 total acres would be disturbed; 122 acres newly disturbed. Consistent with existing DOE plans and policies. No effect on surrounding land uses or local plans. Minimal impacts expected. Mitigations: None proposed.	About 1,339 total acres would be disturbed, about 1,062 acres newly disturbed. Consistent with existing DOE plans and policies. No effect on surrounding land uses and local plans. Minimal impacts expected. Mitigations: None proposed.
Socio-economics[a]	Decrease of 1,280 direct and secondary jobs by 2004. Corresponding population decrease of 1,660. No impact on community services or public finance. Mitigations: None proposed.	Increase of 1,280 direct and secondary jobs by 2004. Corresponding population increase of 640. No impact on community services or public finance. Mitigations: None proposed.	Decrease of 830 direct and secondary jobs by 2004. Corresponding population decrease of 1,470. No impact on community services or public finance. Mitigations: None proposed.	Increase of 2,080 direct and secondary jobs by 2004. Corresponding population increase of 970. No impact on community services or public finance. Mitigations: None proposed.
Cultural resources[a]	About 40 acres, 6 structures, no known sites affected by ground disturbance, structural modifications, and so forth. Requires additional survey for cultural and paleontological resources. Impacts due to alteration of setting unlikely. Mitigations: Specific mitigation measures (for example, data recovery, rehabilitation) determined through consultation with State Historic Preservation Office and Native American groups.	Similar to Alternative A, except about 823 acres, 70 structures, 22 known sites affected. Requires additional survey. Mitigations: Similar to Alternative A.	Similar to Alternative A, except about 355 acres, 11 structures, no known sites affected. Requires additional survey. Mitigations: Similar to Alternative A.	About 1,339 acres, 70 structures, 22 known sites affected by ground disturbance, structural modifications, and so forth. Requires additional survey. Potential impacts due to alteration of setting. Mitigations: Similar to Alternative A.

Table 3.3-1. (continued)

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
Aesthetic and scenic resources	No impacts from new construction or modification of structures. Potential visibility degradation at Craters of the Moon Class I Wilderness Area with air emissions. Mitigations: Potential visual impacts would be further defined and resolved during the permitting process before projects could proceed. Mitigation may include emission control equipment, relocation of projects, or both. Use of standard construction practices to minimize erosion and dust.	Same as Alternative A for construction and modification of structures but greater potential for visibility degradation. Mitigations: Same as Alternative A, but controls may be required on additional projects to reduce oxides of nitrogen emissions.	Same as Alternative B. Mitigations: Similar to Alternative B, although control requirements would not be as extensive.	Same as Alternative B. Mitigations: Same as Alternative B.
Geology	Removal of 158,000 cubic meters of aggregate from onsite gravel and borrow pits. Potentially increased erosion. Consumption of fossil fuels and other earth resources. Mitigations: Possible measures to control localized erosion include minimizing surface disturbance and fugitive dust.	Similar to Alternative A, except removal of 392,000 cubic meters of aggregate. Mitigations: Same as Alternative A.	Similar to Alternative A, except removal of 296,000 cubic meters of aggregate. Mitigations: Same as Alternative A.	Similar to Alternative A, except removal of about 1.8 million cubic meters of aggregate. Mitigations: Same as Alternative A.

Table 3.3-1. (continued)

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
Air resources	Radiological emissions similar in type to those currently experienced; impacts well below acceptable levels, and a very small percentage of the natural background dose. Criteria pollutant impacts and toxic pollutant increments within acceptable levels. Localized dust from construction and decontamination and decommissioning activities. Potential visual impacts discussed under aesthetics and scenic resources in this table. Mitigations: Use of controls on radiological emissions sources. Best available control technology required to reduce emissions of nitrogen dioxide and sulfur dioxide. Standard control measures to reduce fugitive dust generation during construction activities.	Impacts similar to, but slightly greater than Alternative A. Mitigations: Same as Alternative A, with addition of best available control technology to control mercury emissions.	In general, impacts slightly greater than Alternative A, but less than Alternative B. Mitigations: Same as Alternative B.	In general, impacts slightly greater than Alternative B. Mitigations: Same as Alternative B.
Water resources	Water use or effluent discharge would have little effect on the quality or quantity of surface and subsurface waters. Groundwater withdrawal would increase by 106,900 cubic meters over normal annual INEL withdrawal of 7.4 million cubic meters. Mitigations: Implementation of pollution prevention plans and best management practices to reduce future pollution.	Same as Alternative A, except groundwater withdrawal would increase by 298,600 cubic meters. Mitigations: Same as Alternative A.	Same as Alternative A, except groundwater withdrawal would increase by 158,600 cubic meters. Mitigations: Same as Alternative A.	Same as Alternative A, except groundwater withdrawal would increase by 254,000 cubic meters. Mitigations: Same as Alternative A.

Table 3.3-1. (continued)

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
Ecology[a]	Disturbance to 40 acres of habitat. Direct mortality of some displaced animals. No habitat fragmentation. Potential establishment of non-native species. No or limited effects from increased vehicle traffic, lights, noise, human presence, air emissions, etc. Increased potential for train/wildlife collisions. Potential long-term exposure of biota to unremediated wastes. No effects to sensitive or protected species, jurisdictional wetlands, or critical habitats. Mitigations: Preactivity surveys, consultation with U.S. Fish and Wildlife Service, and, if necessary, project modification to ensure no adverse effect on species with special protective status. Identification and, if necessary, avoidance of jurisdictional wetlands. Use of various measures to minimize ground disturbance, reduce animal mortality by vehicles, and minimize exposure and uptake of radionuclides during remediation.	Similar to Alternative A, except disturbance to 823 acres of habitat. Net loss of 591 acres after revegetation. Potential for train/wildlife collisions is up to 6 times greater (assuming 100 percent rail shipment) than Alternative A. Potential habitat fragmentation. Short-term exposure of biota to elevated radionuclide levels possible during remediation. Radioactive uptake in plants and animals would decrease after cleanup. Mitigations: Similar to Alternative A.	Similar to Alternative B, except disturbance of about 355 acres of habitat. Net loss of 123 acres after revegetation. Mitigations: Similar to Alternative A.	Similar to Alternative B, except disturbance of about 1,339 acres of habitat. Net loss of about 1,108 acres after revegetation. Potential for train/wildlife collisions is up to 12 times greater (assuming 100 percent rail shipment) than Alternative A. Mitigations: Similar to Alternative B.
Noise	Noise levels of new projects and activities similar to existing noise levels. No adverse impact expected. Mitigations: None proposed.	Same as Alternative A. Mitigations: None proposed.	Same as Alternative A. Mitigations: None proposed.	Same as Alternative A. Mitigations: None proposed.

Table 3.3-1. (continued)

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
Traffic and transportation	**Incident-free waste (truck)**: 0.081 latent cancer fatalities. Nonradiological risk of fatality: 0.019. **Incident-free spent nuclear fuel (truck)**: Differs by subalternative and degree of examination: 0.0022 latent cancer fatalities. Nonradiological risk of fatality: 0.059. **Offsite accident risk for waste (truck)**:1 Differs by waste type. Highest risk for low-level waste transport by truck. Accident risk: 0.0028 latent cancer fatalities. Nonradiological risk of fatality: 0.30 **Offsite accident risk for spent nuclear fuel (truck)**: Differs by subalternative. Accident risk: 4.1 x 10^{-4} latent cancer fatalities. Nonradiological risk of fatality: 0.047. Mitigations: Choose truck routes using U.S. Department of Transportation (DOT) guidelines; use of approved shipment containers; abide by DOT requirements; use U.S. Environmental Protection Agency protective action guidelines.	**Incident-free waste (truck)**: 0.58 latent cancer fatalities. Nonradiological risk of fatality: 0.14. **Incident-free spent nuclear fuel (truck)**: Differs by subalternative 0.41 to 0.56 latent cancer fatalities. Nonradiological risk of fatality: 0.045 to 0.052. **Offsite accident risk for waste (truck)**: Differs by waste type. Highest risk for low-level waste transport by truck. Accident risk: 0.0029 latent cancer fatalities. Nonradiological risk of fatality: 2.0. **Offsite accident risk for spent nuclear (truck)**: Differs by subalternative Accident risk: 0.0011 latent cancer fatalities. Nonradiological risk of fatality: 0.77. Mitigations: Same as Alternative A.	**Incident-free waste (truck)**: 0.12 latent cancer fatalities. Nonradiological risk of fatality: 0.034. **Incident free spent nuclear fuel (truck)**: Differs by destination: 1.2 to 1.6 latent cancer fatalities. Nonradiological risk of fatality: 0.083 to 0.12. **Offsite accident risk for waste (truck)**: Differs by waste type. Highest risk for low-level waste transport by truck. Accident risk: 0.00078 latent cancer fatalities. Nonradiological risk of fatality: 0.42. **Offsite accident risk for spent nuclear (truck)**: Differs by destination. Accident risk: 0.0020 latent cancer fatalities. Nonradiological risk of fatality: 1.4. Mitigations: Same as Alternative A.	**Incident-free waste (truck)**: 1.2 latent cancer fatalities. Nonradiological risk of fatality: 0.29. **Incident free spent nuclear fuel (truck)**: 1.1 latent cancer fatalities. Nonradiological risk of fatality: 0.067. **Offsite accident risk for waste (truck)**: Differs by waste type. Highest risk for low-level waste. Accident risk: 0.0020 latent cancer fatalities. Nonradiological risk of fatality: 3.4. **Offsite accident for spent nuclear fuel (truck)**: Accident risk: 0.0048 latent cancer fatalities. Nonradiological risk of fatality: 1.0. Mitigations: Same as Alternative A.
Health and safety	Estimated excess cancers and other health effects, illnesses and injuries are expected to be less than current levels each year of site operation. Mitigations: Best management practices. Occupational and radiological safety programs.	Same as Alternative A. Mitigations: Same as Alternative A.	Same as Alternative A. Mitigations: Same as Alternative A.	Same as Alternative A. Mitigations: Same as Alternative A.

Table 3.3-1. (continued)

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum Treatment, Storage, and Disposal)	Alternative D (Maximum Treatment, Storage, and Disposal)
INEL services	Estimated annual increases above current levels: 20,000 megawatt-hours electricity; 106,900 cubic meters water; 3.8 million liters wastewater discharge; 2.5 million liters fossil fuel. No adverse impact expected. Mitigations: Energy and water conservation management practices, materials recycling.	Estimated annual increases above current levels: 95,200 megawatt-hours electricity; cubic meters water; 7.2 million liters wastewater discharge; 9.3 million liters fossil fuel. Possibly expanded fire protection, security, and emergency services. No adverse impact expected. Mitigations: Similar to Alternative A.	Estimated annual increases above current levels: 62,000 megawatt-hours electricity; 158,600 cubic meters water; 5.8 millon liters wastewater discharged; 2.9 million liters fuel. No adverse impact expected. Mitigations: Similar to Alternative A.	Estimated annual increases above current levels: 114,000 megawatt-hours electricity; 254,000 cubic meters water; 10.6 millon liters wastewater discharged; 10.2 million liters fossil fuel. Possibly expanded fire protection, security, and emergency services. No adverse impact expected. Mitigations: Similar to Alternative A.
Accidents	Probability of a fuel handling accident: 1 in 100 each year, resulting in a 2.0×10^{-3} rem dose, and a 1.0×10^{-8} risk of fatal cancer to the maximally exposed individual. Probability of a chain reaction accident at the Idaho Chemical Processing Plant: 1 in 1,000 each year, resulting in a 0.001 rem dose, and a 5.0×10^{-10} risk of fatal cancer to the maximally exposed individual. Probability of fire at the Waste Experimental Reduction Facility unit: 1 in 1000 each year, resulting in a 0.0028 rem dose, and a 1.4×10^{-9} risk of fatal cancer to the maximally exposed individual. Risks from accidents are low and well within DOE safety goal. Mitigations: Emergency planning preparedness and response programs.	Probability of a fuel handling accident: 1 in 21 each year, resulting in a 2.0×10^{3} rem dose, and a 4.8×10^{-8} risk of fatal cancer to the maximally exposed individual. Probability of fire at the Waste Experimental Reduction Facility unit: 1 in 500 each year, resulting in a 0.0028 rem dose, and a 2.8×10^{-9} risk of fatal cancer to the maximally exposed individual. Risks from accidents are low and well within DOE safety goal. Mitigations: Similar to Alternative A.	Probability of a fuel handling accident: 1 in 12 each year, resulting in a 2.0×10^{-3} rem dose, and a 8.6×10^{4} risk of fatal cancer to the maximally exposed individual. Probability of fire at the Waste Experimental Reduction Facility unit: 1 in 500 each year, resulting in a 0.0028 rem dose, and a 2.8×10^{-9} risk of fatal cancer to the maximally exposed individual. Risks from accidents analyzed are low and well within DOE safety goal. Mitigations: Similar to Alternative A.	Probability of a fuel handling accident: 1 in 5 each year, resulting in a 2.0×10^{3} rem dose, and a 2.0×10^{-7} risk of fatal cancer to the maximally exposed individual. Probability of fire in the Waste Experimental Reduction Facility unit: 1 in 100 each year, resulting in a 0.0028 rem dose, and a 1.4×10^{-8} risk of fatal cancer to the maximally exposed individual. Risks from accidents are low and well within DOE safety goal. Mitigations: Similar to Alternative A.

a. Numbers for these sections have been rounded. Exact numbers may be found in Sections 5.2, Land Use, 5.3, Socioeconomics, 5.4, Cultural Resources, and 5.9, Ecological Resources, of Volume 2 of this Environmental Impact Statement.

in existing developed areas on the INEL site (see Section 4.2). None of the alternatives would conflict with existing land use policies for the INEL site, existing uses of lands bordering the INEL site, or local land use plans.

Minimal impact to land use would be anticipated for any of the alternatives, and no mitigation measures are proposed.

3.3.2 Socioeconomics

In evaluating socioeconomic impacts (Section 5.3), each of the four alternatives was analyzed by comparing projected changes in employment, earnings, population, housing, community services, and public finance with 1995 baseline conditions. This analysis was based on the expected changes in employment and population that would occur under each alternative. It is projected that after 1995, baseline employment at the INEL would decline over the course of the ten-year study period. Therefore, to determine the cumulative changes in employment and population from 1995 to 2005, changes caused by each alternative were combined with the projected baseline changes.

None of the alternatives would result in greater employment and population in the region of influence by 2005 than in 1995. However, when compared to projected baseline employment declines, employment increases associated with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would partially offset projected baseline employment declines in every year of the study period. Conversely, employment decreases associated with Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) would significantly add to projected baseline employment declines after the year 2000. All four alternatives would generate initial increases in employment, due primarily to construction activities.

Implementation of Alternative A (No Action) would result in an employment decrease of approximately 1,280 jobs by 2004, with a corresponding population decrease of approximately 1,660 persons. Implementation of Alternative B (Ten-Year Plan) would result in an employment increase of approximately 1,280 jobs by 2004, with a corresponding population increase of approximately 640 persons. Implementation of Alternative C (Minimum Treatment, Storage, and Disposal) would result in an employment decrease of approximately 830 jobs by 2004, with a corresponding population decrease of approximately 1,470 persons. Implementation of Alternative D (Maximum Treatment, Storage, and Disposal) would result in an employment increase of approximately 2,080 jobs by 2004, with a corresponding population increase of approximately 970 persons.

All four alternatives would, when added to the declining employment baseline, result in cumulative employment and population decreases. Alternative A (No Action) would result in cumulative decreases in employment and population of approximately 4,810 and 6,220, respectively. Alternative B (Ten-Year Plan) would result in cumulative decreases in employment and population of approximately 2,250 and 3,920, respectively. Alternative C (Minimum Treatment, Storage, and Disposal) would result in cumulative decreases in employment and population of approximately 4,350 and 6,030, respectively. Alternative D (Maximum Treatment, Storage, and Disposal) would result in cumulative decreases in employment and population of approximately 1,450 and 3,590, respectively.

Under all alternatives, estimated employment and population changes would not be expected to be sufficient to generate discernible impacts to the economic resources of the region. Therefore, no mitigation measures would be required.

3.3.3 Cultural Resources

As discussed in Section 5.4, potential direct impacts to cultural resources at the INEL site would be caused primarily by ground disturbance from construction activities, vandalism, modifications of historically significant structures, or changes in the environmental setting.

Alternative A (No Action) would disturb 40 acres, at least 6 potentially significant structures, and no known archaeological sites; Alternative B (Ten-Year Plan) would affect 823 acres, 70 structures, and 22 known sites; Alternative C (Minimum Treatment, Storage, and Disposal) would affect approximately 355 acres, 11 structures, and no known archaeological sites; and Alternative D (Maximum Treatment, Storage, and Disposal) would disturb approximately 1,339 acres, 70 structures, and 22 known sites. Only a fraction of the land that would be disturbed under the alternatives has undergone intensive survey for cultural resources (Alternative A, 18 percent; Alternative B, 9 percent; Alternative C, 15 percent; Alternative D, 12 percent). In the unsurveyed areas, undiscovered archaeological, traditional Native American, and paleontological resources may exist and could potentially be adversely impacted. Therefore, under each of the alternatives, a cultural resource or paleontological survey would be required.

Except for Alternative D (Maximum Treatment, Storage, and Disposal), none of the alternatives would be likely to adversely affect the environmental setting of potentially significant cultural resources.

Under the regulations of the National Historic Preservation Act, impacts to significant cultural resources that would otherwise be found to be adverse may be reduced by appropriate scientific or historic research or by rehabilitating buildings and structures. The Shoshone-Bannock Tribe would be consulted during planning and while implementing actions potentially affecting traditional cultural properties.

3.3.4 Aesthetic and Scenic Resources

No adverse impacts to aesthetic and scenic resources at the INEL would be expected from new construction or modification of structures associated with any of the four alternatives. New facilities would likely be located within or near existing facility areas and at least 0.5 mile (0.8 kilometer) from public highways. In all instances, new facilities would resemble existing facilities and would not change the visual character of the INEL site.

Very conservative modeling has indicated that the potential exists for visual impacts at the Craters of the Moon Class I Wilderness Area. Potential visual impacts could be averted by relocating the projects or by using combustion control equipment to limit nitrogen dioxide emissions. These impacts could be further defined and resolved during the permitting process. Standard construction practices would be used to minimize erosion and dust.

3.3.5 Geology

Implementing any one of the four alternatives would result in minor, localized impacts on geological resources. The impacts would be caused by excavating and grading at new construction sites and by excavating aggregate material to construct new facilities. Estimates for the required aggregate range from 158,000 cubic meters for Alternative A (No Action) to 1.8 million cubic meters for Alternative D (Maximum Treatment, Storage, and Disposal). A secondary impact to geology would be the potential for increased soil erosion. Indirect impacts to geologic resources would include the consumption of fossil fuels, concrete, and other earth resources.

The potential for soil erosion would be mitigated by using construction practices designed to control storm runoff and slope stability. No other mitigation measures are proposed.

3.3.6 Air Resources

Estimates of the type and amount of airborne radionuclide emissions (Section 5.7) likely to result from the various alternatives indicate that in all four cases the types of emissions from proposed activities would be similar to those emitted by current INEL site operations, but that the quantities would vary substantially depending on the waste management option. These releases would occur primarily through stacks or vents, although some fugitive emissions could also occur. In all cases, doses would be well below applicable standards and a very small percentage of the natural background dose.

Nonradiological pollutants include criteria pollutants and toxic (hazardous) air pollutants emitted from stacks, vents, and fugitive sources. For criteria pollutant emissions, the predicted maximum concentrations in ambient air at INEL site boundary locations, along public roads, and at Craters of the Moon Wilderness Area would be below the State and National Ambient Air Quality Standards for all alternatives. Concentrations of toxic air pollutants at offsite and public road locations are predicted to be below applicable State of Idaho incremental standards for all alternatives. In all instances, predicted onsite concentrations of toxic air pollutants from the alternatives are below occupational exposure limits established by the American Conference of Governmental Industrial Hygienists and Occupational Safety and Health Administration.

The alternatives were evaluated to determine if predicted emissions would exceed established standards for the potential for ozone formation, Prevention of Significant Deterioration increment consumption, degradation of visibility at Craters of the Moon Wilderness Area, stratospheric ozone depletion, acidic deposition, and global warming. The following conclusions were reached:

- For all alternatives, emissions of volatile organic compounds would be expected to have a small effect on ozone formation.

- Prevention of Significant Deterioration regulations state that a proposed major project, together with the sum of other major projects in the same impact area, may not contribute to an increase in attainment pollutants above an allowable increment. The maximum Class I increment consumption has been assessed for each alternative and found not to exceed 76 percent of the allowable increment for 3-hour sulfur dioxide, and lesser amounts for all other averaging times and pollutants. In Class II areas, the maximum increment consumption would be 50 percent of the 24-hour increment for respirable particulates.

- Conservative visibility screen analysis indicated that a potential for visual impacts exists at Craters of the Moon Wilderness Area for all alternatives, due primarily to nitrogen dioxide emissions. These impacts would be further defined and resolved during the permitting process. Project relocation, emission controls, or both would be required if more refined modeling still predicts visibility impact. Emission controls may, in fact, be required by other regulations, even if visibility degradation criteria are not exceeded.

- While none of the alternatives would involve production or use of ozone-depleting substances, each alternative could potentially release certain chemicals associated with the depletion of the ozone layer, primarily from environmental remediation activities. These releases would be extremely small compared with global loadings and can be considered to have small effects.

- Emissions of sulfur and nitrogen compounds would not be expected to contribute significantly to acidity levels in precipitation either in the region or over greater distances.

- Emissions of greenhouse gases (carbon dioxide, methane, nitrous oxides, and chlorofluorocarbons) from alternatives would be exceedingly small on a global basis and would not have any detectable effect on global warming.

The alternatives would be expected to provide only a small increase in vehicular-induced air quality impacts. Construction of projects associated with each of the proposed alternatives would not be expected to result in exceeding the ambient air quality standards for respirable particulate matter or total suspended particulates at the INEL site boundary, although short-term localized exceedances along onsite public roads could occur.

For Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal), air pollutant control equipment, administrative controls, changes in raw material feed, or design changes would likely be required on specific projects to reduce emissions of nitrogen dioxide, sulfur dioxide, and mercury to levels that are considered best available control technology. Similar levels of control would be required in sources of sulfur dioxide and nitrogen dioxide under Alternative A (No Action).

3.3.7 Water Resources

Each alternative was evaluated with respect to its potential impacts on water quality (both surface and subsurface water) and water use (Section 5.8). Computer modeling of contaminant transport in both the unsaturated and saturated zones shows that existing contaminant plumes do not have discernible impacts on regional groundwater quality and that no contaminants are presently migrating or likely to migrate offsite in concentrations above U.S. Environmental Protection Agency drinking water standards.

None of the environmental restoration or waste management projects would intentionally discharge hazardous or radioactive liquid effluents above established standards to subsurface and surface water. Implementation of pollution prevention plans and best management practices would further reduce the possibility of future pollution. Therefore, no discernible impacts on regional water quality would be expected for any of the alternatives.

Estimated groundwater withdrawal would increase over the normal annual groundwater withdrawal of 7.4 million cubic meters for all alternatives. The increases would range from 106,900 cubic meters (28 million gallons) for Alternative A (No Action) to 298,600 cubic meters (79 million gallons) for Alternative B (Ten-Year Plan). These increases in usage would be within INEL's consumptive use water right of 43 million cubic meters (11.4 billion gallons) per year. The maximum increase in water usage would be equivalent to one additional irrigation pump operating for 8 days a year. No adverse impact on water use would be anticipated.

3.3.8 Ecology

Potential ecological effects for all alternatives would vary in scale, depending on the specific locations of proposed activities (Section 5.9). The primary effect would be loss or alteration of habitat. Most would be sagebrush-steppe or previously disturbed habitat. Other potential effects would include direct mortality caused by land clearing, facility removal, or vehicular traffic; displacement of some species; change in habitat use by animals due to human presence nearby; and exposure to radionuclides, hazardous contaminants, and wastes. Habitat fragmentation would be a potential impact in all cases except Alternative A (No Action).

Federal protected and candidate species and State-sensitive species would probably not be affected by implementing any alternative. No critical habitat for protected species has been designated on the INEL site; therefore, no effects would occur. Jurisdictional wetlands and aquatic resources would probably not be affected under any of the alternatives.

Activities under Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal) would result in similar types of short-term and long-term ecological impacts, although the size and location of impacted areas would differ. Potential short-term impacts from the alternatives include loss of plant productivity, localized biodiversity loss, and the potential establishment of nonnative plants on the acreage that would be disturbed. The long-term net loss of land productivity would result from constructing and operating new facilities, expanding the landfill, and excavating sand and gravel. For all alternatives except Alternative A, revegetating with native plants and grasses on disturbed land would lessen the long-term net loss of potential habitat. Remediation of sites and facilities would lower long-term radionuclide exposure and uptake by plants and animals. However, in the short-term, remediation may increase exposure and uptake by plants and animals compared with current levels. For Alternatives B, C, and D, potential long-term exposure and uptake would be lower compared with Alternative A as additional sites and facilities would be remediated.

For all alternatives, preactivity surveys for sensitive and protected species and habitats, identification of jurisdictional wetlands, and consultation with appropriate agencies may be required. Needed mitigations would be explicitly identified, based on the results of the surveys and consultations.

3.3.9 Noise

As discussed in Section 5.10, noise impacts at INEL for each alternative would come from noises generated during the transportation of personnel and materials to and from the INEL site and within nearby communities. These noises would largely be a function of the size of the workforce and would be related to the use of buses.

Because the overall operations workforce stationed at the INEL site would be expected to decrease during the ten-year study period for all alternatives (see Section 5.3, Socioeconomics), the overall noise level resulting from INEL site bus transportation would be expected to decrease slightly.

No adverse noise impacts would be anticipated, and no mitigation measures would be required.

3.3.10 Traffic and Transportation

The increased traffic and transportation near the INEL caused by activities associated with all four of the alternatives would be within the capacity of the current road system and would cause minimal impacts (see Section 5.11).

The risks of health effects from transporting radiological and nonradiological materials were calculated considering both incident-free conditions and accident scenarios. For offsite incident-free transportation of radioactive waste and spent nuclear fuel, about three latent cancer fatalities were estimated to result from all alternatives for both occupational and general population exposures. Less than one nonradiological fatality was estimated for all alternatives for members of the public.

The potential impacts from onsite transportation accidents involving spent nuclear fuel or radioactive waste were evaluated for the alternatives by assessing bounding accident scenarios. The bounding accident scenarios are extremely unlikely events with likelihoods ranging from once in 26,000 years to once in ten million years. For the bounding onsite spent nuclear fuel transportation accident, the fatal cancer risk for the population within 80 kilometers (50 miles) would be on the order of one in a million years for a rural population zone and about one in 90,000 years for a suburban population zone. For the bounding onsite radioactive waste transportation accident, the fatal cancer risk for the population within 80 kilometers (50 miles) would be on the order of one in 500 million years for a rural population zone and about one in 4 million years for a suburban population zone.

The potential impacts from offsite transportation accidents involving spent nuclear fuel or radioactive waste were evaluated by calculating the probabilities and consequences from a spectrum of unlikely accidents. The resulting estimates of accident risk were used to compare relative transportation impacts among the alternatives, as shown in Table 3.3-1. For spent nuclear fuel, the radiological risk from transportation accidents would be highest for Alternative C (Minimum Treatment, Storage, and Disposal) and would be minimized by Alternative A (No Action). For radioactive waste, radiological risk from transportation accidents would be highest for Alternative B (Ten-Year Plan) and the minimum risk would occur under Alternative C.

In addition to radiological risks associated with the accidental release of radioactivity, transportation accidents also pose nonradiological risks, such as risk of fatality from the physical impact sustained during an accident. As shown in Section 5.11, the risk of fatalities from vehicle impacts would be approximately 10 to 10,000 times higher than the risk of fatal cancers from accidental release of radioactivity. From this perspective, the nonradiological risk from transportation accidents would be highest for Alternative D (Maximum Treatment, Storage, and Disposal) and would be minimized by Alternative A (No Action).

The potential impacts from offsite transportation accidents involving nonradiological hazardous materials and wastes would be bounded by accidents associated with shipments of bulk chemicals. The bounding accident would be a release of nitric acid from a tanker truck and has a likelihood ranging from once in 2,000 years to once in 200,000 years. The accident would be most likely to occur in a rural population zone with neutral weather conditions and one person might be exposed to potentially life-threatening concentrations of nitric acid in the air. The most unlikely accident would occur in an urban population zone under stable weather conditions and could potentially expose over 3,000 persons to life-threatening air concentrations.

The impacts to the regional traffic system around the INEL would be minimal for all alternatives.

Impacts of transportation could be mitigated in a number of ways, including choosing shipment routes using U.S. Department of Transportation routing guidelines and using approved shipment containers.

3.3.11 Health and Safety

Under all the alternatives, the activities to be performed by workers and their associated work place hazards would be similar to those for current INEL activities. Conservative estimates of potential impacts to public health and safety were made for all alternatives for both radiological and nonradiological exposures. Implementing any of the alternatives would result in a small potential for additional fatal cancers for the population within 80 kilometers (50 miles) of the INEL site due to radiological exposures. The total additional fatal cancers would range from about 0.002 for Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) to about 0.05 for Alternative D (Maximum Treatment, Storage, and Disposal). Risk of fatal cancer to the maximally exposed worker would range from one in about 770,000 (Alternatives A and C) to one in about 400,000 (Alternative D). The risk of fatal cancer to the maximally exposed offsite individual would range from one in about 1,400,000 (Alternative A) to one in about 270,000 (Alternative D).

Again, using conservative modeling methods and assumptions, exposure to nonradiological substances would not be expected to result in adverse health effects for onsite workers, although benzene contributions in Alternative D (Maximum Treatment, Storage, and Disposal) would represent a very small increase (about 0.1 percent) over the baseline. At the INEL site boundary and public roads, adverse health effects from exposure to mercury and hydrochloric acid cannot be completely ruled out under Alternatives B (Ten-Year Plan) and D. The lifetime cancer risk from offsite concentrations of carcinogenic air pollutants was assessed for offsite individuals at areas predicted to have the highest estimated carcinogen air concentrations. This risk would be approximately one in 500,000 for all alternatives.

Work place hazards would be reduced by the occupational and radiological safety programs and regulatory standards currently in place. Collective radiation doses, resulting health effects, and estimated nonradiological health effects would be expected to be less than current levels for all alternatives because of the expected decline in total employment at the INEL.

3.3.12 Idaho National Engineering Laboratory Services

The consumption of electrical energy and fossil-based fuels, the withdrawal of water, and the discharge of wastewater at the INEL site would be greatest under Alternative D (Maximum Treatment, Storage, and Disposal). Under all alternatives, impacts from new facility construction and electrical and utility usage would be expected to be minor. The expected increases in fossil fuel usage would be within the INEL site supply capability. Increases in INEL fire, security, and emergency services might be required for Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

The INEL facilities within the City of Idaho Falls would not be expected to expand under any of the alternatives. Therefore, city services and natural gas supplies would not be impacted by implementation of any of the alternatives.

3.3.13 Facility Accidents

The potential accidents that could occur at INEL facilities during implementation of the alternatives would be expected to be similar to those that have occurred in the past. Additional accident scenarios, such as fire, human error, sabotage, and natural phenomena, were identified and analyzed for potential impacts on human health and the environment. The maximum reasonably foreseeable accident scenarios were selected to reflect the waste types, hazardous materials, and decontamination and decommissioning activities applicable to every alternative.

For Alternative A (No Action), limited potential would exist for a fuel handling accident (likelihood of occurrence of one in 100 each year). Limited potential exists for calcined waste dispersion at the Idaho Chemical Processing Plant (likelihood of occurrence of one in 100,000 each year). These accidents would produce a one in 100 million risk of fatal cancer per year for a person who receives the maximum possible exposure while standing at the INEL site boundary. Limited potential (likelihood of occurrence of one in 1,000 each year) would exist for a fire at the Waste Experimental Reduction Facility or the Radioactive Waste Management Complex. Fires at these facilities could release mixed low-level or low-level radioactive waste to the environment; however, the risk of fatal cancer would be less than cited above.

Using the same maximum reasonably foreseeable accident scenarios for Alternative B (Ten-Year Plan), there would be an increased potential (one in 21 each year) for a fuel handling accident caused by construction activities and the receipt of additional offsite spent nuclear fuel shipments to the INEL site. Like Alternative A (No Action), the risk of fatal cancer per year for the maximally exposed individual standing at the INEL site boundary would be small (one in 21 million). The risk of fire at the Radioactive Waste Management Complex or the Waste Experimental Reduction Facility would increase by a factor of two over Alternative A because of projected waste-handling activities. The risks of fatal cancer per year resulting from these accidents would be one in 300 million.

For Alternative C (Minimum Treatment, Storage, and Disposal), there would be limited potential (likelihood of occurrence of one in 12 per year) for a fuel handling accident due to increased fuel handling activities. The chance of a fire at the Waste Experimental Reduction Facility would be one in 500 because of the increased handling necessary to package and transport mixed low-level and low-level waste from the INEL site. Like Alternatives A (No Action) and B (Ten-Year Plan), the corresponding risk of fatal cancer per year would be small for the maximally exposed individual at the site boundary.

The potential for accidents under Alternative D (Maximum Treatment, Storage, and Disposal) would be greater than under the other alternatives because of the receipt of additional offsite shipments of waste and relatively long-cooled spent nuclear fuel, and spent nuclear fuel processing for ultimate disposal. The additional handling needed to receive and store spent nuclear fuel would be approximately 20 times that of Alternative A (No Action). Although the frequency of potential fuel handling accidents would be greater than under other alternatives, the consequences would not. Likewise, the consequences would be approximately the same for an accidental fire involving mixed low-level and low-level waste. The risk of fire would be expected to be more than ten-fold greater than under Alternative A due to the receipt of DOE complex-wide waste for treatment, storage, and disposal.

For all alternatives, the risk of accidents would be low and well within DOE safety goals.

3.3.14 Conclusion

The four alternatives present different approaches to organizing environmental restoration, spent nuclear fuel, and waste management activities at the INEL over the next ten years. Each alternative provides some continuity for existing facilities and activities. Implementing each alternative, however, would produce different environmental consequences.

For the various disciplines, these impacts may be major or minor, direct or indirect, adverse or beneficial, long-term or short-term. For example, one difference among the alternatives would be the amount of remediation at the INEL site, which would have implications for environmental consequences. Under all the alternatives except Alternative A (No Action), contaminated areas would be cleaned up in accordance with agreements outlined in the Federal Facility Agreement and Consent Order. The land would then be available for reuse, reducing the potential long-term risks of contamination to human health and the environment. Implementing Alternative A (No Action), however, would continue the current use restrictions for land identified as contaminated, as well as violate DOE commitments and applicable environmental laws.

Among the four alternatives, Alternative C (Minimum Treatment, Storage, and Disposal) would perhaps have the fewest overall environmental consequences for the INEL. Because spent nuclear fuel and all waste types, except high-level waste, would be transferred to another site, impacts associated with health and safety, air resources, and water resources would decrease. However, environmental impacts would consequently increase at the receiving DOE site(s). Alternative C would also offer the least potential for using INEL facilities and developing new technologies to address waste-related issues affecting the total DOE complex.

Alternative D (Maximum Treatment, Storage, and Disposal) would probably have the greatest overall potential for environmental consequences. This alternative would also result in the largest commitment of the INEL resources to address waste-related issues throughout the DOE complex.

The alternatives differ in the approximate disturbed acreage within and outside of existing facilities. More land would be disturbed by Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) because of waste management and environmental restoration. Immediate consequences of disturbing land, especially outside current facility areas, would include habitat loss, displacement or mortality of individual plants or animals, and temporary exposure of plants and animals to elevated radionuclide levels.

Different patterns of moving nonradioactive and radioactive materials in each alternative would result in different collective doses to workers and the public during normal (incident-free) transportation. More shipments of waste and spent nuclear fuel are planned for Alternative D (Maximum Treatment, Storage, and Disposal) than for the other alternatives, which would result in correspondingly higher exposures. Alternative A (No Action) would yield the smallest collective dose, while the collective doses for Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal) would be approximately equal.

3.4 Preferred Alternative

DOE's Preferred Alternative for Volume 2 of this EIS is the most like Alternative B (Ten-Year Plan), but includes elements of other alternatives for some waste types.

Under the Preferred Alternative, similar to the activities described under Alternative B (Ten-Year Plan), existing environmental restoration projects and waste management facility operations and projects would continue. Besides existing facilities and projects, currently proposed projects as listed in Table 3.4-1 for 1995 through 2005 would be implemented. These projects would be implemented to continue to meet INEL's mission and to help ensure regulatory compliance.

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 comply with regulations and agreements and would depend on decisions based on Site Treatment Plans, to be negotiated under the Federal Facility Compliance Act, and on the Waste Management Programmatic EIS. These activities could result in acceptance of additional offsite-generated materials and waste. Newly generated waste would potentially increase, reflecting regulatory requirements, as negotiated, and increased environmental restoration activities. Non-aluminum-clad spent nuclear fuel, transuranic, and mixed low-level waste would be received from offsite. Aluminum-clad spent nuclear fuel would be transported to the Savannah River Site. Naval spent nuclear fuel would continue to be received and examined at the Expended Core Facility. Onsite waste management would emphasize treatment capabilities. The transuranic waste and mixed low-level waste received from other DOE sites would be treated, and the residue would be returned to the original (generating) DOE site 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 Agency, and with other affected states. Ongoing remediation and decommissioning and decontamination projects would be continued, and additional projects would be conducted. Environmental restoration activities would be conducted in accordance with the Federal Facility Agreement and Consent Order and associated Action Plan.

Preferred Alternative

Spent nuclear fuel	• Examine and store naval spent nuclear fuel • Receive additional non-aluminum-clad spent nuclear fuel from offsite • Complete Expended Core Facility Dry Cell Project • Phase out pools at Building 603 of the Idaho Chemical Processing Plant • Expand storage capacity in pools at Building 666 of the Idaho Chemical Processing Plant (rerack) • Phase in new dry storage • Demonstrate electrometallurgical processing • Transfer aluminum-clad spent nuclear fuel to Savannah River Site
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 and 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) • Develop treatment processes that minimize high-activity waste • Plan a facility to immobilize both liquid and solid calcine
Transuranic waste	• Accept transuranic waste from offsite for treatment • Retrieve/move transuranic and alpha low-level waste to new compliant storage • Treat offsite and onsite transuranic and alpha low-level waste • Transport transuranic waste offsite for disposal • 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 low-level 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 waste offsite for treatment, storage, disposal
Infrastructure	• Radiological and Environmental Sciences Laboratory Replacement • Health Physics Instrument Laboratory • Industrial/Commercial Landfill • Gravel Pit Expansions • Central Facilities Area Clean Laundry and Respirator Facility

Table 3.4-1. Projects at the Idaho National Engineering Laboratory associated with the Preferred Alternative[a]

Expended Core Facility Dry Cell Project
Increased Rack Capacity for CPP-666
Additional Increased Rack Capacity (CPP-666)
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage
Experimental Breeder Reactor-II Blanket Treatment
Electrometallurgical Process Demonstration
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)
Engineering Test Reactor D&D
Materials Test Reactor D&D
Fuel Processing Complex (CPP-601) D&D
Fuel Receipt and Storage Facility (CPP-603) D&D
Headend Processing Plant (CPP-640) D&D
Waste Calcine Facility (CPP-633) D&D
Tank Farm Heel Removal Project
Waste Immobilization Facility[b]
Radioactive Scrap/Waste Facility
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste
Idaho Waste Processing Facility
Waste Experimental Reduction Facility Incineration
Mixed/Low-Level Waste Disposal Facility
Nonincinerable Mixed Waste Treatment
Remote Mixed Waste Treatment Facility
Sodium Processing Project
Greater-Than-Class-C Dedicated Storage
Industrial/Commercial Landfill Expansion
Gravel Pit Expansions
Central Facilities Area Clean Laundry and Respirator Facility
Calcine Transfer Project (Bin Set #1)
Plasma Hearth Process Project
Test Area North Pool Fuel Transfer[c]
Remediation of Groundwater Contamination[c]
Pit 9 Retrieval[c]
Vadose Zone Remediation[c]
Auxiliary Reactor Area (ARA)-II D&D[c]
Boiling Water Reactor Experiment (BORAX)-V D&D[c]
High-Level Tank Farm Replacement (upgrade phase)[c]
Transuranic Storage Area Enclosure and Storage Project[c]
Waste Characterization Facility[c]
Waste Handling Facility[c]
Health Physics Instrument Laboratory[c]
Radiological and Environmental Sciences Laboratory Replacement[c]

a. The Department of Energy would conduct appropriate further National Environmental Policy Act review before implementing some projects.

b. Sodium-bearing and calcine waste treatment technology selection would be implemented through this facility.

c. These ongoing projects have been included in the environmental analysis represented in this Environmental Impact Statement. National Environmental Policy Act documentation had been or was planned to be completed before June 1995.

3.4.1 Preferred Alternative Decision Process

DOE's decision process was designed to objectively identify and evaluate a Preferred Alternative. As indicated in Section 3.3, the environmental impacts for Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal) were all very small. Thus, the identification process considered several other factors besides environmental impacts, including regulatory compliance, DOE programmatic missions, public comments, national security and defense, cost, practicality of treatment implementation, and DOE policy. Public input considered in the decision process included public comments regarding air, water, land use, and transportation.

In developing the decision criteria, regulatory compliance was of overriding importance. In addition to regulatory compliance, each alternative was rated on its ability to meet selected performance criteria. Performance criteria used included (a) public issues and concerns, (b) cost, (c) DOE policy and compatibility with INEL mission, and (d) practicality of implementing treatment, storage, and disposal. Where practical, quantitative factors were used to make objective comparisons among the alternatives for each performance criterion. The final identification of the Preferred Alternative was based on the ranking of each of the alternative's ability to satisfy the performance criteria.

3.4.2 Conclusions

The process resulted in the identification of a Preferred Alternative that is very similar to Alternative B (Ten-Year Plan). The modifications to Alternative B (Ten-Year Plan) included in the Preferred Alternative would be actions that would enhance DOE's ability to comply with applicable laws, regulations, and obligations, enhance the regulatory compliance posture of the INEL, and enhance the INEL's mission capability.

DOE's Preferred Alternative is consistent with the Navy's Preferred Alternative for naval spent nuclear fuel management identified in the draft EIS—to continue refueling and defueling of nuclear-powered vessels and prototypes, and to transport naval spent nuclear fuel to the Idaho National Engineering Laboratory for full examination and interim storage, using the same practices as in the past. For a discussion of the DOE alternatives for spent nuclear fuel management, see Volume 1 of this EIS.

Projects proposed within the Preferred Alternative are listed in Table 3.4-1 and are described in more detail in Appendix C (Information Supporting the Alternatives). Specifics on how these projects would be used to complete the goals of the major waste programs, spent nuclear fuel management, and environmental restoration are described in the following sections and accompanying tables.

3.4.3 Spent Nuclear Fuel Management

For spent nuclear fuel management, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan). As shown in Table 3.4-2, specific types of offsite spent nuclear fuel could be received, including naval, Fort St. Vrain, West Valley, and other special-case commercial reactors, as well as other non-aluminum-clad spent nuclear fuel from university and foreign research reactors. Aluminum-clad spent nuclear fuel currently stored at the INEL would be shipped to the Savannah River Site for storage. Naval spent nuclear fuel would be examined at the Expended Core Facility at the Naval Reactors Facility and then stored at the Idaho Chemical Processing Plant. The Expended Core Facility Dry Cell Project would be implemented. Additional storage would be gained hy implementing projects for installing additional racks in the storage pools at the Idaho Chemical Processing Plant Building 666. Wet storage in Building 603 would be completely phased out. A new dry storage facility would be constructed and phased in. Spent nuclear fuel would be consolidated onsite at CPP-666. At Argonne National Laboratory-West, the Experimental Breeder Reactor-II Blanket Treatment project and demonstration of the electrometallurgical process would occur.

3.4.4 Environmental Restoration

3.4.4.1 Remediation. For environmental remediation, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan). Environmental remediation activities would proceed in compliance with the negotiated agreements and in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act process and the Federal Facility Agreement and Consent Order. All currently planned interim actions and new remedial investigations and feasibility studies would be implemented at each waste area group, leading to a comprehensive remedial investigation/ feasibility study for all waste area groups Remedial actions would be implemented under this alternative if determined necessary by the Record of Decision determined under the Comprehensive

Table 3.4-2. Preferred Alternative: Summary of proposed spent nuclear fuel management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).

Generation	Transportation	Stabilization/Treatment	Storage	Research and Development	Naval fuel examination
Limited onsite generation from INEL test reactors	Additional receipts of non-aluminum-clad spent nuclear fuel from Fort St. Vrain, West Valley and other special-case commercial reactors, as well as some university and foreign research reactors Naval spent nuclear fuel from defueling points plus onsite transfer for interim storage Casks for offsite receipts supplied by others Onsite spent nuclear fuel transfer in existing casks for consolidation Shipment of aluminum-clad spent nuclear fuel to the Savannah River Site	Current INEL spent nuclear fuel inventory stabilized as needed Offsite receipts stabilized as needed • Dry Fuel Storage Facility; Fuel Receiving, Canning/ Characterization, and Shipping	Onsite consolidation plus upgrading and expansion of storage to accommodate offsite receipts • Test Area North Pool Fuel Transfer • Increased Rack Capacity for CPP-666 • Additional Increased Rack Capacity (CPP-666) • Fort St. Vrain Spent Nuclear Fuel Shipment and Storage Phase out miscellaneous storage facilities and CPP-603 wet storage Phase in dry storage • Dry Fuel Storage Facility; Fuel Receiving, Canning/ Characterization, and Shipping	Research and development activities expanded as planned • Experimental Breeder Reactor-II Blanket Treatment • Electrometallurgical Process Demonstration	Examination at existing Expended Core Facility • Expended Core Facility Dry Cell Project

Environmental Response, Compensation, and Liability Act process and the Federal Facility Agreement and Consent Order.

3.4.4.2 Decontamination and Decommissioning. For decontamination and decommissioning, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan). For the Preferred Alternative, decontamination and decommissioning would be initiated for the nine facilities identified in Table 3.4-3. Ongoing projects would be completed in accordance with established priorities, and the proposed actions would be completed to a level consistent with overall risk reduction and reuse capabilities. When possible, actions would emphasize possible reuse or partial dismantlement of facilities.

3.4.5 Waste Management

The activities and facilities proposed for managing waste (high level, transuranic, mixed, low level, and hazardous) under the Preferred Alternative are summarized in the following sections and accompanying tables.

Table 3.4-3. Preferred Alternative: Summary of environmental restoration management activities and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).

Activities	Decontamination and Decommissioning (D&D) Projects	Remediation Projects
Conduct projects in accordance with Federal Facility Agreement and Consent Order (FFA/CO) and Action Plan Waste generation quantity and increase similar to current quantities planned Reuse and partial dismantlement of D&D projects	• Auxiliary Reactor Area-II • Boiling Water Reactor Experiment-V • Engineering Test Reactor • Materials Test Reactor • Fuel Processing Complex (CPP-601) • Fuel Receipt/Storage Facility (CPP-603) • Headend Processing Plant (CPP-640) • Waste Calcine Facility (CPP-633) • Central Liquid Waste Processing Facility	• Remediation of Groundwater Contamination • Pit 9 Retrieval • Vadose Zone Remediation • Complete all interim actions or remedial investigation/feasibility studies (RI/FS) scheduled under FFA/CO, including comprehensive RI/FS for Waste Area Groups 1 through 10[a] • RI/FS-remedial action for spills, contaminated soil, tanks, sewage lagoons, and so forth

a. Waste Area Groups: 1-Test Area North, 2-Test Reactor Area, 3-Idaho Chemical Processing Plant, 4-Central Facilities Area, 5-Power Burst Facility/Auxiliary Reactor Area, 6-Experimental Breeder Reactor-I/Boiling Reactor Experiment, 7-Radioactive Waste Management Complex, 8-Naval Reactors Facility, 9-Argonne National Laboratory-West, 10-Snake River Aquifer and other areas.

3.4.5.1 High-Level Waste. The following discusses the management activities and technology decisions associated with high-level waste.

3.4.5.1.1 Management Activities—For high-level waste management, the Preferred Alternative differs from Alternative B (Ten-Year Plan), as summarized in Table 3.4-4. For the period 1995 to 2005 under the Preferred Alternative, operation of the New Waste Calcining Facility would resume such that high-level waste from previous reprocessing would be calcined before January 1, 1998. Because some existing liquid waste storage tanks would be taken out of service during this time period, the Tank Farm Heel Removal Project would proceed. The upgrade of an existing facility at Argonne National Laboratory-West for interim high-level waste storage would be achieved.

Planning for the conversion of both liquid and calcine to a final disposable solid would proceed and would involve a waste immobilization facility that includes separation technology that would minimize the volume of high-activity waste. DOE would conduct appropriate further National Environmental Policy Act review before making decisions on the design, construction, and operation of a waste immobilization facility. Development of this facility would be negotiated in conjunction with efforts currently being undertaken with the State of Idaho under the Federal Facility Compliance Act. These efforts include the development of a Site Treatment Plan, which would provide a schedule for the development and implementation of treatment technologies. The High-Level Tank Farm New Tanks Project would not be implemented under the Preferred Alternative.

3.4.5.1.2 Technology Selection—A waste immobilization facility would include a separations step for liquid waste before vitrification. Existing calcine would be dissolved in a pretreatment step before separation. The separation options for both sodium-bearing liquid waste and calcine include precipitation, radionuclide partitioning, and freeze crystallization. Separation would result in a greatly reduced high-level waste volume.

Treatment would produce a high-activity waste form suitable for placement in a geologic repository and a low-activity waste form that could be delisted or disposed of in a waste disposal site approved under the Resource Conservation and Recovery Act. The high-activity waste form would be glass or glass ceramic, and the low-activity waste form would be grout, glass, or glass-ceramic.

Table 3.4-4. Preferred Alternative: Summary of proposed high-level waste management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).

Generate	Retrieve	Receive	Characterize	Store	Treat	Transport	Dispose
From high-level waste calcining system flushes/ cleanups via high-level waste evaporator and Process Equipment Waste Evaporator Waste from decontamination and decommissioning projects at the Idaho Chemical Processing Plant	Demonstrate calcine retrieval from early bin set • Calcine Transfer Project (Bin set #1)	No offsite waste received	Develop acceptance criteria for disposal in geologic repository	Interim storage of liquid in underground tanks pending treatment • High-Level Tank Farm Replacement (upgrade phase) Prepare existing tanks to phase out use • Tank Farm Heel Removal Project Continue storing solids in existing bins in concrete vaults Expand high-level waste storage at Argonne National Laboratory-West • Radioactive Scrap/Waste Facility	Continue converting liquid to calcine (solid) Plan waste immobilization facility for converting liquid and calcine to glass or ceramic for ultimate disposal. Immobilization technology to include separation of high- and low-activity fractions • Waste Immobilization Facility	Transport to geologic repository when identified	Dispose low-activity fraction from separations offsite or at INEL Dispose high-activity fraction in geologic repository when identified

3.4.5.2 Transuranic Waste. For transuranic waste, the Preferred Alternative as described in Table 3.4-5 differs from Alternative B (Ten-Year Plan) in that it allows the INEL to receive additional waste from offsite for treatment (possibly 20,000 cubic meters instead of 6,000 cubic meters under Alternative B). Additional waste would be received depending on decisions based on the Site Treatment Plans negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic EIS. Because most of the transuranic waste is mixed waste and may require treatment before disposal, it would be subject to the requirements of the Federal Facility Compliance Act. The Site Treatment Plans developed under the Federal Facility Compliance Act may require that some types of waste be shipped from one site to the other to take advantage of existing or future regionalized capability. The Preferred Alternative would allow the construction of the treatment facilities necessary to comply with the Federal Facility Compliance Act. Transuranic waste could be transported to the Waste Isolation Pilot Plant if the waste acceptance criteria are met.

Projects for retrieving, characterizing, and treating INEL transuranic waste would be implemented. These projects would prepare the waste for disposal in a national repository or for onsite disposal (for wastes that can meet the onsite performance assessment). In addition to projects identified as ongoing (Transuranic Storage Area Enclosure and Storage project and the Waste Characterization Facility), either the Idaho Waste Processing Facility or the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility could be constructed (an alternate could be the use of Pit 9 facilities for treating transuranic waste). After treatment of INEL waste and depending on the Site Treatment Plan negotiated under the Federal Facility Compliance Act and the decision associated with the Waste Management Programmatic EIS, up to 20,000 cubic meters (26,000 cubic yards) of waste would be received from the DOE complex as treatment capacity became available. After treatment, the waste residuals would be returned to the generator or transported to an approved offsite disposal facility. INEL waste that meets the Waste Acceptance Criteria for the Waste Isolation Pilot Plant would be transported for disposal.

3.4.5.3 Low-Level Waste. For low-level waste, the Preferred Alternative is the same as Alternative B (Ten-Year Plan). This alternative best meets the mission requirements for INEL by providing for onsite disposal and treatment, but does not make INEL a disposal site for large amounts of offsite waste. INEL-generated low-level waste would be treated onsite and offsite and disposed onsite at the Radioactive Waste Management Complex and the Mixed Low-Level Waste Disposal

Table 3.4-5. Preferred Alternative: Summary of proposed transuranic waste (TRU) management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).[a,b]

Generate	Retrieve	Receive	Characterize	Store	Treat	Transport	Dispose
Generate small amount of waste from proposed onsite activities (350 m^3)	Retrieve up to 10,400 m^3 per year TRU and alpha-low-level waste from Transuranic Storage Area (TSA), Air Support Building and Environmental Remediation activities, and place in storage • TSA Enclosure and Storage Project	Depending on the decisions based on the Site Treatment Plan negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic EIS, receive up to 20,000 m^3 of waste from the Department of Energy (DOE) Complex	Characterize a representative sample of retrieved waste • Waste Characterization Facility	Store received, retrieved, and newly generated waste before and after treatment pending availability of disposal • TSA Enclosure and Storage Project	Treat to meet disposal requirements • Idaho Waste Processing Facility • Private Sector Alpha-Mixed Low-Level Waste (MLLW) Treatment Facility • Pit 9 Retrieval (environmental restoration waste) Research and Development •Plasma Hearth Process Project	Transport 2,500 m^3 per year (total 12,500 m^3) certified waste to the Waste Isolation Pilot Plant starting in 1998 Transport waste to commercial treatment • Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of alpha-Contaminated MLLW Return product resulting from the treatment of DOE Complex waste to originator or to an offsite disposal location.	No onsite disposal of TRU Potential alpha-MLLW Disposal at INEL or other DOE sites

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise specified.
b. To convert cubic meters to cubic yards, divide by 0.765.

Facility, as indicated in Table 3.4-6 . Low-level waste that is most suitable for incineration would be treated at the Waste Experimental Reduction Facility or at an offsite commercial facility.

3.4.5.4 Mixed Low-level Waste. For mixed low-level waste, the Preferred Alternative differs from Alternative B (Ten-Year Plan), as described in Table 3.4-7, to allow offsite waste to be received for treatment at the INEL. The modification would allow the movement of waste to comply with the Site Treatment Plans negotiated under the Federal Facility Compliance Act and decisions based on the Waste Management Programmatic EIS. Mixed waste management activities would include onsite and offsite treatment of mixed waste. To achieve these activities, the Waste Experimental Reduction Facility incinerator would operate, and the Nonincinerable Mixed Waste Treatment Project would be completed. The Mixed/Low-level Waste Disposal Facility would be constructed for onsite disposal of treated INEL-generated low-level and mixed low-level waste.

To support treatment of onsite and offsite generated waste, the Idaho Waste Processing Facility or the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility would have the capacity to treat mixed low-level waste (an alternate could be the use of Pit 9 facilities for treating waste). (For analysis purposes, this capacity has been assumed to be similar to the mixed waste treatment capability of the Mixed/Low-level Waste Treatment Facility.) Offsite waste would be accepted as treatment capacity became available. Small quantities of untreated offsite waste could be accepted for storage within INEL storage facility permit limitations. Treated offsite waste would be returned to the generator or transported to an appropriate offsite disposal facility.

3.4.5.5 Greater-Than-Class C Low-Level Waste. For greater-than-Class C low-level waste, the Preferred Alternative differs from Alternative B (Ten-Year Plan) as follows. The greater-than-Class C low-level waste program would continue at the INEL; also work would continue on the siting of a greater-than-Class C low-level waste storage facility that may not necessarily be located at the INEL. This facility would be the subject of separate National Environmental Policy Act review regardless of its location. This dedicated facility would receive up to 30,000 (at a rate of 1,000 per year) greater-than-Class C sources for storage. This waste would be stored in monitored, retrievable casks that are shielded, leaktight, and weather tight until the sources were recycled or until a disposal facility was available.

Table 3.4-6. Preferred Alternative: Summary of proposed low-level waste management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).[a,b]

Generate	Receive	Store	Treat	Transport	Dispose
Generate 72,000 m^3	No offsite waste received	Store waste short-term pending treatment and disposal	Nonincineration treatment at the existing Waste Experimental Reduction Facility Waste treated offsite or onsite by incineration • Waste Experimental Reduction Facility Incineration • Idaho Waste Processing Facility	Transport 20,000 m^3 waste to commercial treatment and return to the INEL site for disposal	Dispose 34,000 m^3 treated and untreated waste at the existing Radioactive Waste Management Complex Additional disposal capacity • Mixed/ Low-Level Waste Disposal Facility

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise specified.
b. To convert cubic meters to cubic yards, divide by 0.765.

Table 3.4-7. Preferred Alternative: Summary of proposed mixed low-level waste management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory (INEL).[a,b]

Generate	Receive	Store	Treat	Transport	Dispose
Generate waste from environmental restoration, decontamination and decommissioning, and operations (16,200 m^3)	Depending on the decisions based on the Site Treatment Plan negotiated under the Federal Facility Compliance Act and the Waste Management Programmatic EIS, receive waste from the Department of Energy (DOE) Complex up to the maximum onsite treatment capacity.	Store non-treated INEL waste pending treatment. Store treated INEL waste pending disposal	Offsite treatment as necessary Onsite nonincineration and incineration treatment • Nonincinerable Mixed Waste Treatment •Waste Experimental Reduction Facility Incineration • Private Sector alpha-Mixed Low-Level Waste Treatment Facility • Idaho Waste Processing Facility Treatment of sodium coolant • Sodium Processing Project • Remote Mixed Waste Treatment Facility Research and Development • Plasma Hearth Process Project	Transport waste offsite as necessary for treatment and/or disposal Return product resulting from the treatment of DOE Complex waste to originator or to an offsite disposal location	Dispose of INEL originated treated characteristic waste onsite at the Radioactive Waste Management Complex Dispose of waste at an offsite facility Disposal of INEL originated mixed waste • Mixed/ Low-Level Waste Disposal Facility

a. All waste quantities are totals for the 1995 to 2005 period unless otherwise specified.
b. To convert cubic meters to cubic yards, divide by 0.765.

3.4.5.6 Hazardous Waste. For hazardous waste, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan) and is summarized in Table 3.4-8. Private-sector offsite treatment, storage, and disposal facilities would continue to be used.

3.4.5.7 Infrastructure. For INEL infrastructure, the Preferred Alternative would be the same as Alternative B (Ten-Year Plan). Existing facilities may be upgraded, including expansion of the industrial commercial landfill and the gravel pits.

3.4.6 Environmental Consequences of the Preferred Alternative

3.4.6.1 Introduction. The environmental consequences that may result from implementing the Preferred Alternative are described in this section. The structure of this section closely parallels that of Chapter 4, Affected Environment, and of Chapter 5, Environmental Consequences. The potential impacts of the Preferred Alternative are described in the following sections relative to the four proposed alternatives [A (No Action), B (Ten-Year Plan, C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal)] described in Section 3.1 and analyzed in Chapter 5.

3.4.6.2 Land Use Impacts from the Preferred Alternative. The Preferred Alternative would result in land disturbance similar to Alternative B (Ten-Year Plan). Approximately 317 hectares (783 acres) would be disturbed; of this total, approximately 100 hectares (246 acres) have been previously disturbed and 217 hectares (537 acres) are open space. Of the 317 hectares that would be disturbed, about 44 percent (138 hectares) are inside existing facility area fence lines or boundaries and 56 percent (178 hectares) are outside of these boundaries. The projects with the largest land disturbance under the Preferred Alternative would be the Industrial/Commercial Landfill Expansion Project, the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, and the Mixed Low-Level Waste Disposal Facility. These projects are described in Appendix C (Information Supporting the Alternatives). Proposed activities would be consistent with existing DOE land use plans for continued operations, environmental restoration, and waste management, and would be similar to uses in existing developed areas on the site. Under this alternative, no effects on surrounding land uses or local land use plans would be expected.

Table 3.4-8. Preferred Alternative: Summary of proposed hazardous waste management functions and related projects (denoted by bullets) at the Idaho National Engineering Laboratory.

Store	Treat	Transport	Dispose
Store short-term pending offsite shipment Stage Argonne National Laboratory -West Waste • Waste Handling Facility	Treat reactives onsite Research and development • Plasma Hearth Process Project	Transport waste offsite for treatment, storage, and disposal	No onsite disposal

3.4.6.3 Socioeconomic Impacts from the Preferred Alternative. The socioeconomic impacts under the Preferred Alternative would be similar to those under Alternative B (Ten-Year Plan). Implementing the Preferred Alternative could potentially generate 600 direct jobs in the region of influence during the peak employment year (2000), representing a 7.0 percent increase over the 1995 baseline INEL employment of approximately 8,620. By 2004, direct employment would amount to approximately 540 jobs, a 6.3 percent increase from baseline. The secondary employment generated in the region would yield total employment impacts of 1,470 jobs in 2000 and 1,310 jobs in 2004. Total employment impacts expected under the Preferred Alternative represent less than 1.4 percent of total regional employment. Increases in employment associated with the Preferred Alternative would partially offset the reduction in employment at the INEL resulting from contractor consolidation.

Population in-migration associated with implementing the Preferred Alternative may amount to about 960 persons during the peak employment year, an increase that represents less than 0.4 percent of the total regional population. By 2004, population increases would decline to approximately 650 persons, a 0.2 percent increase in regional population. During the peak employment year, population increase could result in a temporary increase in housing demand of about 280 units, representing approximately 0.4 percent of the current housing stock in the region of influence. Assuming that the general conditions associated with the current housing market continue (see Section 4.3.2.2, Housing), this increase in demand would be unlikely to generate perceptible impacts on the existing market. By 2004, the expected housing demand associated with population in-migration under the Preferred Alternative would amount to approximately 190 units, representing approximately 0.3 percent of total available units. In-migration could be less because many of the jobs could be filled locally from people made available by INEL contractor consolidation.

The population changes estimated under the Preferred Alternative are not likely to generate notable impacts on community services, public finance, or other socioeconomic resources within the region of influence.

3.4.6.4 Cultural Resource Impacts from the Preferred Alternative. Impacts to cultural resources under the Preferred Alternative would be similar to those under Alternative B (Ten-Year Plan). Facility expansion, new facility construction, and gravel pit expansion would affect about 317 hectares (783 acres) of land and 66 structures would be modified, decommissioned, or demolished. A total of 13 hectares (33 acres) have been surveyed and 22 sites, which may be affected by the Preferred Alternative, have been identified. The remaining 304 hectares (750 acres) have not been surveyed. In all areas, ground disturbance would have the potential to affect archaeological, traditional, and paleontological sites located on the surface of the ground or buried beneath recent sediments. In locations that have been intensively surveyed, many areas of concern can be identified, but in unsurveyed locations, the sensitive areas would not be known until field work was completed. Potential impacts may occur due to alteration in the setting of a traditional, archaeological, or historic resource caused by the introduction of additional noise, air emissions, or night lights. Although most of these activities would take place within or immediately adjacent to existing facilities currently engaged in similar activities, some construction is proposed for areas outside of existing facilities. If significant archaeological or historic sites or traditional resources are in proximity, the additional noise, pollution, contamination, or lighting may adversely affect these resources.

3.4.6.5 Aesthetic and Scenic Impacts from the Preferred Alternative. The Preferred Alternative would implement projects similar to those described under Alternative B (Ten-Year Plan). As with the other alternatives, the air quality analysis of contrast reduction due to project emissions was within the acceptable criterion limits for views within the Craters of the Moon Wilderness Area, but the color shift indicated a potential for visual degradation associated with project emissions from the Idaho Waste Processing Facility, the Waste Immobilization Facility, and two boilers at the Radioactive Waste Management Complex. Emission controls for oxides of nitrogen, as discussed for Alternative B (Ten-Year Plan), may be required to pass the screening-level analysis.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that may affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust.

3.4.6.6 Geologic Impacts from the Preferred Alternative. The geological impacts from the Preferred Alternative would be associated with (a) excavating surface deposits at new facility construction sites and (b) using aggregate resources to construct and operate new facilities and for remediation activities, as needed. The volume of aggregate extracted from INEL site gravel and borrow pits would be similar to that under Alternative B (Ten-Year Plan).

3.4.6.7 Air Resources Impacts from the Preferred Alternative. The potential radiological and nonradiological consequences on air resources from implementation of the Preferred Alternative are described below.

3.4.6.7.1 Radiological Emissions and Dose Consequences—Radionuclides emitted by facilities associated with the Preferred Alternative would be similar in nature and amount to those of Alternative B (Ten-Year Plan). With respect to specific waste stream or program area, radiological impacts from the Preferred Alternative would be essentially identical to Alternative B for spent nuclear fuel, low-level waste, greater-than-Class C low-level waste, hazardous waste, and environmental restoration. For the high-level, transuranic, and mixed low-level waste program areas, these impacts would lie between those estimated for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal). For all waste streams taken together, the net result would be impacts to a maximally exposed individual less than 5 percent higher than those for Alternative B; for comparison, the impacts to a maximally exposed individual under Alternative D would be approximately 30 percent higher than those for Alternative B. These dose consequences would be very low, both with respect to applicable standards and when compared with natural background levels.

3.4.6.7.2 Nonradiological Emissions and Consequences—The nonradiological emissions and impacts from the Preferred Alternative would be similar to Alternative B (Ten-Year Plan) for spent nuclear fuel, low-level waste, greater-than-Class C low-level waste, hazardous waste, and environmental restoration. For the high-level, transuranic, and mixed low-level waste program areas, these impacts would lie between those estimated for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal). For the total alternative, cumulative emissions of criteria pollutants would be similar to the amount calculated for Alternative B.

Toxic air pollutant emissions and impacts would be slightly higher than Alternative B (Ten-Year Plan). This would be due to the projected increased processing of transuranic and mixed low-level wastes under the Preferred Alternative activities, which would have greater toxic air pollutant emission rates. Emissions of combined toxic air pollutants resulting from implementing the Preferred Alternative would be less than 1 percent higher than those for Alternative B; for comparison, the emissions of combined toxic air pollutants under Alternative D (Maximum Treatment, Storage, and Disposal) could be approximately 100 percent higher than those for Alternative B. This alternative would also contribute only minor amounts of toxic air pollutants to onsite levels. Impacts would be within allowable criteria in all instances.

The degree to which other air quality-related values (such as visibility degradation, stratospheric ozone depletion, and so forth) would be affected are less than the impacts projected for Alternative D (Maximum Treatment, Storage, and Disposal), as described in Section 5.7.4. Similarly, construction-related impacts would be less than those described for Alternative D (Maximum Treatment, Storage, and Disposal) in Section 5.7.6. The Preferred Alternative would result in small increases in vehicular-induced air quality impacts, as described in Section 5.7.5.

3.4.6.8 Water Resources Impacts from the Preferred Alternative. Impacts to water resources from the Preferred Alternative would be similar to Alternative B (Ten-Year Plan). Continued shipments of spent nuclear fuel would not affect the quality of water resources because it is stored in contained storage pools or dry storage containers and isolated from the environment. Activities under the Preferred Alternative would not discharge waste to the subsurface; hence, it would not affect source terms identified by Lehto (1993) and used in modeling. Water consumption would be about 202,600 cubic meters (53 million gallons), which represents an increase of 3.1 percent above average total INEL consumption. Most of this increase would be associated with the Waste Immobilization Facility and the Idaho Waste Processing Facility. Given that 1.77 billion cubic meters (470 billion gallons) of water flow under the INEL site each year (Robertson et al. 1974), the additional volume of water consumed under this alternative would only be 0.017 percent of that passing under the INEL site. The Preferred Alternative would have a small impact on the quality or quantity of surface water or groundwater in the Snake River Plain Aquifer.

3.4.6.9 Ecological Impacts from the Preferred Alternative. Potential nonradiological and radiological effects to biota from the Preferred Alternative would be similar to those described under Alternative B (Ten-Year Plan). About 317 hectares (783 acres) would be disturbed under the Preferred Alternative [217 hectares (537 acres) of undisturbed habitat and 100 hectares (246 acres) of previously disturbed habitat]. To minimize the potential short-term effects of the disturbances described above, about 94 hectares (232 acres) of the disturbed area would be revegetated. Consequently, there would be a long-term net loss of 223 hectares (551 acres). The majority of the long-term acreage loss would be from the construction and operation of one of two new facilities (Private Sector Alpha-Mixed Low-Level Waste Treatment Facility or the Idaho Waste Processing

Facility) several kilometers from existing facilities, and from the expansion of the landfill. Either of the two new facilities would encompass about 81 hectares (200 acres), while the landfill expansion would encompass about 113 hectares (280 acres). In addition, the construction of a new facility would result in limited habitat fragmentation.

3.4.6.10 Noise Impacts from the Preferred Alternative. Because the operations workforce stationed at the INEL site would be expected to be less than the baseline for all years of all alternatives, the overall noise level resulting from site transportation would be expected to be generally lower than the baseline. The number of trucks carrying waste and spent nuclear fuel under any alternative would be much lower than the several hundred buses (about 300 routes) that travel to and from the INEL each day. No environmental impact due to noise would be expected from the any of the alternatives considered, including the Preferred Alternative.

3.4.6.11 Traffic and Transportation Impacts from the Preferred Alternative. Under the Preferred Alternative, the INEL would receive increased shipments of transuranic and mixed low-level waste from various DOE sites similar to, but less than, Alternative D (Maximum Treatment, Storage, and Disposal). Treated residue would be returned to the generator or transported to an approved disposal facility. Shipments of low-level waste, shipments of hazardous waste to offsite disposal facilities, and shipments of bulk hazardous chemicals to the INEL site would be similar to Alternative B (Ten-Year Plan). The total number of waste shipments under the Preferred Alternative would be less than Alternative D because INEL would not receive low-level waste from offsite locations, as analyzed for Alternative D.

The Preferred Alternative for spent nuclear fuel corresponds to Alternative B (Ten-Year Plan). The Navy would resume shipments of spent nuclear fuel from naval sites to the INEL and ongoing shipments of irradiated test specimens would continue from the INEL to offsite locations. All of the Fort St. Vrain spent nuclear fuel currently in storage in Colorado and all commercial-type spent nuclear fuel stored at the West Valley Demonstration Project in New York and the Babcock & Wilcox Lynchburg Research Center in Virginia would be transported to the INEL site. The INEL site would receive shipments of some of the non-aluminum-clad spent nuclear fuel from DOE research and test reactors currently stored at other DOE sites. In addition, the INEL site would receive non-aluminum-clad spent nuclear fuel shipments from various domestic university and foreign research reactors and other non-DOE, U.S. Government reactors. Aluminum-clad spent nuclear fuel currently stored at the INEL would be shipped to the Savannah River Site for storage.

3.4.6.11.1 Incident-Free Transportation—For truck shipments of waste, the impacts would be similar to, but less than, Alternative D (Maximum Treatment, Storage, and Disposal at the INEL). Over the 1995 to 2005 period, collective radiation dose would be less than 1,700 person-rem occupational and 940 person-rem general population, and less than one cancer fatality is estimated. Over the 1995 to 2035 period, spent nuclear fuel truck shipments would yield approximately 340 person-rem (occupational) and 760 person-rem (general population). Train shipments of waste and spent nuclear fuel would yield much lower doses.

3.4.6.11.2 Transportation Accidents—Under all alternatives considered, including the Preferred Alternative, the maximum reasonably foreseeable onsite transportation accidents associated with spent nuclear fuel and waste would involve baseline activities. The maximum reasonably foreseeable onsite spent nuclear fuel transportation accident involves the inadvertent shipment of a short-cooled fuel element (fuel out of the reactor for 10 to 25 days) from the Advanced Test Reactor to the Idaho Chemical Processing Plant.

The impacts of offsite transportation accidents involving radioactive wastes would be similar to Alternative B (Ten-Year Plan) for low-level waste and would be less than Alternative D (Maximum Treatment, Storage, and Disposal) for transuranic waste and mixed low-level waste.

The potential impacts from offsite transportation accidents involving nonradiological hazardous materials and wastes would be bounded by accidents associated with shipments of bulk chemicals such as a tanker truck containing nitric acid. One or more individuals could be exposed to life-threatening concentrations of nitric acid in the air should such an accident occur.

The impacts to the regional traffic system around the INEL would be minimal for the Preferred Alternative.

3.4.6.12 Health and Safety Impacts from the Preferred Alternative. In general, the potential impacts to the health and safety of workers at the INEL and the public living in the vicinity of the INEL would be very similar to those for Alternative B (Ten-Year Plan). Small increases to the impacts under Alternative B would result from differences in the management of high-level, transuranic, and mixed low-level waste under the Preferred Alternative. However, as discussed below, impacts would be much closer to Alternative B than Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.6.12.1 Health effects to the Public and Worker from Releases to the Environment—Health risks from radioactive emissions to air and water would be essentially identical to those for Alternative B (Ten-Year Plan) for spent nuclear fuel, low-level waste, greater-than-Class C low-level waste, hazardous waste, and environmental restoration. For the high-level, transuranic, and mixed low-level waste programs, radiological health impacts would be slightly larger than those for Alternative B. For all waste streams taken together, the net result would be impacts to a maximally exposed individual less than 5 percent higher than those for Alternative B; for comparison, the impacts to a maximally exposed individual under Alternative D (Maximum Treatment, Storage, and Disposal) would be approximately 30 percent higher than those for Alternative B.

Health risks from toxic chemical emissions for the Preferred Alternative would also be slightly higher than those for Alternative B (Ten-Year Plan). This increase would be due to the management of high-level, transuranic, and mixed low-level wastes under the Preferred Alternative. These activities would be associated with the largest contribution to total chemical emissions. Toxic air pollutants emissions would be within allowable criteria in all cases. For all waste streams taken together, the net result would be emissions of combined toxic air pollutants less than 1 percent higher than those for Alternative B; for comparison, the emissions of combined toxic air pollutants under Alternative D (Maximum Treatment, Storage, and Disposal) would be approximately 100 percent higher than those for Alternative B.

3.4.6.12.2 Occupational Health and Safety Impacts from the Preferred Alternative—The average radiation dose and the number of occupational injuries and illnesses are expected to be proportional to the number of workers at the INEL under each alternative. The average number of both construction and nonconstruction workers under the Preferred Alternative would be less than 1 percent higher than those for Alternative B (Ten-Year Plan). For comparison, the corresponding number under Alternative D (Maximum Treatment, Storage, and Disposal) would be approximately 45 percent higher. Therefore, occupational health and safety impacts under the Preferred Alternative would be very similar to Alternative B.

3.4.6.13 Idaho National Engineering Laboratory Services Impacts from the Preferred Alternative. The Preferred Alternative includes all the projects included in Alternative B (Ten-Year Plan). In addition, the scope of two of the projects would be expanded under the Preferred Alternative to accommodate the increased quantities of materials. The new buildings constructed at the INEL would have 102,000 square meters (1,096,000 square feet) of floor space. Accordingly, the Preferred Alternative increases, above baseline, in usage rates for utilities are estimated to be 98,000 megawatt-hours per year of electricity (47 percent increase), 202,000 cubic meters (53.4 million gallons) per year of water (3.1 percent increase), and 7.2 million liters (1.9 million gallons) per year of wastewater discharge (I percent increase) (Hendrickson 1995). These usage rates would be similar to those for Alternative B (Ten-Year Plan), and would be expected to be below the system capabilities and use limits.

Fossil fuel usage would increase by 5,495,000 liters (1,450,000 gallons) of heating oil, 1,082,000 liters (286,000 gallons) of diesel fuel, and 2,732,000 liters (722,000 gallons) of propane annually (Hendrickson 1995). The Preferred Alternative heating oil usage would be 49 percent above baseline, diesel fuel usage would be 19 percent above baseline, and propane usage would be 480 percent above baseline. The large increase in propane usage results from both facility heating and incineration. The increases would be similar to the Alternative B (Ten-Year Plan) increases and would be within the INEL supply system capabilities. Construction associated with the Preferred Alternative projects would be expected to require about 100,000 cubic meters (130,000 cubic yards) of concrete.

The Preferred Alternative would not be expected to require increases in INEL site fire, security, or emergency services.

3.4.6.14 Facility Accident Impacts from the Preferred Alternative. Potential secondary impacts from facility accidents are shown in Table 5.14-4 of Volume 2 of this EIS. Worker risks would be similar to those characterized by Alternative A (No Action). Workers near the source of releases have a potential risk of injury or death. Potential facility accident impacts for the Preferred Alternative are evaluated below for spent nuclear fuel and waste types.

3.4.6.14.1 Spent Nuclear Fuel—The bounding accident characteristics within each frequency category that differ from those specified for Alternative A (No Action), as discussed in Section 5.14.3 of Volume 2 of this EIS, would be the same as those characterized for Alternative B (Ten-Year Plan), as described in Section 5.14.4 of Volume 2 of this EIS and illustrated in Figures 5.14-6, 5.14-7, and 5.14-8. The incremental risk of accidents over those assessed in Alternative A (No Action) (Section 5.14.3) would be related to construction activities and the receipt of additional offsite spent nuclear fuel shipments at the INEL site.

For analysis purposes, operations at Argonne National Laboratory-West were assumed to continue as in Alternative A (No Action), and because of the short-cooled fuel handled at this facility, the Alternative A accidents would continue to bound the design basis and beyond design basis accident frequency categories under Alternative B (Ten-Year Plan).

3.4.6.14.2 High-Level Waste—The frequency of construction accidents and minor radiological accidents would increase as a result of proposed actions. The consequences of accidents associated with high-level waste facilities under the Preferred Alternative, however, would be the same as those described under Alternative B (Ten-year Plan) and would be bounded by those analyzed under Alternative A (No Action).

3.4.6.14.3 Transuranic Waste—The incremental risk accidents over those assessed in Alternative A (No Action) would be related to the receipt of DOE complex waste from offsite locations for examination, treatment, and shipping to offsite storage or disposal sites. The transuranic waste inventory at the INEL site would be increased by less than that evaluated for Alternative D (Maximum Treatment, Storage, and Disposal) because the Preferred Alternative requires offsite shipment of the treated transuranic waste. The frequency of fires was assumed to increase by no more than a factor of ten because not all fires would be associated with the increased handling and storage of waste. The frequency of a lava flow event would be the same as that assessed under Alternative A, but the consequences are assumed to increase by less than that evaluated for Alternative D (Maximum Treatment, Storage, and Disposal) because of a smaller inventory. Risks from facility accidents involving transuranic wastes, therefore, would be less than those evaluated under Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.6.14.4 Mixed and Low-Level Waste—The incremental risk of accidents over those assessed in Alternative A (No Action) would be related to the receipt of DOE complex mixed low-level waste from offsite locations for treatment, storage, and disposal. The annual mixed low-level waste volume managed at the INEL site would be increased over Alternative A (No Action) but would be less than that assumed under Alternative D (Maximum Treatment, Storage, and Disposal). Waste would be managed by additional inventory turnover in existing storage facilities and a new treatment facility. Facility accident risks would be characterized by increased frequencies of handling-related fires and higher consequences related to higher inventories. However, the risks for the Preferred Alternative would be less than those under Alternative D (Maximum Treatment, Storage, and Disposal) because of the lower waste inventories.

3.4.6.14.5 Hazardous Materials—The consequences of maximum reasonably foreseeable accidents associated with hazardous waste or chemicals would be the same under the Preferred Alternative as those analyzed under Alternative A (No Action). Lower consequence accidents could also occur as a result of proposed actions.

3.4.6.14.6 Environmental Remediation and Decontamination and Decommissioning—The incremental risk of accidents over those assessed in Alternative A (No Action) would be related to expanded environmental remediation and decontamination and decommissioning activities (including construction) on the basis of current plans. However, accidents associated with environmental remediation at Pit 9 at the Radioactive Waste Management Complex would bound consequences of accidents at other activities on the INEL site. Therefore, the consequences of maximum reasonably foreseeable accidents associated with environmental remediation and decontamination and decommissioning activities would be the same under the Preferred Alternative as those analyzed under Alternative A (No Action).

3.4.7 Cumulative Impacts from Connected or Similar Actions

Cumulative impacts are the incremental impact of the proposed action added to all other past, present, and reasonably foreseeable future actions. The cumulative impacts of the Preferred Alternative would be similar to those described for Alternative B (Ten-Year Plan) in Section 5.15 of Volume 2 of this EIS, and less than those for Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.8 Adverse Environmental Effects Which Cannot be Avoided

The construction and operation of facilities under the Preferred Alternative would result in some unavoidable adverse impacts to the environment. Such impacts would be similar to those described for Alternative B (Ten-Year Plan) in Section 5.16 of Volume 2 of this EIS. Changes in project design and other measures could eliminate, avoid, or reduce many of these to minimal levels.

3.4.9 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Implementing the Preferred Alternative would cause some small impacts to the environment and would permanently commit certain resources (see Section 5.17 of Volume 2 of this EIS). Under the Preferred Alternative, short-term uses of resources would be greater than Alternative A (No Action), but less than those for Alternative D (Maximum Treatment, Storage, and Disposal). Because of remediation efforts related to the Preferred Alternative, impacts would result in enhanced long-term productivity compared with Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal).

3.4.10 Irreversible and Irretrievable Commitments of Resources

Implementing the Preferred Alternative would cause the irreversible and irretrievable commitment of certain resources. Under the Preferred Alternative, the commitment of such resources as aggregate, concrete, energy, water, and land allocated for waste disposal, would be similar to those for Alternative B (Ten-Year Plan) as described in Section 5.18 of Volume 2 of this EIS, and would be less than those for Alternative D (Maximum Treatment, Storage, and Disposal).

3.4.11 Mitigation

Possible mitigation measures for proposed activities in the Preferred Alternative are the same as those discussed in Section 5.19 of Volume 2 of this EIS.

3.4.12 Environmental Justice

The effects of proposed actions under the Preferred Alternative are small and would not constitute a disproportionately high adverse impact to any particular segment of the population, including minority or low-income communities (see Section 5.20).

4. AFFECTED ENVIRONMENT

4.1 Introduction

Chapter 4 describes the existing environment at the Idaho National Engineering Laboratory site, the Idaho Falls facilities, and the surrounding region. Only those areas that might be affected by the proposed spent nuclear fuel program and environmental restoration and waste management alternatives are included. This chapter provides the environmental conditions against which the potential environmental effects of the various alternatives can be measured.

Chapter 4 summarizes the existing data and technical literature in each discipline, providing citations to the supporting technical references listed in Chapter 9 that contain substantiating details.

4.2 Land Use

The INEL site encompasses 571,000 acres (230,000 hectares) within Butte, Bingham, Bonneville, Jefferson, and Clark counties (see Figure 4.2-1). This section includes a brief description of existing land uses at the INEL and in the surrounding region, and land use plans and policies applicable to the surrounding area.

4.2.1 Existing and Planned Land Uses at the Idaho National Engineering Laboratory

Categories of land use at the INEL site include facility operations, grazing, general open space, and infrastructure, such as roads. Facility operations include industrial and support operations associated with energy research and waste management activities (activities also conducted at the Idaho Falls facilities). Land is also used for recreation and environmental research associated with the designation of the INEL as a National Environmental Research Park. Much of the INEL site is open space that has not been designated for specific uses. Some of this space serves as a buffer zone between INEL facilities and other land uses. About 2 percent of the total INEL site area (11,400 acres or 4600 hectares) is used for facilities and operations. Public access to most facility areas is restricted. Approximately 6 percent of the INEL site, or 34,260 acres (13,870 hectares), is devoted to public roads and utility rights-of-way that cross the site. Recreational uses include public tours of general facility areas and the Experimental Breeder Reactor-I (a National Historic Landmark) and controlled hunting, which is generally restricted to half a mile (0.8 kilometer) within the INEL boundary. Between 300,000 and 350,000 acres (121,000 and 142,000 hectares) are used for cattle and sheep grazing. A 900-acre (400-hectare) portion of this land, located at the junction of Idaho State Highways 28 and 33, is used by the U.S. Sheep Experiment Station as a winter feed lot for approximately 6,500 sheep. Grazing is not allowed within 2 miles (3 kilometers) of any nuclear facility, and, to avoid the possibility of milk contamination by long-lived radionuclides, dairy cattle are not permitted. Rights-of-way and grazing permits are granted and administered by the U. S. Department of the Interior's Bureau of Land Management. Selected land uses at the INEL and in the surrounding region are presented in Figure 4.2-2.

DOE land use plans and policies applicable to the INEL include the INEL *Institutional Plan for FY 1994-1999* (DOE-ID 1993a) and the *INEL Technical Site Information Report* (Smith et al. 1993). The *Institutional Plan* provides a general overview of INEL facilities, outlines strategic

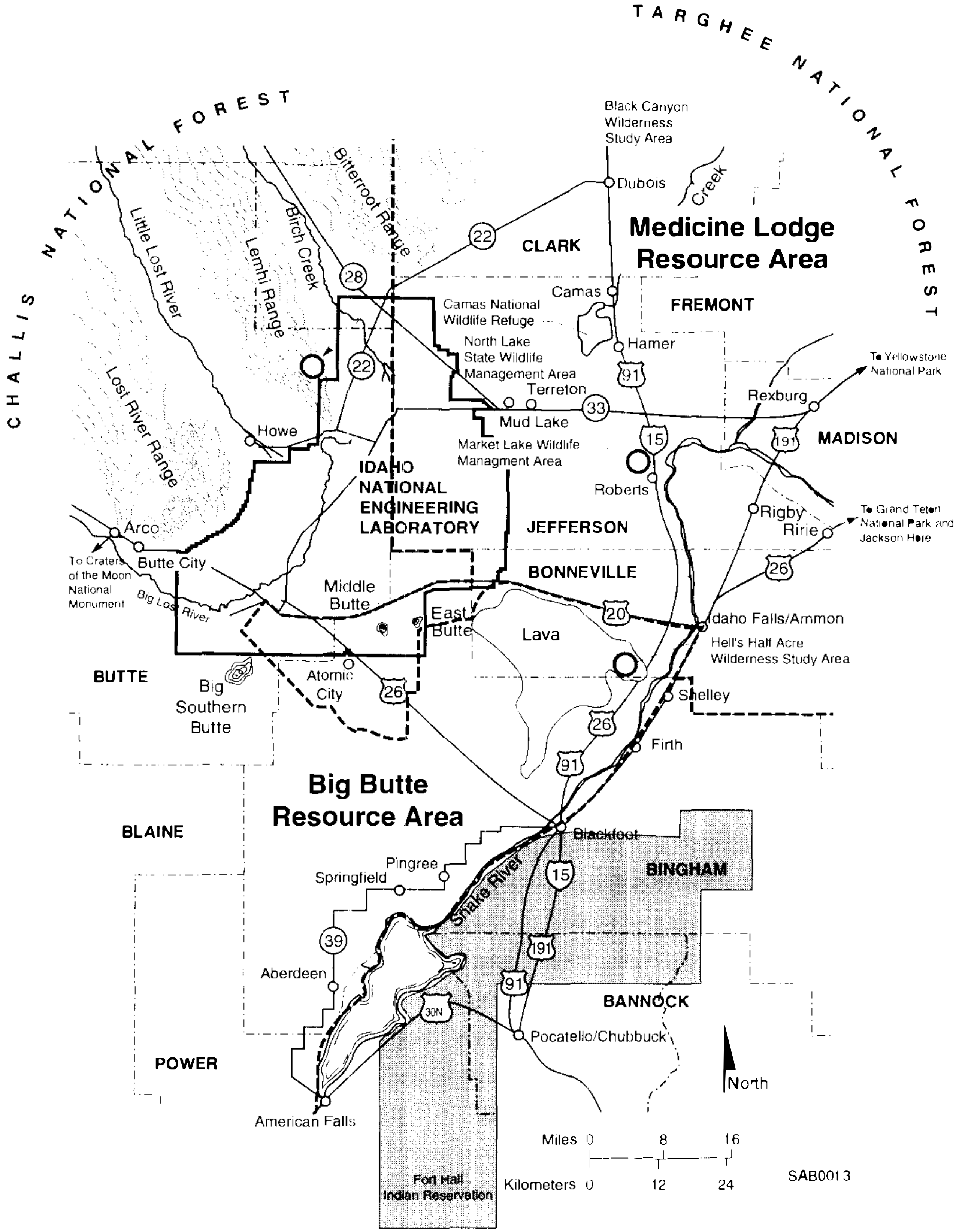


Figure 4.2-1. Idaho National Engineering Laboratory site vicinity map.

ANL-W Argonne National Laboratory-West
ARA Auxiliary Reactor Area
CFA Central Facilities Area
EBR-I Experimental Breeder Reactor - I
ICPP Idaho Chemical Processing Plant
NRF Naval Reactors Facility
PBF Power Burst Facility
RWMC Radioactive Waste Management Complex
TAN Test Area North
TRA Test Reactor Area
WERF Waste Experimental Reduction Facility

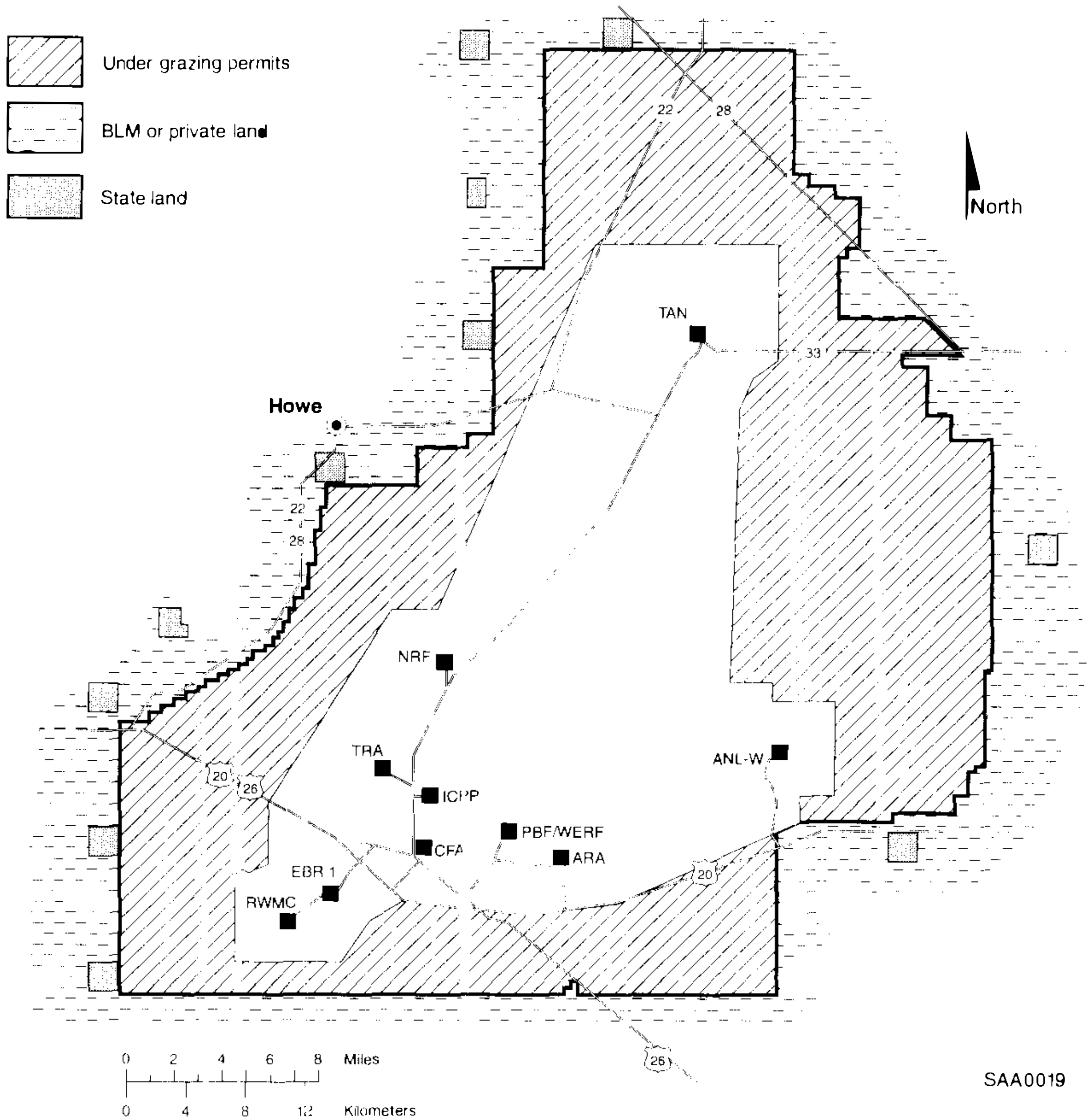


Figure 4.2-2. Selected land uses at the Idaho National Engineering Laboratory site and in the surrounding region.

program directions and major construction projects, and identifies specific technical programs and capital equipment needs. The *Technical Site Information Report* presents a 20-year master plan for development activities at the site. In general, it is expected that energy research and waste management activities would continue in existing facility areas and, in some instances, expand into undeveloped site areas. These documents also describe environmental restoration, waste management, and spent nuclear fuel activities. Projected future land use scenarios for the next 25 to 50 years include outgrowth of current functional areas and possible development of waterfowl production ponds within existing grazing areas.

The INEL site is located within the Medicine Lodge Resource Area (approximately 140,415 acres or 56,800 hectares in the eastern and southern portions of the INEL site) and the Big Butte Resource Area (430,499 acres or 174,000 hectares in the central and western portions), both of which are administered by the Bureau of Land Management (see Figure 4.2-1). Under Resource Management Plans, portions of these resource areas are managed for grazing and wildlife habitat. No mineral exploration or development is allowed on INEL land.

No onsite land use restrictions due to Native American treaty rights would exist for any of the alternatives described in this Environmental Impact Statement. The INEL site does not lie within any of the land boundaries established by the Fort Bridger Treaty. Furthermore, the entire INEL site is land occupied by the U.S. Department of Energy, and therefore that provision in the Fort Bridger Treaty that allows the Shoshone and Bannock Indians the right to hunt on the unoccupied lands of the United States does not presently apply to any land upon which the INEL is located. Potential impacts of the alternatives upon Native American and other cultural resources, and potential mitigation measures, are discussed in Chapter 5, Section 5.20 on Environmental Justice, and Section 5.4, Cultural Resources.

4.2.2 Existing and Planned Land Use in Surrounding Areas

Lands surrounding the INEL site are owned by the Federal government, the State of Idaho, and private parties. Land uses on federally owned land consist of grazing, wildlife management, range land, mineral and energy production, and recreation. State-owned lands are used for grazing, wildlife management, and recreation. Privately owned lands are used primarily for grazing, crop production, and range land.

Small communities and towns located near the INEL boundaries include Mud Lake to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. The larger communities of Idaho Falls/Ammon, Rexburg, Blackfoot, and Pocatello/Chubbuck are located to the east and southeast of the INEL site. The Fort Hall Indian Reservation is located southeast of the INEL site. Recreation and tourist attractions in the region surrounding the INEL site include Craters of the Moon National Monument, Hell's Half Acre Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Wildlife Refuge, Market Lake State Wildlife Management Area, North Lake State Wildlife Management Area, Yellowstone National Park, Targhee and Challis National Forests, Sawtooth National Recreation Area, Sawtooth Wilderness Area, Sawtooth National Forest, Grand Teton National Park, Jackson Hole recreation complex, and the Snake River (see Figures 4.2-1 and 4.2-2).

Lands surrounding the INEL site are subject to Federal and State planning laws and regulations. Planning for and use of Federal lands and their resources are governed by Federal rules and regulations that require public involvement in their implementation. Land use planning in the State of Idaho is derived from the Local Planning Act of 1975 (State of Idaho Code 1975). Since the State currently has no land use planning agency, the Idaho legislature requires that each county adopt its own land use planning and zoning guidelines. County plans that are applicable to lands bordering the INEL site include the Clark County Planning and Zoning Ordinances and Interim Land Use Plan (Clark County 1994), the Bonneville County Comprehensive Plan (Bonneville County 1976), the Bingham County Zoning Ordinance and Planning Handbook (Bingham County 1986), the Jefferson County Comprehensive Plan (Jefferson County 1988), and the Butte County Comprehensive Plan (Butte County 1976). Land use planning for INEL facilities located within the Idaho Falls city limits is subject to Idaho Falls planning and zoning restrictions (City of Idaho Falls 1989, 1992).

All county plans and policies encourage development adjacent to previously developed areas in order to minimize the need to extend infrastructure improvements and to avoid urban sprawl (DOE-ID 1993b). Because the INEL is remotely located from most developed areas, INEL lands and adjacent areas are not likely to experience residential and commercial development, and no new development is planned near the INEL site (DOE-ID 1993b). However, recreational and agricultural uses are expected to increase in the surrounding area in response to greater demand for recreational areas and the conversion of range land to crop land (DOE-ID 1993b).

4.3 Socioeconomics

Socioeconomic resources assessed here are characterized in terms of employment, income, population, housing, community services, and public finance. These resources are often interrelated in their response to a particular action. Changes in employment, for example, may lead to population movements into or out of a region, leading to changes in demand for housing and community services.

The region of influence for the socioeconomic analysis was determined to be a seven-county area comprised of Bingham, Bonneville, Butte, Clark, Jefferson, Bannock, and Madison counties (see Appendix F, Section F-1, Socioeconomics). Based on a survey of INEL personnel (DOE-ID 1991), over 97 percent of the employees reside in this region of influence. The region of influence also includes the Fort Hall Indian Reservation and Trust Lands (home of the Shoshone-Bannock Tribes), located in Bannock, Bingham, Caribou, and Power counties.

The following sections present a brief overview of existing and projected baseline conditions for each socioeconomic characteristic.

4.3.1 Employment and Income

Historically, the regional economy has relied predominantly on natural resource use and extraction; today, farming, ranching, and mining remain important components of the economy. Idaho Falls is the retail and service center for the region of influence, and Pocatello has evolved into an important processing and distribution center and site of higher education institutions. Agriculture and ranching, including buffalo ranching, are important contributors to the economy of the Fort Hall Indian Reservation.

4.3.1.1 Employment. The labor force in the region of influence has increased from 92,159 in 1980 to 104,654 in 1991 (see Table 4.3-1) at an average annual growth rate of approximately 1.2 percent. In 1991, the region of influence accounted for approximately 20 percent of the total State labor force of 504,000 (ISDE 1992). The labor force in the region of influence is expected to increase to 117,128 hy 2004 (see Table 4.3-2).

Table 4.3-1. Historical labor force and unemployment rates for counties and the region of influence surrounding the Idaho National Engineering Laboratory.[a]

	1980		1985		1990		1991	
Area	Labor force	Unemployment rate	Labor force	Unemployment rate	Labor force	Unemployment rate	Labor force	Unemployment rate
Bannock	32,064	7.2	33,763	7.8	30,493	6.4	30,635	6.3
Bingham	14,768	7.9	16,922	8.0	16,564	6.8	17,366	6.3
Bonneville	30,220	5.2	35,181	5.2	36,965	4.6	38,516	4.5
Butte	1.318	5.8	1,583	5.6	1,645	5.0	1,669	5.6
Clark	416	7.0	539	5.0	730	2.6	758	2.6
Jefferson	6,212	6.8	7,148	7.4	6,943	6.6	7,243	6.2
Madison	7,161	5.4	7,817	5.6	8,495	5.4	8,467	4.8
Region of influence	92,159	6.4	102,953	6.7	101,835	5.7	104,654	5.5

a. Source: ISDE (1986, 1991, 1992).

Table 4.3-2. Projected labor force, employment, and population in the region of influence surrounding the Idaho National Engineering Laboratory.[a]

Category	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Labor force	108,667	109,607	110,547	111,487	112,427	113,367	114,308	115,248	116,188	117,128
Employment	101,450	102,328	103,205	104,083	104,960	105,838	106,716	107,593	108,471	109,348
Population	247,990	251,518	255,096	258,726	262,406	266,140	268,667	271,219	273,795	276,395

a. Source: ISDE (1992); SAIC (1994).

Unemployment rates varied considerably among the counties of the region of influence in 1991, ranging from 2.6 percent in Clark County to 6.3 percent in Bannock and Bingham Counties (see Table 4.3-1). Since 1980, the average annual unemployment rate for the region has ranged from 5.3 percent in 1989 to 8.3 percent in 1983. In 1991, the average annual unemployment rate for the region of influence was 5.5 percent compared to the average State-wide rate of 6.2 percent.

Retail trade and educational services are the two largest employment sectors in the region, respectively accounting for 17.6 and 11.4 percent of employment in 1989 (USBC 1992). In Bonneville County, retail trade accounted for 17.9 percent of the total county employment of 32,016, while professional and related services accounted for 16.8 percent. The largest employment sectors in other counties are manufacturing in Bingham County; retail trade in Bannock and Jefferson Counties; agriculture, forestry, and fishing in Butte and Clark Counties; and educational services in Madison County.

4.3.1.2 Income. Between 1979 and 1989, real median household income increased in Butte, Clark, Jefferson, and Madison counties and decreased in Bannock, Bingham, and Bonneville counties (USBC 1982, 1992). In 1989, median household income ranged from $23,000 in Madison County to $30,462 in Bonneville County, compared to $25,257 for Idaho and $30,056 for the nation. Per capita income in 1989 was consistent with median income, with Bonneville County having the highest per capita income ($12,123) and Madison County the lowest ($7,385). However, all counties had per capita income levels below that of the United States of $14,420.

4.3.1.3 Idaho National Engineering Laboratory. The INEL plays a substantial role in the regional economy. During Fiscal Year 1990, the INEL directly employed approximately 11,100 personnel, accounting for almost 12 percent of total regional employment. The population directly supported by INEL employment was estimated to be approximately 38,000 persons, or 17 percent of the total regional population. Major employment groups at the INEL are DOE-ID contractors, DOE-ID, Argonne National Laboratory-West, and the Naval Reactors Facility (see Figure 4.3-1). In 1992, total direct INEL employment was approximately 11,600 jobs (DOE-ID 1994). Projections indicate that the total number of jobs at the INEL is expected to be 8,620 in Fiscal Year 1995 and 7,250 in Fiscal Year 2004 (Tellez 1995, DOE 1994a).

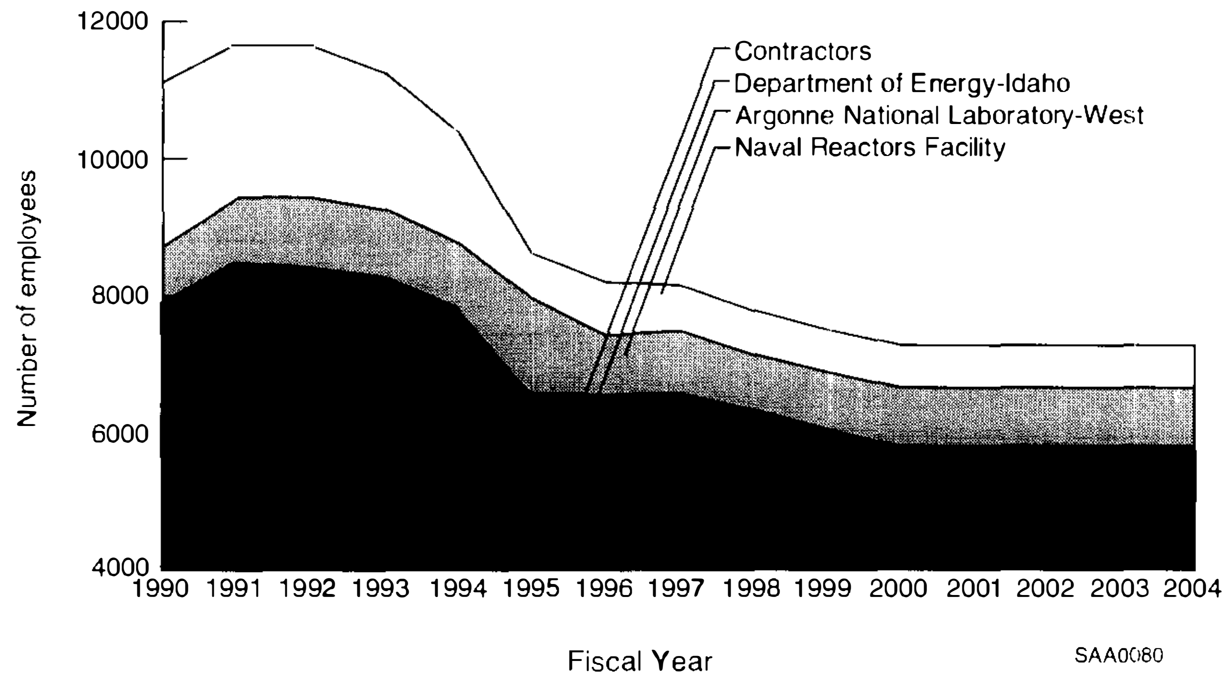


Figure 4.3-1. Historical and projected baseline employment at the Idaho National Engineering Laboratory (Tellez 1995, DOE-ID 1994).

Projected decreases in direct INEL employment are primarily related to contractor consolidation, productivity improvements, and privatization, which account for 67 percent of projected job losses between Fiscal Year 1994 and Fiscal Year 2004, and to reduced activities at the Naval Reactors Facility, which accounts for 30 percent of projected job losses. Contract consolidation at DOE-ID resulted in the consolidation of several contracts under one contract. The consolidation eliminated redundant activities previously performed by each individual contractor and offered early retirement options or other options (for example, voluntary separation) to current INEL contractor employees. Privatization of INEL activities may shift employment from direct INEL employment to private companies.

For Fiscal Year 1990, the total budget for the INEL was $1,200 million. Financial planning projections for the INEL indicate that funding levels are expected to decrease from $1,020 million in Fiscal Year 1995 to $820 million in Fiscal Year 2004 (see Figure 4.3-2). These figures do not include funding for projects associated with the alternatives analyzed in Section 5.3, Socioeconomics.

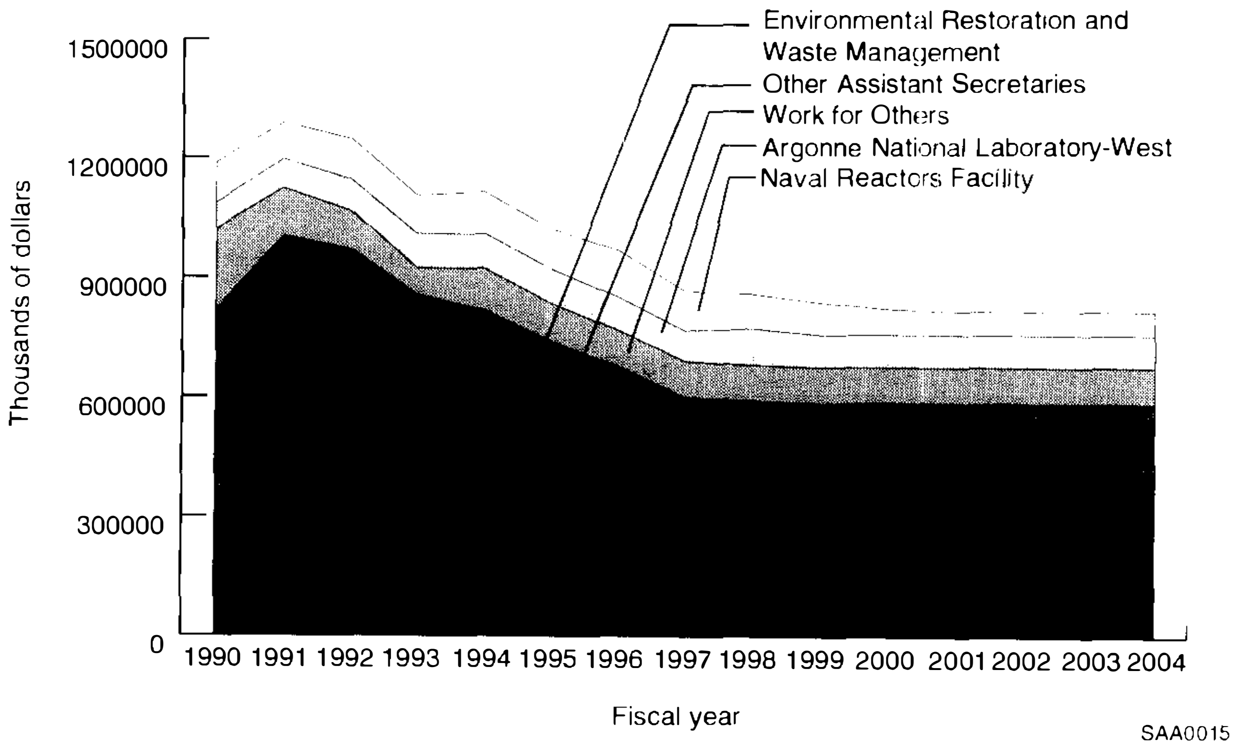


Figure 4.3-2. Historical and projected funding at the Idaho National Engineering Laboratory by Assistant Secretary (Lloyd 1995).

The largest DOE-ID program is environmental restoration and waste management, with projected funding of almost $557 million in Fiscal Year 1995 and $420 million in Fiscal Year 2004. Funding for environmental restoration and waste management is expected to decrease by 25 percent between Fiscal Years 1995 and 2004, while funding for the INEL as a whole is expected to decrease by 20 percent. On average, an estimated 46 percent of total INEL expenditures (20 percent of nonpayroll expenditures and 97 percent of payroll expenditures) would be spent within the region of influence.

Wages and salaries paid to INEL employees totaled nearly $477 million in Fiscal Year 1992. In addition, $113.9 million of direct expenditures were made in the regional economy for goods and services. Consistent with the projected decrease in employment over the period 1995 to 2005, payroll is also projected to decline. Total INEL payroll is expected to decrease from $373 million in Fiscal Year 1995 to approximately $314 million by Fiscal Year 2004 (in 1993 constant year dollars).

4.3.2 Population and Housing

Population and housing statistics for the region of influence surrounding the INEL are discussed in the following sections.

4.3.2.1 Population. From 1960 to 1990, population growth in the region of influence mirrored State-wide growth. During this period, the region's population increased at an average annual rate of approximately 1.3 percent, while the growth rate for the State was 1.4 percent. Between 1980 and 1990, population growth in the region of influence approximately equaled that of the State, with an average growth rate of 0.6 percent per year. The region of influence had a 1990 population of 219,713, which comprised 22 percent of the State's total population of 1,006,749. The most populous counties were Bannock and Bonneville, which together contained over 60 percent of the seven-county total (Figure 4.3-3). Butte and Clark were the least populous of the counties in the region of influence. The largest cities in the region of influence were Pocatello and Idaho Falls, with 1990 populations of approximately 46,000 and 44,000, respectively. In 1990, the Fort Hall Indian Reservation and Trust Lands contained 5,113 residents, with the majority (52 percent) residing in Bingham County.

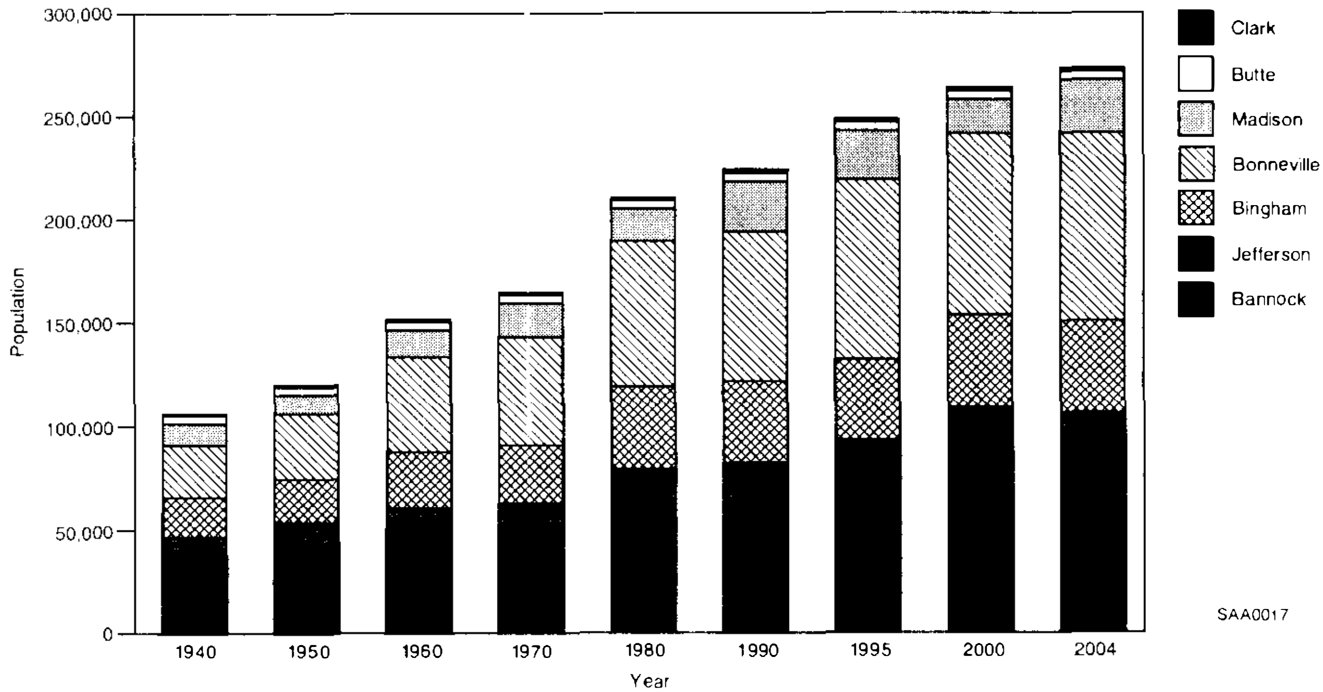


Figure 4.3-3. Historical and projected total population for the counties of the region of influence surrounding the Idaho National Engineering Laboratory from 1940 through 2004 (USBC 1982, 1992).

The population within an 80-kilometer (50-mile) circle centered at Argonne National Laboratory-West (on the INEL site) has been characterized for the purposes of identifying whether any disproportionately high and adverse impacts might exist to minority or low-income populations. The population within this circle surrounding the INEL site is shown to be 7 percent minority and 14 percent low-income, based on U.S. Bureau of Census information and the definitions and approach presented in Section 5.20, Environmental Justice.

Population in the region of influence is projected to reach 276,395 persons by 2004 based on population and employment trends (see Table 4.3-2). Over the period 1990 to 2004, the average annual growth rate is projected to be 1.6 percent compared to a projected State-wide annual growth rate of 1.7 percent.

4.3.2.2 Housing. Bonneville and Bannock counties (which respectively include the cities of Idaho Falls and Pocatello) provided 67 percent of the 73,230 year-round housing units in the region of influence in 1990 (see Table 4.3-3). Of this number, approximately 70 percent were single-family units, 17 percent were multifamily units, and 13 percent were mobile homes. Most of the multifamily units (75 percent) were located in Bonneville and Bannock Counties. About 29 percent of the occupied housing units in the region were rental units and 71 percent were homeowner units.

Table 4.3-3. Number of housing units, vacancy rates, median house value, and median monthly rent by county and the region of influence surrounding the Idaho National Engineering Laboratory.[a]

	Homeowner housing units			Rental units		
County/region	Number of units	Vacancy rates	Median value ($)	Number of units	Vacancy rates	Median monthly rent ($)
Bannock	16,447	2.4	53,300	7,467	10.3	294
Bingham	9,010	2.0	50,700	2,955	9.2	284
Bonneville	17,707	1.9	63,700	7,375	6.2	366
Butte	780	4.6	41,400	302	16.2	243
Clark	177	1.7	37,300	114	9.6	281
Jefferson	4,000	2.0	54,300	992	4.1	314
Madison	3,522	1.3	68,700	2,392	2.8	299
Region of influence	51,674	2.1	(b)	21,556	4.6	(b)

a. Source: USBC (1992).

b. Not applicable.

The median value of owner-occupied housing units ranged from $37,300 in Clark County to $68,700 in Madison County, and median monthly rents ranged from $243 in Butte County to $366 in Bonneville County. In 1990, there were 1,510 occupied housing units on the Fort Hall Indian Reservation and Trust Lands (USBC 1992) and a vacancy rate of 14 percent.

4.3.3 Community Services and Public Finance

Selected community services and public finance statistics for the region of influence surrounding the INEL are discussed in the following sections.

4.3.3.1 Community Services. The following selected community services within the region of influence are considered: public schools, law enforcement, fire protection, and hospital services. Pertinent characteristics of these services for the region of influence are summarized in Table 4.3-4.

Seventeen public school districts and three non-public schools provide educational services for about 57,000 children within the region of influence. Of these students, about 6,500 are dependents of INEL-related employees. During the 1990-1991 academic year, most public school districts spent an average of $3,000 to $4,000 per student annually. Higher education in the region is provided by the University of Idaho, Idaho State University, Brigham Young University - Ricks College, and the Eastern Idaho Technical College.

Law enforcement services in the region are provided by 7 county sheriff's offices, 12 city police departments, and the Idaho State Police. There was a total of 426 sworn officers and 100 other law enforcement personnel in 1991, over 59 percent of which served Bannock and Bonneville counties.

There are 18 fire districts in the region of influence, which operate a total of 30 fire stations staffed by 179 paid and 313 volunteer firefighters. Bingham, Bonneville, Butte, Clark, and Jefferson counties, which surround the INEL, have developed emergency plans to be implemented in the event of a radiological or hazardous materials emergency. The emergency plans include memoranda of understanding with DOE, procedures for notification and response, listings of emergency equipment and facilities, evacuation routes, and training programs.

Table 4.3-4. Summary of public services available in the region of influence surrounding the Idaho National Engineering Laboratory.[a]

Public service	Bannock	Bingham	Bonneville	Butte	Clark	Jefferson	Madison
Schools							
Number of public school districts	2	5	3	1	1	3	2
Total enrollment	15,455	11,311	17,896	765	166	5,339	5,967
Number of INEL-related students (excluding military)	485	1,532	4,040	301	5	134	47
Health Care Delivery							
Number of hospitals	3	2	1	1	0	0	1
Number of licensed beds	309	238	311	4	0	0	52
Law Enforcement							
Number of sworn law enforcement officers	151	65	143	4	2	18	43
Total personnel per 1,000 population	2.5	2.0	2.2	1.3	6.3	1.6	1.9
Fire Protection							
Number of fire stations	9	7	6	2	1	4	1
Number of firefighters	166	96	121	15	7	63	24
Number of firefighting vehicles	37	25	24	3	1	11	6
Municipal Solid Waste Disposal							
Number of landfills meeting U.S. Environmental Protection Agency regulations	1[b]	3[c]	1	2	0	1	0
Expected lifespan in years	30	3-6	50	30	0	2	0

a. Sources: IDE (1991), IDHW (circa 1990), IDLE (1991), Kouris (1992a), and Kouris (1992b).

b. Fort Hall Mine Landfill is being redesigned to meet U.S. Environmental Protection Agency standards.

c. Aberdeen Landfill may close due to noncompliance with U.S. Environmental Protection Agency standards.

Eight hospitals serve the region of influence with a total of over 900 licensed beds and a capacity of nearly 128,000 patient days. Occupancy rates range from 22.0 to 61.7 percent in the region (IDHW circa 1990). Regional ambulance services are provided by county governments and the Blackfoot, Dubois, Idaho Falls, and Pocatello fire departments. A private ambulance company serves residents in Butte County. The region of influence is also served by four quick response units, two medical helicopters, and two clinics specializing in emergency medical services (Hardinger 1990, U.S. West Direct 1992).

Municipal solid waste generated in the region is transported to county landfills. In 1992, twelve landfills served the region of influence. Four county landfills (one each in Bannock, Clark, Jefferson, and Madison counties) are being closed before reaching their planned capacity due to noncompliance with new U.S. Environmental Protection Agency standards (CFR 1991). New municipal landfills that meet new U.S. Environmental Protection Agency standards will replace the closed county landfills.

4.3.3.2 Public Finance. In Fiscal Year 1991, total county revenues for the region of influence amounted to approximately $90 million excluding Bonneville County (see Table 4.3-5), mostly from taxes and intergovernmental transfers. In 1991, the total assessed value of taxable property in the region of influence was about $4.47 billion. In addition to property tax revenues, local governments (cities and counties) also receive revenue from sales tax disbursements and revenue-sharing programs. Approximately 60 to 85 percent of the total revenues received by each county is derived from these two sources.

Although DOE is a Federal agency and exempt from paying State or local taxes, INEL employees and contractors are not. In 1992, INEL employees paid an estimated $59.6 million in Federal withholding tax and $23.5 million in State withholding tax.

In 1991, the major categories of county government expenditures were as follows: general government services, 27 percent; road maintenance, 18 percent; public safety, 16 percent; health and welfare programs, 16 percent; sanitation and public works, 9 percent; debt service, 3 percent; trust remittances, 2 percent; and other expenditures, 9 percent.

Table 4.3-5. Total revenues and expenditures by county in the region of influence surrounding the Idaho National Engineering Laboratory for Fiscal Year 1991.[a]

County	Total revenues ($)	Total expenditures ($)
Bannock	16,232,274	14,216,708
Bingham	11,434,200	10,708,011
Bonneville[b]	50,186,650	51,850,100
Butte	1,417,684	1,397,012
Clark	1,236,849	1,086,379
Jefferson	4,408,236	4,566,074
Madison	5,249,432	5,662,080
Seven-county region	90,165,325	89,446,364

a. Sources: Ghan (1992), Bingham County (circa 1992), McFadden (circa 1992), Swager & Swager (1992a), Swager & Swager (1992b), Draney, Searle, and Associates (1992), Schwendiman & Sutton (1992).

b. Bonneville County's financial statements and total revenue data include special accounts for schools, cities, cemeteries, fire districts, ambulance districts, and other special accounts not found in other county budgets. The majority of intergovernmental revenue is used to fund these accounts.

4.4 Cultural Resources

This section discusses all cultural resources at the INEL, including prehistoric and historic archaeological sites, historic sites and structures, and traditional resources that are of cultural or religious importance to local Native Americans. Paleontological localities on the INEL site are also discussed.

4.4.1 Archaeological Sites and Historic Structures

As summarized in the INEL Draft Management Plan for Cultural Resources (Miller 1992), the INEL contains a rich and varied inventory of cultural resources. This includes fossil localities that provide an important paleoecological context for the region and the numerous prehistoric archaeological sites that are preserved within it. These latter sites, including campsites, lithic workshops, cairns, and hunting blinds, among others, are also an important part of the INEL inventory. These sites provide information about the activities of aboriginal hunting and gathering groups who inhabited the area for approximately 12,000 years. Archaeological sites, pictographs, caves, and many other features of the INEL landscape are also important to contemporary Native American groups for historical, religious, and traditional reasons. Historic sites document use of the area during the late 1800s and 1900s. These include the abandoned town of Powell/Pioneer, a northern spur of the Oregon Trail known as Goodale's Cutoff, many small homesteads, irrigation canals, sheep/cattle camps, and stage/wagon trails. Finally, important information on the historical development of nuclear science in America is also preserved in the many scientific and technical facilities constructed within the INEL boundaries.

As of June 1994, more than 100 cultural resource surveys have been conducted over approximately 4 percent of the area within the INEL site. During the course of these surveys, most of which have been conducted near major facility areas, 1,506 archaeological resources have been identified, including 688 prehistoric sites, 38 historic sites, 753 prehistoric isolates, and 27 historic isolates (Miller 1992. Gilbert and Ringe 1993). Until formal significance evaluations (archaeological testing and historic records searches) are completed, all of the cultural sites in this inventory are considered to be potentially eligible for nomination to the National Register of Historic Places. However, all of the isolates have been categorized as unlikely to meet eligibility requirements (Yohe 1993).

Due to the relatively high density of prehistoric sites on the INEL site and the need to allow for consideration of these resources during Federal undertakings, a preliminary study, which resulted in the development of a predictive model, has been completed. This study identified areas where densities of sites are apparently highest and the potential impacts to significant archaeological resources, as well as the costs of compliance, will likely increase correspondingly (Ringe 1993). This information is intended to provide some guidance for INEL project managers in selecting appropriate areas for new construction. However, it does not take the place of inventories that are required by the National Historic Preservation Act in advance of all ground-disturbing projects (NHPA 1966). The predictive model was constructed using a multivariate technique on environmental variables associated with areas containing sites and areas with no sites. This model shows that prehistoric cultural resources appear to be concentrated in association with certain definable physical features of the land. In this context, very high densities of resources are likely to be found along the Big Lost River and Birch Creek, atop buttes, and within craters and caves. The Lemhi Mountains, the Lake Terreton basin, and a 1.75-mile- (2,800-meter-) wide zone along the edge of local lava fields probably contain a fairly high density of sites. Within the extensive flows of basaltic lava and along the low foothills of the Lemhi Mountains, site density is classified as moderate. The lowest density of prehistoric resources probably occurs within the floodplain of the Big Lost River and the alluvial fans emerging from the Birch Creek Valley, within the sinks, and within the recent Cerro Grande lava flow. However, a classification of low or medium density does not eliminate the possibility that significant resources exist within those areas. Although this model has not been tested, it is useful as a planning guide for defining those areas most likely to contain archaeological resources based on past surveys.

Although no systematic inventory of historically significant facilities associated with the creation and operation of the INEL has been completed, a preliminary study indicated that all INEL facilities will require evaluation (Braun et al. 1993). The Experimental Breeder Reactor-I is a National Historic Landmark listed in the National Register of Historic Places. To date, however, few of the other properties have been formally evaluated for eligibility to the National Register of Historic Places. However, Memoranda of Agreement between DOE, the Idaho State Historic Preservation Office, and the National Advisory Council on Historic Preservation establish that certain structures located at Test Area North (DOE 1993a) and Auxiliary Reactor Area (DOE 1993b) are eligible for nomination. These memoranda outline specific techniques for preserving the historic value of the areas in conformance with the requirements of the Historic American Building Survey and the

Historic American Engineering Record. Other facilities on the INEL site are likely to require similar efforts if scheduled for major modification, demolition, or abandonment.

4.4.2 Native American Cultural Resources

Because Native American people hold the land sacred, in their terms the entire INEL reserve is culturally important. Cultural resources, to the Shoshone-Bannock Tribes, include all forms of traditional lifeways and usages of all natural resources. This includes not only prehistoric archaeological sites, which are important in a religious or cultural heritage context, but also features of the natural landscape and air, plant, water, or animal resources that have special significance. These resources may be affected by changes in the visual environment (construction, ground disturbance, or introduction of a foreign element into the setting), dust particles, or by contamination. Geographically, the INEL site is included within a large territory once inhabited by and still of importance to the Shoshone-Bannock. Plant resources used by the Shoshone-Bannock that are located on or near the INEL site are listed in Table 4.4-1. Areas significant to the Shoshone-Bannock would include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, and the Big Lost River.

Five Federal laws prompt consultation between Federal agencies and Native American tribes: the National Environmental Policy Act (NEPA 1970), the National Historic Preservation Act, as amended (NHPA 1966), the American Indian Religious Freedom Act (AIRFA 1978), the Archaeological Resources Protection Act (ARPA 1979), and the Native American Graves Protection and Repatriation Act (NAGPRA 1990). In accordance with these directives and in consideration of DOE's written Native American policy (DOE 1990, 1992), DOE at the INEL has committed to additional interaction and exchange of information with the Shoshone-Bannock Tribes of the nearby Fort Hall Indian Reservation and is developing procedures for consultation and coordination. This relationship is outlined in a formal Working Agreement between the Shoshone-Bannock and DOE (DOE-ID 1992). In addition, the Cultural Resources Management Plan for the INEL (Miller 1992) and the curation agreement for permanent storage of archaeological materials are planned for completion by June 1996. The Cultural Resources Management Plan would define procedures for involving the Shoshone-Bannock during the planning stages of project development. The curation

Table 4.4-1. Plants used by the Shoshone-Bannock that are located on or near the Idaho National Engineering Laboratory site.

Plant family	Type of use	Location on INEL site	Abundance
Desert parsley	Medicine, food	Scattered	Common
Milkweed	Food, tools	Roadsides	Scattered, uncommon
Sagebrush	Medicine, tools	Throughout	Common, abundant
Balsamroot	Food, medicine	Around buttes	Common but scattered
Thistle	Food	Scattered throughout	Common but scattered
Gumweed	Medicine	Disturbed areas	Common
Sunflower	Medicine, food	Roadside	Common
Dandelion	Food, medicine	Throughout	Common
Beggar's ticks	Food	Disturbed areas throughout	Common, abundant
Tansymustard	Food, medicine	Disturbed areas	Common
Cactus	Food	Throughout	Common, abundant
Honeysuckle	Food, tools	Big Southern Butte	Common on butte
Goosefoot	Food	Throughout	Common, abundant
Russian thistle	Food	Disturbed areas throughout	Common, abundant
Dogwood	Food, medicine, tools	Webb Springs, Birch Creek	Common where found
Juniper	Medicine, tools, food	Throughout	Common to abundant
Gooseberry	Food	Scattered throughout	Common
Mentha arvensis	Medicine	Big Lost River	Uncommon
Wild onion	Food, medicine, dye	Throughout	Common
Calochortus spp.	Food	Buttes	Common
Fireweed	Food	Throughout	Common
Pine	Food, tools, medicine	Big Southern Butte	Common on butte
Douglas fir	Medicine	Big Southern Butte	Common on butte
Plantain	Medicine, food	Throughout	Uncommon
Wildrye	Food, tools	Throughout	Common, abundant
Indian ricegrass	Food	Throughout	Common, abundant
Bluegrass	Food, medicine	Throughout	Common, abundant
Serviceberry	Food, tools, medicine	Buttes	Common where found
Chokecherry	Food, medicine, tools, fuel	Buttes	Common where found
Wood's rose	Food, smoking, medicine, ritual	Big Lost River, Big Southern Butte	Common, abundant
Red raspberry	Food, medicine	Big Southern Butte	Uncommon
Willow	Medicine	Throughout in moist areas	Common
Coyote tobacco	Smoking, medicine	Big Lost River, Webb Springs	Uncommon
Cattail	Food, tools	Sinks, outflow from facilities	Uncommon

a. Source: Anderson et al. (1995).

agreement would provide for the repatriation of burial goods in accordance with the Native American Graves Protection and Repatriation Act.

4.4.3 Paleontological Resources

There are 31 known fossil localities at the INEL site, and available information suggests that the region has relatively abundant and varied paleontological resources. Preliminary analyses suggest that these materials are most likely to be found in association with archaeological sites; in areas of basalt flows; in deposits of the Big Lost River, Little Lost River, and Birch Creek; in deposits of Lake Terreton and playas; in some wind and sand deposits; and in sedimentary interbeds or lava tubes within local lava flows (Miller 1992: Table 3-1).

4.5 Aesthetic and Scenic Resources

This section describes the visual character of the INEL site and briefly discusses scenic areas in the vicinity of the INEL. An additional description of visual impacts to offsite areas is contained in Section 4.7, Air Resources.

4.5.1 Visual Character of the Idaho National Engineering Laboratory Site

The INEL site is bordered on the north and west by the Bitterroot, Lemhi, and Lost River mountain ranges. Volcanic buttes near the southern boundary of the INEL can be seen from most locations on the site and the Fort Hall Indian Reservation. Most of the INEL site consists of open, undeveloped land, predominantly covered by large sagebrush and grasslands (see Section 4.9, Ecological Resources). Pasture and irrigated farmland border much of the INEL site (see Section 4.2, Land Use).

Nine facility areas are located on the INEL site. Although the INEL has a master plan, no specific visual resource standards have been established. The generally low density INEL facilities look like commercial/industrial complexes and are dispersed throughout the INEL site. The structures range in height from 10 feet (3 meters) to approximately 100 feet (30 meters), with a few stacks and towers that reach up to 250 feet (76 meters). Although many INEL facilities are visible from highways, most facilities are located over half a mile (0.8 kilometers) from public roads. The facility closest to a public road (0.4 mile or 0.6 kilometer) is the Water Reactor Research Test Facility (about 60 feet or 18 meters in height), located off State Highway 33. This section of Highway 33 is used primarily by the INEL workforce at Test Area North.

About 90 miles (144 kilometers) of paved public highway run through the INEL site. U.S. Highway 20 runs east and west across the southern portion, and has one rest stop within the INEL boundaries. This is the highway most heavily used by the INEL workforce. It is a direct route from the Idaho Falls area to Boise, Idaho, and recreational areas such as Sun Valley and Craters of the Moon National Monument. The Experimental Breeder Reactor-I, just off Highway 20, is a National Historic Landmark. It had 14,000 visitors in 1992 (Braun 1993) but was closed temporarily for repairs in 1993. U.S. Highway 26 runs southeast and northwest, intersecting Highway 20 near the Central Facilities Area. State Highways 22, 28, and 33 cross the northeastern part of the INEL site.

4.5.2 Scenic Areas

The Craters of the Moon National Monument is located about 15 miles southwest of the INEL site's western boundary. The seasonal visual range from Craters of the Moon is from 81 to 97 miles (130 to 156 kilometers) (Notar 1993). The Monument is located in a designated Wilderness Area, for which Class I (very high) air quality standards, or minimal degradation, must be maintained, as defined by the Clean Air Act (CFR 1977, 1990). Under the Clean Air Act, air quality is defined to include visibility and scenic view considerations.

Lands adjacent to the INEL site, under Bureau of Land Management jurisdiction, are designated as Visual Resource Management Class II areas (BLM 1984, 1986). This designation urges preservation and retention of the existing character of the landscape. Lands within INEL site boundaries are designated as Class III and IV, the most lenient classes in terms of modification. The Bureau of Land Management is considering the Black Canyon Wilderness Study Area, located adjacent to the INEL, for Wilderness Area designation (BLM 1986), which, if approved, would result in an upgrade of its Visual Resource Management class from Class II to Class I.

Features of the natural landscape have special significance to the Shoshone-Bannock tribes. The visual environment of the INEL site is within the visual range of the Fort Hall Indian Reservation.

4.6 Geology

This section describes the geological, seismic, and volcanic characteristics of the INEL site and surrounding region.

4.6.1 General Geology

The INEL site is located on the Eastern Snake River Plain (Figure 4.6-1). The Plain forms a broad, northeast-trending, crescent-shaped trough with low relief, comprised primarily of basaltic lava flows. These flows at the surface range in age from 1.2 million to 2,100 years. The Plain features thin, discontinuous, interbedded deposits of wind-blown loess and sand; water-borne alluvial fan, lacustrine, and flood-plain alluvial sediments; and rhyolitic domes formed 1,200,000 to 300,000 years ago (Kuntz et al. 1990) (Figure 4.6-2). The Plain is bounded on the north and south by the north-to-northwest-trending mountains and valleys of the Basin and Range Province, comprised of folded and faulted rocks that are more than 70 million years old. The Plain is bounded on the northeast by the Yellowstone Plateau. The major episode of Basin and Range faulting began 20 to 30 million years ago and continues today, most recently associated with the October 28, 1983, Borah Peak earthquake [Ms 7.3; 0.022 to 0.078g at the INEL site (Jackson 1985)], which occurred along the Lost River fault, approximately 100 kilometers (62 miles) from INEL site facilities, and the 1959 Hebgen Lake earthquake (Ms 7.5), approximately 150 kilometers (93 miles) from the INEL site (Figure 4.6-1).

The northeast-trending volcanic terrain of the Plain has a markedly different geologic history and tectonic pattern compared to the older folded and faulted terrain of the northwest-trending Basin and Range. The northwest-trending Basin and Range faults have not been observed to extend across the Plain. Four northwest-trending volcanic rift zones are known to lie across the Plain at or near the INEL site; they have been attributed to basaltic eruptions that occurred 4 million to 2,100 years ago (Bowman 1995, Hackett and Smith 1992, Kuntz et al. 1990).

The seismic characteristics of the Plain and the adjacent Basin and Range Province also are different. Earthquakes and active faulting are associated with Basin and Range tectonic activity. The Plain has historically experienced few and small earthquakes (King et al. 1987, Pelton et al. 1990, WCC 1992, Jackson et al. 1993).

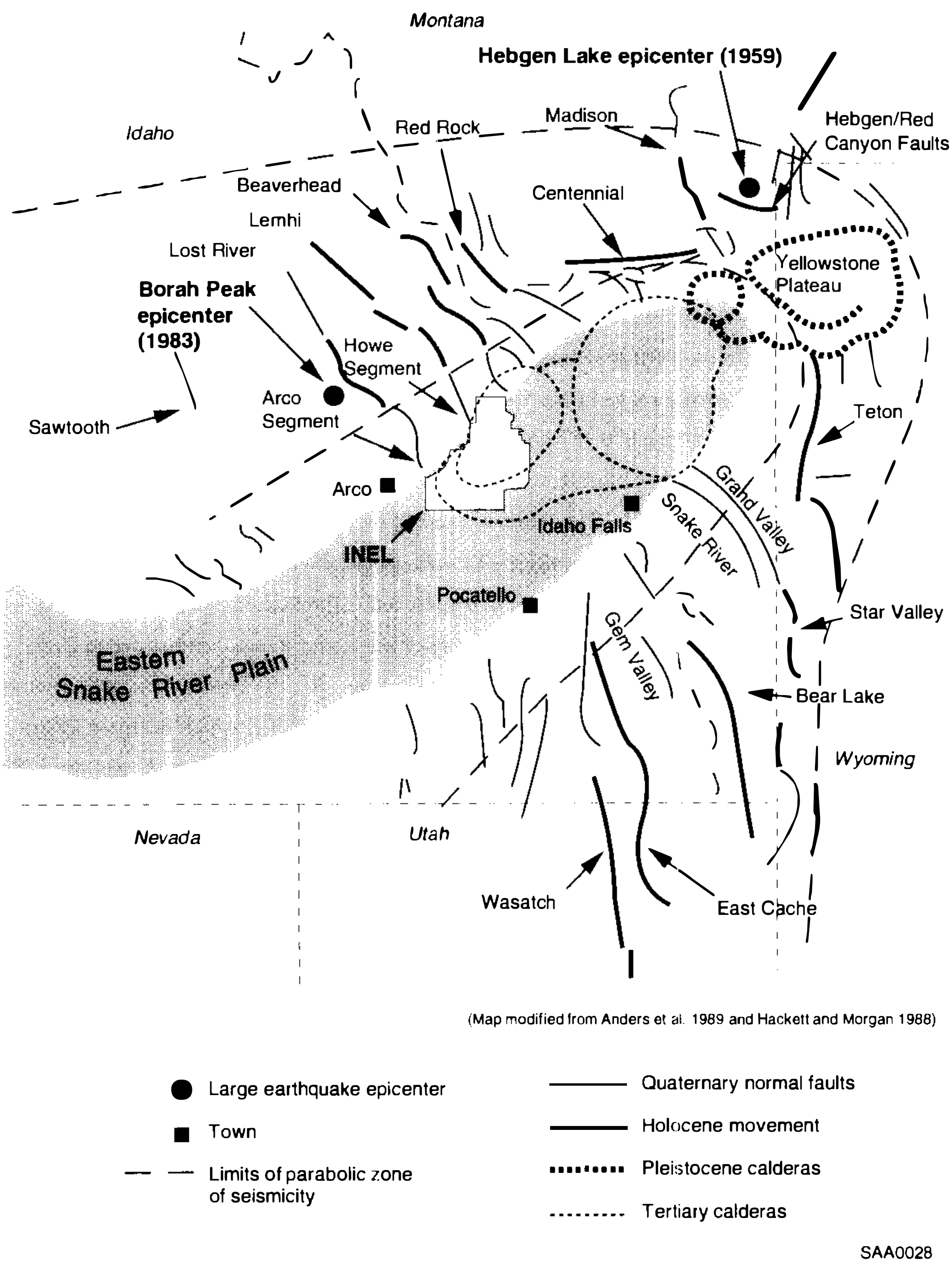


Figure 4.6-1. Geologic features in the region of the Idaho National Engineering Laboratory site.

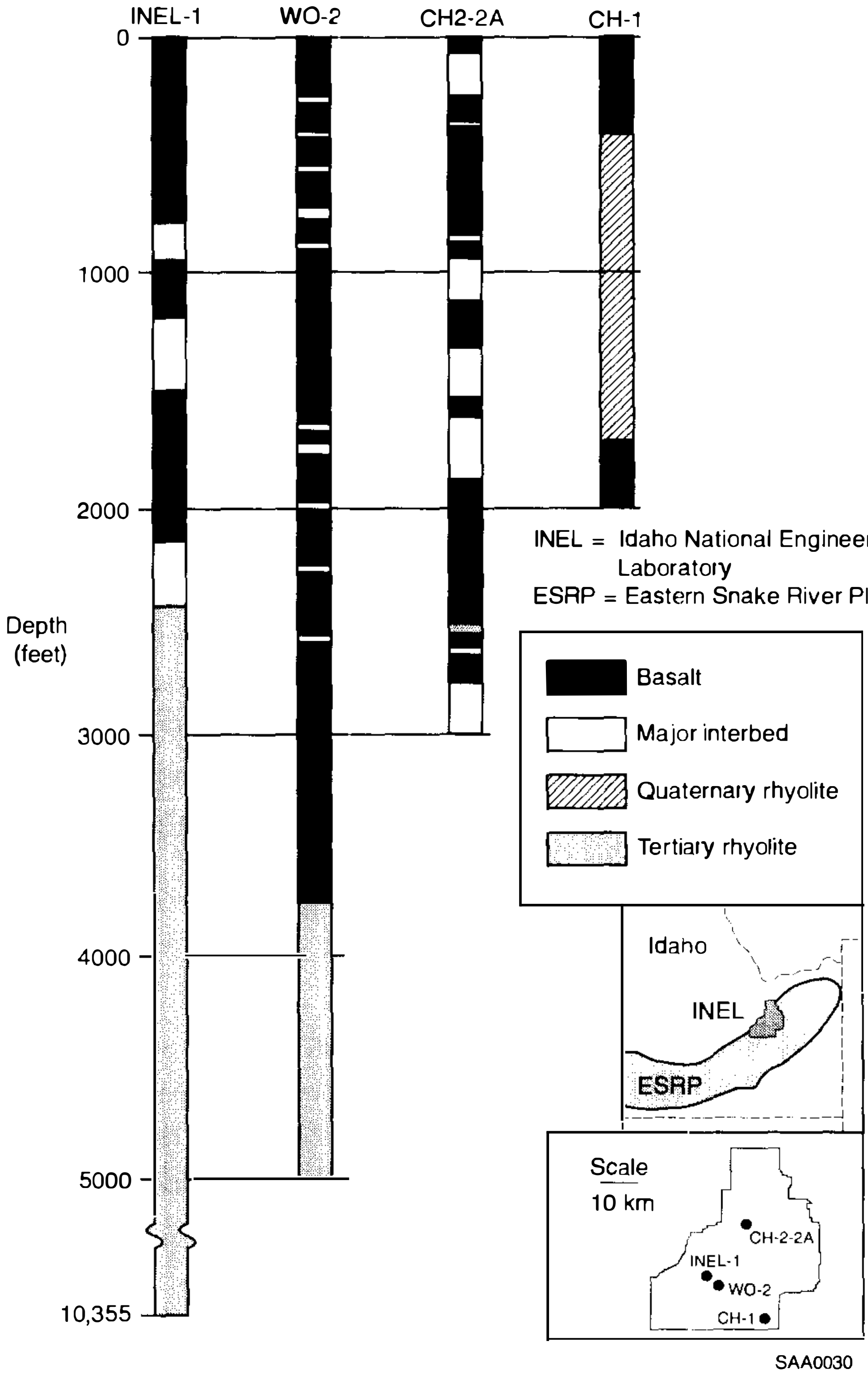


Figure 4.6-2. Lithologic logs of deep drill holes on the Idaho National Engineering Laboratory site (Doherty 1979a,b; Doherty et al. 1979, Hackett and Smith 1992). (To convert from feet to meters, multiply by 0.3048.)

A typical soil association occurring on a lava flow on the INEL site consists of three to four soil series differentiated from one another largely on the basis of soil depth. The INEL site landscapes are covered with a thin-to-thick blanket of eolian sediments, which are deposited in episodes associated with climatic cycles. The thickness of eolian sediments on the INEL site is generally less than 2.1 meters (7 feet) and commonly between 0.3 to 0.9 meters (1 to 3 feet). Most soils formed in eolian deposits containing a layer of secondary carbonates, which ranges from powdery to cemented.

4.6.2 Natural Resources

A geothermal exploration well was drilled at the INEL site to a depth of 3,147 meters (10,320 feet) in 1979. A temperature of 142°C (288°F) was measured, but no commercial quantities of geothermal fluids were identified (Mitchell et al. 1980). Mineral resources include several quarries or pits within the INEL site boundary to supply sand, gravel, pumice, silt, clay, and aggregate for road construction and maintenance, new facility construction and maintenance, waste burial activities, and ornamental landscaping cinders. During the course of excavation, the gravel pits may be studied to characterize the local surficial geology of the INEL site. Outside the INEL site boundary, mineral resources include sand, gravel, pumice, phosphate, and base and precious metals (Strowd et al. 1981, Mitchell et al. 1981). The geologic history of the Plain makes the potential for petroleum production at the INEL site very low.

4.6.3 Seismic Hazards

The distribution of earthquakes at and near the INEL site from 1884 to 1989 clearly shows that the Plain has a remarkably low rate of seismicity, whereas the surrounding Basin and Range has a fairly high rate of seismicity (Figure 4.6-3, WCC 1992). The mechanism for faulting and generation of earthquakes in the Basin and Range is attributed to northeast-southwest directed crustal extension.

Several investigators have suggested hypotheses for the low rate of seismic activity within the Plain compared to the Centennial Tectonic Belt (Stickney and Bartholomew 1987) and Intermountain Seismic Belt (Smith and Arabasz 1991):

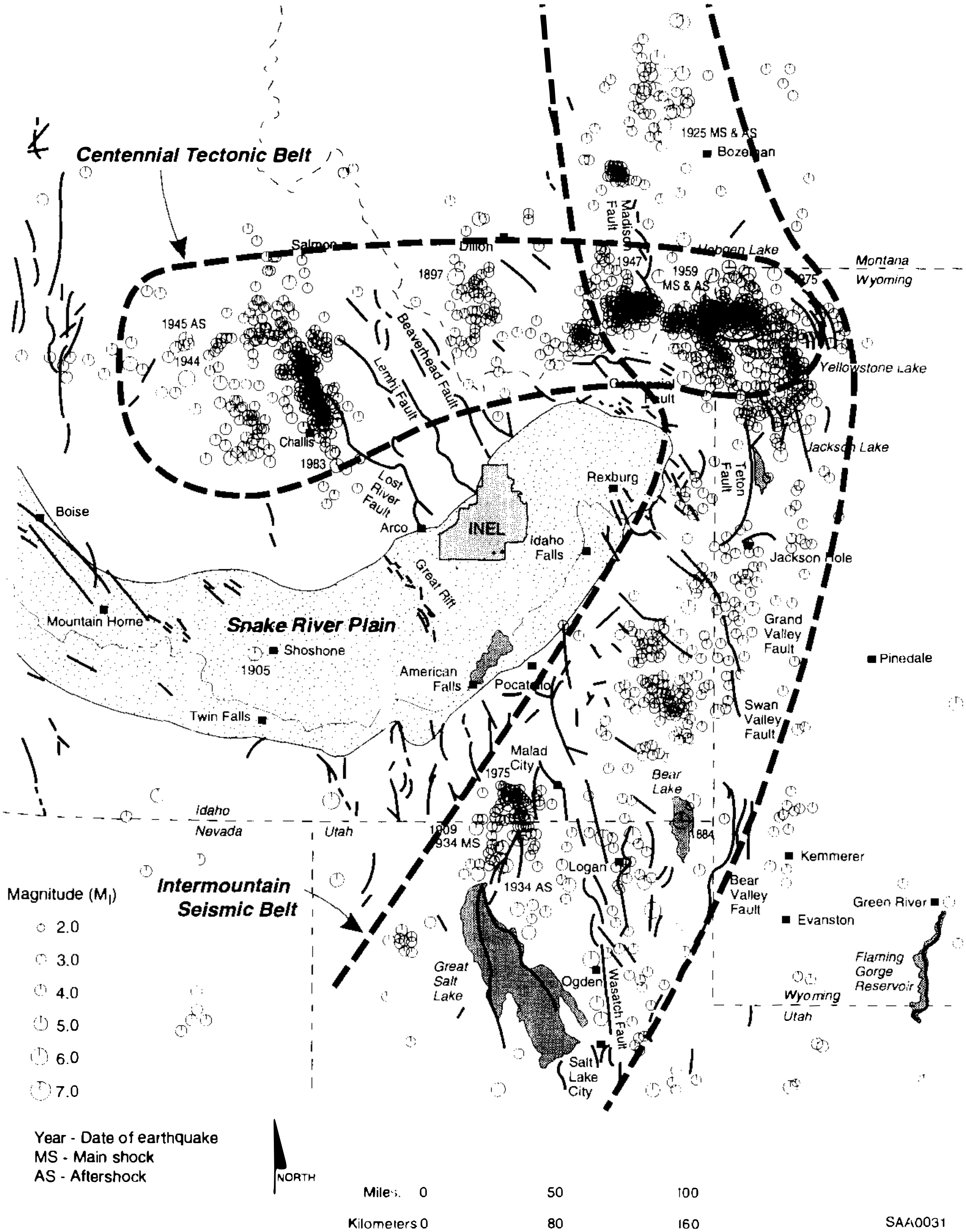


Figure 4.6-3. Historical earthquakes in the Idaho National Engineering Laboratory region with magnitudes greater than 2.5 (1884 to 1989) (WCC 1992).

- Smith and Sbar (1974) and Brott et al. (1981) suggested that high crustal temperatures beneath the Plain and adjacent region inside the seismic parabola (Figure 4.6-1) resulted in ductile deformation (aseismic creep), in contrast to the brittle deformation (rock fracture) that occurs in the Basin and Range.

- Anders et al. (1989) suggested that the Plain and the adjacent region inside the seismic parabola (Figure 4.6-1) have increased integrated lithospheric strength. They proposed that the presence of mid-crustal mafic intrusive rock strengthens the crust so that it is too strong to fracture (see also Smith and Arabasz 1991).

- Parsons and Thompson (1991) proposed that magmatic dike injection suppresses normal faulting and associated seismicity by altering the local tectonic stress field. As dikes are injected in volcanic rift zones, they push apart the surrounding rocks and decrease differential stress, thereby preventing earthquakes from occurring.

- Recently, Anders and Sleep (1992) proposed that introduction of mantle-derived magma into the midcrust beneath the Plain has decreased faulting and earthquakes by lowering the rate of deformation.

The markedly different late-Tertiary and Quaternary tectonic and seismic histories of the Plain and Basin and Range Province reflect the dissimilar deformational processes acting in each region. Both regions are being subjected to the same extensional stress field (Weaver et al. 1979, Zoback and Zoback 1989, Pierce and Morgan 1992, Jackson et al. 1993); however, crustal deformation within the Plain occurs through dike injection and, in the Basin and Range, through large-scale normal faulting (Rodgers et al. 1990, Parsons and Thompson 1991, Hackett and Smith 1992).

Major seismic hazards include the effects from ground shaking and surface deformation (surface faulting, tilting). Other potential seismic hazards (for example, avalanches, landslides, mudslides, soil settlement, and soil liquefaction) are not likely to occur at the INEL site because the local geologic conditions are not conducive to them. Based on the seismic history and the geologic conditions, earthquakes greater than magnitude 5.5 (and associated strong ground shaking and surface fault rupture) are not likely to be generated within the Plain. However, moderate to strong ground shaking can affect the INEL site from earthquakes in the Basin and Range. Patterns of seismicity and locations of mapped faults are used to assess potential sources of future earthquakes and to estimate levels of ground motion at the INEL site. The sources and maximum magnitudes of earthquakes that could produce the maximum levels of ground motions at all INEL site facilities include (WCC 1990, 1992):

- A moment magnitude 7.0 earthquake at the southern end of the Lemhi fault along the Howe and Fallert Springs segments

- A moment magnitude 7.0 earthquake at the southern end of the Lost River fault along the Arco segment

- A moment magnitude 5.5 earthquake associated with dike injection in either the Arco or Lava Ridge-Hell's Half Acre Volcanic Rift Zones and the Axial Volcanic Zone

- A "random" moment magnitude 5.5 earthquake occurring within the Eastern Snake River Plain.

An example of the relationship of the peak ground acceleration on the INEL site to the annual frequency of occurrence of seismic events for various seismic hazards in the region, including the above four events, is illustrated in Figure 4.6-4 (WCFS 1993). The curves were developed specifically for the site of the Idaho Chemical Processing Plant in the south-central INEL site and do not directly apply to other INEL site areas. Ground motion contributions from seismic sources not shown on Figure 4.6-4 (that is, Intermountain Seismic Belt, Idaho Batholith, and Yellowstone Region) are significantly smaller because of their distant locations or lower maximum magnitudes. The INEL site-specific seismic hazard study (WCFS 1993) will provide curves similar to Figure 4.6-4 for other INEL site areas. INEL site seismic design basis events are determined by the INEL Natural Phenomena Committee and incorporated into the INEL Architectural and Engineering Standards based on studies (WCC 1990). Section 5.14, Facility Accidents, presents the potential impacts of postulated seismic events.

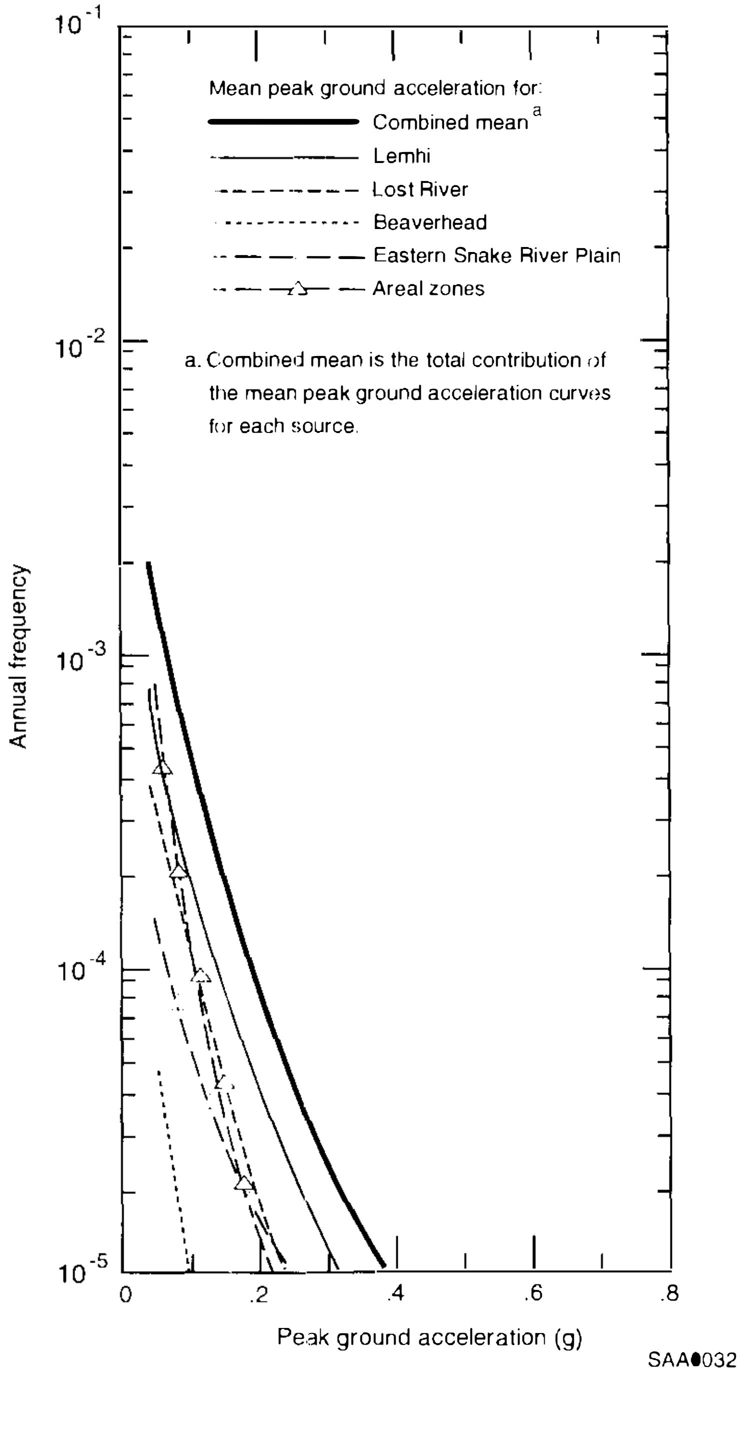


Figure 4.6-4. Contribution of the various seismic sources to the mean peak ground acceleration at the Idaho Chemical Processing Plant (WCFS 1993).

4.6.4 Volcanic Hazards

Volcanic hazards at the INEL site can come from sources inside or outside the Plain's boundaries. Volcanic hazards include the effects of lava flows, ground deformation (fissures, uplift, subsidence), volcanic earthquakes (associated with magmatic processes as distinct from earthquakes associated with tectonics), and ash flows or airborne ash deposits (Bowman 1995). Most of the basalt volcanic activity occurred from 4 million to 2,100 years ago in the INEL site area. The most recent and closest volcanic eruption occurred 2,100 years ago at the Craters of the Moon National Monument 25 kilometers (15 miles) southwest of the INEL site (Kuntz et al. 1992). The rhyolite domes along the Axial Volcanic Zone formed between 1.2 and 0.3 million years ago and have a recurrence interval of about 200,000 years. Therefore, the probability of future dome formation affecting INEL site facilities is very low.

Catastrophic Yellowstone eruptions have occurred three times in the past 2 million years, but the INEL site lies more than 160 kilometers (70 miles) from the Yellowstone Caldera rim, and high-altitude winds would not disperse Yellowstone ash in the direction of the INEL site. For these reasons of infrequency, great distance, and unfavorable dispersal, pyroclastic flows or ash fallout from future Yellowstone eruptions are not expected to impact the INEL site.

Basaltic lava flows and eruptions from fissures or vents have been considered in this Environmental Impact Statement. Based on a probability analysis of the volcanic history in and near the southcentral INEL site area, the Volcanism Working Group (VWG 1990) estimated that the conditional probability that basaltic volcanism would affect a south-central INEL site location is less than 2.5×10^{-5} per year (once per 40,000 years or longer), where the hazard associated with Axial Volcanic Zone volcanism is greatest. The probability of volcanic impact on INEL site facilities farther north, where both silicic and basaltic volcanism bave been older and less frequent, is estimated to be less than 10^{-6} per year (once every million years or longer). The statistics of 116 measured INEL-area lava flow lengths and areas were used to define the two lava flow hazard zones (Figure 4.6-5). The mean lava flow length plus one standard deviation from the mean corresponds to 14 kilometers (8.7 miles). The hazard for a particular site within or near a volcanic zone is much lower, typically by an order of magnitude or more, and must be assessed on a site-specific basis (Bowman 1995). Section 5.14, Facility Accidents, presents the effects of a hypothetical lava flow that covers the INEL Radioactive Waste Management Complex (RWMC).

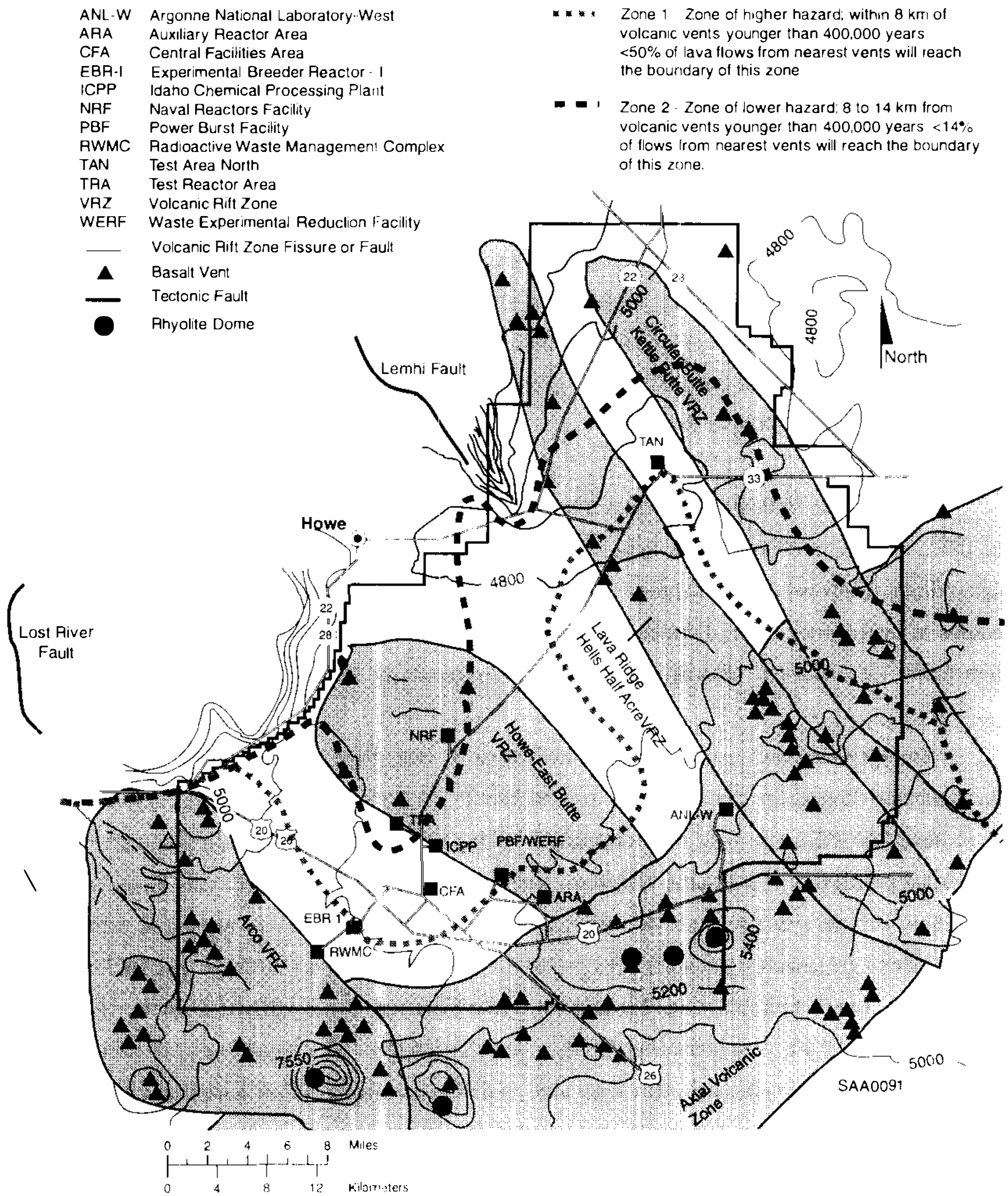


Figure 4.6-5. Map of the Idaho National Engineering Laboratory, showing locations of volcanic rift zones and lava flow hazard zones.

4.7 Air Resources

This section describes the air resources of the INEL site and the surrounding area. The discussion includes the climatology and meteorology of the region, a summary of applicable regulations, descriptions of radiological and nonradiological air contaminant emissions, and a characterization of existing and projected levels of air pollutants. The analysis includes both existing facilities and those that were expected (at the time the analysis was performed) to be operational before June 1, 1995. Additional detail and background information on the material presented in this section is presented in Appendix F, Section F-3, Air Resources, of Volume 2 of this EIS.

4.7.1 Climate and Meteorology

The Eastern Snake River Plain climate exhibits low relative humidity, wide daily temperature swings, and large variations in annual precipitation. Average seasonal temperatures measured onsite range from -7.3°C (Celsius) [(18.8°F (Fahrenheit)] in winter to 18.2°C (64.8°F) in summer, with an annual average temperature of about 5.6°C (42°F). Temperature extremes range from a summertime maximum of 39.4°C (103°F) to a wintertime minimum of -45°C (-49°F). Large year-to-year variations in average monthly and seasonal temperatures are common, as are large variations in temperature in different locations. Annual precipitation is light, averaging 22.1 centimeters (8.71 inches), with monthly extremes of zero to 12.8 centimeters (5 inches). The maximum 24-hour precipitation rate is 4.6 centimeters (1.8 inches). The greatest short-term precipitation rates are primarily attributable to thunderstorms, wbich occur approximately two or three days per month during the summer. The average annual snowfall is 70.1 centimeters (27.6 inches), with extremes of 151.6 centimeters (59.7 inches) and 17.3 centimeters (6.8 inches). Relative humidity ranges from an average minimum of 27 percent to a maximum of 79 percent on an annual basis.

The INEL site is in the belt of prevailing westerlies; however, these winds are normally channeled by the mountain ranges bordering the Eastern Snake River Plain into a southwest wind. Most offsite locations experience the predominant southwest/northeast wind flow of the Eastern Snake River Plain, although subtle terrain features near some locations cause considerable variations from this flow regime. An illustration of annual wind flow is provided by the wind roses in Figure 4.7-1. These wind roses show the frequency of wind direction (in other words, the direction from which the

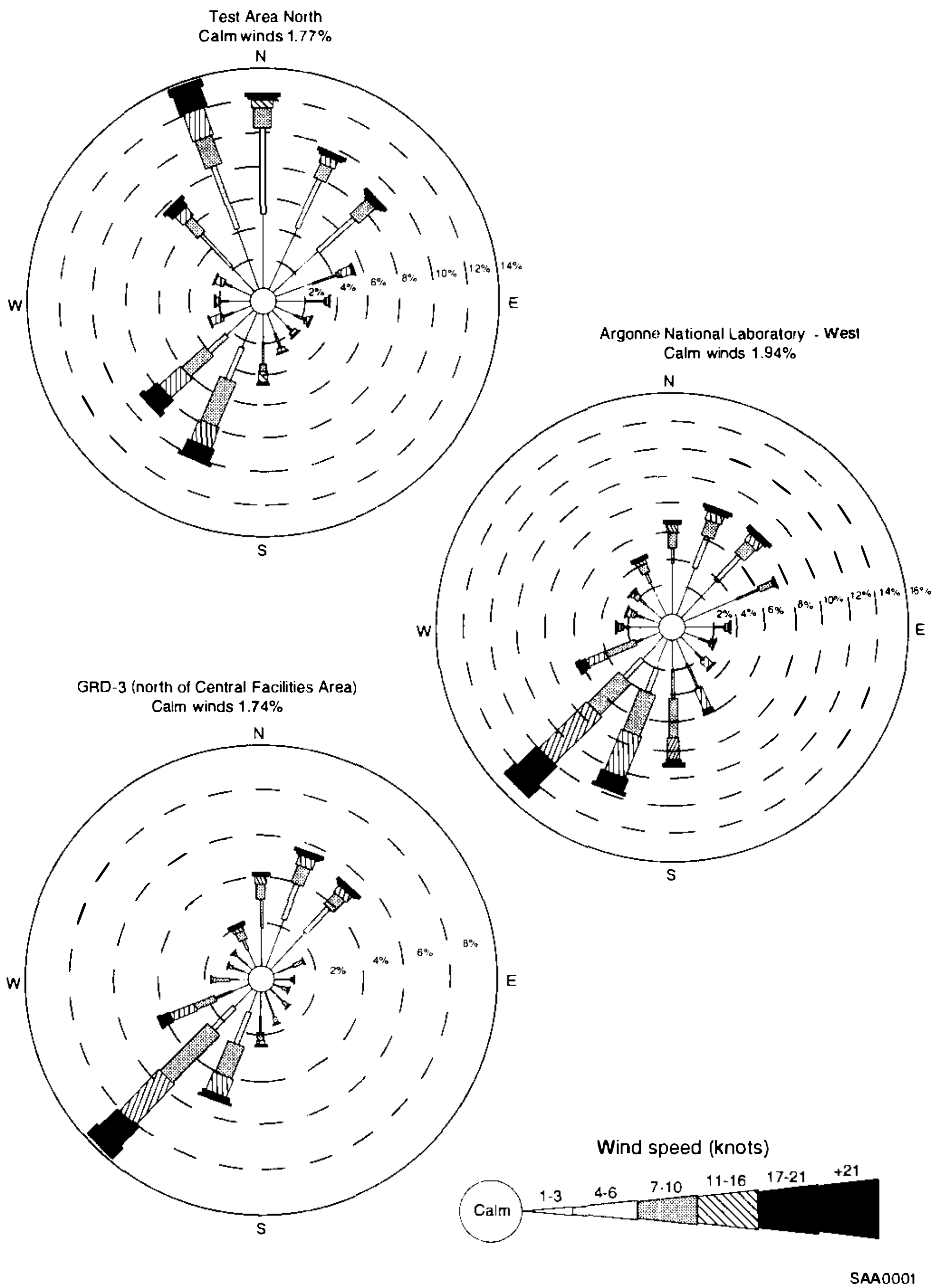


Figure 4.7-1. Annual average wind direction and speed at meteorological monitoring stations on the Idaho National Engineering Laboratory site.

wind blows) and speed at three meteorological monitoring sites on the INEL site for the period 1988 to 1992. The highest hourly average near-ground wind speed measured onsite is 22.8 meters per second (51 miles per hour) from the west-southwest, with a maximum instantaneous gust of 34.9 meters per second (78 miles per hour) (Clawson et al. 1989). Other than thunderstorms, severe weather is uncommon. Five funnel clouds (tornadoes not touching the ground) and no tornadoes have been reported onsite from 1950 to 1988. Visibility in the region is good because of the low moisture content of the air and minimal sources of visibility-reducing pollutants. At Craters of the Moon Wilderness Area [approximately 20 kilometers (12.4 miles) southwest of the INEL site], the seasonal visual range is from 130 to 156 kilometers (81 to 97 miles) (Notar 1993).

Air pollutant dispersion is a result of the processes of transport and diffusion of airborne contaminants in the atmosphere. Transport is the movement of a pollutant in the wind field, while diffusion refers to the process whereby a pollutant plume is diluted by turbulent eddies. Vertical diffusion of pollutants may be restricted or enhanced by the temperature gradient of the atmosphere (that is, the change in temperature with altitude). Lapse conditions, which tend to enhance vertical diffusion, occur slightly less than 50 percent of the time. Conversely, thermal stratification or inversion conditions, which inhibit vertical diffusion, occur slightly more than 50 percent of the time. The height to which the pollutants can freely diffuse is known as the mixing depth, while the layer of air from the ground up to the mixing depth is known as the mixed layer. Estimates of the monthly average depth of the mixed layer range from 120 meters (400 feet) in December to 900 meters (3,000 feet) in July. Nocturnal (nighttime) inversions form at approximately sunset and dissipate about one to two hours after sunrise. These inversions are often ground-based, meaning that the temperature increases with height from the ground (Clawson et al. 1989).

4.7.2 Standards and Regulations

Air quality regulations have been established to protect the public from potential harmful effects of air pollution. These regulations (a) designate acceptable levels of pollution in ambient air, (b) establish limits on radiation doses to members of the public, (c) establish limits on air pollutant emissions and resulting deterioration of air quality due to vehicular and other anthropogenic sources, (d) require air permits to regulate (control) emissions from stationary (nonvehicular) sources of air pollution, and (e) designate prohibitory rules, such as rules that prohibit open burning. The Federal Clean Air Act (and amendments) provides the framework to protect the nation's air resources and public health and welfare. In Idaho, the U.S. Environmental Protection Agency and the State of Idaho Department of Health and Welfare, Division of Environmental Quality, are jointly responsible for establishing and implementing programs that meet the requirements of the Federal Clean Air Act. INEL site activities are subject to air quality regulations and standards established under the Clean Air Act and by the State of Idaho (IDHW 1994) and to internal policies and requirements of DOE. Air quality standards and programs applicable to INEL site operations are summarized in Figure 4.7-2 and described in further detail in Appendix F, Section F-3, Air Resources, of Volume 2 of this EIS.

4.7.3 Radiological Air Quality

The population of the Eastern Snake River Plain is exposed to environmental radiation from both natural and manmade sources. This section summarizes the sources and levels of radiation exposure in this geographical region, including sources of airborne radionuclide emissions from the INEL site. Estimates of radioactivity levels and radiological doses from current INEL site operations, including anticipated increases to the baseline (increases from facilities expected to become operational by June 1, 1995), are provided and discussed.

4.7.3.1 Sources of Radioactivity. The major source of radiation exposure in the Eastern Snake River Plain is natural background radiation. Sources of radioactivity related to INEL site operations contribute a small amount of additional exposure.

Background radiation includes sources such as cosmic rays; radioactivity naturally present in soil, rocks, and the human body; and airborne radionuclides of natural origin (such as radon). Radioactivity still remaining in the environment as a result of atmospheric testing of nuclear weapons also contributes to the background radiation level, although in very small amounts. The natural background dose for residents of the Eastern Snake River Plain is estimated at 351 millirem per year, with more than half (about 200 millirem per year) caused by the inhalation of radioactive particles formed by the decay of radon (Hoff et al. 1992, NCRP 1987).

INEL site operations can result in releasing radioactivity to air either directly (such as through stacks or vents) or indirectly (such as by resuspension of radioactivity on contaminated grounds). Concentrations of radionuclides in direct releases are monitored or estimated based on knowledge of

Clean Air Act

Federal Program

National Ambient Air Quality Standards (NAAQSs)
- Set limits on ambient air concentrations of sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, lead, and ozone (criteria pollutants)
- Primary standards for protection of public health; secondary standards for protection of public welfare

Prevention of Significant Deterioration (PSD)
- Limits deterioration of air quality and visibility in areas that are better than the NAAQSs
- Requirement for Best Available Control Technology on major sources in attainment areas.

New Source Performance Standards
- Regulate emissions from specific types of industrial facilities (for example, fossil fuel-fired steam generators and incinerators)

National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Control airborne emissions of specific substances harmful to human health
- Specific provisions regulate benzene, mercury, beryllium, asbestos, and other hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem per year

Clean Air Act Amendments of 1990
- Sweeping changes to the Clean Air Act, primarily to address acid rain, nonattainment of NAAQSs, operating permits, hazardous air pollutants, potential catastrophic releases of acutely hazardous materials, and stratospheric ozone depletion
- Specific rules and policies not yet fully developed and implemented in all areas (for example, hazardous air pollutants)

State of Idaho Administration Program

Current Regulations of the State of Idaho Department of Health and Welfare (IDHW 1994) include:

Idaho Ambient Air Quality Standards (AAQSs)
- Similar to NAAQSs but also include standards for total suspended particulates and fluorides

New Source Program
- Permit to Construct (PTC) is required for essentially any construction or modification of a facility that emits an air pollutant
- Major facilities require PSD analysis and PTC

Carcinogenic and Noncarcinogenic Toxic Air Pollutant Increments
- Defines acceptable ambient concentrations for many specific toxic air pollutants associated with sources constructed or modified after May 1, 1994
- Requires demonstration of preconstruction compliance with toxic air pollutant increments

Operating Permits
- Required for nonexempt sources of air pollutants
- Define operating conditions and emissions limitations, as well as monitoring and reporting requirements

DOE Compliance Program

Policy to comply with applicable regulations and maintain emissions at levels as low as reasonably achievable
- Policy implemented through DOE orders
- DOE (Headquarters) orders apply to all DOE and DOE-contractor operations
- DOE-Idaho Operations Office (DOE-ID) supplemental directives provide direction and guidance specific to the INEL

The most relevant DOE orders and their DOE-ID supplemental directives are:
- DOE Order 5400.1 establishes general environmental protection program requirements and assigns responsibilities for ensuring compliance with applicable laws, regulations, and DOE policy
- DOE Order 5400.5 provides guidelines and requirements for radiation protection of the public
- DOE Order 5480.1B establishes the Environment, Safety, and Health (ES&H) Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1)
- DOE Order 5480.4 prescribes the application of mandatory ES&H standards that shall be used by all DOE and DOE-contractor operations (implemented via DOE-ID Supplemental Directive 5480.4)
- DOE Order 5480.19 provides guidelines and requirements for plans and procedures in conducting operations at DOE facilities (implemented via DOE-ID Supplemental Directive 5480.19)

Figure 4.7-2. Overview of Federal, State, and U.S. Department of Energy programs for air quality management.

the materials used and activities performed. Indirect releases are estimated using engineering calculations that relate surface contamination levels to expected airborne concentrations.

Emissions from INEL site facilities include the noble gases (argon, krypton, and xenon) and iodine; particulate fission products, such as ruthenium, strontium, and cesium; radionuclides formed by neutron activation, such as tritium (hydrogen-3), carbon-14, and cobalt-60; and heavy elements, such as uranium, thorium, and plutonium, and their decay products. Historically, the radionuclide with the highest emission rate is the noble gas krypton-85, which is released mainly by chemical reprocessing of spent nuclear fuel and processing of high-level waste at the Idaho Chemical Processing Plant (ICPP).[a] Activities at the Idaho Chemical Processing Plant also release relatively small amounts of iodine-129, an isotope of concern because of its long half-life (16 million years) and biological properties. (Iodine isotopes taken into the body tend to accumulate in the thyroid gland.) Reactor operations release mainly noble gas isotopes with short half-lives, including argon-41 and isotopes of xenon (mainly xenon-131m, -133, -135, and -138). Other activities at the INEL site, including waste management operations, result in very low levels of airborne radionuclide emissions. Table 4.7-1 provides a summary of the principal types of airborne radioactivity emitted from existing INEL site facilities, plus estimated emissions from projects expected at the time the analysis was performed to become operational before June 1, 1995. For all existing facilities except the Idaho Chemical Processing Plant, these estimates are based on emissions data for 1991. Emission rates for the Idaho Chemical Processing Plant are based on actual 1993 emissions data, scaled upward to reflect operation of the New Waste Calcining Facility (a high-level waste processing operation) at maximum permitted levels. Thus, the radiological emissions are representative of a baseline year that includes processing of high-level waste, but not spent nuclear fuel processing.

4.7.3.2 Existing Radiological Conditions. Monitoring and assessment activities are conducted to characterize existing radiological conditions at the INEL site and surrounding environment. Results of these activities show that exposures resulting from airborne radionuclide emissions are well within applicable standards and are a small fraction of the dose from background sources. These results are discussed separately below for onsite and offsite environments.

a. Fuel reprocessing at the INEL site ceased in April 1992, and baseline emission rates do not include contributions from reprocessing. Rather, processing-related emissions are assessed in Section 5.7, Air Resources, as potential impacts associated with possible future spent nuclear fuel management activities.

Table 4.7-1. Summary of airborne radionuclide emissions (in curies) from facility areas at the Idaho National Engineering Laboratory site.[a]

Facility	Tritium/ carbon-14	Iodines	Noble gases	Mixed fission and activation products[b]	U/Th/TRU[c]
Argonne National Laboratory-West	1.0×10^{2}	(d)	1.3×10^{4}	8.1×10^{-4}	1.8×10^{-6}
Central Facilities Area	2.6×10^{0}	5.0×10^{-7}	(d)	1.9×10^{-5}	9.6×10^{-7}
Idaho Chemical Processing Plant	4.3×10^{1}	6.4×10^{-2}	1.0×10^{4}	3.6×10^{-2}	9.4×10^{-9}
Naval Reactors Facility	1.9×10^{-1}	6.3×10^{-6}	5.7×10^{-1}	5.6×10^{-5}	(d)
Power Burst Facility/ Waste Experimental Reduction Facility	4.9×10^{1}	(d)	(d)	1.3×10^{0}	9.8×10^{-3}
Radioactive Waste Management Complex	(d)	(d)	(d)	2.6×10^{-5}	4.2×10^{-6}
Test Area North	1.2×10^{-1}	(d)	(d)	5.6×10^{-6}	1.5×10^{-5}
Test Reactor Area	1.6×10^{2}	1.6×10^{-2}	3.3×10^{3}	3.0×10^{0}	1.8×10^{-6}
INEL Total	2.1×10^{3}	1.1×10^{-1}	1.2×10^{5}	5.6×10^{0}	1.0×10^{-2}

a. Except for the Idaho Chemical Processing Plant, emissions estimates are based on 1991 operations. Idaho Chemical Processing Plant emissions are based on 1993 emissions but are scaled upward to reflect operation of the New Waste Calcining Facility at maximum permitted levels. Anticipated projects included in the baseline include the Waste Experimental Reduction Facility (compacting and sizing operations but not incineration), Argonne National Laboratory-West Fuel Cycle Facility, and Portable Water Treatment Unit, as described in Appendix F, Section F-3, Air Resources.
b. Mixed fission and activation products that are primarily particulate in nature (for example, cobalt-60, strontium-90, and cesium-137).
c. U/Th/TRU = Radioisotopes of uranium, thorium, or transuranic elements such as plutonium, americium, and neptunium.
d. The emissions for this group are negligibly small or zero.

4.7.3.2.1 Onsite Doses—An indication of onsite radiological conditions is obtained by comparing measured concentrations with those from INEL site boundary communities and distant locations. Results from onsite and boundary community locations include contributions from background conditions and INEL site emissions, while distant locations represent background conditions beyond the influence of INEL site emissions. These data show that 1991 average airborne radioactivity and radiation exposure levels within and around the INEL site were no different than those at distant stations. The average annual dose (as measured by thermoluminescent dosimeters during 1991) was 127 millirem for distant locations and 125 millirem for boundary community locations (Hoff et al. 1992).

Air dispersion models were applied to assess the radiation dose to workers at major INEL site facility areas as a result of cumulative emissions from existing facilities and those expected to become operational before June 1, 1995 (Leonard 1993, 1994). Results of this assessment indicate that the maximum dose at any onsite area is currently about 0.2 millirem per year. This dose could increase to about 4 millirem per year if the maximum projected operation of the Portable Water Treatment Unit at the Power Burst Facility Area is included; however, that operation is temporary (one to two years) and is not representative of a permanent increase in the baseline. If only permanent facility emissions are considered, the baseline worker dose could increase to 0.32 millirem per year. The actual and projected doses are a very small fraction of the DOE-established occupational dose limit (5,000 millirem per year) and are below the National Emissions Standard for Hazardous Air Pollutants (NESHAP) dose limit of 10 millirem per year. The National Emissions Standard for Hazardous Air Pollutants limit, established under the Clean Air Act, applies to the highest exposed member of the public (not to workers) but is the most restrictive limit for airborne releases and serves as a useful comparison for these results.

4.7.3.2.2 Offsite Doses—The offsite population may receive a radiation dose as a result of radiological conditions directly attributable to INEL site operations. The dose associated with baseline radiological emissions (existing facilities and those expected at the time the analysis was performed to become operational before June 1, 1995) is assessed for a maximally exposed individual and for the population within 80 kilometers (50 miles). The maximally exposed individual is a hypothetical person whose habits and proximity to the INEL site are such that the person would receive the highest dose projected to result from sitewide radiological emissions. The dose calculated for the maximally exposed individual as a result of current and projected sitewide emissions is about 0.05 millirem, which is well below both the National Emissions Standard for Hazardous Air Pollutants dose limit (10 millirem per year) and the dose received from background sources (351 millirem per year). Figure 4.7-3 illustrates a comparison of these dose rates. As evident in this figure, the 10-millirem dose limit is a very small fraction of the background level and provides a high degree of protection.

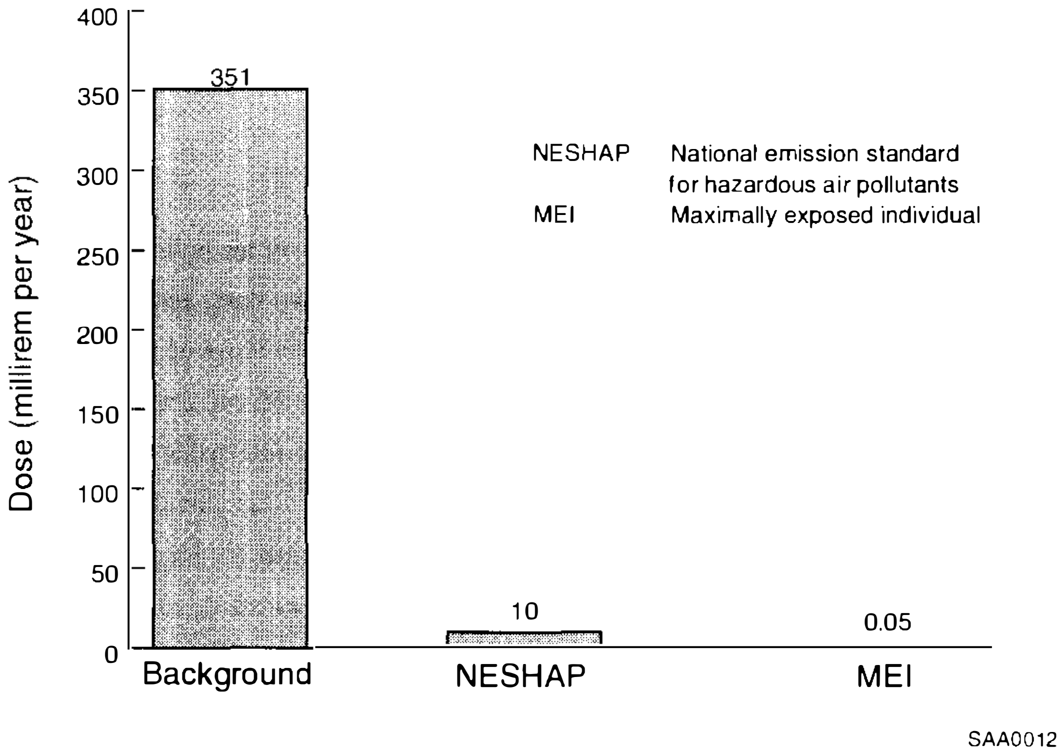


Figure 4.7-3. Comparison of radiation dose to the maximally exposed individual (due to current and projected radiological emissions at the Idaho National Engineering Laboratory site) to the National Emission Standard for Hazardous Air Pollutants dose limit and the dose from background sources.

The collective dose to the surrounding population as a result of INEL site emissions, assessed using 1990 U.S. Census Bureau data for the total population residing within a circular area with an 80-kilometer (50-mile) radius extending from each facility, is about 0.3 person-rem. The population dose is distributed over a population of about 120,000, resulting in an average individual dose of well below 0.001 millirem. The population dose of 0.3 person-rem is very small when compared with the dose received by the same population from background sources (over 40,000 person-rem). For future years, the baseline population dose is projected to increase (even though baseline emission rates do not rise) by an amount corresponding to the growth of the surrounding population.

4.7.3.3 Summary of Radiological Conditions. Radioactivity and radiation levels resulting from INEL site emissions are very low, well within applicable standards, and negligible when compared to doses received from natural background sources. This applies both to onsite conditions to which INEL site workers or visitors may be exposed, and offsite locations where the general population resides. Health risks associated with maximum potential exposure levels in the onsite and offsite environments are described in Section 4.12, Health and Safety.

4.7.4 Nonradiological Conditions

Persons in the Eastern Snake River Plain are exposed to sources of air pollutants, such as agricultural and industrial activities, residential woodburning, wind-blown dust, and automobile exhaust. Many of the activities at the INEL also emit air pollutants. The types of pollutants that are assessed here include (a) the criteria pollutants regulated under the National and State Ambient Air Quality Standards and (b) other types of pollutants with potentially toxic properties called toxic (or hazardous) air pollutants. Criteria pollutants include nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and respirable particulate matter (particles less than 10 micrometers in diameter, which are small enough to pass easily into the lower respiratory tract), for which National Ambient Air Quality Standards have been established. Total suspended particulate matter is also designated by the State of Idaho as a criteria pollutant. Volatile organic compounds are assessed as precursors leading to the development of ozone.[a] Toxic air pollutants include cancer-causing agents, such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as materials with noncancer health hazards, such as fluorides, ammonia, and hydrochloric and sulfuric acids.

4.7.4.1 Sources of Air Emissions. The types of nonradiological emissions from INEL facilities and activities are similar to those of other major industrial complexes the size of the INEL. Combustion sources such as boilers and emergency generators emit both criteria and toxic air pollutants. Sources such as chemical processing operations, waste management activities (other than combustion), and research laboratories emit primarily toxic air pollutants. A total of 26 toxic air pollutants have been identified that are emitted from existing INEL facilities in quantities exceeding the screening level established by the State of Idaho. (The health hazard associated with toxic air pollutants emitted in lesser quantities is considered low enough by the State of Idaho not to require detailed assessment.) Waste management, construction, and related activities (such as excavation) also generate fugitive particulate matter.

a. Ozone is formed by reactions of oxides of nitrogen and oxygen in the presence of sunlight. Volatile organic hydrocarbons, sometimes called precursor organics, contribute to the formation of ozone. Oxides of nitrogen and volatile organic hydrocarbons are, therefore, regulated as precursors to ozone formation.

Baseline emission rates for existing facilities have been characterized for two separate cases. The *actual emissions case* represents the collective emission rates of nonradiological pollutants experienced by INEL facilities during 1991 for criteria pollutants and 1989 for toxic air pollutants. These are the most recent years for which complete data are available. In contrast to this actual case, emissions have also been estimated for a hypothetical maximum year. This is appropriate because many facilities that are governed by conditions imposed by operating permits (such as maximum hours of operation or emission rates) typically operate at levels well below those allowed by the permit. It is conceivable that emission rates of currently operated facilities could increase greatly and still remain within the bounds of permitted conditions. The *maximum emissions case* has, therefore, been characterized. This baseline case represents a scenario in which all permitted sources at the INEL are assumed to operate in such a manner that they emit specific pollutants to the maximum extent allowed by operating permits or applicable regulations. The baseline also includes projected increases (that is, emissions from projects expected at the time the analysis was performed to become operational before June 1, 1995.) A summary of criteria and toxic air pollutant emission rates for the actual and maximum emissions cases, including projected increases, is provided in Table 4.7-2.

4.7.4.2 Existing Conditions. For most of the pollutants included in this assessment (including all toxic air pollutants), insufficient monitoring data exist to allow a meaningful description of existing air quality. Rather, the characterization of existing nonradiological conditions relies on an extensive program of air dispersion modeling. The modeling program applied for this purpose utilized computer codes, methods, and assumptions that are considered acceptable by the U.S. Environmental Protection Agency and the State of Idaho for regulatory compliance purposes. In general, the Industrial Source Complex-2 (ISC-2) model was used for assessment of criteria pollutants and selected toxic air pollutants; the Fugitive Dust Model (FDM) was used to assess impacts due to fugitive dust emissions; and the simpler SCREEN model was used to assess other toxic air contaminants. The SCREEN model incorporates methods and data that tend to overestimate impacts, and it is useful for identifying cases that require additional, more refined (ISC-2) assessment. The methodology applied in these assessments is described in detail in Appendix F, Section F-3, Air Resources, of Volume 2 of this EIS. The remainder of this section describes the results of the air dispersion modeling effort in terms of air quality conditions associated with the actual and maximum baseline cases. In particular, assessment results are presented for concentrations of pollutants in air within and around the INEL site.

Table 4.7-2. Annual average and maximum hourly emission rates of nonradiological air pollutants for the actual and maximum baseline cases at the Idaho National Engineering Laboratory.

Pollutant	Actual case		Maximum case		Projected increases[a]	
	Annual average (kilograms per year)	Maximum hourly (kilograms per hour)	Annual average (kilograms per year)	Maximum hourly (kilograms per hour)	Annual average (kilograms per year)	Maximum hourly (kilograms per hour)
Criteria pollutants						
Carbon monoxide	300,000	150	2,200,000	250	1,300	27
Nitrogen dioxide	740,000	450	3,000,000	780	4,400	95
Sulfur dioxide	200,000	120	1,700,000	350	2,100	16
Particulate matter[b]	300,000	220	900,000	290	2,400	9.8
Lead	4.1	0.084	68	0.8	6.9	7.8×10^{-4}
Toxic pollutants[c]						
Acetaldehyde	31	0.39	180	0.68	0	0
Ammonia	1,600	3.4	6,500	3.4	0	0
Arsenic	4.2	9.0×10^{-4}	24	6.3×10^{-3}	0	0
Benzene	340	15	530	16	30	0.86
1,3-Butadiene	220	0.81	390	1.8	0	0
Carbon tetrachloride	28	0.083	28	0.083	4.5×10^{-5}	9.1×10^{-7}
Chloroform	1.9	5.5×10^{-3}	1.9	5.5×10^{-3}	0.045	4.5×10^{-6}
Chromium - trivalent	3.1	2.5×10^{-3}	38	0.013	0.0295	3.4×10^{-6}
Chromium - hexavalent	0.4	6.2×10^{-4}	26	7.2×10^{-3}	0.0016	1.8×10^{-7}
Cyclopentane	350	0.58	350	0.58	0	0
Dichloromethane	620	0.29	1,100	0.29	0.0091	4.1×10^{-5}
Formaldehyde	740	1.3	3,300	2.7	220	7.6
Hydrazine	8.3	9.5×10^{-4}	8.3	9.5×10^{-4}	0	0
Hydrochloric acid	1,500	0.34	1,500	0.34	0	0
Mercury	200	0.023	200	0.023	0	0
Napthalene	16	2.2	16	2.2	0	0
Nickel	270	0.057	1,000	0.24	0.35	4.5×10^{-5}
Nitric acid	1,500	1.7	97,000	12	0	0
Phosphorus	56	0.024	210	0.072	0	0
Potassium hydroxide	990	0.24	2,100	0.24	0	0
Propionaldehyde	62	0.24	110	0.41	0	0
Styrene	4.7	0.74	4.7	0.74	0	0
Tetrachloroethylene	980	0.11	980	0.11	0	0
Toluene	580	56	580	56	0	0
Trichloroethylene	4.5	0.013	4.5	0.013	0.18	6.4×10^{-5}
Trimethylbenzene	87	12	87	12	0	0

a. Increases include the Fuel Cycle Facility at Argonne National Laboratory-West; the INEL Research Center expansion; and the Utility Systems Upgrade Project at the Idaho Chemical Processing Plant, as well as existing facilities that became operational after the baseline year.
b. All particulate matter is assumed to consist of respirable particles less than 10 microns in diameter (that is, PM-10); includes PM-10 emissions from fugitive sources.
c. Toxics that are listed in State of Idaho regulations and are emitted in levels that exceed screening criteria.

4.7.4.2.1 Onsite Conditions—The existing conditions have been assessed for each facility area as a result of cumulative emissions from sources located within that area as well as other areas of the INEL site. Except for public roads, criteria pollutant levels are not assessed for onsite locations because standards for these pollutants apply only to ambient air locations (that is, locations to which the general public has access). Toxic air pollutants, however, are assessed because of potential exposure of workers to these hazardous substances. Typically, the dominant contributors to pollutant levels at each of these areas are sources within that area. Onsite levels of specific toxics are compared to occupational exposure limits set for these substances by either the Occupational Safety and Health Administration (OSHA) or the American Conference of Government Industrial Hygienists. (The lower of the two limits is used.)

Results of the onsite assessment for both the actual and maximum emissions are presented in Table 4.7-3. For most of the toxics, the estimated onsite concentrations of toxic air pollutants are well below levels established for protection of workers. The maximum short-term benzene concentration (that is, the highest level predicted to occur over an eight-hour period) slightly exceeds the standard at the highest predicted location within the Central Facilities Area. These levels result primarily from emissions associated with petroleum fuel storage, handling, and combustion. All other toxic pollutant levels at onsite locations are well within the most restrictive occupational exposure limits.

4.7.4.2.2 Offsite Conditions—Estimated maximum offsite pollutant concentrations were calculated for locations along the INEL site boundary and for public roads within the site boundary. These are considered ambient air locations because the public has general access. Pollutant levels were also calculated for Craters of the Moon Wilderness Area. The results for criteria pollutants are presented in Table 4.7-4 and indicate that all concentrations are well within the ambient air quality standards for both the actual and maximum emissions cases. For the maximum emissions baseline, the highest sulfur dioxide concentration (over a 3-hour period) at the site boundary is about 13 percent of the standard, while the highest 24-hour particulate matter level is about 33 percent of the standard. Levels of all other pollutants are below 12 percent of applicable standards. The highest offsite levels are estimated to occur at the boundary south and south-southwest of the Central Facilities Area. Somewhat higher results were obtained for public roads traversing the site, with 24-hour particulate matter at 53 percent of the standard and 3- and

Table 4.7-3. Highest predicted concentrations of toxic air pollutants at onsite locations for the maximum baseline case at the Idaho National Engineering Laboratory site, including anticipated increases to the baseline.

Toxic air pollutant	Location of maximum concentration[a]	Maximum eight-hour concentration ($\mu g/m^3$)	Occupational exposure limit[b] ($\mu g/m^3$)	Percent of standard
Carcinogens				
Acetaldehyde	ANL-W	1.1×10^2	1.8×10^5	<1
Arsenic	CFA	2.8×10^{-1}	1.0×10^1	3
Benzene	CFA	3.1×10^3	3.0×10^3	103
Butadiene	TRA	3.8×10^3	2.2×10^4	17
Carbon tetrachloride	RWMC	2.5×10^2	1.3×10^4	2
Chloroform	RWMC	1.7×10^1	9.8×10^3	<1
Formaldehyde	ANL-W	5.7×10^1	9.0×10^2	6
Hexavalent chromium	ICPP/TAN	2.4×10^0	5.0×10^1	5
Hydrazine	TRA	1.8×10^{-3}	1.0×10^2	<1
Methylene chloride	CFA/ICPP	3.2×10^0	1.7×10^5	<1
Nickel	CFA	4.1×10^1	1.0×10^2	41
Perchloroethylene	CFA	4.3×10^2	1.7×10^5	<1
Trichloroethylene	RWMC	4.0×10^1	2.7×10^5	<1
Noncarcinogens				
Ammonia	ICPP	9.7×10^2	1.7×10^4	6
Cyclopentane	CFA	1.1×10^3	1.7×10^6	<1
Hydrochloric acid	CFA	1.1×10^2	7.0×10^3	2
Mercury	ICPP	3.0×10^0	5.0×10^1	6
Naphthalene	CFA	2.3×10^3	5.0×10^4	5
Nitric acid	ICPP	7.7×10^2	5.0×10^3	15
Phosphorus	TAN	5.5×10^1	1.0×10^2	55
Potassium hydroxide	ANL-W	1.4×10^1	2.0×10^3	<1
Styrene	PBF	3.5×10^2	2.1×10^5	<1
Toluene	CFA	2.5×10^4	1.9×10^5	13
Trimethylbenzene	CFA	1.3×10^4	1.2×10^5	11
Trivalent chromium	TAN	6.3×10^0	5.0×10^2	1

a. ANL-W = Argonne National Laboratory-West; PBF = Power Burst Facility; ICPP = Idaho Chemical Processing Plant; CFA = Central Facilities Area; TRA = Test Reactor Area; TAN = Test Area North; RWMC = Radioactive Waste Management Complex.

b. Occupational exposure limits are eight-hour, time-weighted averages established by the American Conference of Governmental Industrial Hygienists (ACGIH) or Occupational Safety and Health Administration (OSHA); the lower (most restrictive) of the two limits is used.

Table 4.7-4. Ambient air concentrations of criteria pollutants for the maximum baseline scenario at the Idabo National Engineering Laboratory site, including anticipated increases to the baseline.

		Baseline concentration ($\mu g/m^3$)				Approximate percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Applicable standard[a] ($\mu g/m^3$)	Site boundary	Public roads	Craters of the Moon
Carbon monoxide	One-hour	362	614	134	40,000	0.9	2	0.3
	Eight-hour	104	284	28	10,000	1	3	0.3
Nitrogen dioxide	Annual	1	4	0.2	100	1	4	0.2
Lead	Quarterly	0.0002	0.001	<0.0001	1.5	0.01	0.1	<0.01
Particulate matter[b]	24-hour	13	33	3	150	9	22	2
	Annual	1	3	0.1	50	1	6	0.2
Particulate maner[c]	24-hour	50	80[d]	10	150	33	53	7
	Annual	2	5[d]	1	50	4	10	2
Sulfur dioxide	Three-hour	168	579	60	1,300	13	45	5
	24-hour	43	135	10	365	12	37	3
	Annual	2	6	0.3	80	3	8	0.4

a. National Ambient Air Quality Standards; all standards are primary except for three-hour sulfur dioxide, which is secondary.
b. Particulate matter from stationary emission points. All particulate matter is assumed to consist of respirable particles less than 10 microns in diameter (that is, PM-10). The State of Idaho also has a standard for total suspended particulates, but the Federal standard for PM-10 is more restrictive.
c. Cumulative contributions from stationary point sources, fugitive emissions sources (such as vehicle travel on paved and unpaved roads), and landfills and concrete batch plant operations.
d. Does not include fugitive emissions caused by vehicular traffic.

24-hour sulfur dioxide at 45 and 37 percent of the standard, respectively Values at the Craters of the Moon Wilderness Area were below 10 percent of applicable standards in all cases. It should be noted that actual emissions from INEL site facilities are much lower than those assumed for the maximum scenario, so there is a wide margin of protection inherent in these results. Figure 4.7-4 illustrates the difference in actual and maximum emissions for criteria and toxic air pollutants.

Concentrations of criteria pollutants from certain sources are also compared to Prevention of Significant Deterioration (PSD) regulations, which have been established to ensure that air quality remains good in those areas where ambient air quality standards are not exceeded. (See Section F-3.3.1.2 for a description of these regulations.) These Prevention of Significant Deterioration increments are allowable increases over baseline conditions from sources that have become operational after certain baseline dates. Increments have been established by Federal and State

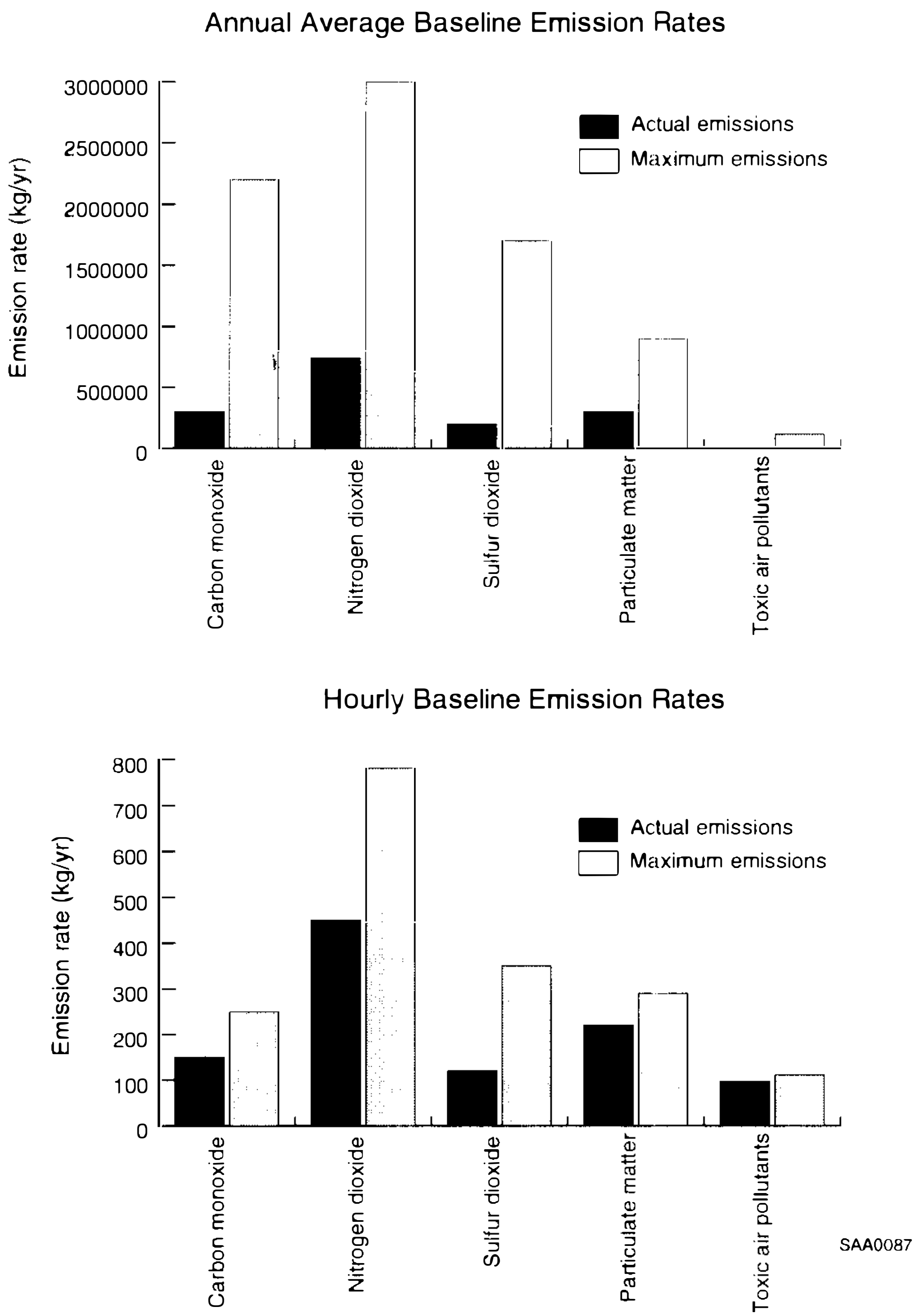


Figure 4.7-4. Comparison of actual emission rates for criteria and toxic air pollutants at the Idaho National Engineering Laboratory site with the rates assumed for the maximum emissions scenario.

regulations for sulfur dioxide, total suspended particulates, and nitrogen dioxide, and by Federal regulations for respirable particulate matter. Separate increments are established for pristine areas, such as national parks or wilderness areas (termed Class I areas) and for the nation as a whole (Class II areas). Craters of the Moon Wilderness Area is the Class I area nearest the INEL site. The amount of increment consumed by existing sources subject to Prevention of Significant Deterioration regulation has been assessed (Raudsep et al. 1995). These results are presented in Tables 4.7-5 and 4.7-6 for Class I and II areas, respectively, for all increment consuming sources projected as of May 1, 1994. The amount of increment consumed for Prevention of Significant Deterioration sources operating at maximum allowable emission rates is less than 10 percent of the allowable increment for all annual evaluations but somewhat higher for short-term assessments. The maximum increment consumed at Craters of the Moon is 53 percent of the 3-hour sulfur dioxide level and, in Class II areas, 43 percent of the 24-hour level for respirable particulate matter.

Concentrations of toxic air pollutants are compared to the ambient air standards recently promulgated for new sources by the State of Idaho Rules for Control of Air Pollution in Idaho (IDHW 1994). These standards are increments that apply only to new or modified sources and not to existing emissions. Nevertheless, these increments are useful as reference levels for comparing current conditions with recommendations for ensuring public health protection in association with new sources of emissions. Thus, the discussion that follows refers to these increments as reference levels. Annual average concentrations of carcinogenic toxics are assessed for offsite locations (site boundary and Craters of the Moon Wilderness Area), while levels of noncarcinogenic toxics are assessed for locations along public roads as well as offsite locations.

Maximum offsite concentrations of carcinogenic toxics, which are summarized in Table 4.7-7, are observed to occur at the site boundary due south of the Central Facilities Area. All carcinogenic air pollutant levels are below the reference levels. Noncarcinogenic air pollutant levels are summarized in Table 4.7-8. For site boundary locations, these levels are all well below the reference levels (1 percent or less). Levels at some public road locations, which are closer to emissions sources, are higher than site boundary locations, but still well below the reference levels. All pollutant levels estimated for Craters of the Moon Wilderness Area are much less than 1 percent of the reference levels suitable for comparison.

Table 4.7-5. Prevention of Significant Deterioration (PSD) increment consumption at the Craters of the Moon Wilderness (Class I) Area by existing sources subject to Prevention of Significant Deterioration regulation.[a]

Pollutant	Averaging time	PSD increment[b] ($\mu g/m^3$)	Maximum predicted concentration ($\mu g/m^3$)	Percent of PSD increment consumed
Sulfur dioxide	3-hour	25	13	53
	24-hour	5	2	40
	Annual	2	0.08	4
Respirable particulates[c]	24-hour	8	0.94	12
	Annual	4	0.015	0.4
Total suspended particulates	24-hour	10	0.94	9.4
	Annual	5	0.015	0.3
Nitrogen dioxide	Annual	2.5	0.003	0.1

a. Source: Raudsep et al. (1995).
b. All increments specified are State of Idaho standards except those for respirable particulates, which were recently promulgated by the U.S. Environmental Protection Agency.
c. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).

Table 4.7-6. Prevention of Significant Deterioration (PSD) increment consumption at Class II areas at the Idaho National Engineering Laboratory site by existing sources subject to Prevention of Significant Deterioration regulation.[a]

Pollutant	Averaging time	PSD increment[b] ($\mu g/m^3$)	Maximum predicted concentration at the site boundary ($\mu g/m^3$)	Maximum predicted concentration along public roads ($\mu g/m^3$)	Amount of PSD increment consumed[c] ($\mu g/m^3$)	Percent of PSD increment consumed
Sulfur dioxide	3-hour	512	43	72	72	14
	24-hour	91	6.9	20	20	22
	Annual	20	0.49	1.8	1.8	9
Respirable particulates[d]	24-hour	30	3.7	13	13	43
	Annual	17	0.11	0.9	0.9	5.3
Total suspended particulates	24-hour	37	3.7	13	13	35
	Annual	19	0.11	0.9	0.9	4.7
Nitrogen dioxide	Annual	25	0.03	0.22	0.2	0.9

a. Source: Raudsep et al. (1995).
b. All increments specified are State of Idaho standards except those for respirable particulates, which were recently promulgated by the U.S. Environmental Protection Agency.
c. The highest value of either the site boundary or public road locations is used.
d. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).

Table 4.7-7. Highest predicted concentrations of carcinogenic air pollutants at site boundary locations for the maximum baseline case at the Idaho National Engineering Laboratory site, including anticipated increases to the baseline.

Toxic air pollutant	Annual average concentration ($\mu g/m^3$)	Standard[a] ($\mu g/m^3$)	Percent of standard
Acetaldehyde	1.1×10^{-2}	4.5×10^{-1}	2
Arsenic	9.0×10^{-5}	2.3×10^{-4}	39
Benzene	2.9×10^{-2}	1.2×10^{-1}	24
Butadiene	1.0×10^{-3}	3.6×10^{-3}	28
Carbon tetrachloride	6.0×10^{-3}	6.7×10^{-2}	9
Chloroform	4.0×10^{-4}	4.3×10^{-2}	< 1
Formaldehyde	1.2×10^{-2}	7.7×10^{-2}	16
Hexavalent chromium	6.0×10^{-5}	8.3×10^{-5}	72
Hydrazine	1.0×10^{-6}	3.4×10^{-4}	< 1
Methylene chloride	6.0×10^{-3}	2.4×10^{-1}	3
Nickel	2.7×10^{-3}	4.2×10^{-3}	65
Perchloroethylene	1.1×10^{-1}	2.1×10^{0}	5
Trichloroethylene	9.7×10^{-4}	7.7×10^{-2}	1

a. Acceptable ambient concentrations for carcinogens (AACC) listed in Rules for the Control of Air Pollution in Idaho. Acceptable ambient concentrations for carcinogens are increments that apply only to new (not existing) sources and are used here only as reference levels.

Table 4.7-8. Highest predicted concentrations of noncarcinogenic toxic air pollutants at site boundaries and public road locations at the Idaho National Engineering Laboratory site, including anticipated increases to the baseline.

Toxic air pollutant	Location	Annual average concentration ($\mu g/m^3$)	Standard[a] ($\mu g/m^3$)	Percent of standard
Ammonia	Public road	6.0×10^{0}	1.8×10^{2}	3
	Site boundary	4.1×10^{-1}		<1
Cyclopentane	Public road	2.7×10^{0}	1.7×10^{4}	<1
	Site boundary	3.9×10^{-2}		<1
Hydrochloric acid	Public road	9.8×10^{-1}	7.5×10^{0}	13
	Site boundary	9.7×10^{-2}		1
Mercury	Public road	4.2×10^{-2}	1.0×10^{0}	4
	Site boundary	1.3×10^{-2}		1
Naphthalene	Public road	1.8×10^{1}	5.0×10^{2}	4
	Site boundary	1.9×10^{-3}		<1
Nitric acid	Public road	6.4×10^{-1}	5.0×10^{1}	1
	Site boundary	2.6×10^{-1}		<1
Phosphorus	Public road	3.0×10^{-1}	1.0×10^{0}	30
	Site boundary	8.9×10^{-3}		<1
Potassium hydroxide	Public road	2.0×10^{-1}	2.0×10^{1}	1
	Site boundary	2.0×10^{-1}		1
Proprionaldehyde	Public road	3.0×10^{-1}	4.3×10^{0}	7
	Site boundary	6.4×10^{-3}		<1
Styrene	Public road	1.3×10^{0}	1.0×10^{3}	<1
	Site boundary	2.4×10^{-4}		<1
Toluene	Public road	3.7×10^{2}	3.8×10^{3}	10
	Site boundary	6.2×10^{-2}		<1
Trimethylbenzene	Public road	1.0×10^{2}	1.2×10^{3}	8
	Site boundary	1.0×10^{-2}		<1
Trivalent chromium	Public road	3.6×10^{-2}	5.0×10^{0}	<1
	Site boundary	2.2×10^{-3}		<1

a. Acceptable ambient concentrations (AAC) listed in Rules for the Control of Air Pollution in Idaho (IDHW 1994). Acceptable ambient concentrations are increments that apply only to new (not existing) sources and are used here only as reference levels.

4.7.4.3 Summary of Nonradiological Air Quality. The baseline conditions of nonradiological air quality on and around the INEL site have been estimated for actual and maximum emissions scenarios. The air quality is good and within applicable guidelines. The area around the INEL site is in attainment or unclassified for all National Ambient Air Quality Standards. Levels of criteria pollutants are well within the ambient air quality standards for both scenarios. For toxic emissions, all INEL site boundary and public road levels are below reference levels appropriate for comparison. Within the INEL site, a very localized and slight exceedance occurs for levels of benzene at the Central Facilities Area. All other toxic pollutant levels at onsite locations are well below applicable limits. Health risks associated with maximum potential exposure levels in the onsite and offsite environments are described in Section 4.12, Health and Safety, of Volume 2 of this EIS.

4.8 Water Resources

This section describes existing regional and INEL site hydrologic conditions and discusses existing water quality for surface and subsurface water, water use, and water rights. The subsurface water section also describes the saturated zone below the water table and the vadose zone (or unsaturated zone and perched water bodies) located between the land surface and the water table. Technical support for this section is provided in Appendix F, Section F-2, Geology and Water, of Volume 2 of this EIS.

4.8.1 Surface Water

Other than intermittent streams and surface water bodies and manmade percolation, infiltration, and evaporation ponds, there is little surface water at the INEL site. The following sections discuss regional drainage conditions, local runoff, flood plains. and surface water quality. Figure 4.8-1 supports discussions in this section.

4.8.1.1 Regional Drainage. The INEL site is located in the Mud Lake-Lost River Basin, a closed drainage basin that includes three main tributaries—the Big and Little Lost Rivers and Birch Creek. These surface water features drain mountain watersheds located directly west and north of the INEL site. However, most of the surface water flow is diverted for irrigation before it reaches site boundaries (Barraclough et al. 1981), resulting in little or no surface water flow for periods of up to several years in duration within the boundaries of the INEL site (Pittman et al. 1988).

The Big Lost River drains approximately 376,000 hectares (1,450 square miles) of land before reaching the INEL site. Approximately 48 kilometers (30 miles) upstream of Arco, Idaho, Mackay Dam controls and regulates river flow, which continues southeast past the towns of Moore and Arco and onto the Eastern Snake River Plain. The river channel then crosses the southwestern boundary of the INEL site, where surface water flow can be controlled by the INEL Diversion Dam. During heavy runoff events, surface water is diverted to a series of natural depressions, designated as spreading areas. The purpose of the diversion system is to prevent flooding of downstream facilities and ice jams from developing in the channel. The Big Lost River continues northeasterly across the INEL site to an area of natural infiltration basins (playas or sinks) near Test Area North. Surface

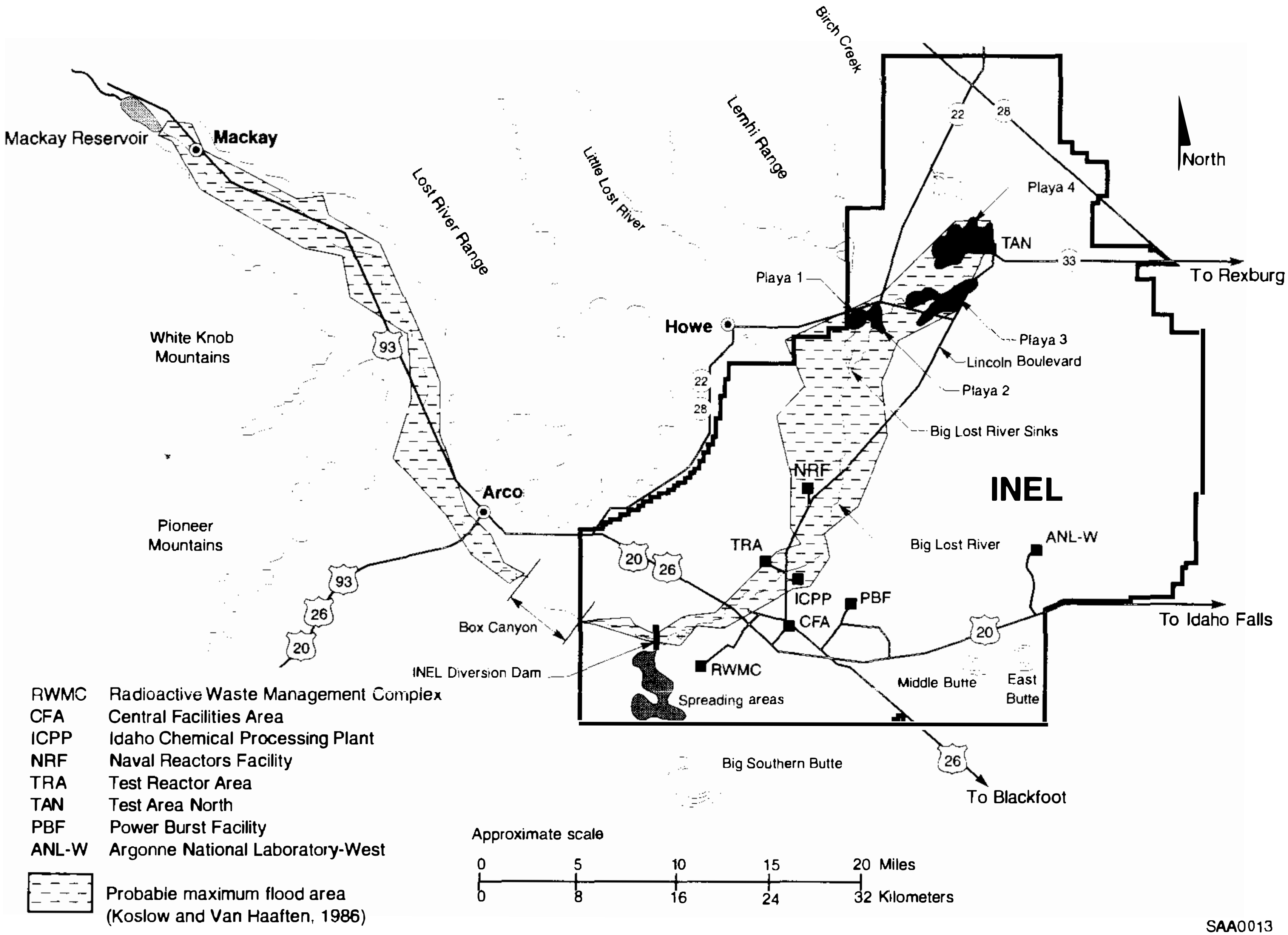


Figure 4.8-1. Locations of selected Idaho National Engineering Laboratory site facilities shown with the predicted inundation area for the probable maximum flood-induced overtopping failure of the Mackay Dam (Bennett 1990).

water from the Big Lost River does not usually reach the western boundary of the INEL site; however, during an unusually wet year, flow can continue as far north as the Birch Creek Playa (Playa 4). Because most of the INEL is located in a closed basin, surface water rarely, if ever, flows off the site.

Birch Creek drains an area of approximately 194,000 hectares (750 square miles). In the summer, upstream of the INEL site, surface water from Birch Creek is diverted for irrigation and hydropower production. In the winter, water flow crosses the northwest corner of the INEL site, entering a manmade channel constructed 6.4 kilometers (4 miles) north of Test Area North, where it then infiltrates into channel gravels, recharging the aquifer (Bishop 1993).

The Little Lost River drains an area of approximately 183,000 hectares (705 square miles). Streamflow is diverted for irrigation use north of Howe. Surface water from the Little Lost River has not reached the INEL site in recent times; however, during high stream flow years, water from the Little Lost River has reached the INEL site, where it then infiltrated into the subsurface (EG&G Idaho 1984).

4.8.1.2 Local Runoff. Surface water generated from local precipitation will flow into topographic depressions (lower elevations than the surrounding terrain) on the INEL site. This surface water either evaporates or infiltrates into the ground. Ponding of the runoff in a few low areas may increase subsurface moisture content, enhancing migration of localized contaminants in the unsaturated zone (Wilhelmson et al. 1993).

Localized flooding can occur at the INEL site when the ground is frozen and runoff from melting snow is combined with heavy spring rains. The Radioactive Waste Management Complex was flooded in 1962, 1969, and 1982 by local runoff from rapid spring thaws; and Test Area North was flooded in 1969 due to rapid snowmelt (Koslow and Van Haaften 1986). After the flooding events, the addition of dikes, diversion channels, settling basins, and sump pumps at the Subsurface Disposal Area at the Radioactive Waste Management Complex and Test Area North have alleviated snowmelt flooding at these facilities (Dames & Moore 1992, Koslow and Van Haaften 1986).

The Dames & Moore study (1992) evaluated the design of these flow systems for minimizing the potential for flood waters to come into contact with stored wastes and to ensure that flood-induced erosion did not expose buried or covered-up radioactive waste materials (Dames & Moore 1992, DOE 1990). Peak flows, water surface elevations, and velocities for the 100-, 500-, and 1,000-year floods, the one-half probable maximum flood, and the probable maximum flood were estimated at key locations along the Radioactive Waste Management Complex Main and East Channel flow systems. This analysis indicated that the existing Adams Boulevard culvert would be overtopped by the one-half probable maximum flood and probable maximum flood events, allowing for potential erosion in the vicinity. Field inspection of dikes, railroad embankments, and culverts indicated that these structures may not be able to withstand a severe flood event, for which their failure would result in higher flood peaks at downstream locations. Evaluation of the impacts of any potential overtopping breaches was beyond the scope of the study.

4.8.1.3 Flood Plains. Intermittent surface water flow and the INEL Diversion Dam (constructed in 1958 and enlarged in 1984) have effectively prevented flooding from the Big Lost River onto the INEL site. However, flooding from the Big Lost River might occur onsite if high water in the Mackay Dam or the Big Lost River were coupled with a dam failure. Koslow and Van Haaften (1986) examined the consequences of a Mackay Dam failure during a seismic event, structural failure coincident with the 100- and 500-year recurrence interval floods, and during a probable maximum flood (hypothetical flood that is considered to be the most severe event possible). The results from all dam failures studied indicate flooding would occur outside the banks of the Big Lost River from Mackay Dam to Test Area North, except within Box Canyon (Figure 4.8-1). The water velocity on the INEL site would range from 0.18 to 0.91 meters per second (0.6 to 3.0 feet per second), with water depths outside the banks of the Big Lost River ranging from 0.61 to 1.22 meters (2 to 4 feet) (Koslow and Van Haaften 1986). Because of the low velocity and shallow depth of the water, flooding would not pose a threat of structural damage to facilities.

An updated 100-year floodplain map for the Big Lost River is currently being developed by INEL personnel and is expected to be completed in 1996. The projects identified in Appendix C, Information Supporting the Alternatives, of Volume 2 of this EIS would be located using the most currently available floodplain information. Pending completion of the updated 100-year floodplain map, it is assumed that the area encompassed by the probable maximum flood is greater than that for the 100-year flood. As discussed above, the impact to INEL facilities from the probable maximum flood would be small.

4.8.1.4 Surface Water Quality. Water quality in the Big and Little Lost Rivers and Birch Creek is similar and has not varied a great deal over the period of record. Measured physical, chemical, and radioactive parameters have not exceeded applicable drinking water quality standards (USGS 1982-1993). Chemical composition is determined primarily by the carbonate mineral composition of the rocks in surrounding mountain ranges northwest of the INEL site and by the chemical composition of irrigation water return flow to the surface water (Robertson et al. 1974).

INEL site activities do not directly affect the quality of surface water outside the INEL site because surface water does not flow directly offsite (Hoff et al. 1990). Discharges from INEL site facilities are made to manmade seepage and evaporation basins, rather than to natural surface water bodies in accordance with the Clean Water Act. However, water from the Big Lost River System, as well as seepage from wastewater disposal facilities (in other words, percolation and evaporation ponds and septic tank systems) and storm water injection wells, does infiltrate into the Snake River Plain Aquifer (Robertson et al. 1974, Wood and Low 1988, Bennett 1990). These areas are inspected, monitored, and sampled as stipulated in the INEL Stormwater Pollution Prevention Program (DOE-ID 1993a).

4.8.2 Subsurface Water

Subsurface water at the INEL site occurs in the Snake River Plain Aquifer and the vadose zone. This section describes regional and local hydrogeologic conditions and subsurface water quality. Generally, the term groundwater refers to water in the saturated zone that enters freely into wells under confined and unconfined conditions (Driscoll 1986). Subsurface water in the vadose zone, or unsaturated zone, is referred to as vadose water. (See Section 4.8.2.5.3, Perched Water Quality, for a description of vadose zone hydrology.)

4.8.2.1 Regional Hydrogeology. The INEL site overlies the Snake River Plain Aquifer, the largest aquifer in Idaho (Figure 4.8-2). This aquifer underlies the Eastern Snake River Plain and covers an area of approximately 2,490,000 hectares (9,611 square miles). Groundwater in the aquifer generally flows to the south and southwest. Water storage in the aquifer is estimated at 2.5×10^{12} cubic meters (2 billion acre-feet), which is approximately the same as the volume of water contained in Lake Erie (Robertson et al. 1974). Irrigation wells can yield as much as

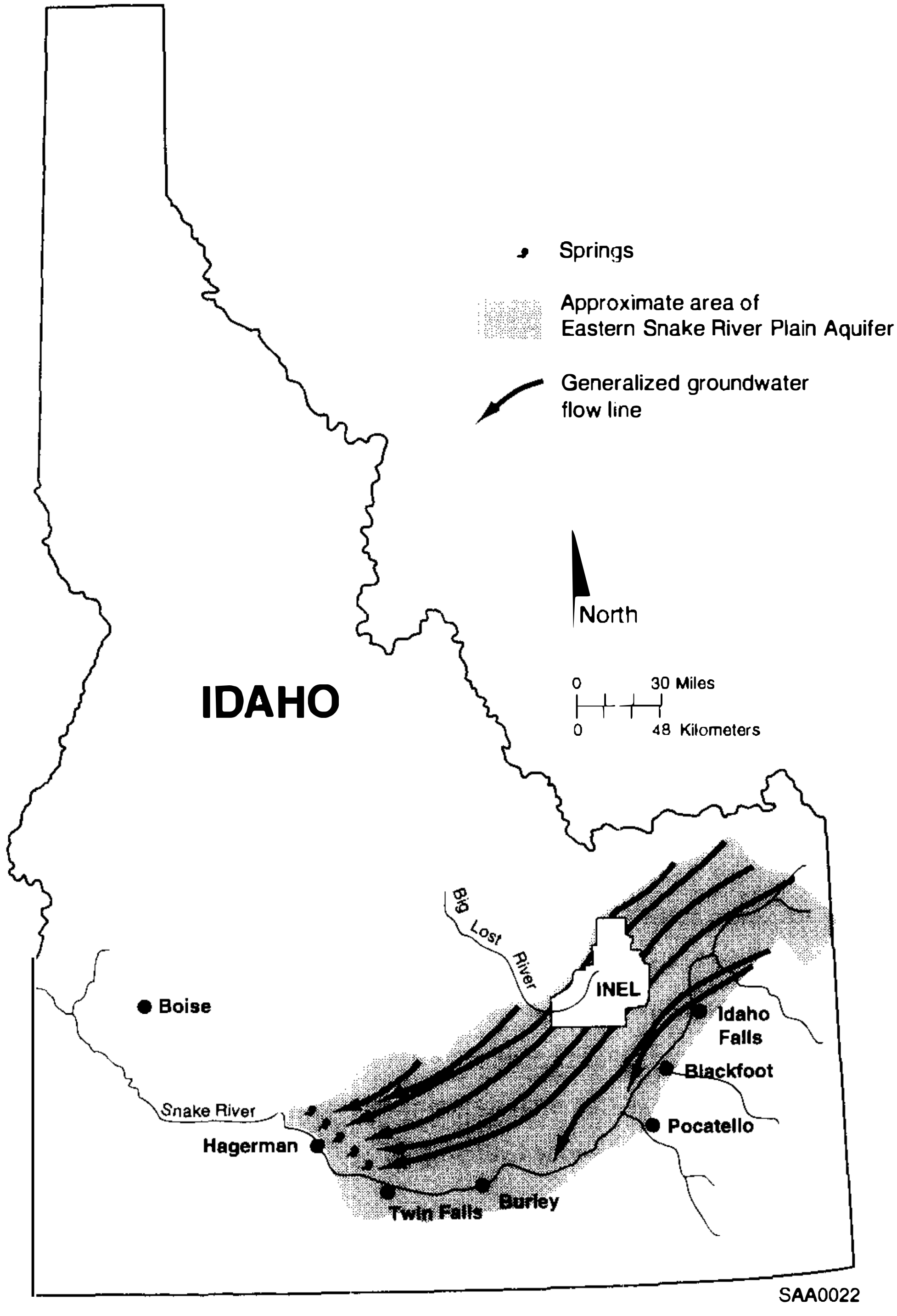


Figure 4.8-2. Location of the Idaho National Engineering Laboratory site, Eastern Snake River Plain, and generalized groundwater flow direction of the Snake River Plain Aquifer (Barraclough et al. 1981).

26.5 cubic meters per minute (7,000 gallons per minute) of water (Garabedian 1992). The Snake River Plain Aquifer is among the most productive aquifers in the nation.

The drainage basin recharging the Snake River Plain Aquifer covers an area of approximately 9,060,000 hectares (35,000 square miles). The aquifer is recharged by infiltration of irrigation water, seepage from stream channels and canals, underflow from tributary stream valleys extending into the watershed, and direct infiltration from precipitation (Garabedian 1992). Most recharge occurs in surface water-irrigated areas and along the northeastern margins of the plain. Groundwater is primarily discharged from the aquifer through springs that flow into the Snake River and pumping for irrigation. Major springs and seepages that flow from the aquifer are located near the American Falls Reservoir (southwest of Pocatello), the Thousand Springs area between Milner Dam and King Hill (near Twin Falls), and between Lorenzo and Louisville, along the Snake River.

4.8.2.2 Local Hydrogeology. The INEL site covers about 230,000 hectares (890 square miles) of the north-central portion of the Snake River Plain Aquifer. Depth to groundwater from the land surface at the INEL site ranges from approximately 61 meters (200 feet) in the north to over 274 meters (900 feet) in the south (Pittman et al. 1988). Groundwater flow is generally toward the south-southwest, and the upper surface is primarily unconfined (not overlain by impermeable soil or bedrock). However, the aquifer behaves as if it were partially confined because of localized geologic conditions (Whitehead 1987). The occurrence and movement of groundwater in the aquifer is dependent on the geologic setting and the recharge and discharge of water within that setting. Most of the aquifer is comprised primarily of numerous relatively thin, basaltic flows with interbedded sediments extending to depths of 1,067 meters (3,500 feet) below the land surface (Bishop 1993). A majority of the groundwater migrates horizontally through fractured interflow zones (broken and rubble zones) that occur at various depths. Water also migrates vertically along joints and the interfingering edges of interflow zones (Garabedian 1986). Sedimentary interbeds may restrict the vertical movement of groundwater.

The rate water moves through the ground depends on the hydraulic gradient (change in elevation and pressure with distance in a given direction) of the aquifer, the effective porosity (percentage of void spaces), and hydraulic conductivity (capacity of a porous media to transport water) of the sediments and basalt. The upper 61 to 244 meters (200 to 800 feet) of the basalts have a markedly higher hydraulic conductivity than rocks below 458 meters (1,500 feet). Therefore, the base of the aquifer is considered to range from 244 to 458 meters (800 to 1,500 feet) below land surface. Estimated flow rates within the aquifer range from 1.5 to 6.1 meters per day (5 to 20 feet per day) (Barraclough et al. 1981).

The ability to transmit water (transmissivity) and the ability to store water (storativity) are important physical properties of the aquifer. In general, the hydraulic characteristics of the aquifer allow water to be readily transmitted, particularly in the upper portions. The variability in how the aquifer transmits and stores water increases the difficulty in aquifer investigations and modeling.

Near the INEL site, the aquifer is recharged by irrigation return and precipitation in the mountains to the west and north. Most of the inflow to the aquifer results from underflow of groundwater along alluvial-filled valleys adjacent to the Eastern Snake River Plain and secondarily from adjacent surface water drainages (that is, Big and Little Lost Rivers and Birch Creek). Recharge at the INEL site is also related to the amount of precipitation, particularly snowfall, for a given year (Barraclough et al. 1981).

4.8.2.3 Vadose Zone Hydrology. The vadose zone (unsaturated zone) extends from the land surface down to the regional water table. Within the vadose zone, the geologic materials are occupied partially by water and partially by air. Subsurface water occurring in the vadose zone is referred to as vadose water. This complex zone at the INEL site consists of surface sediments (primarily clay and silt, with some sand and gravel) and numerous relatively thin, basaltic flows, with some sedimentary interbeds. Thick surficial deposits are found in the northern part of the INEL site, which thin southward where basalt is exposed at the surface.

The vadose zone protects the groundwater by filtering out many contaminants through adsorption, buffering dissolved chemical wastes, and slowing the transport of contaminated liquids to the aquifer. The vadose zone also protects the aquifer by slowing the migration of large volumes of liquid or dissolved contaminants released to the environment through spills or migration from disposal pits or ponds, allowing natural decay processes to occur.

Travel times for water through the vadose zone are important for understanding contaminant movement. The flow rates in the vadose zone are directly dependent on the extent of fracturing and clay coatings on the fractures, the percentage of sediments versus basalt, and the moisture content of vadose zone material. Flow increases under wetter conditions and slows under dryer conditions. For example, under unsaturated flow conditions near the Radioactive Waste Management Complex, an investigation into water movement in surface sediments found that infiltration ranged from 0.36 to 1.1 centimeters per year (0.14 to 0.43 inches per year) (Cecil et al. 1992). However, under nearly saturated conditions in surface sediments, standing water at land surface in the same area moved vertically 2.1 meters (6.9 feet) in less than 24 hours (Kaminsky 1991). Under saturated conditions and matrix flow, over 100 days were required for saturation of a 50-centimeter- (20-inch)-long basalt rock from the Radioactive Waste Management Complex (Bishop 1991).

4.8.2.4 Perched Water. Locally, saturated conditions may exist within the vadose zone above the water table and are called perched water. Perched water occurs when water migrates vertically and laterally from the surface until it encounters an impermeable layer of dense basalt or fine sedimentary material (Bishop 1993). Perched water may spread laterally, sometimes hundreds of meters, and then move over the edges of the impermeable layer and continue downward. Several perched water bodies can form between the land surface and the water table.

In general, the formation of perched water bodies slows the downward migration of fluids that infiltrate into the vadose zone from the surface. The largest occurrence of perched water at the INEL site is generally related to the presence of disposal ponds or other surface water bodies but can also be related to vadose zone disposal wells. These bodies have been detected at the Idaho Chemical Processing Plant, Test Reactor Area, Test Area North, and Radioactive Waste Management Complex (Bishop 1993). For example, a field study performed in 1986 at the Idaho Chemical Processing Plant showed that perched water occurs in three areas at possibly three depth zones. These bodies are located at depths ranging from approximately 9 meters (30 feet) to 98 meters (322 feet) below ground surface and extend laterally as much as 1.097 meters (3,600 feet) (Bishop 1993). In general, the chemical concentrations, shape, and size of these bodies have fluctuated over time in response to the volume of water discharged to the infiltration ponds.

4.8.2.5 Subsurface Water Quality. Subsurface water quality is affected by natural water chemistry and contaminants originating at the INEL site. Monitoring programs are conducted under the INEL Groundwater Protection Management Program (Case et al. 1990). Under this program, the INEL Groundwater Monitoring Plan (Sehlke and Bickford 1993) was established to fulfill the groundwater monitoring requirements of DOE Order 5400.1, "General Environmental Protection

Program" (DOE 1990). As specified in the plan, samples are collected from surface water, perched water, and aquifer wells to identify contaminants and contaminant migration to and within the aquifer.

4.8.2.5.1 Natural Water Chemistry—The natural groundwater chemistry of the Snake River Plain Aquifer beneath the INEL site is determined by several factors. These factors include the weathering reactions that occur as water interacts with minerals in the aquifer and the chemical composition of (a) groundwater originating outside of the INEL site, (b) precipitation falling directly on the land surface, and (c) streams, rivers, and runoff infiltrating into the aquifer (Wood and Low 1986, 1988). The chemistry of the groundwater is different, depending on the source areas. For example, groundwater from the northwest contains calcium, magnesium, and bicarbonate leached from sedimentary rocks; and groundwater from the east contains sodium, fluorine, and silicate resulting from contact with volcanic rocks (Robertson et al. 1974).

The natural chemistry affects the mobility of contaminants introduced into the subsurface from INEL site activities. Many dissolved contaminants are adsorbed (or attached) to the surface of rocks and minerals in the subsurface, thereby retarding the movement of contaminants in the aquifer and inhibiting further migration of contamination. However, many naturally occurring chemicals compete with contaminants for adsorption sites on the rocks and minerals or react with contaminants to reduce their attraction to the rock and mineral surfaces.

4.8.2.5.2 Groundwater Quality—Previous waste discharges to unlined ponds and injection wells have introduced radionuclides, nonradioactive metals, inorganic salts, and organic compounds into the subsurface. Solid low-level and transuranic wastes have also been disposed of in several pits at the Subsurface Disposal Area within the Radioactive Waste Management Complex since 1952. (Transuranic waste disposal at the Complex was discontinued in 1970; however, disposal of low-level waste is projected to continue until 2020.) Table 4.8-1 summarizes highest detected concentrations of contaminants observed in the aquifer between 1985 and 1992, concentrations near the INEL site boundary, existing U.S. Environmental Protection Agency maximum contaminant levels, and DOE Derived Concentration Guides. The following paragraphs discuss each category of contaminants and comparisons of observed concentrations to maximum contaminant levels. Trends in groundwater quality are discussed in Section 5.8, Water Resources.

Table 4.8-1. Summary of highest detected contaminant concentrations in groundwater within the Idaho National Engineering Laboratory site (1985 to 1992).

Parameter	Highest detected recent concentration[a] (year)	Recent boundary concentration (year)	Current maximum contaminant level (MCL)	Derived concentration guide (DCG)
Radionuclides in picocuries per liter				
Americium-241	0.91[b] (1990)	< detection limit[c] (1988)	15[d,e]	30[f]
Cesium-137	2,050[b] (1992)	< detection limit[c] (1986)	200[g]	3,000[f]
Cobalt-60	890[b] (1987)	< detection limit[c] (1987)	100[g]	10,000[f]
Iodine-129	3.6[b] (1987)	0.00083-Background[h] (1992)	1[g]	500[f]
Plutonium-238	1.28[b] (1990)	< detection limit[c] (1988)	15[d,e]	40[f]
Plutonium-239/240	1.08[b] (1990)	< detection limit[c] (1988)	15[d,e]	30[f]
Strontium-90	640[b] (1992)	< detection limit[c] (1988)	8[g,i]	1,000[f]
Tritium	48,000[b] (1988)	Background[j] (1988)	20,000[e,g]	2,000,000[f]
Nonradioactive metals in milligrams per liter				
Cadmium	0.0073[b] (1992)	Background[c] (1988)	0.005[d]	Not applicable
Chromium (total)	0.21[b] (1988)	Background[c] (1988)	0.1[d]	Not applicable
Lead	0.009[b] (1987)	Background[c] (1987)	0.015[g,k]	Not applicable
Mercury	0.0004[b] (1987)	Background[c] (1987)	0.002[d]	Not applicable
Inorganic salts in milligrams per liter				
Chloride	200[b] (1991)	—	250[d]	Not applicable
Nitrate	5.4[b] (as N) (1988)	Background[l] (1988)	10 (as N)[d]	Not applicable
Sulfate	140[m] (1985)	Background[l] (1985)	250[d]	Not applicable
Organic compounds in milligrams per liter				
Carbon tetrachloride	0.0066[b] (1993)	< detection limit[n] (1988)	0.005[d]	Not applicable
Chloroform	0.951[n] (1988)	< detection limit[n] (1988)	0.1[d,o]	Not applicable
1,1-dichloroethylene	0.009[b] (1989)	< detection limit[n] (1989)	0.007[d]	Not applicable
Cis-1,2-dichloroethylene	3.9[b] (1992)	< detection limit[n] (1988)	0.07[d]	Not applicable
Trans-1,2-dichloroethylene	2.6[b] (1988)	< detection limit[n] (1988)	0.1[d]	Not applicable
Tetrachloroethylene	0.051[b] (1992)	< detection limit[n] (1988)	0.005[d]	Not applicable
1,1,1-trichloroethane	0.012[b] (1989)	< detection limit[n] (1988)	0.2[d]	Not applicable
Trichloroethylene	4.6[b] (1992)	< detection limit[n] (1989)	0.005[d]	Not applicable
Vinyl chloride	0.027[n] (1989)	< detection limit[n] (1989)	0.002[d]	Not applicable

a. Concentrations are generally for the period 1987 to 1992.
b. Values taken from Golder (1994).
c. Values taken from Orr and Cecil (1991).
d. MCL values taken from EPA (1993).
e. Maximum contaminant levels have not been established for plutonium-238, plutonium-239, plutonium-240, and americium-241. However, these radionuclides have not been detected above the established limits for gross alpha particle activity or the proposed adjusted gross alpha activity maximum contaminant limits for drinking water.
f. DCGs for radionuclides taken from DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993).
g. MCL values taken from 40 CFR 141 (CFR 1993).
h. Value taken from Mann (1994).
i. Calculated value based on total body or organ doses of 4 millirem per year.
j. Value taken from Mann and Cecil (1990).
k. Lead action level.
l. Values taken from Robertson et al. (1974); Edwards et al. (1990).
m. Values taken from Pittman et al. (1988).
n. Values taken from Mann (1990) and Liszewski and Mann (1992).
o. Value is for total trihalomethanes, which is the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform).

Radionuclides. Radionuclide concentrations in the Snake River Plain Aquifer beneath the INEL 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 (Pittman et al. 1988, Orr and Cecil 1991). Radionuclides released and observed in the groundwater include tritium, strontium-90, iodine-129, cobalt-60, cesium-137, plutonium-238, plutonium-239/240, and americium-241 (Golder 1994). Most of the radionuclides released have been observed at the Idaho Chemical Processing Plant and Test Reactor Area facility areas. However, radionuclides have also been observed in the Test Area North disposal well, near the Central Facilities Area, and in perched water near the Radioactive Waste Management Complex.

Concentrations of radionuclides in the aquifer have decreased over time. This decrease is attributed to reduced discharges, adsorption, radioactive decay, and improved waste management practices. As of 1992, concentrations of iodine-129, cobalt-60, tritium, strontium-90, and cesium-137 exceeded the U.S. Environmental Protection Agency maximum contaminant levels for radionuclides in drinking water in localized areas inside the INEL site boundary (Mann et al. 1988, Orr and Cecil 1991). Plutonium-238, plutonium-239/240, and americium-241 have not been detected at concentrations above the maximum contaminant levels at the INEL site (Golder 1994).

Extremely low concentrations of iodine-129 and tritium have migrated outside of INEL site boundaries. In 1992, iodine-129 concentrations were measured in two wells south of the INEL site boundary below the U.S. Environmental Protection Agency's maximum contaminant level, as follows: (a) 10×10^{-6} picocuries per liter in Well No. 11, located approximately 6 kilometers (4 miles) beyond the boundary, and (b) 30×10^{-6} picocuries per liter in Well No. 14, located 13 kilometers (8 miles) beyond the boundary (Mann 1994). Tritium concentrations were observed much below maximum contaminant levels just south of the INEL site boundary in 1985. By 1988, the tritium plume encompassed by the 500-picocuries-per-liter contour was back inside the INEL site boundary, and its size has continued to decrease (Orr and Cecil 1991). Cobalt-60, strontium-90, cesium-139, plutonium-238, plutonium-240/241, and americium-241 have not been detected outside the INEL site boundaries.

Nonradioactive Metals. Sodium, chromium, lead, and mercury have been released on the INEL site and into the subsurface through unlined ponds and deep wells. Of these metals, sodium was released in the greatest quantity from water treatment processes; however, it is not considered toxic and does not have an established maximum contaminant level. In 1988, chromium concentrations exceeding the maximum contaminant level were measured near the Test Reactor Area. Lead and mercury have been observed at concentrations below the maximum contaminant level near the Idaho Chemical Processing Plant (Orr et al. 1991).

Inorganic Salts. Chloride, sulfate, and nitrate have been released into the subsurface by human activities at the INEL site. Although chloride and sulfate have been released, only nitrate has exceeded maximum contaminant levels (near the Idaho Chemical Processing Plant in 1981). Disposal of nitrates to the injection well and infiltration ponds at the Idaho Chemical Processing Plant accounts for the elevated nitrate levels in the central portion of the INEL site. Since 1988, the levels of nitrate have decreased to below the maximum contaminant level as a result of reduced disposal rates.

Organic Compounds. Concentrations of volatile organic compounds have been detected in the aquifer beneath the INEL site. Many of these compounds were detected at amounts near the detection limit (0.002 milligrams per liter), which is the lowest concentration at which a contaminant can be detected by a specific analytical method. However, concentrations of the following compounds exceeding the maximum contaminant levels have been observed in and near the Test Area North disposal well: chloroform, 1,2-cis-dichloroethylene, 1,1-dichloroethylene, 1,2-transdichloroethylene, trichloroethylene, tetrachloroethylene, and vinyl chloride (Leenheer and Bagby 1982, Mann and Knobel 1987, Mann 1990, Liszewski and Mann 1992, Golder 1994). Carbon tetrachloride was detected beneath the Radioactive Waste Management Complex in the aquifer at concentrations above the maximum contaminant level; however, this concentration was only observed once.

4.8.2.5.3 Perched Water Quality—Wastewater discharges from INEL site operations have infiltrated into the vadose zone and created locally perched water beneath the INEL site. Elevated concentrations of the following contaminants have been detected in samples collected from the following locations: tritium, cesium-137, cobalt-60, chromium, and sulfate concentrations in deep perched water near the Test Reactor Area; tritium in shallow perched water and carbon tetrachloride, chloroform, 1,1,1-trichloroethane, tricholorethylene, tetrachloroethylene, and 1,1,-dichloroethylene in deep perched water near the Radioactive Waste Management Complex; and strontium-90 in perched water near the Idaho Chemical Processing Plant (Bishop 1993). In general, the chemical concentrations, shape, and size of these bodies have fluctuated over time in response to the volume of water discharged to the infiltration ponds. Potential concentrations of contaminants in all perched water bodies have not yet been measured. Trends in perched water quality are discussed in Section 5.8, Water Resources.

4.8.3 Water Use and Rights

Surface water is not withdrawn at the INEL site. The three surface water features at or near the INEL site (Big and Little Lost Rivers and Birch Creek) have the following designated uses: agricultural water supply, cold-water biota, salmonid spawning, and primary and secondary contact recreation. However, surface water is not used for any of these designations within the INEL site boundaries. In addition, waters in the Big Lost River and Birch Creek have been designated for domestic water supply and as special resource waters.

Groundwater use on the Snake River Plain includes irrigation, food processing, aquaculture, and domestic, rural, public, and livestock supply. Water use for the upper Snake River drainage basin and Snake River Plain Aquifer was 16.4×10^9 cubic meters per year (4.3×10^{12} gallons per year) during 1985, which was over 50 percent of the water used in Idaho and approximately 7 percent of agricultural withdrawals in the nation. Most of the water withdrawn from the eastern Snake River Plain [1.8×10^9 cubic meters per year (4.7×10^{11} gallons per year)] is used for agriculture. The aquifer is the source of all water used at the INEL site. INEL site activities withdraw water at an average rate of 7.4×10^6 cubic meters per year (1.9×10^9 gallons per year) (DOE-ID 1993b, c). However, the baseline annual withdrawal rate dropped to 6.5×10^6 cubic meters (1.7×10^9 gallons) in 1995. The average annual withdrawal is equal to approximately 0.4 percent of the water consumed from the Snake River Plain Aquifer, or 53 percent of the maximum annual yield of a typical irrigation well, if pumped 365 days a year. Of the quantity of water pumped from the aquifer, a substantial portion is discharged to the surface or subsurface and eventually returned to the aquifer (DOE-ID 1993b, c).

As designated by the Safe Drinking Water Act (42 U.S.C, Section 1427), a sole-source aquifer is defined as one that supplies 50 percent of the drinking water consumed in the area overlying the aquifer. Sole-source aquifer areas have no alternative source or combination of sources that could physically, legally, and economically supply all who obtain their drinking water from the aquifer. Because groundwater supplies 100 percent of the drinking water consumed within the eastern Snake River Plain (Gaia Northwest 1988) and an alternative drinking water source or combination of sources is not available, the U.S. Environmental Protection Agency designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (FR 1991).

DOE holds a Federal Reserved Water Right for the INEL site, which permits a water pumping capacity of 2.3 cubic meters per second (80 cubic feet per second) and a maximum water consumption of 43 million cubic meters per year (11.4×10^9 gallons per year) for drinking, process water, and noncontact cooling. Because it is a Federal Reserved Water Right, the INEL site's priority on water rights dates back to its establishment in 1950. The legal and administrative framework for the water rights adjudication process is currently being evaluated for the State of Idaho.

4.9 Ecological Resources

This section describes tbe biotic resources on the INEL site, which are typical of the Great Basin and Columbia Plateau. Threatened and endangered species, wetlands, and the extent of human-caused radionuclides in plants and animals are discussed. Because the existing major facility areas are expected to be affected most by the proposed actions, tbe biotic resources in those areas are emphasized. However, because other resources (for example, more mobile species like pronghorn) could be affected, biotic resources for the entire INEL site also are briefly described.

4.9.1 Flora

Vegetation on the INEL site is primarily of shrub-steppe vegetation and is a small fraction of tbe 45 million hectares (111.2 million acres) of this vegetation type found in the Intermountain West. The 15 vegetation associations identified on the INEL site range from primarily shadscale-steppe vegetation at lower altitudes through sagebrush- and grass-dominated communities to juniper woodlands along the foothills of the nearby mountains and buttes (Rope et al. 1993, Kramber et al. 1992, Anderson 1991). These associations can be grouped into six types: juniper woodland, native grassland, shrub-steppe, lava, modified, and wetland vegetation types (Figure 4.9-1). Over 90 percent of the INEL is covered by shrub-steppe vegetation, which is dominated by big sagebrush (*Artemisia tridentata*), saltbush (*Atriplex* spp.), and rabbitbrush (*Chrysothamnus* spp.). Grasses include cheatgrass (*Bromus tectorum*), Indian ricegrass (*Oryzopsis hymenoides*), wheatgrasses, (*Agropyron* spp.), and squirreltail (*Sitanion hysterix*). Herbaceous plants include phlox (*Phlox* spp.), wild onion (*Allium*), milkvetch (*Astragalus* spp.), Russian thistle (*Salsola kali*), and various mustards. Additional detailed information on plant communities is described in Rope et al. (1993).

Disturbed areas (grazing not included) cover only 1.3 percent of the INEL site. Disturbed areas frequently are dominated by introduced annuals, including Russian thistle and cheatgrass. These species usually provide less food and cover for wildlife compared to perennial native species and are competitive with perennial native species. Therefore, these disturbed areas serve as a source of seeds tbat may increase the potential for the increased establishment of Russian thistle and cheatgrass into tbe surrounding undisturbed areas. Vegetation adjacent to each facility is generally similar to the vegetation types mapped in Figure 4.9-1. Vegetation within each facility area is primarily disturbed

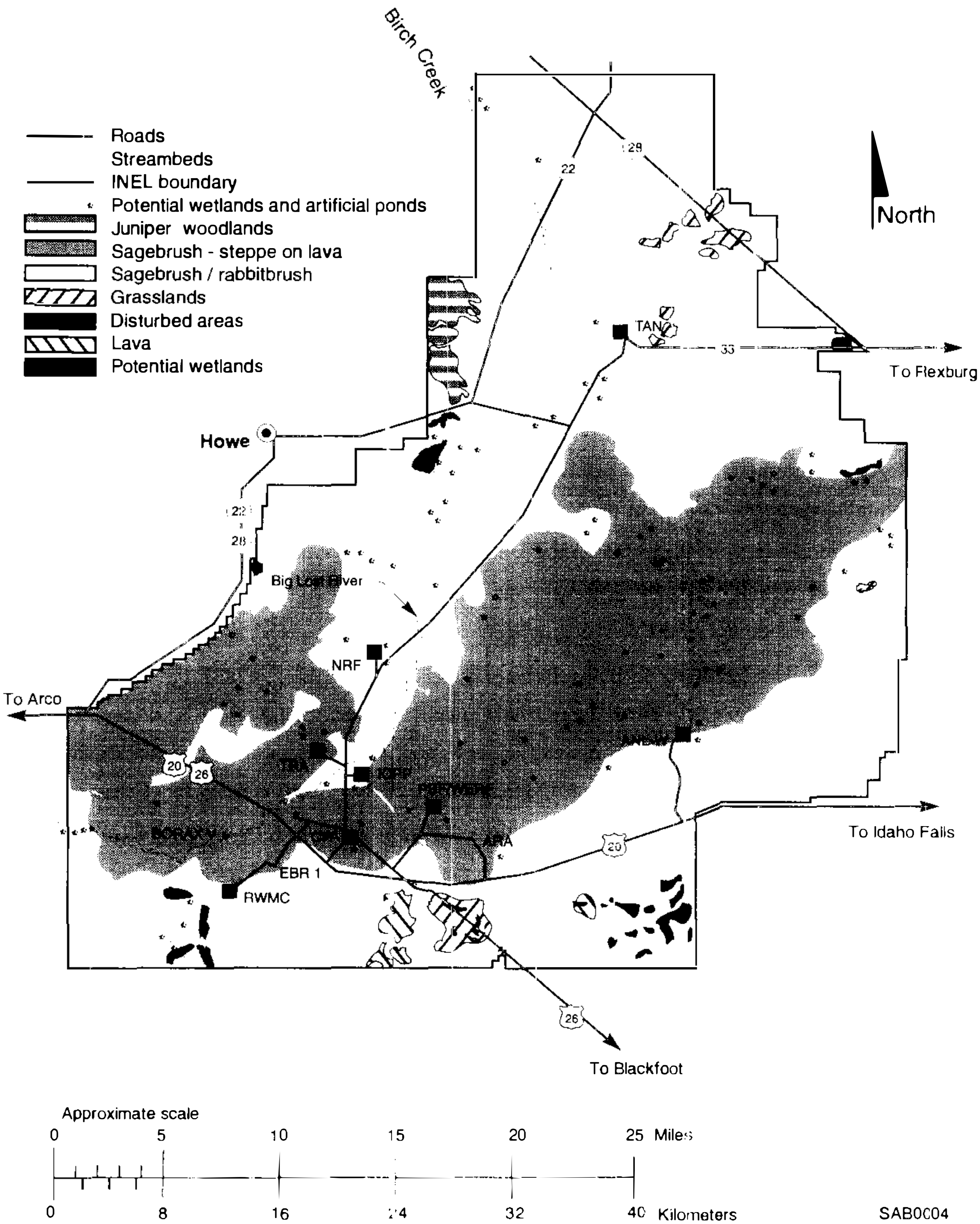


Figure 4.9-1. Approximate distribution of vegetation map at the Idaho National Engineering Laboratory site.

or landscaped. Species diversity on the INEL is similar to diversity on like-sized areas and physiognomy in the Intermountain west. The diversity on the INEL is heavily influenced by the shrub-steppe vegetation covering over 90 percent of the INEL. Diversity is lower on disturbed and modified areas and higher on areas of greater moisture content.

4.9.2 Fauna

The INEL site supports animal communities typical of shrub-steppe vegetation and habitats. Over 270 vertebrate species have been observed, including 46 mammal, 204 bird, 10 reptile, 2 amphibian, and 9 fish species (Arthur et al. 1984, Reynolds et al. 1986). Common species include small mammals (mice, ground squirrels, rabbits, and hares), elk, songbirds (sage sparrow, western meadowlark), sage grouse, lizards, and snakes (rattlesnakes). Migratory species, including pronghorn, waterfowl, and raptors, use the INEL site for part of the year. (Some pronghorn remain on the site year round.) Predators observed on the INEL site include bobcats, mountain lions, and coyotes. Trout and salmon species have been observed in the Big Lost River when it has flowed on to the INEL site. Additional information on fauna is provided in Rope et al. (1993). Baseline train and wildlife collisions are discussed in 4.11.4 (Accidents) of Volume 2 of this Environmental Impact Statement.

4.9.3 Threatened, Endangered, and Sensitive Species

Federal- and State-protected, candidate, and sensitive species were identified using State and Federal regulatory agency lists (Lobdell 1992, 1995), the Idaho Department of Fish and Game Conservation Data Center list, and information from INEL site surveys.

Two Federal endangered and nine Federal Category 2 candidate animal species were identified as potentially occurring on the INEL site (Table 4.9-1). Federal endangered peregrine falcons have been observed within the boundary of the INEL infrequently only in winter and for only brief periods. Federal endangered bald eagles are observed each winter near or on the INEL, but only in the remote areas of the INEL about 32 kilometers (20 miles) north of the Test Area North and on the INEL site near Howe. Neither of these areas is close to proposed activities. The Federal candidate Category 2 ferruginous hawk nests and is observed primarily near juniper woodlands. This habitat is remote from facilities. The Federal candidate Category 2 white-faced ibis is an infrequent migrant

Table 4.9-1. Threatened and endangered species, species of special concern, and sensitive species that may be found on the Idaho National Engineering Laboratory site.

	Name	Status[a]	Comments
Birds	Northern goshawk *(Accipiter gentilis)*	C2, SSC, FS, BLM	The **ferruginous hawk** nests on and migrates through the INEL. This species is found throughout the INEL but is observed more frequently in juniper woodlands. **Peregrine falcons** have been observed rarely in the winter and not observed at all during other seasons. The last sighting was in 1993 (Morris 1993a). It is not known to nest on the INEL and is not commonly observed near facilities (Reynolds 1993a). The **bald eagle** is a winter resident and is locally common in the far north end and on the western edge of the INEL near Howe (Reynolds 1993b). It is not known to nest on the INEL and is not commonly observed near facilities (Reynolds 1993a). The **white-faced ibis** uses aquatic, riparian, nearby upland habitats, and some man-made ponds, but it is an uncommon migrant at the INEL. The **long-billed curlew** is known to nest on the north end of the INEL near agricultural lands. The northern goshawk is a casual migrant through the INEL.
	Burrowing owl *(Athene cunicularia)*	C2, BLM	
	Ferruginous hawk *(Buteo regalis)*	C2, BLM	
	Swainson's hawk *(Buteo swainsoni)*	BLM	
	Great egret *(Casmerodius albus)*	SSC	
	Merlin *(Falco columbarius)*	SSC, BLM	
	Peregrine falcon *(Falco peregrinus)*	E	
	Gyrfalcon *(Falco rusticolus)*	BLM	
	Common loon *(Gavia immer)*	SSC, FS	
	Bald eagle *(Haliaeetus leucocophalus)*	E	
	Long-billed curlew *(Numenius americanus)*	SPS, BLM	
	American white pelican *(Pelicanus erythrorhynchos)*	SSC	
	White-faced ibis *(Plegadis chihi)*	C2	
Mammals	Merriam's shrew *(Sorex merrami)*	SPS	The **pygmy rabbit** is common on the INEL, but its distribution is patchy (Reynolds et al. 1986). Roosts and hibernation caves for **Townsend's big-eared bat** occur on the INEL. About six caves are known to be used by the species. All are over 7 kilometers (3 miles) from facilities. Brood caves may also exist on the site but have not been located.
	Pygmy rabbit *[Brachylagus (Sylvilagus) idahoensis]*	C2, BLM, SSC	
	California myotis *(Myotis californicus)*	SSC	
	Fringed myotis *(Myotis thysanodes)*	SSC	
	Western pipistrelle *(Pipistrellus hesperus)*	SSC, BLM	
	Townsend's western big-eared bat *(Plecotus townsendii)*	C2, SSC, FS, BLM	
	Long-eared myotis *(Myotis evotis)*	C2	
	Small-footed myotis *(Myotis subulatus)*	C2	
Plant	Lemhi milkvetch *(Astragalus aquilonius)*	BLM, FS, INPS-S	The species identified as sensitive, rare, or unique are uncommon on the INEL because they require unique microhabitat conditions. The plant species are distant from disturbed facilities.
	Painted milkvetch *(Astragalus ceramicus var. apus)*	3c, INPS-M	
	Winged-seed evening primrose *(Camissonia pterosperma)*	BLM, INPS-S	
	Nipple cactus *(Coryphantha missouriensis)*	INPS-M	
	Sepal-tooth dodder *(Cascuta denticulata)*	INPS-1	
	Spreading gilia *[Ipomopsis (Gilia) polycladon]*	BLM, INPS-2	
	King's bladderpnd *(Lesquerella kingii var. cobrensis)*	INPS-M	
	Tree-like oxytheca *(Oxytheca dendroidea)*	INPS-S	
Insects	Idaho pointheaded grasshopper *(Acrolophitus punchellus)*	C2, BLM	Occurs just north of the INEL.

a. Key:
- C2 = Federal category 2 species.
- 3c = No longer considered for Federal listing.
- E = Federal and State endangered species.
- SSC = State species of special concern.
- SPS = State protected species
- BLM = Bureau of Land Management monitored.
- FS = U.S. Forest Service monitored.
- INPS-S = Idaho Native Plant Society sensitive.
- INPS-M = Idaho Native Plant Society monitoried
- INPS-1 = Idaho Native Plant Society State Priority 1
- INPS-2 = Idaho Native Plant Society State Priority 2

that uses aquatic and upland areas. The Federal candidate Category 2 burrowing owl is an infrequent migrant that uses grassland and shrub-steppe habitat. Caves used by the Townsend's big-eared bat are several miles from proposed activities, and a survey of bat species is currently under way.

Two State-protected species (Merriam's shrew and the long-billed curlew) potentially occur on the INEL site. Ten animal species listed by the State as species of special concern occur on the INEL site. None of the Federal- or State-listed animal species have been observed near any of the facilities where proposed actions would occur (Rope et al. 1993, Reynolds 1993a). No Federal- or State-listed plant species were identified as potentially occurring on the INEL site. Eight plant species identified by other Federal agencies and the Idaho Native Plant Society as sensitive, rare, or unique are known to occur on the INEL site (Lobdell 1995).

4.9.4 Wetlands

Aquatic habitats on the INEL site are limited to scattered wet areas, artificial ponds, and intermittent waters. The U.S. Fish and Wildlife Service National Wetlands Inventory maps show over 130 potential wetlands; these maps and a subsequent survey (Hampton et al. 1995) indicate these potential wetlands cover more than 1,180 hectares (2,900 acres) of the INEL site. Over 70 percent of the potential wetlands are found near the Big Lost River and its spreading areas and playas, the Birch Creek Playa, and in an area north of and in the general vicinity of Argonne National Laboratory-West. The rest are scattered throughout the INEL site. In 1994, the INEL began evaluating the potential wetlands to determine which areas meet the U.S. Army Corps of Engineers definition of jurisdictional wetlands (COE 1987). In addition, the functional use and importance of the potential wetlands is being evaluated. As of December 1994, at least one area at the Big Lost River sinks was found to meet the criteria for jurisdictional wetland delineation.

Approximately 20 potential wetlands listed by the U.S. Fish and Wildlife Service are near facilities and are mostly man-made (for example, industrial waste and sewage treatment ponds, borrow pits, and gravel pits) and, therefore, may not be considered regulated jurisdictional wetlands (Figure 4.9-1). There is one area north of the Test Reactor Area under evaluation as a jurisdictional wetland. Other potential wetlands include portions of the Big Lost River channel near the Idaho Chemical Processing Plant and the Birch Creek Playa containing Test Area North facilities. Limited riparian (riverbank) communities with mature trees are found along the Big Lost River (Reynolds

1993a), reflecting the intermittent flow in the river (1986 and 1993 were the last two years with flow reported on the site). The scattered artificial ponds, potential wetlands, and intermittent waters serve as water sources to many wildlife species including bats, song birds, and mammals. Some artificial ponds are not fenced (for example, ponds at Argonne National Laboratory-West) and are used by pronghorn.

4.9.5 Radioecology

Potential radiological effects on plants and animals are measured at the population, community, or ecosystem level. However, for threatened and endangered species, harm to individuals is important. Radionuclides are found above background levels in individuals belonging to some plant and animal species on and surrounding the INEL site (Morris 1993b). Measurable effects of radionuclides on plants and animals, however, have only been observed in individuals on areas adjacent to INEL facilities, and not at the population, community, or ecosystem levels. The following is information on doses, concentrations, and effects reported for animals on the INEL site.

Halford and Markham (1984) and Arthur et al. (1986) studied maximally exposed small mammals at the Test Reactor Area radioactive waste percolation pond and at the Subsurface Disposal Area at the Radioactive Waste Management Complex. These studies concluded that the small mammals received doses similar to those shown to reduce life expectancies in other small mammals at other locations. Statistically significant differences in several physiological parameters were found between deer mice inhabiting the Test Reactor Area radioactive waste percolation pond, the Subsurface Disposal Area, and control areas (Evenson 1981). However, radiation exposures were too small to cause cellular changes in the mice. A comparison between barn swallow nestlings exposed to sediments from the Test Reactor Area pond and control birds revealed a statistically significant difference in growth rates (Millard et al. 1990). However, this difference could not definitely be attributed to exposure. All studies reported that doses to individual organisms were too low to cause any effects at the population level. Doses and exposures to animals from 1992 at both the Subsurface Disposal Area and the Test Reactor Area are probably lower than the doses reported in the above studies because 0.6 meter (2 feet) of additional soil cover the contaminated pits and trenches (Wilhelmsen and Wright 1992), and the percolation pond is now less attractive to animals (Morris 1993c).

Elevated radionuclide concentrations have been observed in some individual animals and plants outside the boundaries of INEL facilities and off the INEL site. Iodine-129 concentrations in vegetation and in rabbit thyroids have been reported in excess of background up to 30 kilometers (18.6 miles) from the Idaho Chemical Processing Plant fence (Markham 1974). Iodine-129 has also been detected above background in pronghorn tissue collected on the INEL site (Markham 1974) and from pronghorn collected as far away as Craters of the Moon National Monument and Monida Pass (Markham et al. 1982). In a study of raptor nesting, Craig et al. (1979) concluded that detectable radionuclide levels would only be observed within 3.5 kilometers (2.2 miles) from the Radioactive Waste Management Complex. In these examples, the dose from internal consumption of radionuclides was less than is thought to be required for observable effects to occur to individual animals (IAEA 1992). Also, on the basis of limited data and the infrequent and few bald eagles and ferruginous hawks observed near contaminated areas, these species probably are not consuming harmful concentrations of radioactive contaminants in their prey (Morris 1993c). A similar conclusion can be made for peregrine falcons because they have rarely been seen on or near the INEL site, and have never been seen near contaminated INEL ponds.

4.10 Noise

Existing INEL-related noises of public significance stem from buses, trucks, private vehicles, helicopters, and freight trains that transport people and materials to and from the INEL site and DOE's Idaho Falls facilities. During the normal work week, most of the 4,000 to 5,000 employees who work at the INEL site are transported daily to the site from surrounding communities and back again over approximately 300 bus routes. About 300 to 500 private vehicles also travel to and from the INEL site each day. Noise measurements taken along U.S. Highway 20 about 15 meters (50 feet) from the roadway during a peak commuting period indicate that the sound level from traffic ranges from 64 to 86 decibels (dBA) (Abbott et al. 1990), with the primary source coming from buses (71 to 81 dBA). Although few people reside within 15 meters (50 feet) of the roadway, the results indicate that INEL traffic noise may be objectionable to members of the public residing near principal highways or busy bus routes.

Public exposure to aircraft noise is also due in part to INEL-related activities. Air cargo and business travel of INEL personnel via commercial air transport represents a substantial portion of all such travel in and out of regional airports. Onsite INEL security patrol and surveillance flights do not adversely affect individuals offsite because of the INEL site's remoteness. However, INEL helicopter flights that originate or terminate in Idaho Falls do expose members of the public to the unique noises produced by these aircraft. Because the number of flights per day is limited and most flights occur during daylight hours when people are not sleeping, public exposure to aircraft nuisance noise is not considered to be great.

Normally, no more than one train per day and usually fewer than one train per week services the INEL via the Scoville spur. Rail transport noises originate from diesel engines, wheel/track contact, and whistle-warnings at rail crossings. Even with only one or two exposures to these sources per day, individuals residing near the railroad tracks find the noises mildly objectionable.

The noise level at the INEL ranges from 10 dBA for the rustling of grass to 115 dBA, the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration (OSHA), from the combined sources of industrial operations, construction activities, and vehicular traffic, including aircraft. The playas and remote lava flows of the INEL site have relatively low ambient noise levels of about 35 to 40 dBA. Onsite, in accordance with INEL procedures, industrial hygiene practices assure hearing protection for workers. Noise limits for the workplace are established to protect workers in accordance with OSHA standards (CFR 1992). Site workers are required by OSHA to wear ear protection devices when exposed to noise levels above 85 dBA on an eight-hour time-weighted average. Shredding and painting operations at the Central Facilities Area produced the highest noise levels measured at the INEL at 104 dBA and 99 dBA, respectively. The computer room measured 88 dBA, and the snack bar measured 60 dBA. The noise generated at the INEL site is not propagated at detectable levels offsite, since all public areas are at least 8 kilometers (5 miles) away from site facility areas.

Previous studies of the effects of noise on wildlife indicate that even very high intermittent noise levels at the INEL (over 100 dBA) would have no deleterious effect on wildlife productivity (Leonard 1993).

4.11 Traffic and Transportation

Roads are the primary access to and from the INEL site. Commercial shipments are transported by truck and plane, some bulk materials are transported by train, and waste is transported by truck and train. This section discusses the existing traffic volumes, transportation routes, transportation accidents, and waste and materials transportation. Also discussed are the historical waste and materials transportation and baseline radiological exposures from waste and materials transportation. The information in this section has been summarized from Lehto (1993).

4.11.1 Roadways

4.11.1.1 Infrastructure—Regional and Site Systems. The existing regional highway system is shown in Figure 4.11-1. Two interstate highways serve the regional area. Interstate 15, a north-south route that connects several cities along the Snake River, is approximately 40 kilometers (25 miles) east of the INEL site. Interstate 86 intersects Interstate 15 approximately 64 kilometers (40 miles) south of the INEL site and provides a primary linkage from Interstate 15 to points west. Interstate 15 and U.S. Highway 91 are the primary access routes to the Shoshone Bannock reservation. U.S. Highways 20 and 26 are the main access routes to the southern portion of the INEL site. Idaho State Routes 22, 28, and 33 pass through the northern portion of the INEL site, with State Route 33 providing access to the northern INEL site facilities. Table 4.11-1 shows the baseline (1991) traffic for several of these access routes. The level of service of these segments currently is designated "free flow," which is defined as "operation of vehicles is virtually unaffected by the presence of other vehicles."

An onsite road system of approximately 140 kilometers (87 miles) of paved surface has been developed, including about 29 kilometers (18 miles) of service roads that are closed to the public. Most of the roads are adequate for the current level of normal transportation activity and could handle some increased traffic volume. The onsite road system at the INEL undergoes continuous maintenance.

4.11.1.2 Infrastructure—Idaho Falls. Approximately 4,000 DOE and DOE contractor personnel administer and support INEL work through offices in Idaho Falls. DOE shuttle vans

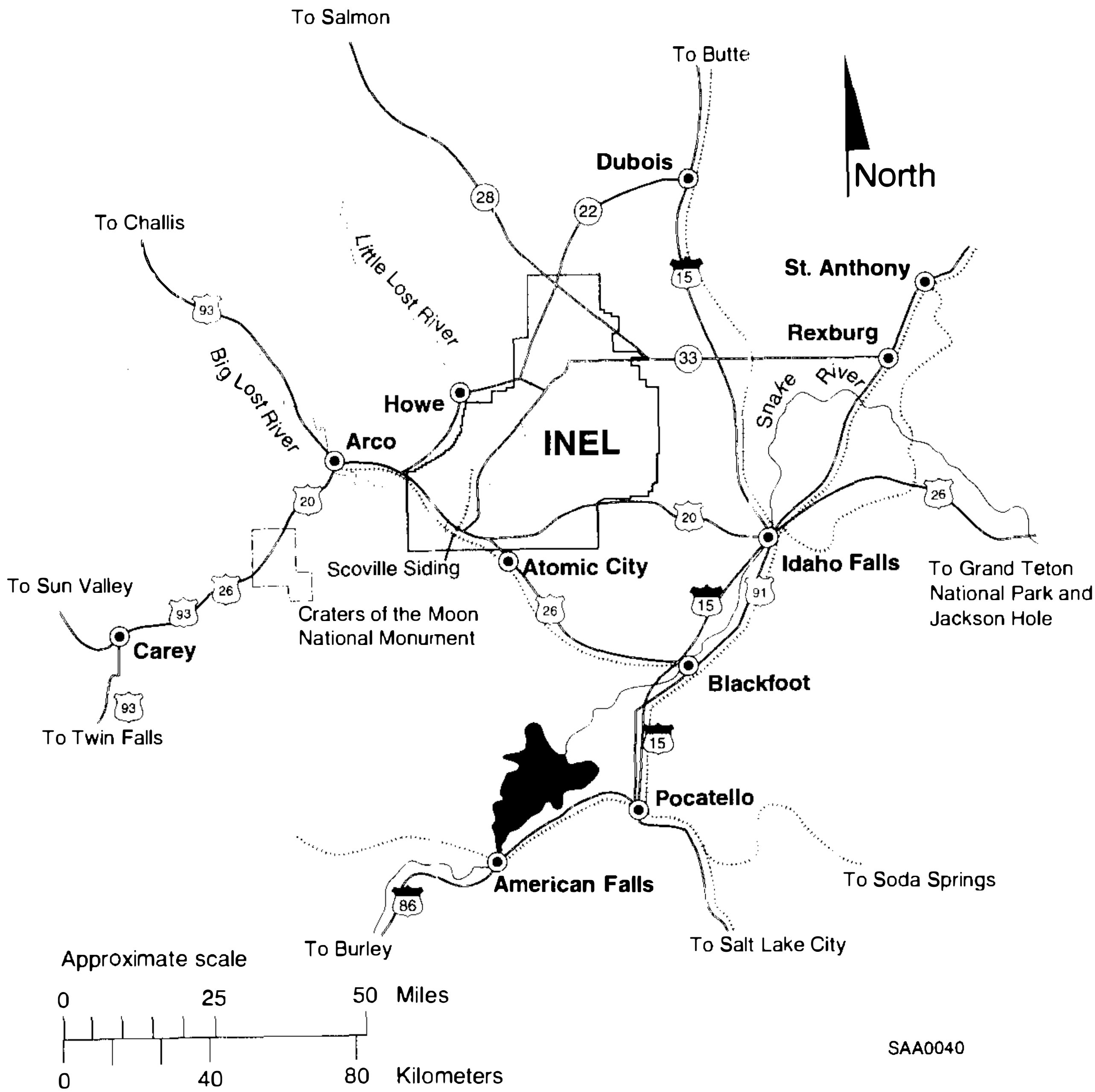


Figure 4.11-1. Transportation routes in the vicinity of the Idaho National Engineering Laboratory.

Table 4.11-1. Baseline traffic for selected highway segments in the vicinity of the Idaho National Engineering Laboratory site.[a]

Route	Average daily traffic	Peak hourly traffic[b]
U.S. Highway 20—Idaho Falls to INEL	2,290	344
U.S. Highway 20/26—INEL to Arco	1,500	225
U.S. Highway 26—Blackfoot to INEL	1,190	179
State Route 33—west from Mud Lake	530	80
Interstate 15—Blackfoot to Idaho Falls	9,180	1,380

a. Source: 1991 Rural Traffic Flow Map, State of Idaho.

b. Estimated as 15 percent of average daily traffic.

provide hourly transport between in-town facilities. Currently, one of the busiest intersections is at Science Center Drive and Fremont Avenue, which serves the Willow Creek Building, Engineering Research Office Building, INEL Electronic Technology Center, and DOE office buildings. The intersection is congested during peak weekday hours, but it is designed for the current traffic.

4.11.1.3 Transit Modes. Four major modes of transit use the regional highways, community streets, and INEL site roads to transport people and commodities: DOE buses and shuttle vans, DOE motor pool vehicles, commercial vehicles, and personal vehicles. Table 4.11-2 summarizes the baseline miles for INEL-related traffic.

4.11.2 Railroads

Union Pacific Railroad lines in southeastern Idaho are shown on Figure 4.11-1. Idaho Falls receives railroad freight service from Butte, Montana, to the north, and from Pocatello and Salt Lake City to the south. The Union Pacific Railroad's Blackfoot-to-Arco Branch, which crosses the southern portion of INEL, provides rail service to the INEL site. This branch connects with a DOE spur line at the Scoville Siding, then links with developed areas within the INEL. Rail shipments to and from the INEL site usually are limited to bulk commodities, spent nuclear fuel, and radioactive waste. Table 4.11-3 shows the rail shipments for Fiscal Years 1988 through 1992.

Table 4.11-2. Baseline annual vehicle miles traveled for traffic related to the Idaho National Engineering Laboratory site.[a]

Mode of travel and transportation	Vehicle miles traveled[b]
DOE buses	6,068,200
Other DOE vehicles	9,183,100
Personal vehicles on highways to INEL	7,500,000
Commercial vehicles	905,900
TOTAL	23,657,200

a. Source: Lehto (1993).

b. To convert from miles to kilometers, multiply by 1.609.

Table 4.11-3. Loaded rail shipments to and from the Idaho National Engineering Laboratory site (1988 to 1992).[a]

Fiscal year	Inbound	Outbound
1988	63	44
1989	43	19
1990	34	3
1991	18	0
1992	23	0

a. Sources: DOE Shipment Mobility/Accountability Collection System database; Volume 1 of this EIS (Appendix D, Attachment A, Transportation of Naval Spent Nuclear Fuel).

4.11.3 Airports and Air Traffic

Airlines provides Idaho Falls with jet aircraft passenger and cargo service. Horizon and Skywest provide commuter service to both the Idaho Falls and Pocatello airports. In addition, local charter service is available in Idaho Falls, and private aircraft use the major airport and numerous other fields in the area. The total number of landings at the Idaho Falls airports for 1991 and 1992 were 5,367 and 5,598, respectively. The Idaho Falls and Pocatello airports collectively record nearly 7,500 landings annually.

Non-DOE air traffic over the INEL site is limited to altitudes greater than 305 meters (1,000 feet) over buildings and populated areas, and non-DOE aircraft are not permitted to use the site. The primary air traffic at the INEL site is DOE helicopters, which are used for security and very rare emergency purposes. Specific operations stations and duties are designated for these helicopters.

4.11.4 Accidents

For the years 1987 through 1992, the average motor vehicle accident rate was 0.94 accidents per million kilometers (1.5 accidents per million miles) for INEL vehicles, which compares with an accident rate of 1.5 accidents per million kilometers (2.4 accidents per million miles) for all DOE complex vehicles and 8 accidents per million kilometers (12.8 accidents per million miles) nationwide for all motor vehicles (Lehto 1993). There are no recorded air accidents associated with the INEL.

Collisions between wildlife and trains or motor vehicles are an impact from any human activities involving transportation of materials or humans. In years with high snow accumulation, collisions between wildlife and trains increase. Wildlife, such as antelope, often bed down on the train tracks and use the tracks for migration routes when snow is abundant. Train collisions with wildlife can involve large numbers of animals and have a significant impact on the local population. For example, one large documented train/antelope accident near Aberdeen, Idaho, in the winter of 1976 resulted in a total population loss of 160 antelope (Compton 1994). While this accident was not related to INEL operations, it illustrates the potential impacts of such collisions. Accidents involving motor vehicles and wildlife generally involve individual animals, and may occur during any season.

4.11.5 Transportation of Waste and Materials

Hazardous, radioactive, industrial, commercial, and recyclable wastes are transported on the INEL site. Numerous regulations and requirements govern transportation of hazardous and radioactive materials (Lehto 1993). Hazardous materials include commercial chemical products and hazardous wastes that are nonradioactive and are regulated and controlled based on their chemical toxicity. Four main categories of radioactive materials are associated with environmental restoration and waste management activities: spent nuclear fuel, transuranic wastes, mixed low-level wastes, and low-level wastes. High-level wastes are stored at the INEL, but shipments of high-level wastes are not planned within the timeframe of this EIS.

4.11.5.1 Baseline Radiological Doses from Waste and Materials Transportation. To establish a baseline of radiological doses from incident-free, onsite waste and materials transportation at the INEL that is not related to the shipments for the alternatives evaluated in this EIS, six years of data (1987 through 1992, inclusive) were used. Results are presented in Table 4.11-4 in terms of the collective doses and cancer fatalities for 1995 to 2005. The baseline includes no offsite shipments; offsite shipments are addressed in the analyses of alternatives in Chapter 5.

Table 4.11-4. Cumulative doses and fatalities from incident-free onsite shipments at the Idaho National Engineering Laboratory site for 1995 to 2005.[a]

	Estimated collective dose (person-rem)	Estimated cancer fatalities	Estimated nonradiological fatalities[b]
Occupational	6.6	0.0026	0
General population	0.14	0.000070	0

a. Source: Maheras (1993).

b. There are no nonradiological accident-free fatalities for onsite shipments. These fatalities are only applicable to urban areas, and the INEL site is a rural area.

4.12 Health and Safety

The purpose of this section is to present the potential health effects to workers and the public as a result of current operations at the INEL. For the purpose of this assessment, current operations include all existing facilities and those projects that were expected to be completed by June 1, 1995.

This section provides estimates of health impacts from releases of radioactive and nonradioactive contaminants to the atmosphere and groundwater. This section also summarizes historical health and safety data and INEL programs designed to protect workers. A detailed explanation of the health effects methodology is contained in Appendix F, Section F-4, Health and Safety, of this EIS.

4.12.1 Public Health and Safety

Health risks from air emissions are estimated by modeling worst-case emission scenarios. These emissions have been estimated for a baseline case. This baseline case represents a scenario where all permitted sources at the INEL are assumed to operate in such a manner that they emit specific pollutants to the maximum extent allowed by operating permits or applicable regulations. Further information on these baseline atmospheric emissions is found in Section 4.7, Air Resources. These modeled emissions are used to postulate maximum potential exposure levels in the onsite and offsite environments. Health effects calculated using this type of information provide an extremely conservative "worst-case" estimate of potential health effects.

Health effects estimates from groundwater contaminants were calculated using the highest reported drinking water supply system concentrations or, in the case of public exposure, the highest reported offsite groundwater concentrations. These concentration estimates are based on those discussed in Section 4.8, Water Resources, of this EIS.

4.12.1.1 Health Effects Resulting from Atmospheric Releases. For routine airborne releases from facilities, health effects were assessed for the following three categories of exposed individuals: (a) maximally exposed individual located at the site boundary, (b) population within 80 kilometers (50 miles) of the operating facilities, and (c) maximally exposed onsite worker.

4.12.1.1.1 Radiological Health Risk—The human health risk associated with radiological air emissions is assessed based on risk factors contained in *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991). The measure of impact used for evaluating potential radiation exposures is risk of fatal cancers. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in millirem) and the estimated lifetime probability of fatal cancer.

For the calculation of health effects from exposure to airborne radionuclides, the modeled annual doses provided in Section 4.7, Air Resources, of this EIS, were multiplied by the appropriate risk factors from ICRP (1991). The risk, from one year of exposure, is expressed as the increased lifetime chance of developing fatal cancer. A detailed explanation of the health effects methodology is contained in Appendix F, Section F-4, Health and Safety, of this EIS.

Tables 4.12-1 and 4.12-2 provide summaries of the annual dose, risk factor, and estimated increased lifetime risk of developing fatal cancer based on the annual exposure. These data are presented for the maximally exposed onsite worker, maximally exposed individual near the site boundary, and surrounding population for the year 1995.

Table 4.12-1. Lifetime excess fatal cancer risk due to annual exposure to routine airborne releases at the Idaho National Engineering Laboratory site.

Maximally exposed individual	Annual dose (millirem)	Risk factor (risk/millirem)	Risk (excess fatal cancer)
Onsite worker	3.2×10^{-1}	4.0×10^{-7}	1.3×10^{-7}
Offsite individual (public)	5.0×10^{-2}	5.0×10^{-7}	2.5×10^{-8}

Table 4.12-2. Increased population risk of developing excess fatal cancers due to routine airborne releases at the Idaho National Engineering Laboratory site.

Year	Population dose (person-rem)	Risk factor (risk/person-rem)	Risk (number of fatal cancers)
1995[a]	3.0×10^{-1}	5.0×10^{-4}	1.5×10^{-4}

a. The population dose and cancer risk for 1995 is based on data provided in Section 4.7 of this EIS.

The offsite individual annual dose of 0.05 millirem corresponds to a lifetime increased fatal cancer risk of approximately 1 in 40 million. The worker dose of 0.32 millirem corresponds to a lifetime increased fatal cancer risk of approximately 1 in 7 million.

Table 4.12-2 provides summaries of the dose, risk factor, and estimated increased lifetime risk of developing fatal cancer based on the annual exposure to the surrounding population for the year 1995. The surrounding population consists of approximately 120,000 people within a 80-kilometer (50-mile) radius of the individual INEL sources. The total baseline collective population dose of 0.30 person-rem corresponds to approximately 0.0002 fatal cancers occurring within the population over the next 70 years.

4.12.1.1.2 Nonradiological Health Risk—For nonoccupational exposures, data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose-response values approved by the U.S. Environmental Protection Agency. These values include slope factors and unit risks for evaluating cancer risks, reference doses and reference concentrations for evaluating exposure to noncarcinogens, and primary National Ambient Air Quality Standards for evaluating criteria pollutants. For evaluating occupational exposures, the applicable occupational standards were used.

For the evaluation of occupational health effects, the modeled chemical concentration was compared with the applicable occupational standard. The comparison was made by calculating a hazard quotient. The hazard quotient is the ratio between the calculated concentration in air and the applicable standard. If the hazard quotient is less than 1, then no adverse health effects are expected.

Table 4.12-3 presents hazard quotients for onsite toxic air pollutants. The noncarcinogenic hazard index (summed hazard quotients) for each facility is less than 1. This indicates that no adverse health effects are projected as a result of noncarcinogenic emissions.

Table 4.12-4 provides the hazard quotients for onsite carcinogens. These modeled concentrations are not representative of average workplace concentrations, but reflect the maximum potential concentrations that could occur. In all cases, with the exception of benzene, the hazard quotients for individual chemicals are less than 1.

Table 4.12-3. Hazard quotients for highest predicted concentrations of noncarcinogenic toxic air pollutants at Idaho National Engineering Laboratory site locations for the maximum baseline case.

Toxic air pollutant	Location of maximum concentration[a]	Baseline concentration ($\mu g/m^3$)	Occupational exposure limit[b] ($\mu g/m^3$)	Hazard quotient
Ammonia	ICPP	9.7×10^2	1.7×10^4	0.06
Cyclopentane	CFA	1.1×10^3	1.7×10^6	<0.01
Hydrochloric acid	CFA	1.1×10^2	7.0×10^3	0.02
Mercury	ICPP	3.0×10^0	5.0×10^1	0.06
Naphthalene	CFA	2.3×10^3	5.0×10^4	0.05
Nitric acid	ICPP	7.7×10^2	5.0×10^3	0.15
Phosphorus	TAN	5.5×10^1	1.0×10^2	0.55
Potassium hydroxide	ANL-W	1.4×10^1	2.0×10^3	<0.01
Styrene	PBF	3.5×10^2	2.1×10^5	<0.01
Toluene	CFA	2.5×10^4	1.9×10^5	0.13
Trimethylbenzene	CFA	1.3×10^4	1.2×10^5	0.11
Trivalent chromium	TAN	6.3×10^0	5.0×10^2	0.01

a. ANL-W = Argonne National Laboratory-West; ICPP = Idaho Chemical Processing Plant; CFA = Central Facilities Area; TRA = Test Reactor Area; RWMC = Radioactive Waste Management Complex; TAN = Test Area North.

b. Occupational exposure limits are eight-hour time-weighted averages established by the American Conference of Governmental Industrial Hygienists or Occupational Safety and Health Administration; the lower (most restrictive) of the two limits is used.

Carcinogenic Effects. For carcinogenic effects to the public, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (that is, incremental or excess individual lifetime cancer risk).

Values for slope factors and unit risks were taken from the U.S. Environmental Protection Agency's Integrated Risk Information System database (EPA 1994). If the information was not available in this database, other sources were used, primarily the U.S. Environmental Protection Agency's Health Effects Assessment Summary Tables (EPA 1993).

Table 4.12-4. Hazard quotients for highest predicted concentrations of carcinogenic air pollutants at Idaho National Engineering Laboratory site locations for the maximum baseline case.

Toxic air pollutant	Location of maximum concentration[a]	Baseline concentration ($\mu g/m^3$)	Occupational exposure limit ($\mu g/m^3$)	Hazard quotient
Acetaldehyde	ANL-W	1.1×10^2	1.8×10^5	<0.01
Arsenic	CFA	2.8×10^{-1}	1.0×10^1	0.03
Benzene	CFA	3.1×10^3	3.0×10^3	1.03
Butadiene	TRA	3.8×10^3	2.2×10^4	0.17
Carbon tetrachloride	RWMC	2.5×10^2	1.3×10^4	0.02
Chloroform	RWMC	1.7×10^1	9.8×10^3	<0.01
Formaldehyde	ANL-W	5.7×10^1	9.0×10^2	0.06
Hexavalent chromium	ICPP/TAN	2.4×10^0	5.0×10^1	0.05
Hydrazine	TRA	1.8×10^{-3}	1.0×10^2	<0.01
Methylene chloride	CFA/ICPP	3.2×10^0	1.7×10^5	<0.01
Nickel	CFA	4.1×10^1	1.0×10^2	0.41
Perchloroethylene	CFA	4.3×10^2	1.7×10^5	<0.01
Trichloroethylene	RWMC	4.0×10^1	2.7×10^5	<0.01

a. ANL-W = Argonne National Laboratory-West; ICPP = Idaho Chemical Processing Plant; CFA = Central Facilities Area; TRA = Test Reactor Area; RWMC = Radioactive Waste Management Complex; TAN = Test Area North.

For carcinogenicity, the probability of an individual developing cancer over a lifetime is estimated by multiplying the slope factor (milligram per kilogram-day) for the substance by the chronic (70-year average) daily intake. Hence, the slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. This risk is considered a conservative estimate because the upper bound estimate for the slope factor is used, with the "true" risk likely being less.

Noncarcinogenic Effects. Noncarcinogenic effects are presented using the method described in the U.S. Environmental Protection Agency's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (EPA 1989). This approach presents noncarcinogenic effects in terms of a hazard quotient, which is the ratio between the calculated concentrations in air or drinking water and the reference dose or reference concentration, respectively. Doses or concentrations for each chemical and exposure pathway are compared with the route-specific reference dose or reference concentration. If the hazard quotient is less than 1, then no adverse health effects are expected. For onsite toxic pollutants, the applicable standard, instead of the reference concentration, was used to calculate hazard quotients.

For criteria pollutants (ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead) that are regulated through the National Ambient Air Quality Standards, the potential for health effects was based on a hazard quotient given by the ratio of calculated air concentration to the appropriate regulatory limit.

Table 4.12-5 provides hazard quotients based on maximum noncarcinogenic concentrations at INEL site boundary and public highway locations. The locations of these modeled concentrations are dependent on different points and times of release, so that no single individual could be exposed to all of these chemicals at once. Therefore, these chemical hazard quotients are evaluated separately and not summed. For the individual chemicals, all hazard quotients are less than 1. This indicates that no adverse health effects are projected as a result of noncarcinogenic emissions.

Table 4.12-6 provides an estimate of the excess cancer risk for 70-year exposure to the maximum baseline offsite carcinogenic concentrations. Like the data in Table 4.12-5, the locations of these modeled concentrations are dependent on different points and times of release so the risks are not summed. The results of this assessment indicate that the offsite lifetime excess cancer risk ranges from 7.2×10^{-7} (about 1 occurrence in 1.4 million) to 1.6×10^{-9} (about 1 occurrence in 625 million).

Table 4.12-7 presents hazard quotients for maximum baseline offsite criteria air pollutants. The hazard quotient for each chemical at the various locations is less than 1. This indicates that no adverse health effects are projected as a result of criteria pollutant emissions. Because the locations of these modeled concentrations are dependent on point and time of release, the hazard quotients are not summed.

Table 4.12-5. Hazard quotients for highest predicted noncarcinogenic toxic air pollutant concentrations at the Idaho National Engineering Laboratory—eight-hour site boundary and public road exposures.

Toxic air pollutant	Location	Maximum concentration ($\mu g/m^3$)	Reference concentration ($\mu g/m^3$)	Hazard quotient
Ammonia	Public road	6.0×10^0	1.8×10^2	0.03
	Site boundary	4.1×10^{-1}		<0.01
Cyclopentane	Public road	2.7×10^0	1.7×10^4	<0.01
	Site boundary	3.9×10^{-2}		<0.01
Hydrochloric acid	Public road	9.8×10^{-1}	7.5×10^0	0.13
	Site boundary	9.7×10^{-2}		0.01
Mercury	Public road	4.2×10^{-2}	1.0×10^0	0.04
	Site boundary	1.3×10^{-2}		0.01
Naphthalene	Public road	1.8×10^1	5.0×10^2	0.04
	Site boundary	1.9×10^{-3}		<0.01
Nitric acid	Public road	6.4×10^{-1}	5.0×10^1	0.01
	Site boundary	2.6×10^{-1}		<0.01
Phosphorus	Public road	3.0×10^{-1}	1.0×10^0	0.30
	Site boundary	8.9×10^{-3}		<0.01
Potassium hydroxide	Public road	2.0×10^{-1}	2.0×10^1	0.01
	Site boundary	2.0×10^{-1}		0.01
Propionaldehyde	Public road	3.0×10^{-1}	4.3×10^0	0.07
	Site boundary	6.4×10^{-3}		<0.01
Styrene	Public road	1.3×10^0	1.0×10^3	<0.01
	Site boundary	2.4×10^{-4}		<0.01
Toluene	Public road	3.7×10^2	3.8×10^3	0.10
	Site boundary	6.2×10^{-2}		<0.01
Trimethylbenzene	Public road	1.0×10^2	1.2×10^3	0.08
	Site boundary	1.0×10^{-2}		<0.01
Trivalent chromium	Public road	3.6×10^{-2}	5.0×10^0	<0.01
	Site boundary	2.2×10^{-3}		<0.01

Table 4.12-6. Excess cancer risk based on 70-year exposure to the highest predicted concentrations of carcinogenic air pollutants at Idaho National Engineering Laboratory site boundary locations.

Toxic air pollutant	Baseline concentration ($\mu g/m^3$)	Unit risk (risk per $\mu g/m^3$)	Risk (excess cancers)
Acetaldehyde	1.1×10^{-2}	2.2×10^{-6}	2.4×10^{-8}
Arsenic	9.0×10^{-5}	4.3×10^{-3}	3.9×10^{-7}
Benzene	2.9×10^{-2}	8.3×10^{-6}	2.4×10^{-7}
Butadiene	1.0×10^{-3}	2.8×10^{-4}	2.8×10^{-7}
Carbon tetrachloride	6.0×10^{-3}	1.5×10^{-5}	9.0×10^{-8}
Chloroform	4.0×10^{-4}	2.3×10^{-5}	9.2×10^{-9}
Formaldehyde	1.2×10^{-2}	1.3×10^{-5}	1.6×10^{-7}
Hexavalent chromium	6.0×10^{-5}	1.2×10^{-2}	7.2×10^{-7}
Hydrazine	1.0×10^{-6}	4.9×10^{-3}	4.9×10^{-9}
Methylene chloride	6.0×10^{-3}	4.7×10^{-7}	2.8×10^{-9}
Nickel	2.7×10^{-3}	2.4×10^{-4}	6.5×10^{-7}
Perchloroethylene	1.1×10^{-1}	4.8×10^{-7}	5.3×10^{-8}
Trichloroethylene	9.7×10^{-4}	1.7×10^{-6}	1.6×10^{-9}

4.12.1.2 Health Effects Resulting from Groundwater Releases. This section summarizes potential health effects to both onsite and offsite populations from radionuclides and carcinogenic and noncarcinogenic chemicals in water. More detailed information on concentrations of these pollutants is contained in Section 4.8, Water Resources, of this EIS. A discussion of health effects calculations is contained in Appendix F, Section F-4, Health and Safety, of this EIS. To calculate health effects from radionuclide concentrations in water, the total quantity of radionuclide ingested must be converted to an effective dose equivalent and then the appropriate risk factor applied. This is accomplished by multiplying the concentration of radionuclide in the drinking water (microcuries per liter) by the consumption rate (liters per day) and by the consumption period (days) to obtain the quantity of radionuclide ingested. This ingested quantity (microcuries) is then multiplied by the appropriate dose conversion factor (millirems per microcurie) to obtain the dose that is then multiplied by the appropriate risk factor.

Table 4.12-7. Hazard quotients for ambient air concentrations of criteria pollutants for the maximum baseline scenario at Idaho National Engineering Laboratory site.

Pollutant	Averaging time	Baseline concentration ($\mu g/m^3$): Site boundary	Baseline concentration ($\mu g/m^3$): Public roads	Baseline concentration ($\mu g/m^3$): Craters of the Moon	Applicable standard[a] ($\mu g/m^3$)	Hazard quotient[b]: Site boundary	Hazard quotient[b]: Public roads	Hazard quotient[b]: Craters of the Moon
Carbon monoxide	1-hour	600	1,200	170	40,000	0.015	0.03	0.004
	8-hour	180	340	35	10,000	0.018	0.034	0.004
Nitrogen dioxide	Annual	5	9	1	100	0.046	0.094	0.008
Lead	Quarterly	0.0008	0.002	0.0002	1.5	0.001	0.001	0.0001
Particulate matter[c]	24-hour	17	31	8	150	0.11	0.21	0.055
	Annual	1	3	0.3	50	0.026	0.052	0.006
Particulate matter[d]	24-hour	50	80[e]	10	150	0.33	0.53	0.07
	Annual	2	5[e]	1	50	0.04	0.10	0.02
Sulfur dioxide	24-hour	100	230	39	365	0.27	0.63	0.11
	3-hour	240	520	88	1,300	0.18	0.40	0.068
	Annual	2	4	1	80	0.026	0.054	0.01

a. National Ambient Air Quality Standards; all standards are primary except for 3-hour sulfur dioxide, which is secondary.

b. Hazard quotients were calculated by dividing the baseline concentrations (before rounding) by the applicable standards.

c. Particulate matter from stationary emission points; all particulate matter is assumed to consist of respirable particles less than 10 microns in diameter (that is, PM-10). The State of Idaho also has a standard for total suspended particulates, but the Federal standard for PM-10 is more restrictive.

d. Cumulative contributions from stationary point fugitive emission sources such as vehicle travel on paved and unpaved roads, and landfill and concrete batch plant operation.

e. Does not include fugitive emissions caused by vehicle traffic.

Dose conversion factors were obtained from Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (EPA 1988). These dose conversion factors were used to convert a quantity of intake to an effective dose equivalent for the subsequent application of the appropriate risk factor obtained in ICRP (1991). Table 4.12-8 lists the exposure-to-dose conversion factors.

4.12.1.2.1 Potential Health Effects to the Onsite Population—Estimates of potential health effects for onsite workers were made assessing drinking water sampling data reported by Anderson and Peterson-Wright (1993). The highest average radionuclide concentration in any INEL site drinking water distribution system occurred at the Central Facilities Area. The radionuclide measured was tritium, at a concentration of 16,470 picocuries per liter. This level is below regulatory limits and is projected to decrease because of changes in facility procedures, dilution in the aquifer, and the radioactive decay of tritium. Consumption of this water for 50 years would result in an estimated dose equivalent of 14 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 180,000.

No chemical carcinogens were detected in a drinking water distribution system in excess of maximum contaminant levels. This would indicate an excess incidence of cancer risk of less than 1 occurrence in 1 million.

For all reported noncarcinogenic chemical contaminants, the calculated hazard quotient (that is, the ratio of contaminant to reference dose) was less than 1. This indicates that no adverse health effects are expected as a result of these contaminants.

Table 4.12-8. Exposure-to-dose conversion factors for selected radionuclides.

Isotope	Dose conversion factor (millirem per microcurie)
Tritium	6.40×10^{-2}
Iodine-129	2.76×10^{2}
Strontium-90	1.42×10^{2}

4.12.1.2.2 Potential Health Effects to the Offsite Population—For the offsite population, health effects were estimated using an iodine-129 concentration of 0.00083 picocuries per liter, measured at the INEL site boundary in 1992 (Mann 1994). Consumption of this water for the lifetime of an individual would result in an estimated dose equivalent of 0.012 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 170 million.

4.12.2 Occupational Health and Safety

This section summarizes historical health and safety data and INEL programs designed to protect workers. The radiation doses and nonradiological hazards presented here are based on monitoring results and reported injuries. For routine workplace hazards, the health risk is presented as reported injuries, illness, and fatalities in the workforce. For occupational exposure to ionizing radiation, health effects assessments are based on actual exposure measurements. In addition, there is a potential for small increments of radiation dose and exposure to toxic materials from atmospheric and groundwater releases on the INEL site. Information on these potential impacts is presented above in Section 4.12.1.

4.12.2.1 Radiological Exposure and Health Effects. Radiological protection programs for INEL occupational workers are based on requirements in DOE orders and on guidance in DOE and INEL radiological control manuals.

Workers at the INEL may be exposed either internally or externally to radiation. The largest fraction of dose received by INEL workers is from external radiation. All personnel who could receive annual external radiation exposures greater than 100 millirem are assigned a thermoluminescent dosimeter that is worn at all times during work on the INEL site. The dosimeter measures the amount and type of external radiation dose the worker receives. Internal radiation doses constitute a small fraction of the occupational dose at the INEL. All instances of measurable internal radioactivity are investigated to determine the cause and assess the potential for additional internal dose to the workforce.

Between 1987 and 1991, out of an average of 10,980 workers per year, about 6,000 individuals were monitored annually at the INEL for radiation exposure. Of those monitored, about 32 percent received measurable radiation doses. For those five years, the average occupational dose to individuals with measurable doses was about 0.16 rem, giving an average collective dose of about 300 rem. The resulting number of expected excess fatal cancers would be less than 1 for each year of operation (about 0.12 fatal cancers).

4.12.2.2 Nonradiological Exposure and Health Effects to the Onsite Population. At the INEL, occupational nonradiological health and safety programs are composed of industrial hygiene programs and occupational safety programs. Industrial hygiene programs address such subjects as toxic chemicals and physical agents, carcinogens, noise, biological hazards, lasers, asbestos, ergonomic factors, and surplus materials. Occupational safety programs address such subjects as machine safety, hoisting and rigging, electrical safety, building codes, welding safety, and compressed gas cylinders.

The monitoring and sampling programs established by industrial hygienists provide data to characterize the more common toxic chemicals, such as asbestos, beryllium, cadmium, lead, welding fumes, oxides of nitrogen, hydrogen fluoride, and acids. Through industrial hygiene surveys and job hazard analyses to evaluate workplace hazards, measures are imposed to control exposures within permissible exposure limits.

The DOE recordkeeping and reporting system is aimed at accurately measuring the safety performance of DOE and DOE contractors. Total injury and illness incidence rates at the INEL varied from an annual average of 1.8 to 4.9 per 200,000 work hours from 1987 to 1991. There were 1,337 total recordable injury and illness cases at the INEL from 1987 to 1991 for an average of 8,385 employees per year working a total of 79,654,000 hours. Of the 1,337 cases at the INEL, 114 (8.5 percent) were classified as occupational illnesses (55—repeated trauma disorders; 34—skin diseases or disorders; 13—respiratory condition because of toxic agents; 6—all other illnesses; 4—disorders because of physical agents; and 2—dust diseases of the lungs). Total injury and illness rates for INEL workers are comparable to those for DOE and its contractors, which averaged 3.4 per 200,000 work hours from 1988 to 1992 (DOE 1993). For comparison, rates in private industry across the United States were 8.5 per 200,000 work hours for 1983 to 1992 (NSC 1993).

Only one fatal accident occurred at the INEL over the period from 1987 to 1991. A worker at the Idaho Chemical Processing Plant was killed in a pedestrian-forklift accident in 1991.

The motor vehicle accident rate at the INEL (for government vehicles) for 1987 to 1991 averaged 1.4 accidents (over $500 loss) per 1 million miles.

Only two reportable losses over $1,000 caused by fire occurred from 1987 to 1991: $25,000 damage in 1989 and $63,000 in 1991. A total of 20 reportable nonfire property damage losses (over $1,000) occurred from 1987 to 1991. The total value of the loss from these 20 cases was $1,292,000. In 1988, seven cases accounted for a loss of $1,026,000 and represented 80 percent of the five-year total.

4.13 Idaho National Engineering Laboratory Services

This section discusses water, electricity, and fuel capacities and consumption, wastewater disposal, and security and emergency protection at INEL facilities.

4.13.1 Water Consumption

The water supply for the INEL site is provided by a system of about 30 wells, with pumps and storage tanks, administered by DOE Idaho Falls facilities are provided water by the City of Idaho Falls water supply system, which includes about 16 wells. Because of the distance between site facility areas, the water supply systems for each facility are independent of each other.

DOE holds a Federal Reserved Water Right for the INEL site. Under this agreement, INEL has claim to 2.3 cubic meters per second (36,000 gallons per minute) of groundwater, not to exceed 43 million cubic meters (11.4 billion gallons) per year. The average INEL site water consumption from 1987 through 1991 was 7.36 million cubic meters (1.94 billion gallons) per year, calculated based on the cumulative volumes of water withdrawn from the wells. Shutdown of the A1W and S5G training facilities at the Naval Reactors Facility, which use about 1.0 million cubic meters (265 million gallons) per year, should result in a projected 1995 baseline usage of about 6.4 million cubic meters (1.7 billion gallons) per year. The average water consumption of Idaho Falls facilities is estimated to be 300,000 cubic meters (79 million gallons) per year. The total pumping rate from the aquifer is not measured and would depend on the number of pumps operating. There is a slight possibility that the pumping rate of 2.3 cubic meters per second (36,000 gallons per minute) could be exceeded for very short periods, such as during recovery from an extended power outage when many pumps would be running to refill depleted storage tanks.

4.13.2 Electricity Consumption

Commercial electrical power is supplied to the INEL site from the Antelope substation through two feeders to the federally owned Scoville substation. The Scoville substation supplies electrical power directly to the INEL site electrical power distribution system. The present contract to supply electrical power to the INEL site is with Idaho Power Company and provides for Idaho Power Company to furnish "up to 45,000 kilowatts monthly" at 13.8 kilovolts (IPC/DOE 1986).

Electric power supplied by Idaho Power is generated by hydroelectric generators located along the Snake River in southern Idaho and by the Bridger and Valmy coal-fired thermal electric generation plants located in southwestern Wyoming and northern Nevada.

Rated capacity of the INEL site power transmission loop line is 124 megavolt-amperes. Peak demand on the system from 1990 through 1993 was about 40 megavolt-amperes, and the average usage was about 217,000 megawatt-hours per year. This usage rate would be expected to decrease by about 4 percent by 1995 due to shutdown of the A1W and S5G facilities. Addition of the new substation for the Radioactive Waste Management Complex is expected to be completed in 1996 and is accounted for in the impact analysis of the power usage for the Radioactive Waste Management Complex facilities included in Section 5.13, Idaho National Engineering Laboratory Services.

INEL facilities in Idaho Falls receive electric power from the City of Idaho Falls, which operates four hydroelectric power generation plants on the Snake River along with substation and distribution facilities. Supplemental power is supplied to the City of Idaho Falls by the Bonneville Power Administration, which operates hydroelectric plants on the Columbia River system. In 1993, Idaho Falls facilities used 31,500 megawatt-hours of electricity.

4.13.3 Fuel Consumption

Fuels consumed at the INEL site include several liquid petroleum fuels, coal, and propane gas. All fuels are transported to the site for storage and use. Natural gas is the only reported fuel consumed at the INEL Idaho Falls facilities; this fuel is provided by the Intermountain Gas Company through a system of underground lines.

The average annual fuel consumption at the INEL site from 1990 through 1992 is: heating oil, 10,578,000 liters (2,795,000 gallons); diesel fuel, 5,690,000 liters (1,500,000 gallons); propane gas, 568,000 liters (150,000 gallons); gasoline, 2,107,000 liters (557,000 gallons); jet fuel, 276,600 liters (73,100 gallons); and kerosene, 128,000 liters (33,800 gallons). About 8,200 metric tons (9,000 tons) of coal are also used at the INEL site. Fuel storage is provided for each facility, and fuel inventories are restocked as necessary. No fossil fuel shortage has ever occurred at the INEL site.

4.13.4 Wastewater Disposal

Wastewater systems at the smaller onsite facility areas consist primarily of septic tanks, drain fields, and lagoons. The larger facility areas, such as the Central Facilities Area, Idaho Chemical Processing Plant, and Test Reactor Area, have wastewater treatment facilities. Idaho Falls facilities are serviced by the City of Idaho Falls wastewater treatment system.

Average annual wastewater discharge volume at the INEL site for 1989 through 1991 was 537 million liters (142 million gallons). Wastewater from Idaho Falls facilities is not metered but is estimated to be 300 million liters (79 million gallons) per year. The difference between water pumped and estimated wastewater discharge is caused mainly by evaporation from ponds and cooling towers, irrigation of landscaped areas, and discharge of unmetered wastewater.

4.13.5 Security and Emergency Protection

This section describes the fire protection/fire prevention, security, and emergency preparedness resources for the INEL site and the surrounding INEL areas. The discussion includes the Fire Department for the area, the Safeguards and Security Division, and the Emergency Preparedness Organization.

4.13.5.1 Idaho National Engineering Laboratory Fire Department. The contractor-operated Fire Department staffs and operates three fire stations on the INEL site that support the entire INEL site. These stations are located on the north end at Test Area North, at Argonne National Laboratory-West, and at the Central Facilities Area. Each station has a minimum of one engine company capable of supporting any fire emergency in their assigned area. The Fire Department has a staff of 44 fire fighters and 11 support personnel and operates with a minimum critical staff of 7 fire fighters at any one time. Besides providing fire fighting services, the Fire Department provides the INEL site ambulance, emergency medical technician (EMT), and hazardous material response services. The Fire Department has mutual aid agreements with other fire-fighting entities, such as the Bureau of Land Management and the Cities of Idaho Falls, Blackfoot, and Arco. Through these agreements, DOE facilities within the City of Idaho Falls are served by the Idaho Falls Fire Department.

4.13.5.2 Department of Energy and Idaho National Engineering Laboratory Emergency Preparedness. Each DOE INEL contractor administers and staffs its own emergency preparedness program under the direction and supervision of DOE. All contractor programs for emergency control and response are compatible. The Warning Communications Center, with oversight from DOE, is the communication and overall control center for support to the on-scene commanders in charge of the emergency response. The DOE emergency preparedness system includes mutual aid agreements with all regional county and major city fire departments, police, and medical facilities. Through the agreements, DOE facilities within the City of Idaho Falls are serviced by the Idaho Falls emergency preparedness organizations.

4.13.5.3 Department of Energy and Idaho National Engineering Laboratory Security. DOE has oversight responsibility for safeguards and security at the INEL. The security program is divided into three categories: security operations, personnel security, and safeguards. Security operations provides for asset protection (classified matter, special nuclear material, facilities, and personnel) and technical security (computer and information). The INEL protective force, staffed by the INEL prime contractor, Lockheed Idaho Technologies Company, is administered under this category. Personnel security processes personnel security clearances. Safeguards is responsible for the management and accountability of special nuclear materials. The INEL protective force, consisting of approximately 200 armed guards and approximately 350 support personnel, provides the onsite personnel that administer the programs. Each smaller INEL contractor also has a safeguards and security staff, subdivided in a similar manner, to manage the security associated with their specific facilities. Contractor safeguards and security staffs range in size from about 5 to 60 persons, depending on the size and complexity of their associated facilities. Each staff works in combination with the INEL protective forces.

5. ENVIRONMENTAL CONSEQUENCES

5.1 Introduction

Chapter 5 describes the environmental consequences to the Idaho National Engineering Laboratory site, Idaho Falls facilities, and surrounding region that may result from implementing each of the spent nuclear fuel and Environmental Restoration and Waste Management Program alternatives. In addition to the potential consequences associated with each alternative, potential consequences associated with certain specific projects are discussed in more detail.

Tables in Chapter 3, Alternatives. list projects to be implemented under each alternative. Appendix C, Information Supporting the Alternatives, identifies acres disturbed, resources used (energy, services, and so forth), personnel required, and other important attributes of each project. These attributes were used to determine the potential impacts of each alternative as discussed below.

The potential effects for each alternative have been estimated by evaluating each individual project proposed for the alternative, summing the projects' collective effects under each alternative, and including synergistic interactions among the individual projects that comprise each alternative.

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

The analyses of hypothetical accidents provide more opportunities for uncertainty, primarily because the calculations must be based on sequences of events and models of effects that have not occurred. In this EIS, the goal in selecting the hypothetical accidents analyzed has been to evaluate events that would produce effects that would be as severe or more severe than any other accidents that might reasonably be foreseen. The models have attempted to provide estimates of the probabilities, source terms, pathways for dispersion and exposure, and the effects on human health and the environment that are as realistic as possible. However, in many cases, the very low probability of the accidents postulated has required the use of models or values for input that produce estimates of consequences and risks that are higher than would actually occur because of the desire to provide results that will not be exceeded.

The use of conservative analyses is not an important problem or disadvantage in this EIS because all of the alternatives have been evaluated using the same methods and data, allowing a fair comparison of all of the alternatives on this same basis. It should be observed that, even using these conservative analytical methods, the risks for all of the alternatives are small.

As described in Chapter 3, Alternative A (No Action) is characterized by operating and maintaining most existing facilities and programs. Alternative A provides a basis for comparison with the impacts of other alternative actions, although it may result in noncompliance with existing government policies, agreements, and environmental requirements. Under Alternative B (Ten-Year Plan), the historical program role and level of support would continue. This would include activities described under Alternative A that would be enhanced to comply with regulatory requirements, protect the environment, and support INEL missions. Alternative C (Minimum Treatment, Storage, and Disposal) would, to the extent possible, minimize spent nuclear fuel, waste management, and environmental restoration activities at the INEL. Under Alternative D (Maximum Treatment, Storage, and Disposal), the INEL would receive and manage the maximum amount of waste and spent nuclear fuel (as defined in Volume 1 of this EIS and in the Waste Management Programmatic EIS) that DOE could transport to the INEL while complying with legal and environmental requirements.

The structure of Chapter 5 closely parallels that of Chapter 4, Affected Environment. The 13 sections of Chapter 4 have corresponding sections in Chapter 5. The sections each contain a section on methodology followed by a discussion of the potential impacts of each alternative evaluated. In addition, for six key disciplines more details on methodologies plus key data are given in Appendix F of Volume 2. These disciplines are socioeconomics, geology, water, air, health and safety, and facility accidents. Throughout Chapter 5 and Appendix F, citations are given to technical references supporting the evaluations. Full citations are provided in Chapter 9 of this volume.

5.2 Land Use

This section discusses the potential effects of the four environmental restoration and waste management alternatives on land use at the INEL site and in the surrounding area.

5.2.1 Methodology

The methodology used in this assessment consisted of comparing proposed land uses and plans to existing land uses and plans. The evaluation of potential effects from each alternative were qualitatively assessed. Potential effects, if any, from converting existing land uses to other uses were also evaluated. The land use impacts of each ongoing and foreseeable project are quantified in Appendix C, Information Supporting the Alternatives.

5.2.2 Land Use Impacts from Alternative A (No Action)

Alternative A (No Action) would result in the disturbance of approximately 40 acres (16 hectares). Out of this total, 35 acres (14 hectares) have been previously disturbed and 5 acres (2 hectares) are open space. Of the 40 acres that would be disturbed, almost all (38 acres) are inside of existing facility area fencelines and boundaries. The projects with the largest land disturbance under Alternative A would be the Transuranic Storage Area Enclosure and Storage Project, the Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning Project, and the Pit 9 Retrieval Project. These projects are described in Appendix C, Information Supporting the Alternatives. Existing and planned land uses within INEL facility areas would not change as a result of Alternative A activities. Proposed activities would be consistent with the existing DOE plans listed in Section 4.2, Land Use, for continued operations, environmental restoration, and waste management, and would be similar to uses in existing developed areas on the site. Under this alternative, proposed activities would not be conducted outside of the INEL boundaries and no effects on surrounding land uses or local land use plans are expected.

5.2.3 Land Use Impacts from Alternative B (Ten-Year Plan)

Alternative B (Ten-Year Plan) would result in the disturbance of approximately 823 acres (333 hectares). Out of this total, approximately 246 acres (100 hectares) have been previously disturbed and 577 acres (233 hectares) are open space. Of the 823 acres that would be disturbed, about 42 percent (342 acres) are inside existing facility area fencelines or boundaries and 58 percent (481 acres) are outside of these boundaries. The projects with the largest land disturbance under Alternative B would be the Industrial/Commercial Landfill Expansion Project, the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, and the Mixed Low-Level Waste Disposal Facility. These projects are described in Appendix C, Information Supporting the Alternatives. Proposed activities would be consistent with existing DOE plans for continued operations, environmental restoration, and waste management and would be similar to uses in existing developed areas on the site. Under this alternative, proposed activities would not be conducted outside of the INEL boundaries and no effects on surrounding land uses or local land use plans are expected. Due to the greater number of acres that would be disturbed, particularly acreage outside of existing facility areas, and the withdrawal of some acreage for the disposal of radioactive waste (see Section 5.18, Irreversible and Irretrievable Effects, of Volume 2), the potential effects on land use from Alternative B activities would be greater than those associated with Alternative A (No Action) activities.

5.2.4 Land Use Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Alternative C (Minimum Treatment, Storage, and Disposal) would result in the disturbance of 355 acres (144 hectares). Out of this total, approximately 233 acres (94 hectares) have been previously disturbed and 122 acres (49 hectares) are open space. Of the 355 acres that would be disturbed, almost all (353 acres) are inside existing facility area fencelines or boundaries. The project with the largest land disturbance under Alternative C would be the Industrial/Commercial Landfill Expansion Project. This project is described in Appendix C, Information Supporting the Alternatives. Proposed activities would be consistent with existing DOE plans for continued operations, environmental restoration, and waste management and would be similar to uses in existing developed areas on the site. Under this alternative, proposed activities would not be conducted outside of INEL boundaries and no effects on surrounding land uses or local land use plans are expected. Due to the greater number of acres that would be disturbed, potential effects from Alternative C activities would be greater than those associated with Alternative A (No Action) activities.

5.2.5 Land Use Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) would result in the disturbance of approximately 1,339 acres (542 hectares). Out of this total, approximately 277 acres (112 hectares) have been previously disturbed and 1,062 acres (430 hectares) are open space. Of the 1,339 acres that would be disturbed, about 27 percent (367 acres) are inside existing facility fencelines or boundaries, and 73 percent (972 acres) are outside these boundaries. The projects with the largest land disturbance under Alternative D would be the Mixed Low-Level Waste Disposal Facility, the Mixed Low-Level Waste Treatment Facility, the Industrial/Commercial Landfill Expansion Project, and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility. These projects are described in Appendix C, Information Supporting the Alternatives. Proposed activities would be consistent with existing DOE plans for continued operations, environmental restoration, and waste management and would be similar to uses in existing developed areas on the site. Under this alternative, proposed activities would not be conducted outside of INEL boundaries, and no effects on surrounding land uses or local land use plans are expected. Due to the greater number of acres that would be disturbed, particularly acreage outside of existing facility areas, and the withdrawal of some acreage for the disposal of radioactive waste and hazardous waste (see Section 5.18, Irreversible and Irretrievable Effects), the potential effects of Alternative D would be greater than those associated with Alternative A (No Action) activities.

5.3 Socioeconomics

Socioeconomic resources, such as employment, income, population, housing, community services, and public finance, are interrelated in their response to implementation of an action. This section describes the potential effects of the INEL environmental restoration and waste management alternatives on the socioeconomic resources of the region of influence. Proposed changes in DOE-related expenditures and workforce levels have the potential to generate economic impacts that may affect local employment, population, and community resources. Mitigation of potential impacts is discussed in Section 5.19, Mitigation. Technical support for this section is provided by Appendix F, Section F-1, Socioeconomics.

5.3.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and secondary effects. Direct effects are changes in INEL employment and expenditures expected to take place under each alternative and include both construction and operations phase impacts. Secondary effects include both indirect and induced impacts. Indirect effects are impacts to regional businesses and employment resulting from changes in DOE regional purchases or nonpayroll expenditures. Induced effects are impacts to regional businesses and employment that result from changes in payroll spending hy affected INEL employees. The total economic impact to the region is the sum of direct and secondary effects. Both the direct and secondary effects were estimated for the region of influence (ROI) described in Section 4.3, Socioeconomics.

The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by DOE in cooperation with INEL contractors and their representatives. Direct employment impacts represent actual increases or decreases in INEL staffing; they do not include changes in staffing due to reassignment of the existing INEL workforce. Total employment and earnings impacts were estimated using RIMS II multipliers developed specifically for the INEL region of influence by the U.S. Bureau of Economic Analysis. A comprehensive discussion of the methodology may be found in Appendix F, Section F-1, Socioeconomics.

The importance of the actions and their impacts is determined relative to the context of the affected environment. Projected baseline conditions in the region of influence, as presented in

Section 4.3, Socioeconomics, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of any of the alternatives. Baseline employment and population represent socioeconomic conditions expected to exist in the region throughout the study period. Potential alternative impacts are analyzed in Chapter 5. Each alternative is expected to generate initial increases in employment and earnings within the region of influence, primarily due to expected construction activities. Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), which include the phaseout of the Expended Core Facility, will result in employment declines by 2004; Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) result in moderate employment increases.

As presented in Section 4.3, Socioeconomics, baseline employment at the INEL is projected to decline over the study period. The projected declines in baseline INEL employment will likely generate secondary job losses in the region of influence and may also contribute to effects on regional population, housing, and community services. The results of the socioeconomic analysis indicate that the impacts associated with the alternatives are expected to offset the effects of these baseline declines during certain years and under some alternatives and may compound the effects under others. The focus of this analysis has been to estimate the potential socioeconomic impacts associated with the implementation of each alternative in order to provide a basis for comparison in evaluating the alternatives. The offsetting (or contributing) effect on projected baseline conditions is addressed in general; however, the projected decline in baseline INEL activity is not an alternative and, therefore, a comprehensive analysis of potential impacts is not specifically addressed. A discussion of cumulative impacts can be found in Section 5.15, Cumulative Impacts and Impacts from Connected or Similar Actions.

5.3.2 Socioeconomic Impacts from Alternative A (No Action)

The impacts from Alternative A (No Action) on employment and earnings, population and housing, and community services in the region of influence are discussed below. The projects with the greatest socioeconomic impacts under Alternative A would be the Pit 9 Retrieval Project and the Transuranic Storage Area Enclosure and Storage Project. These projects are described in Appendix C, Information Supporting the Alternatives.

5.3.2.1 Employment and Earnings. Implementation of Alternative A (No Action) is expected to generate about 360 direct jobs during the peak employment year (1996), representing a 4.2 percent increase over the 1995 baseline INEL employment of approximately 8,620 (Table 5.3-1). This increase primarily would be due to construction jobs for the projects approved before June 1, 1995. By 2004, however, direct employment would decrease by 500 jobs (a 5.8 percent decrease from baseline), due primarily to the phaseout of the Expended Core Facility. Secondary employment generated under Alternative A is expected to range from an increase of about 510 jobs in 1996 to a decrease of about 780 jobs in 2002. The total employment impact (direct plus secondary) in the region of influence is estimated to range from an increase of about 870 jobs in 1996 to a decrease of about 1,280 jobs in 2002 (Figure 5.3-1). (See Appendix F, Section F-1.3, for assumptions regarding employment and population.) Total employment impacts expected under this alternative amount to less than 1.2 percent of total regional employment in any given year of the study period. It is unlikely that employment impacts of this size would generate any long-term adverse effects on the economic activity of the region.

Direct earnings, or payrolls, generated under Alternative A (No Action) would amount to an increase of $9.8 million in 1996 and a decrease of $21.6 million in 2002 (Appendix F, Section F-1,

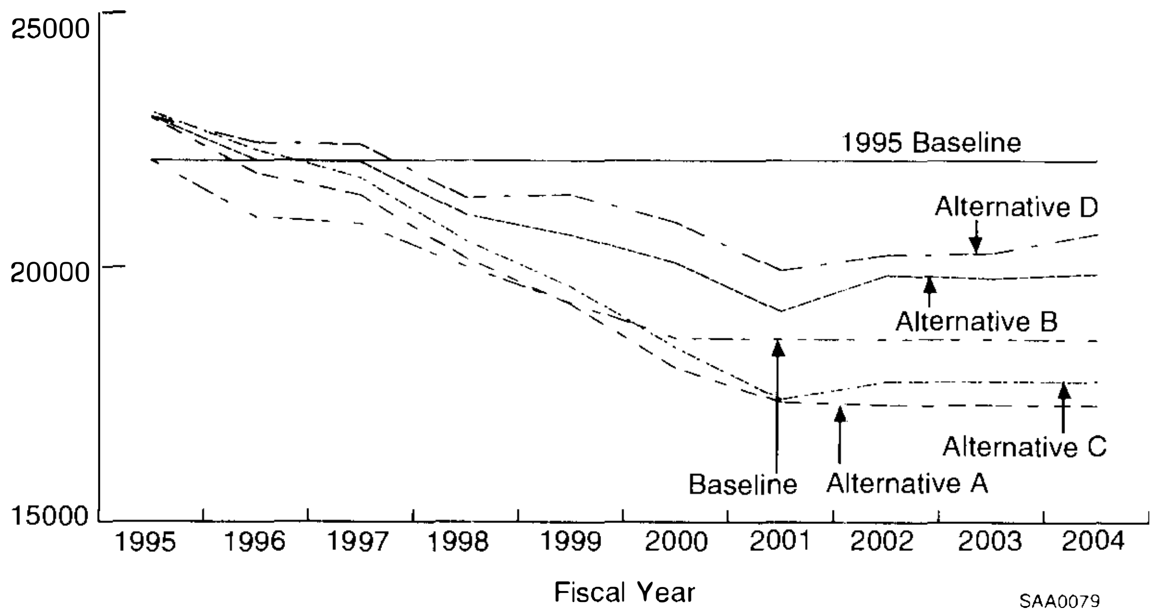


Figure 5.3-1. Total direct and secondary employment by alternatives in the region of influence surrounding the Idaho National Engineering Laboratory (Source: USBEA 1993 and project data sheets found in Volume 2, Appendix C, of this EIS).

Table 5.3-1. Net and overall employment and population impacts on the region of influence surrounding the Idaho National Engineering Laboratory by alternative and fiscal year.[a,b,c]

	Fiscal year									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Change in baseline employment relative to 1995	0	-1121	-1252	-2099	-2812	-3505	-3525	-3525	-3525	-3525
Direct	0	-437	-488	-818	-1096	-1366	-1374	-1374	-1374	-1374
Secondary	0	-684	-764	-1281	-1716	-2139	-2151	-2151	-2151	-2151
Change in baseline population relative to 1995	0	-1451	-1620	-2715	-3638	-4534	-4561	-4561	-4561	-4561
Alternative A (No Action)										
Employment impact	835	872	566	164	-28	-585	-1233	-1283	-1283	-1283
Direct	347	362	232	68	-2	-223	-480	-500	-500	-500
Secondary	489	510	334	96	-26	-361	-752	-783	-783	-783
Overall employment change relative to 1995	835	-249	-686	-1935	-2840	-4089	-4758	-4808	-4808	-4808
Population impact	350	365	340	62	-346	-916	-1595	-1659	-1659	-1659
Overall population change relative to 1995[c]	350	-1085	-1280	-2653	-3984	-5451	-6155	-6220	-6220	-6220
Alternative B (Ten-Year Plan)										
Employment impact	858	1130	1217	1020	1330	1465	537	1244	1179	1275
Direct	356	469	502	420	548	598	220	513	487	527
Secondary	502	661	715	600	781	867	317	731	693	749
Overall employment change relative to 1995	858	9	-35	-1079	-1483	-2040	-2988	-2281	-2346	-2250
Population impact	360	474	625	543	679	955	334	631	597	637
Overall population change relative to 1995[c]	360	-977	-994	-2172	-2959	-3579	-4226	-3930	-3964	-3924
Alternative C (Minimum Treatment, Storage, and Disposal)										
Employment impact	950	1330	909	507	315	-184	-1175	-825	-825	-825
Direct	394	552	375	211	141	-57	-457	-310	-310	-310
Secondary	555	778	535	297	175	-127	-719	-515	-515	-515
Overall employment change relative to 1995	950	208	-343	-1591	-2497	-3689	-4701	-4350	-4350	-4350
Population impact	398	557	484	206	-202	-749	-1571	-1468	-1468	-1468
Ove all population change relative to 1995[c]	398	-893	-1136	-2509	-3840	-5283	-6131	-6028	-6028	-6028
Alternative D (Maximum Treatment, Storage, and Disposal)										
Employment impact	858	1474	1560	1363	2131	2266	1338	1647	1674	2076
Direct	356	612	644	563	881	931	552	680	692	859
Secondary	502	862	916	801	1250	1335	786	966	982	1217
Ove all employment change relative to 1995	858	352	308	-736	-682	-1239	-2188	-1879	-1852	-1449
Population Impact	360	618	769	687	1015	1290	670	799	804	973
Ove all population change relative to 1995[c]	360	-833	-851	-2028	-2623	-3244	-3891	-3761	-3757	-3588

a. Sources: USBEA (1993) and project data sheets found in Volume 2, Appendix C, of this EIS.
b. See Section F-1.3 for assumptions rega ding employment and population.
c. Overall change equals baseline impact plus alternative impact.

Table F-1-4). Total earnings generated in the region of influence are estimated to be an increase of $19.0 million in 1996 and a decrease of $39.5 million in 2002. Similar to the estimated employment impacts, earnings are expected to vary considerably within this range over the study period.

Employment and earnings impacts expected under Alternative A (No Action) would initially offset projected declines in baseline INEL employment and earnings; however, after 1998, employment losses expected under Alternative A would compound projected baseline declines. The overall employment losses expected in the region of influence by 2004 amount to about 1,870 direct jobs and about 4,810 total jobs.

5.3.2.2 Population and Housing. As the demand for workers in a region varies, the population within the region also tends to vary depending on the nature of the change in employment demand. For example, as worker demand increases (or decreases) in a region, some potential workers and their families may move to (or out of) the region in search of new jobs. Likewise, changes in employment expected under Alternative A (No Action) would presumably generate in-migration to the region of influence, in the case of employment increases, and out-migration, in the case of employment decreases.

Based on expected relocation ratios and average household size data, population in-migration associated with the implementation of Alternative A (No Action) may amount to about 370 persons during the peak employment year, an increase which represents less than 0.2 percent of the total regional population (Table 5.3-2). By 2004, however, Alternative A could result in the out-migration of about 1,660 persons, a 0.6 percent decrease in regional population.

Under projected baseline employment conditions at the INEL, the number of direct and secondary jobs in the region of influence could fall by 3,520 over the ten-year period from 1995 to 2004. The elimination of these jobs could induce the relocation of a number of these workers and their families, resulting in the possible out-migration of approximately 4,560 persons by 2004. Through the loss of additional jobs, the implementation of Alternative A (No Action) would contribute to this potential population decline, generating an overall population out-migration of approximately 6,220 persons. The actual magnitude of the total population effect would depend to a large extent on the future availability of comparable employment opportunities within the region relative to the availability of employment elsewhere and to a variety of subjective criteria.

Table 5.3-2. Population effects on the region of influence surrounding the Idaho National Engineering Laboratory for baseline and alternatives by fiscal year.[a,b]

Population	Fiscal year 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Region of influence	247,990	251,518	255,096	258,726	262,406	266,140	268,667	271,279	273,795	276,395
Population change due to baseline declines	0	-1,451	-1,620	-2,715	-3,638	-4,534	-4,561	-4,561	-4,561	-4,561
Region of influence less baseline declines	247,990	250,067	253,476	256,011	258,768	261,606	264,106	266,718	269,234	271,834
Alternative A (No Action)										
Population impact	350	365	340	62	-346	-916	-1,595	-1,659	-1,659	-1,659
Total regional population	248,340	250,433	253,816	256,073	258,422	260,689	262,512	265,059	267,575	270,575
Alternative B (Ten-Year Plan)										
Population impact	360	474	625	543	679	955	334	631	597	637
Total regional population	248,350	250,541	254,102	256,554	259,447	262,561	264,441	267,349	269,831	272,471
Alternative C (Minimum Treatment, Storage, and Disposal)										
Population impact	398	557	484	206	-202	-749	-1,571	-1,468	-1,468	-1,468
Total regional population	248,388	250,625	253,960	256,217	258,566	260,857	262,536	265,251	267,575	270,575
Alternative D (Maximum Treatment, Storage, and Disposal)										
Population impact	360	618	769	687	1,015	1,290	670	799	804	973
Total regional population	248,350	250,685	254,245	256,698	259,783	262,896	264,776	267,518	270,038	272,807

a. Sources: USBC (1982, 1992), USBEA (1993), and project data sheets found in Volume 2, Appendix C, of this EIS.
b. See Section F-1.3 for assumptions regarding employment and population.

During the peak employment period, implementation of Alternative A (No Action) could result in a temporary increase in housing demand of about 110 units, representing less than 0.2 percent of the current housing stock in the region of influence. Assuming that the general conditions associated with the current housing market continue (see Section 4.3.2.2), this small, temporary increase in demand should easily be accommodated. By 2004, the potential out-migration expected under Alternative A could reduce the demand for housing in the region of influence by approximately 480 units, representing approximately 0.7 percent of total available housing units. Given current housing preferences and current vacancy rates of 2.1 percent for homeowner-occupied housing and 4.6 percent for rental housing, the decline in housing demand anticipated under Alternative A could result in vacancy rates for owner-occupied and rental units of 2.8 percent and 5.3 percent, respectively. The decline in projected baseline activity at the INEL could reduce the demand for housing by an additional 1,310 units by 2004, resulting in an overall decrease in demand of about 1,790 units, or 2.4 percent of the current housing stock.

5.3.2.3 Community Services and Public Finance. The population decrease of 1,660 persons expected under Alternative A (No Action) by 2004 represents a decline of less than one percent in the total regional population. It is unlikely that such a small change in regional population would generate any discernible impact on community services and public finance within the region of influence. The effects of the decline in baseline INEL activity, however, could result in an overall population decrease of about 6,220 persons under Alternative A, a 2.3 percent decline in total regional population. School enrollments could decline by approximately 2.5 percent, accompanied by similar decreases in demand for other community services. Similarly, revenues received by the county governments within the region of influence may decrease slightly as a result of the projected declines in regional economic activity.

5.3.3 Socioeconomic Impacts from Alternative B (Ten-Year Plan)

The impacts from Alternative B (Ten-Year Plan) on employment and earnings, population and housing, and community services in the region of influence are discussed below. The projects with the greatest socioeconomic impacts under Alternative B would be the Waste Immobilization Facility and the Remote Mixed Waste Treatment Facility. These projects are described in Appendix C, Information Supporting the Alternatives.

5.3.3.1 Employment and Earnings. Implementation of Alternative B (Ten-Year Plan) is expected to generate about 600 direct jobs in the region of influence during the peak employment year (2000), representing a 7.0 percent increase over the 1995 baseline INEL employment of approximately 8,620 (Table 5.3-1). By 2004, direct employment would amount to about 530 jobs, a 6.1 percent increase from baseline. Secondary employment generated under Alternative B is expected to reach about 870 jobs in the peak year and fall to about 750 jobs by 2004. The total employment impact (direct plus secondary) in the region of influence is estimated to range from an increase of about 1,470 jobs in 2000 to about 1,280 jobs in 2004 (Figure 5.3-1). Total employment impacts expected under Alternative B amount to less than 1.4 percent of total regional employment in any given year of the study period. It is unlikely that employment impacts of this size would generate any long-term adverse effects on the economic activity of the region.

Direct earnings, or payrolls, generated under Alternative B (Ten-Year Plan) would amount to \$18.7 million in 2000, decreasing to \$15.0 million in 2004 (Appendix F, Section F-1, Table F-1-4). Total earnings generated in the region of influence are estimated to be \$35.4 million in 2000, decreasing to \$28.9 million by 2004. Similar to the estimated employment impacts, earnings are expected to vary within this range over the study period.

The positive employment and earnings impacts expected under Alternative B (Ten-Year Plan) would tend to offset the magnitude of the effects of projected declines in baseline INEL employment and earnings. Baseline employment at the INEL is expected to steadily decline over the ten-year study period, resulting in a loss of approximately 1,370 direct jobs and 2,150 secondary jobs by 2004. The overall effect of Alternative B would reduce these job losses to about 840 and 1,400, respectively, by 2004.

5.3.3.2 Population and Housing. Population in-migration associated with the implementation of Alternative B (Ten-Year Plan) may amount to about 960 persons during the peak employment year, an increase that represents less than 0.4 percent of the total regional population (Table 5.3-2). By 2004, population increases would decline to approximately 640 persons, a 0.2 percent increase in regional population.

Under projected baseline employment conditions at the INEL, the number of direct and secondary jobs in the region of influence could fall by 3,520 over the ten-year period from 1995 to

2004. The elimination of these jobs could induce the relocation of a number of these workers and their families, resulting in the possible out-migration of approximately 4,560 persons by 2004. Through the demand for additional workers, the implementation of Alternative B (Ten-Year Plan) would alleviate the effects of this potential population decline, reducing the overall out-migration to approximately 3,920 persons. The degree of offset depends to a large extent on whether the persons losing jobs at the INEL under projected baseline conditions possess the skills required to fill the new jobs generated under Alternative B.

During the peak employment period, implementation of Alternative B (Ten-Year Plan) could result in a temporary increase in housing demand of about 280 units, representing approximately 0.4 percent of the current housing stock in the region of influence. Given current housing preferences and current vacancy rates of 2.1 percent for homeowner-occupied housing and 4.6 percent for rental housing, the increase in housing demand anticipated under Alternative B could reduce the vacancy rates for owner-occupied and rental units to 1.7 percent and 4.2 percent, respectively. Assuming that the general conditions associated with the current housing market continue (see Section 4.3.2.2, Housing), this increase in demand is unlikely to place perceptible strain on the existing market. By 2004, the expected housing demand associated with population in-migration under Alternative B (Ten-Year Plan) would amount to approximately 180 units, representing approximately 0.3 percent of total available housing units. The projected decline in baseline activity at the INEL, however, would more than offset the potential increases in demand for housing expected under Alternative B, resulting in an overall decrease in housing demand of about 1,130 units, or 1.5 percent of the current housing stock.

5.3.3.3 Community Services and Public Finance. The expected population in-migration of 640 persons anticipated under Alternative B (Ten-Year Plan) by 2004 represents an increase of less than 0.3 percent in the total regional population. It is unlikely that such a small change in regional population would generate any discernible impact on community services and public finance within the region of influence. The effects of the decline in projected baseline INEL activity could result in an overall population decrease of about 3,920 persons under Alternative B, a 1.4 percent decline in total regional population. Again, an impact of this magnitude is not expected to be sufficient to notably affect community services and public finance in the region of influence.

5.3.4 Socioeconomic Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

The impacts from Alternative C (Minimum Treatment, Storage, and Disposal) on employment and earnings, population and housing, and community services in the region of influence are discussed in the following subsections. The projects with the greatest socioeconomic impacts under Alternative C would be the Waste Immobilization Facility and the High-Level Tank Farm New Tanks Project. These projects are described in Appendix C, Information Supporting the Alternatives.

5.3.4.1 Employment and Earnings. Implementation of Alternative C (Minimum Treatment, Storage, and Disposal) is expected to generate about 550 direct jobs in the region of influence during the peak employment year (1996), representing a 6.4 percent increase over the 1995 baseline INEL employment of approximately 8,620 (Table 5.3-1). By 2004, however, direct employment would decrease by about 310 jobs (a 3.6 percent decrease from baseline), due primarily to the phaseout of the Expended Core Facility. Secondary employment generated under Alternative C is expected to range from an increase of about 780 jobs in 1996 to a loss of about 520 jobs in 2004. The total employment impact (direct plus secondary) in the region of influence is estimated to range from an increase of about 1,330 jobs in 1996 to a decrease of about 830 jobs in 2004 (Figure 5.3-1). Total employment impacts expected under Alternative C amount to less than 1.3 percent of total regional employment in any given year of the study period. It is unlikely that employment impacts of this size would generate any long-term adverse effects on the economic activity of the region.

Direct earnings, or payrolls, generated under Alternative C (Minimum Treatment, Storage, and Disposal) would amount to an increase of $15.0 million in 1996 and a decrease of $16.5 million in 2004 (Appendix F, Section F-1, Table F-1-4). Total earnings generated in the region of influence are estimated to be an increase of $29.0 million in 1996 and a decrease of $29.5 million in 2004. Similar to the estimated employment impacts, earnings are expected to vary considerably within this range over the study period.

Employment and earnings impacts expected under Alternative C (Minimum Treatment, Storage, and Disposal) would initially offset projected declines in baseline INEL employment and earnings; however, after 1999, employment losses expected under Alternative C would compound projected baseline declines. The overall employment losses expected in the region of influence by 2004 amount to about 1,680 direct jobs and 4,350 total jobs.

5.3.4.2 Population and Housing. Population in-migration associated with the implementation of Alternative C (Minimum Treatment, Storage, and Disposal) may amount to about 560 persons during the peak employment year, an increase that represents less than 0.3 percent of the total regional population (Table 5.3-2). By 2004, however, Alternative C could result in the out-migration of about 1,470 persons, a 0.5 percent decrease in regional population.

Under projected baseline employment conditions at the INEL, the number of direct and secondary jobs in the region of influence could fall by 3,520 over the ten-year period from 1995 to 2004. The elimination of these jobs could induce the relocation of a number of these workers and their families, resulting in the possible out-migration of approximately 4,560 persons by 2004. Through the loss of additional jobs, the implementation of Alternative C (Minimum Treatment, Storage, and Disposal) would contribute to this potential population decline, generating an overall out-migration of approximately 6,030 persons. The actual magnitude of the total population effect would depend to a large extent on the future availability of comparable employment opportunities within the region relative to the availability of employment elsewhere and to a variety of subjective criteria.

During the peak employment period, implementation of Alternative C (Minimum Treatment, Storage, and Disposal) could result in a temporary increase in housing demand of about 160 units, representing approximately 0.2 percent of the current housing stock in the region of influence. Assuming that the general conditions associated with the current housing market continue (see Section 4.3.2.2, Housing), this small, temporary increase in demand should easily be accommodated. By 2004, the potential out-migration expected under Alternative C could reduce the demand for housing in the region of influence by approximately 420 units, representing approximately 0.6 percent of total available housing units. Given current housing preferences and current vacancy rates of 2.1 percent for homeowner-occupied housing and 4.6 percent for rental housing, the decline in housing demand anticipated under Alternative C could result in vacancy rates for owner-occupied and rental units of 2.7 percent and 5.3 percent, respectively. The decline in projected baseline activity at the INEL could reduce the demand for housing by an additional 1,310 units by 2004, resulting in an overall decrease in demand of about 1,730 units, or 2.4 percent of the current housing stock.

5.3.4.3 Community Services and Public Finance. The population decrease of about 1,470 persons expected under Alternative C (Minimum Treatment, Storage, and Disposal) by 2004 represents a decline of less than one percent in the total regional population. It is unlikely that such a small change in regional population would generate any discernible impact on community services and public finance within the region of influence. The effects of the decline in baseline INEL activity, however, could result in an overall population decrease of about 6,030 persons under Alternative C, a 2.2 percent decline in total regional population. School enrollments could decline by approximately 2.4 percent, accompanied by similar decreases in demand for other community services. Similarly, revenues received by the county governments within the region of influence may decrease slightly as a result of the projected declines in regional economic activity.

5.3.5 Socioeconomic Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

The impacts from Alternative D (Maximum Treatment, Storage, and Disposal) on employment and earnings, population and housing, and community services in the region of influence are discussed below. The projects with the greatest socioeconomic impacts under Alternative D would be the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Project and the Spent Fuel Processing Project. These projects are described in Appendix C, Information Supporting the Alternatives.

5.3.5.1 Employment and Earnings. Implementation of Alternative D (Maximum Treatment, Storage, and Disposal) is expected to generate about 930 direct jobs in the region of influence during the peak employment year (2000), representing a 10.8 percent increase over the 1995 baseline INEL employment of approximately 8,620 (Table 5.3-1). By 2004, direct employment would amount to about 860 jobs, a 10.0 percent increase from baseline. Secondary employment generated under Alternative D is expected to reach about 1,340 jobs in the peak year and fall to about 1,220 jobs by 2004. The total employment impact (direct plus secondary) in the region of influence is estimated to range from an increase of about 2,270 jobs in 2000 to 2,080 jobs in 2004 (Figure 5.3-1). Total employment impacts expected under Alternative D amount to less than 2.2 percent of total regional employment in any given year of the study period. It is unlikely that employment impacts of this size would generate any long-term adverse effects on the economic activity of the region.

Direct earnings, or payrolls, generated under Alternative D (Maximum Treatment, Storage, and Disposal) would amount to $27.7 million in 2000, decreasing to $24.1 million in 2004 (Appendix F, Section F-1, Table F-1-4). Total earnings generated in the region of influence are estimated to be $52.9 million in 2000, decreasing to $46.3 million by 2004. Similar to the estimated employment impacts, earnings are expected to vary within this range over the study period.

The positive employment and earnings impacts expected under Alternative D (Maximum Treatment, Storage, and Disposal) would tend to offset the magnitude of the effects of projected declines in baseline INEL employment and earnings. Baseline employment at the INEL is expected to steadily decline over the ten-year study period, resulting in a loss of approximately 1,370 direct jobs and 2,150 secondary jobs by 2004. The overall effect of Alternative D would reduce these job losses to about 520 and 930, respectively, by 2004.

5.3.5.2 Population and Housing. Population in-migration associated with the implementation of Alternative D (Maximum Treatment, Storage, and Disposal) may amount to about 1,290 persons during the peak employment year, an increase that represents less than 0.5 percent of the total regional population (Table 5.3-2). By 2004, population increases would decline to approximately 970 persons, a 0.4 percent increase in regional population.

Under projected baseline employment conditions at the INEL, the number of direct and secondary jobs in the region of influence could fall by 3,520 over the ten-year period from 1995 to 2004. The elimination of these jobs could induce the relocation of a number of these workers and their families, resulting in the possible out-migration of approximately 4,560 persons by 2004. Through the demand for additional workers, the implementation of Alternative D (Maximum Treatment, Storage, and Disposal) would alleviate the effects of this potential population decline, reducing the overall out-migration to approximately 3,590 persons. The degree of offset depends to a large extent on whether the persons losing jobs at the INEL under projected baseline conditions possess the skills required to fill the new jobs generated under Alternative D.

During the peak employment period, implementation of Alternative D (Maximum Treatment, Storage, and Disposal) could result in a temporary increase in housing demand of about 370 units, representing approximately 0.5 percent of the current housing stock in the region of influence. Given current housing preferences and current vacancy rates of 2.1 percent for homeowner-occupied housing and 4.6 percent for rental housing, the increase in housing demand anticipated under Alternative D could reduce the vacancy rates for owner-occupied and rental units to 1.6 percent and 4.1 percent, respectively. Assuming that the general conditions associated with the current housing market continue (see Section 4.3.2.2, Housing), this increase in demand is unlikely to place perceptible strain on the market. By 2004, the expected housing demand associated with population in-migration under Alternative D (Maximum Treatment, Storage, and Disposal) would amount to approximately 280 units, representing approximately 0.4 percent of total available housing units. The projected decline in baseline activity at the INEL, however, would more than offset the potential increases in demand for housing expected under Alternative D, resulting in an overall decrease in housing demand of 1,030 units, or 1.4 percent of the current housing stock.

5.3.5.3 Community Services and Public Finance. The expected population in-migration of about 970 persons anticipated under Alternative D (Maximum Treatment, Storage, and Disposal) by 2004 represents an increase of less than 0.5 percent in the total regional population. It is unlikely that such a small change in regional population would generate any discernible impact on community services and public finance within the region of influence. The effects of the decline in projected baseline INEL activity could result in an overall population decrease of about 3,590 persons under Alternative D, a 1.4 percent decline in total regional population. Again, an impact of this magnitude is not expected to be sufficient to notably affect community services and public finance in the region of influence.

5.4 Cultural Resources

This section discusses the potential impacts of the four environmental restoration and waste management alternatives on cultural resources; that is, archaeological and historic sites, areas of cultural or religious importance to local Native Americans, and paleontological localities on the INEL site.

5.4.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to cultural resources has been established through Federal laws and regulations, including the National Historic Preservation Act as amended (NHPA 1966), the Archaeological Resource Protection Act (ARPA 1979), the Native American Graves Protection and Repatriation Act (NAGPRA 1990), and the American Indian Religious Freedom Act (AIRFA 1978). A project affects a significant resource when it alters the property's characteristics, including relevant features of its environment or use that qualify it as significant according to criteria used for the National Register of Historic Places. Effects may include those listed in the "Protection of Historic Property" (CFR 1986). Impacts to cultural resources of value to Native Americans, such as sacred areas or hunting and gathering areas, should be determined through consultation with the affected Native American groups. Such consultation is also required for assessing impacts to archaeological sites and when encountering human remains.

Potential impacts are assessed by (a) identifying project activities that could directly or indirectly affect significant resources, (b) identifying the known or expected significant resources in areas of potential impact, and (c) determining whether a project activity would have no effect, no adverse effect, or an adverse effect on significant resources (CFR 1986).

Both direct and indirect impacts due to the proposed alternatives were evaluated. At the INEL site, direct impacts to archaeological resources are usually those associated with ground disturbance from construction activities. Direct impacts to existing historic structures may result from demolition, modification, or deterioration of the structures; isolation from or alteration of the property's setting; or the introduction of visual, auditory, or atmospheric elements that are out of character or that alter the property's setting. Direct impacts to traditional resources may occur through land disturbance, vandalism, or by changing the environmental setting of traditional use and sacred areas. Impacts may result from pollution, noise, and contamination that may affect traditional hunting and gathering areas or the visual or auditory setting of sacred areas. Direct impacts to archaeological sites as traditional resources may result from vandalism due to increased access to sites. Because these sites and structures have not been formally evaluated, they are considered to be potentially eligible for nomination to the National Register of Historic Places. Indirect impacts to cultural resources may also occur due to an overall increase in activity at the INEL, which would bring a larger construction workforce in closer proximity to significant sites.

Until construction plans are finalized, it is impossible to determine the total number of sensitive sites that would be affected by each alternative. However, it is possible at this time to list the number of known sites that may be affected and the historic structures that may sustain direct impacts as a result of modification or demolition under the four proposed alternatives. Table 5.4-1 provides this preliminary listing, along with detailed information on acreage, survey areas, sites, and structures affected by projects for each alternative.

5.4.2. Cultural Resource Impacts from Alternative A (No Action)

Alternative A activities include the construction of new facilities and the modification of existing facilities that would disturb 16 hectares (40 acres) of land and may affect a minimum of 6 structures. In areas that have not been subject to intensive cultural resource surveys [7 hectares (18 acres) have been surveyed, 9 hectares (22 acres) have not], there is a potential for adverse impacts to archaeological, Native American, and paleontological resources under this alternative. Proposed structural modifications may also adversely affect historically significant structures and would require consultation with the Idaho State Historic Preservation Office. A signed Memorandum of Agreement between DOE, the Advisory Council on Historic Preservation, and the State Historic Preservation Office (DOE 1993) outlines mitigation procedures for eight structures that may be affected by this alternative within the Auxiliary Reactor Area I, II, and III complex, and that are potentially eligible for nomination to the National Register of Historic Places. Impacts due to alteration in the setting of archaeological or historic resources through the introduction of additional noise, air emissions, or night lights are unlikely for most projects, since these activities would take place within or immediately adjacent to existing facilities where similar activities occur.

Table 5.4-1. Potential impacts to cultural resources at the Idaho National Engineering Laboratory site by project and alternative.

Project name	Alternative[a]	Acres disturbed[b]	Surveyed	Number of sites[c]	Number of structures[c]
Ongoing Projects					
Test Area North Pool Fuel Transfer	ABD	0.8	Yes	0	0
Remediation of Groundwater Contamination	ABCD	3.0	Yes	0	0
Pit 9 Retrieval	ABCD	5.2	Unknown[d]	Unknown	0
Vadose Zone Remediation	ABCD	2.1	Unknown[d]	Unknown	0
Auxiliary Reactor Area-II Decontamination and Decommissioning (D&D)	ABCD	6.5	Yes	0	5[e]
Boiling Water Reactor Experiment-V D&D	ABCD	0.2	Yes	0	1[e]
High-level Tank Farm Replacement (upgrade phase)	ABCD	2.8	Yes	0	0
Transuranic Storage Area Enclosure and Storage Project	ABCD	12.4	Unknown[d]	Unknown	0
Waste Characterization Facility	ABCD	2.1	Unknown[d]	Unknown	0
Waste Handling Facility	ABCD	0.3	Yes[d]	Unknown[f]	0
Health Physics Instrument Lab	ABCD	1.3	Yes	0	0
Radiological and Environmental Sciences Laboratory Replacement	ABCD	2.8	Yes	0	0
Spent Nuclear Fuel Projects					
Expended Core Facility Dry Cell Expansion Project	BD	0.0	(g)	0	1
Increased Rack Capacity for CPP-666	BD	0.0	(g)	0	1
Additional Increased Rack Capacity (CPP-666)	BD	0.0	(g)	0	1
Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	B	18.5	Unknown	Unknown	0
	C	0.0	(g)	0	1
	D	30.0	Unknown	Unknown	1
Fort St. Vrain Spent Nuclear Fuel Receipt & Storage	BD	0.0	(g)	0	0
Spent Fuel Processing	D	0.0	(g)	0	2
Experimental Breeder Reactor II Blanket Treatment	BD	0.0	(e)	0	1
Electrometallurgical Process Demonstration	BCD	0.0	(g)	0	2
Decontamination and Decommissioning Projects					
Central Liquid Waste Processing Facility D&D	BD	0.0	(g)	0	1
Engineering Test Reactor D&D	BD	5.0	Yes	0	12
Materials Test Reactor D&D	BD	2.8	Yes	0	20
Fuel Processing Complex D&D (CPP-601)	BD	0.6	Yes	0	1
Fuel Receipt/Storage Facility (CPP-603) D&D	BD	0.5	Yes	0	1
Headend Processing Plant D&D (CPP-640)	BD	0.0	(g)	0	1
Waste Calcine Facility, D&D	BD	0.5	Yes	0	1
High-Level Waste Projects					
Tank Farm Heel Removal Project	BCD	10.0	Yes	0	11
Waste Immobilization Facility	BCD	0.8	Yes	0	0
High-level Tank Farm New Tanks	CD	20.0	Yes	0	0
New Calcine Storage	D	0.5	Yes	0	0
Radioactive Scrap/Waste Facility	BCD	0.0	(g)	0	0
Transuranic Waste Projects					
Private Sector Alpha-Contaminated Mixed Low-Level Waste (MLLW) Treatment	BD	200	Unknown	Unknown	0

Table 5.4-1. (continued).

Project name	Alternative[a]	Acres disturbed[b]	Surveyed	Number of sites[c]	Number of structures[c]
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated MLLW	BD	1.0	Unknown[d]	Unknown	6
Idaho Waste Processing Facility	BD	40.0	Unknown[d]	Unknown	0
Shipping/Transfer Station	C	5.0	Unknown[d]	Unknown	0
Low-Level Waste Projects					
Waste Experimental Reduction Facility Incineration	BD	0.0	(g)	0	1
Mixed Low-Level Waste Treatment Facility	D	200	Unknown[d]	Unknown	0
Mixed/Low-Level Waste Disposal Facility	B	200	Unknown[d]	Unknown	0
	D	400	Unknown[d]	Unknown	0
Mixed Low-Level Waste Projects					
Nonincinerable Mixed Waste Treatment	BD	0.0	(g)	0	4
Remote Mixed Waste Treatment Facility	BD	1.0	Yes[d]	Unknown[g]	0
Sodium Processing Project	BD	0.03	Yes	0	0
Greater-Than-Class-C Projects					
Greater-than-Class-C Dedicated Storage	BD	1.7	Yes	0	0
Hazardous Waste Projects					
Hazardous Waste Treatment, Disposal, and Storage Facility	D	5.0	Unknown[d]	Unknown	0
Infrastructure Projects					
Industrial/Commercial Landfill Expansion	BCD	280.0	Partially[d]	Unknown	0
Gravel Pit Expansion	B	20.12	Yes[d]	22	0
	D	99.55	Yes[d]	22	0
Central Facilities Area Clean Laundry and Respirator Facility	BD	0.0	(g)	0	1
Technology Development Projects					
Calcine Transfer Project (Bin Set #1)	BD	0.5	Yes	0	0
Plasma Hearth Process Project	BD	0.0	(g)	0	1

a. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal), D = Alternative D (Maximum Treatment, Storage, and Disposal).
b. To convert from acres to hectares, multiply by 0.4047.
c. Where present, sites and structures are not evaluated and are assumed to be potentially significant.
d. Archaeologically sensitive area; known sites in vicinity.
e. These structures have been evaluated and are eligible for the National Register of Historic Places.
f. There are known sites in the project vicinity; exact project location is unknown.
g. Survey not required because no new ground disturbance is necessary.

Visual setting, noise, air quality, or water quality are seen by the Shoshone-Bannock to be important Native American resources. Disturbance of 0.8 hectares (2 acres) associated with construction of a new facility outside of the Radioactive Waste Management Complex may affect these resources. This area has a potential for containing cultural resources, plant, animal, and wetland resources, and development would change the visual setting. These effects would be minimal under Alternative A (No Action) because of the small acreage (a total of two acres) to be disturbed outside of the existing facilities and the minimal release of contaminants. There would, however, be a potential loss of plant and animal diversity, displacement of animals, and exposure to radionuclides, although the level of exposure would be so low that no effect would be expected. Soil erosion could occur during construction of the facility, as well as the release of dust particles. There would be no intentional discharge of radioactive or chemical liquid effluents to the subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations.

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative A (No Action) involves the use of 0.8 hectares (2 acres) outside the existing facility boundaries and 4.2 hectares (10.4 acres) within the Radioactive Waste Management Complex. The proposed new and modified structures are not expected to adversely affect the visual setting. Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that might affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust. The potential for visibility degradation due to facility emissions was analyzed using worst-case conditions, as described in Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to project emissions was shown to be imperceptible; however. the analysis of color shift indicated the potential for visual degradation with project emissions as proposed. Potential visual impacts must, therefore, be further defined and resolved before projects can proceed. The use of additional emissions controls and possibly relocation of projects may be required to reduce potential impacts below acceptable criteria. As the visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource, the Shoshone-Bannock would be consulted before any project is developed that could have impacts to resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air pollutants, and toxic air pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact of radiological emissions, including cumulative emissions from other regional sources, would be well below the applicable standards for protection of the public and a small percentage of the natural background dose. Cumulative emissions of nonradiological pollutants would result in impacts well below State and National Ambient Air Quality Standards designed to protect public health and welfare and would be below all standards for the Prevention of Significant Deterioration.

5.4.3 Cultural Resource Impacts from Alternative B (Ten-Year Plan)

Impacts to cultural resources under Alternative B (Ten-Year Plan) would be similar to tbose under Alternative A (No Action), witb tbe following additions: facility expansion, new facility construction, and gravel pit expansion would affect about 333 hectares (823 acres) of land and 70 structures would be modified, decommissioned, or demolished. A total of 26 hectares (65 acres) have been surveyed, and 22 sites tbat may be affected by tbe project have been identified. The remaining 307 hectares (758 acres) have not been surveyed. Additional projects associated with this alternative that are not yet specified may also cause additional ground disturbance. In all areas, ground disturbance has the potential to affect archaeological, traditional, and paleontological sites located on the surface of the ground or buried beneath recent sediments. In locations that have been intensively surveyed, many areas of concern can be identified; but in unsurveyed locations, the sensitive areas would not be known until field work is completed. Potential impacts may occur due to alteration in the setting of a traditional, archaeological, or historic resource through the introduction of additional noise, air emissions, or night lights. Although most of these activities would take place within or immediately adjacent to existing facilities currently engaged in similar activities, some construction is proposed for areas outside of existing facilities. If significant archaeological or historic sites or traditional resources are in proximity, the additional noise, pollution, contamination, or lighting may adversely affect these resources.

Visual setting, noise, air quality, or water quality are seen by the Shoshone-Bannock to be an important Native American resources. New facilities would be constructed and gravel pits expanded on 195 hectares (481 acres) outside ot existing facilities. Ground disturbance and change in the visual setting would occur in the vicinity of the Idaho Chemical Processing Plant, the Radioactive Waste Management Complex, Test Area North, the Central Facilities Area, and the Naval Reactors Facility. Some facilities would contain permanent generators and night lights, creating a visual and audible intrusion. Areas with sensitive plant and water sources are found near the Idaho Chemical Processing Plant, the Radioactive Waste Management Complex, and Test Area North. Any of these areas, but particularly the area near the Radioactive Waste Management Complex and Test Area North, have a high potential for containing plant, animal, and wetland resources. There is a potential loss of plant and animal diversity, displacement of animals, and exposure to radionuclides, although the level of exposure would be so low that no effect would be expected. Soil erosion could occur during the construction of the facilities, as well as the release of dust particles. There would be no intentional discharge of radioactive or chemical liquid effluents to the subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations. Because of the larger acreage disturbed and the larger number of facilities to be constructed outside of existing facilities (three), effects due to Alternative B (Ten-Year Plan) would be much greater than for Alternative A (No Action).

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative B (Ten-Year Plan) involves the use of about 195 hectares (481 acres) outside existing facility boundaries with additional development within facility boundaries. Although no final siting determination has been made, facilities would likely be located within about two miles of existing site facilities and at least half a mile from any public roads. The proposed new and modified structures are not expected to adversely affect the visual setting. Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that might affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust. The potential for visibility degradation due to facility emissions was analyzed using worst-case conditions, as described in Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to project emissions was shown to be imperceptible; however, the analysis of color shift indicated the potential for visual degradation with project emissions as proposed. Potential visual impacts must, therefore, be further defined and resolved before projects can proceed. The use of additional emissions controls and possibly relocation of projects may be required to reduce potential impacts below acceptable criteria. As the visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource, the Shoshone-Bannock would be consulted before any project is developed that could have impacts to resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air pollutants, and toxic air pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact of radiological emissions, including cumulative emissions from other regional sources, would be well below the applicable standards for protection of the public and a small percentage of the natural background dose. Cumulative emissions of nonradiological pollutants would result in impacts well below State and National Ambient Air Quality Standards designed to protect public health and welfare and are below all standards for the Prevention of Significant Deterioration.

5.4.4. Cultural Resource Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Impacts to cultural resources from Alternative C (Minimum Treatment, Storage, and Disposal) could occur during ground disturbance witbin a 144-hectare (355-acre) area or during tbe modification and dismantling of 11 structures. A total of 21 hectares (52 acres) have been surveyed, but no sites are currently known to exist in tbe project areas. The remaining 123 hectares (303 acres) have not been surveyed. A signed Memorandum of Agreement among DOE, tbe Advisory Council on Historic Preservation, and tbe State Historic Preservation Office outlining mitigation measures for protection of some structures witbin tbe Auxiliary Reactor Area complex (DOE 1993) may be applicable under tbis alternative. However, projects involving excavation or otber ground disturbance could affect archaeological, paleontological, or traditional resources. Impacts due to alteration in tbe setting of a traditional, archaeological, or historic resource through tbe introduction of additional noise, air emissions, or night lights are unlikely, since tbese activities will take place within or immediately adjacent to existing facilities where similar activities occur.

Effects to Native American resources would be similar to Alternative A (No Action). Disturbance of 0.8 hectares (two acres) associated with the construction of a new facility outside of tbe Radioactive Waste Management Complex may affect tbese resources. This area has a potential for containing cultural resources, plant, animal, and wetland resources, and development would change the visual setting. There would be a potential loss of plant and animal diversity, displacement of animals, and exposure to radionuclides, altbough tbe level of exposure would be so low tbat no effect would be expected. Soil erosion could occur during construction of the facility, as well as the release of dust particles. There would be no intentional discharge of radioactive or chemical liquid effluents to tbe subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations. These effects would be miminal under Alternative C (Minimum Treatment, Storage, and Disposal) because of the small acreage [a total of 0.8 hectares (two acres)] to be disturbed outside of tbe existing facilities and tbe minimal release of contaminants.

As discussed in Section 5.5, Aestbetic and Scenic Resources, Alternative C (Minimum Treatment, Storage, and Disposal) involves the use of 0.8 hectares (two acres) outside the existing facility boundaries and 4.2 hectares (10.4 acres) witbin tbe Radioactive Waste Management Complex. The proposed new and modified structures are not expected to adversely affect the visual setting.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that might affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust. The potential for visibility degradation due to facility emissions was analyzed using worst-case conditions, as described in Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to project emissions was shown to be imperceptible; however, the analysis of color shift indicated the potential for visual degradation with project emissions as proposed. Potential visual impacts must, therefore, be further defined and resolved before projects can proceed. The use of additional emissions controls and possibly relocation of projects may be required to reduce potential impacts below acceptable criteria. As the visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource, the Shoshone-Bannock would be consulted before any project is developed that could have impacts to resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air pollutants, and toxic air pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact of radiological emissions, including cumulative emissions from other regional sources, would be well below the applicable standards for protection of the public and a small percentage of the natural background dose. Cumulative emissions of nonradiological pollutants would result in impacts well below State and National Ambient Air Quality Standards designed to protect public health and welfare and would be below all standards for the Prevention of Significant Deterioration.

5.4.5. Cultural Resource Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Impacts to cultural resources from Alternative D (Maximum Treatment, Storage, and Disposal) would disturb a total of 542 hectares (1,339 acres) of ground, 70 structures, and 22 archaeological sites, with the potential for greater impacts to cultural resources than Alternative B, due to the expanded scope of projects dealing with construction and modification of buildings and construction of new structures at several facilities. A minimum of 478 hectares (1,180 acres) that have not been surveyed may contain archaeological, traditional, and paleontological sites. Potential impacts may occur due to alteration in the setting of a traditional, archaeological, or historic resource through the introduction of additional noise, air emissions, or night lights. Although most of these activities would take place within or immediately adjacent to existing facilities where similar activities occur, some construction is proposed for areas outside of existing facilities. If significant archaeological or historic sites or traditional resources are in proximity, the additional noise, pollution, contamination, or lighting may adversely affect these resources.

Effects to Native American resources would be similar to Alternative B (Ten-Year Plan) with an increase in impacts due to an increase in construction outside of existing facilities. A total of 393 hectares (972 acres) could be disturbed outside of existing facilities with the construction of new buildings and the expansion of gravel pits. Ground disturbance and change in the visual setting would occur in the vicinity of the Idaho Chemical Processing Plant, the Radioactive Waste Management Complex, Test Area North, the Central Facilities Area, and the Naval Reactors Facility. Some facilities would contain permanent generators and night lights, creating a visual and audible intrusion. Areas with sensitive plant and water sources are found near the Idaho Chemical Processing Plant, the Radioactive Waste Management Complex, and Test Area North. Any of these areas, but particularly the area near the Radioactive Waste Management Complex and Test Area North, have a potential for containing plant, animal, and wetland resources. There is a potential loss of plant and animal diversity, displacement of animals, and exposure to radionuclides, although the level of exposure would be so low that no effect would be expected. Soil erosion could occur during construction of the facilities, as well as the release of dust particles. There would be no intentional discharge of radioactive or chemical liquid effluents to the subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations. Because of the larger acreage disturbed and the larger number of facilities to be constructed outside of existing facilities (four), effects due to Alternative D (Maximum Treatment, Storage, and Disposal) would be much greater than for the other alternatives.

As discussed in Section 5.5, Aesthetic and Scenic Resources, Alternative D (Maximum Treatment, Storage, and Disposal) involves the use of about 393 hectares (972 acres) outside existing facility boundaries with additional development within facility boundaries. Although no final siting determination has been made, facilities would likely be located within about two miles of existing site facilities and at least half a mile from any public roads. The proposed new and modified structures are not expected to adversely affect the visual setting. Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that might affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust. The potential for visibility degradation due to facility emissions was analyzed using worst-case conditions, as described in Section 5.7, Air Resources. Under adverse conditions, contrast reduction due to project emissions was shown to be imperceptible; however, the analysis of color shift indicated the potential for visual degradation with project emissions as proposed. Potential visual impacts must, therefore, be further defined and resolved before projects can proceed. The use of additional emissions controls and possibly relocation of projects may be required to reduce potential impacts below acceptable criteria. As the visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource, the Shoshone-Bannock would be consulted before any project is developed that could have impacts to resources of importance to the tribes.

Impacts of other air emissions, including radionuclides, criteria air pollutants, and toxic air pollutants, have been analyzed as discussed in Section 5.7, Air Quality. The impact of radiological emissions, including cumulative emissions from other regional sources, would be well below the applicable standards for protection of the public and a small percentage of the natural background dose. Cumulative emissions of nonradiological pollutants would result in impacts well below State and National Ambient Air Quality Standards designed to protect public health and welfare and are below all standards for the Prevention of Significant Deterioration.

5.5 Aesthetic and Scenic Resources

This section discusses the potential effects of the four environmental restoration and waste management alternatives on aesthetic and scenic resources at the INEL site and the surrounding area.

5.5.1 Methodology

Potential impacts to aesthetic and scenic resources include (a) the addition or modification of structures and (b) the addition of pollutants that may alter the view. The impact analyses for all the alternatives focus on the effects of proposed construction activities on the INEL site. Where the facility design of some of the structures has yet to be determined, a more general analysis is provided; however, where construction specifications are known, a more detailed assessment is given. Determination of significant visual resource degradation due to structures is based on the extent of modification to the area. The definition of the degree of acceptable modification considers the nature, density, and extent of sensitive visual resources that contribute to the visual character of an area. If construction activities and ground disturbances associated with the alternative could result in a visual impact that is incompatible with the general setting, impacts would be considered significant.

Potential impacts to aesthetics and visual resources include factors resulting from ongoing operations that would be detrimental to the available views, such as visibility degradation caused by air emissions from operating plants. Additional pollutants released into the atmosphere during both the construction and operation of facilities have the potential to result in visual resource degradation by reducing contrast and causing discoloration. In particular, emissions of oxides of nitrogen and particulate matter may decrease contrast, such as that of a dark object against the borizon, and/or cause a discoloration of the sky or viewed objects. Visibility has been specifically designated as an air quality-related value under the 1977 Prevention of Significant Deterioration Amendments to the Clean Air Act. To determine impacts to visibility on the Craters of the Moon Wilderness Area, a nearby Class I area that includes the Craters of the Moon National Monument, a screening-level air quality analysis has been conducted in accordance with a U. S. Environmental Protection Agency-developed methodology and criteria to determine if the potential for unacceptable visual degradation exists. The methodology for determining air quality impacts is discussed in detail in Air Resources, Section 5.7.4.3.

5.5.2 Aesthetic and Scenic Resource Impacts from Alternative A (No Action)

Under Alternative A (No Action), most project activities would be conducted within existing facility boundaries. These projects are not expected to result in an adverse impact, as the proposed structures would be within the facility fenceline and similar to others in the vicinity. However, the Transuranic Storage Area Retrieval Enclosure and Storage Project consists of 0.8 hectares (2 acres) of new construction outside the existing facility boundaries. Another 4.2 hectares (10.4 acres) of this facility would be located within the Radioactive Waste Management Complex, which is located approximately 6.4 kilometers (4 miles) from U.S. Highway 20. Structure height would be similar to other storage areas—9 to 12 meters (30 to 40 feet). Due to the low building height and the distance from the highway and the Experimental Breeder Reactor-I, a National Historic Landmark, no adverse impact is expected from this proposed action.

The air quality analysis of contrast reduction due to project emissions was well below the acceptable criterion for views within the Craters of the Moon; however, the analysis of color shift indicated the potential for visual degradation associated with project emissions as proposed. The analysis was, therefore, repeated with assumed controls on certain projects which, due to oxides of nitrogen emissions, contribute significantly to the excess color shift value. Emission control equipment to effect at least 70 percent control of oxides of nitrogen would be required on the Pit 9 Retrieval project thermal treatment facility at the Radioactive Waste Management Complex in order to pass the screening-level analysis. Relocation of projects would also be investigated. Potential visual impacts would be further defined and resolved during the air-permitting process before projects could proceed.

The visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an aimportant Native American resource. The Shoshone-Bannock would be consulted before any project were developed that could have impacts to resources of importance to the tribes.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that may affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust.

5.5.3 Aesthetic and Scenic Resource Impacts from Alternative B (Ten-Year Plan)

Alternative B (Ten-Year Plan) includes several decommissioning and decontamination projects, construction of new facilities, and upgrading or replacement of buildings and infrastructure, as well as those projects listed in Alternative A (No Action). Although most projects are expected to be confined to developed areas, four major projects proposed for construction would not be located within facility fencelines. These are the Gravel Pit Expansions, the Mixed Low-Level Waste Treatment Facility, and either the Idaho Waste Processing Facility or the Private Sector Alpha-Mixed Low-Level Waste Treatment Facility.

In those instances where upgrading or replacement of buildings and infrastructure and decontamination and decommissioning projects occur within an established facility area boundary, the visual sensitivity of the proposed action would be low. For example, the decontamination and decommissioning of the Fuel Processing Complex (Building CPP-601) would take place at its current location within the Idaho Chemical Processing Plant facility area boundary. This facility area is in the vicinity of public highways, a rest area, and the Experimental Breeder Reactor-I (a National Historic Landmark), but it is far enough away from these locations [approximately 5 kilometers (3 miles)] that the planned activities would not be noticeable to the public. The proposed new construction projects would be similar in size and shape to the existing structures.

The projects located outside of fencelines are estimated to cover about 170 hectares (420 acres) when completed. (Only three projects would actually be constructed—the Mixed Low-Level Waste Disposal Facility, Gravel Pit Expansions, and either the Idaho Waste Processing Facility or the Private Sector Alpha-Mixed Low-Level Waste Treatment Facility). Although no final siting determination has been made, these projects would probably be located within about two miles of existing site facilities and at least half a mile from any public roads. The proposed 81-hectare (200-acre) Private Sector Alpha-Mixed Low-Level Waste Treatment facility is not sited; however, a location was assumed for modeling. Areas within the INEL site that are considered to have moderate visual sensitivity include the Experimental Breeder Reactor-I and Goodale's Cutoff, a portion of the Oregon Trail that crosses the southwestern section of the site (see Section 4.4.1). A potential visual impact could occur if facilities not yet sited or any of the proposed facilities located outside of fencelines were to be located in these vicinities. However, because all of these facilities would be located within the INEL site and would be similar in size and character to existing structures, no adverse visual impact would be expected.

While the INEL site may be visible from the Craters of the Moon Wilderness Area under certain atmospheric conditions, the viewing distance of approximately 20 kilometers (12 miles) negates any adverse impacts that might be caused by the siting and construction of the proposed facilities or night lighting associated with the proposed activities.

As with Alternative A (No Action), the air quality analysis of contrast reduction due to project emissions was well below the acceptable criterion for views within the Craters of the Moon, however, the analysis of color shift indicated the potential for even greater visual degradation associated with project emissions as proposed. For Alternative B (Ten-Year Plan), more stringent oxides of nitrogen emission controls of at least 90 percent would be required on the Pit 9 Retrieval project thermal treatment facility at the Radioactive Waste Management Complex, the Waste Immobilization Facility incinerator at the Idaho Chemical Processing Plant, and the Idaho Waste Processing Facility. An additional 70 percent control would be required on two boilers at the Radioactive Waste Management Complex in order to pass the screening-level analysis. Relocation of projects would also be investigated. Potential visual impacts would be further defined and resolved during the air-permitting process before projects could proceed.

The visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource. The Shoshone-Bannock would be consulted before any project were developed that could have impacts to resources of importance to the tribes.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that may affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust.

5.5.4 Aesthetic and Scenic Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

There are fewer projects proposed under Alternative C (Minimum Treatment, Storage, and Disposal) than under Alternative B (Ten-Year Plan). All of the projects would be located near or next to other buildings of similar structure except for 0.8 hectares (2 acres) in the Transuranic Storage Area Enclosure and Storage Project, which is located adjacent to the Radioactive Waste Management Complex boundary. With regard to construction projects, since no adverse impacts are associated with the proposed action under Alternative B, presumably the impacts would be even less under Alternative C.

As with the other alternatives, the air quality analysis of contrast reduction due to project emissions was well below the acceptable criterion for views within the Craters of the Moon, but the color shift indicated the potential for visual degradation associated with project emissions as proposed. Oxides of nitrogen emission controls of approximately 70 percent would be required on the Pit 9 Retrieval project thermal treatment facility and 90 percent on the Waste Immobilization Facility in order to pass the screening-level analysis. Relocation of projects would also be investigated. Potential visual impacts would be further defined and resolved during the air-permitting process before projects could proceed.

The visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource. The Shoshone-Bannock would be consulted before any project were developed that could have impacts to resources of importance to the tribes.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that may affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust.

5.5.5 Aesthetic and Scenic Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) would implement the maximum number of treatment, storage, and disposal projects. The proposed projects include those described under Alternative B (Ten-Year Plan) or expanded versions of those projects. For example, under Alternative D, the proposed Mixed Low-Level Waste Disposal Facility would include 160 hectares (400 acres) instead of 81 hectares (200 acres) for Alternative B. The proposed Gravel Pit Expansion and the Dry Fuels Storage Facility would also involve an expanded version of these projects relative to Alternative B. An additional project not included under the Alternative B analysis is the proposed Mixed Low-Level Waste Treatment Facility. This facility would include about 81 hectares (200 acres) and be located outside of the Radioactive Waste Management Complex. Approximately 300 hectares (730 acres) of construction projects would be located outside of the fencelines under this alternative. (Refer to Chapter 3 for a complete description of the proposed actions under Alternative D.) It is not expected, however, that the increase in scope or the additional projects would affect the results of the impact analysis performed for Alternative B. Therefore, since no adverse impacts are associated with the proposed projects under Alternative B with regard to construction and siting, no adverse impacts are anticipated under this alternative.

As with the other alternatives, the air quality analysis of contrast reduction due to project emissions was well below the acceptable criterion for views within the Craters of the Moon, but the color shift indicated the potential for visual degradation associated with project emissions as proposed. Oxides of nitrogen emission controls of approximately 90 percent would be required on the Pit 9 Retrieval project thermal treatment facility, the Waste Immobilization Facility, and the Idaho Waste Processing Facility. An additional 70 percent control on two boilers at the Radioactive Waste Management Complex would be required in order to pass the screening-level analysis. Relocation of projects would also be investigated. Potential visual impacts would be further defined and resolved during the air-permitting process before projects could proceed.

The visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, is seen by the Shoshone-Bannock to be an important Native American resource. The Shoshone-Bannock would be consulted before any project were developed that could have impacts to resources of importance to the tribes.

Construction of the proposed facilities and demolition of existing facilities would produce fugitive dust that may affect visibility temporarily in localized areas. Such activities would be of limited duration, however, and the INEL would follow standard construction practices to minimize both erosion and dust.

5.6 Geology

This section discusses the potential effects of the four environmental restoration and waste management alternatives on geology at the INEL site.

5.6.1 Methodology

Impacts to geologic resources would be associated with (a) excavating surface deposits at new facility construction sites and (b) using aggregate resources to construct and operate new facilities. Information contained in this section is based on a review of available information on the geology of the INEL site.

5.6.2 Geologic Impacts from Alternatives

Proposed INEL environmental restoration and waste management activities would only have minor, localized impacts on the geology of the INEL site for all alternatives evaluated. Direct impacts to geologic resources at the INEL site would be associated with disturbing or extracting surface deposits to construct new facilities and for use as fill for remediation activities, as needed. These impacts may include excavations into the soil and rock of the INEL site, soil mounding and banking, and extracting aggregate materials from gravel and borrow pits on the INEL site. A secondary impact to geology from construction or remediation activities would be the potential for increased soil erosion. Table 5.6-1 gives estimated extraction of aggregate from INEL site gravel and borrow pits.

Other indirect impacts to geologic resources considered in this Environmental Impact Statement are the consumption of fossil fuels, concrete, and other earth resources (Section 5.13, Idaho National Engineering Laboratory Services) and fugitive dust emissions (Section 5.7, Air Resources).

Table 5.6-1. Estimated extraction volumes from gravel and borrow pits on the Idabo National Engineering Laboratory (INEL) site by alternative.[a]

Alternative[b]	Estimated gravel/borrow use (m^3)[c]
A (No Action)	158,000
B (Ten-Year Plan)	392,000
C (Minimum Treatment, Storage, Disposal)	296,000
D (Maximum Treatment, Storage, Disposal)	1,772,000

a. Refer to Appendix C, Information Supporting the Alternatives, for more information on gravel/borrow pits at the INEL site.

b. See Chapter 3, Alternatives, for a description of alternatives identified in this Environmental Impact Statement.

c. To convert from cubic meters to cubic yards, multiply by 1.31.

5.7 Air Resources

This section discusses the potential effects that the environmental restoration and waste management alternatives may have on regional air quality. In particular, it gives the results of assessments on the impacts of construction and operation of facilities associated with each alternative in terms of expected radiation dose and nonradiological pollutant concentration levels. In addition to cumulative impacts, analyses have been performed with respect to projects associated with specific waste management options within each alternative. Additional details on assessment methods, assumptions, and related information are contained in Appendix F, Section F-3, Air Resources, and Belanger et al. (1995a).

5.7.1 Methodology

The assessments predict the maximum consequences at onsite and offsite locations resulting from the release of contaminants from various categories of sources. The types of emissions assessed are the same radiological and nonradiological emissions as those assessed in the baseline cases described in Section 4.7, Air Resources; namely, criteria pollutants (carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, respirable and particulate matter), toxic air pollutants, and radionuclides. Volatile organic compounds, which can lead to the formation of ozone, are also assessed. The categories of sources assessed include stationary sources (such as stacks at proposed facilities), fugitive sources (such as construction and demolition activities), and mobile sources associated with INEL site activities.

5.7.1.1 Methodology for Radiological Consequences. The method for estimating radiological consequences of airborne radionuclide releases from alternative courses of action is described in detail in Appendix F, Section F-3, Air Resources. The principal components of the methodology are source term estimation and dispersion modeling. Source terms for specific projects associated with the four alternatives were estimated using conservative engineering calculations based on knowledge of the proposed facility or activity. Typically, these evaluations considered the processes to be incorporated, materials to be used, activities to be performed within the systems, and operating experience with similar systems. For some projects, emissions estimates had previously been made and documented as part of an Environmental Assessment, Permit to Construct, or other action. In such cases, the previously estimated source terms were either used directly or were revised to reflect updated project definition. The dispersion modeling used the GENII computer code (Napier et al. 1988). This code is well-suited for applications such as this, has been extensively tested, and conforms to applicable software quality assurance criteria. Meteorological and population data specific to the INEL site were incorporated into the model. The GENII model calculates doses from all important pathways of exposure, including external and inhalation dose from immersion in contaminated air, external dose from deposition of radionuclides on ground surfaces, and ingestion of contaminated food products. The ingestion pathway, however, is not a realistic exposure pathway for onsite workers and was not used for those assessments. Doses were assessed separately for each project and then added according to the association of projects with alternatives and waste stream options.

As for baseline radiological assessment, conservative assumptions were applied to avoid underestimating the dose. These included adding of maximum doses calculated for separate projects, even though the locations of maximum impact may be different.

5.7.1.2 Methodology for Nonradiological Consequences. The consequences of criteria pollutant and toxic air pollutant emissions from stationary sources were assessed using methods and data considered acceptable for regulatory compliance determination by Federal and State agencies. In general, these methods were identical to those used in the baseline assessments described in Section 4.7, Air Resources. One difference was the application of the Industrial Source Complex-2 (ISC-2) atmospheric dispersion computer code (EPA 1992a) to assess both criteria and toxic air pollutant emissions, whereas the baseline assessment of toxics relied principally on the simpler, more conservative SCREEN model (EPA 1992b). Dispersion modeling using ISC-2 allows for a reasonable prediction of the impacts of proposed facilities and therefore is suitable for use in this process.

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. To estimate potential worst-case visibility impacts of proposed alternatives at Craters of the Moon Wilderness Area, analysts used the computer code VISCREEN (EPA 1992c), developed by the U.S. Environmental Protection Agency which implements the "Level 1" analysis. This model gives conservative estimates of impacts. (In other words, calculations and assumptions are used that yield results that would be larger than those calculated with more realistic input and modeling assumptions.) The model calculates contrast and color shift (referred to as delta E) for two assumed plume-viewing backgrounds—the horizon sky and a dark terrain object. Results were then compared with acceptable criteria for these parameters.

The nonradiological assessment did not include methods for quantifying impacts related to ozone formation because (a) emissions of volatile organic compounds (which are precursors of ozone formation) are below the significance level designated by the State of Idaho; (b) no simple, well-defined method exists to assess ozone formation potential (Wilson 1993); and (c) while the Idaho Division of Environmental Quality has no ozone monitoring data from the vicinity, it is not aware of problematic ozone levels in the area (Andrus 1994).

5.7.1.3 Methodology for Mobile Source Impacts. The ambient air quality impacts at offsite receptor locations due to the INEL bus fleet operations, INEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEL site facilities were quantitatively predicted using emission factors and a computerized methodology recommended by the U.S. Environmental Protection Agency. The CALINE-3 model, used to implement the U.S. Environmental Protection Agency methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic (Benson 1979). The model was used to predict maximum one-hour ambient air concentrations of carbon monoxide and inhalable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters (9.8 feet) from the edge of the roadway, in accordance with U.S. Environmental Protection Agency guidance. Modeling was conducted for 1993 to quantify the impact due to INEL buses and traffic serving the latest possible projects and activities on the INEL site, the projected impact of projects planned for construction before 1995, and the projected impacts of alternatives.

5.7.1.4 Methodology for Fugitive Dust Impacts. The impacts of existing and proposed sources of fugitive dust were estimated using the U.S. Environmental Protection Agency-recommended Fugitive Dust Model (FDM) (Winges 1991). Twenty-four hour and annual average concentrations were calculated to correspond with ambient air quality standards. Inhalable particulate fractions were estimated to be 64 percent of total dust loading. This value was based on the U.S. Environmental Protection Agency-recommended value (35 percent) for aggregate handling and storage piles, adjusted for the fact that dust suppression by watering tends to preferentially remove larger sized particles.

5.7.2 Emission Rates

Air contaminant emission rates were estimated for each project proposed under the four environmental restoration and waste management alternatives. In some cases, the analysis used release estimates made previously (for example, as part of an Environmental Assessment). Other estimates were based on knowledge of the materials used and activities performed and on experience with operating facilities having similar features or functions. Where applicable, the analysis used emission factors from authoritative reference sources such as EPA (1993).

Many of the projects proposed under the various waste management options are likely to involve some airborne emission of radionuclides. These releases would occur primarily through controlled release points, such as stacks or vents, although some fugitive emissions might also result (for example, from the cleanup of contaminated soils or demolition of contaminated structures). Wherever practicable, these releases would be minimized by measures such as confinement or filtration.

Estimates of the type and amount of airborne radionuclide emissions likely to result from alternative courses of action are presented in Table 5.7-1. These estimates, which are listed by alternative and waste stream, have been made on the basis of knowledge of the materials used and activities performed and on experience with operating facilities that have similar features or functions. These estimates indicate that the types of emissions from proposed activities would be similar to those emitted by current INEL site operations, although the quantities might vary substantially depending on the waste management option.

Projected releases of criteria pollutants by alternative and waste stream are presented in Table 5.7-2. Volatile organic compounds, while not designated as criteria pollutants, are listed in Table 5.7-2 since they may lead to the formation of ozone, which is a criteria pollutant. Because of the many toxic air pollutants, analysts used a screening approach to reduce the number requiring assessment to only those toxic emissions that have the potential to result in concentrations approaching applicable standards or guidelines. The screening method used was to assess only those toxic air

Table 5.7-1. Summary of radionuclide emissions at the Idaho National Engineering Laboratory site by alternative and source group.

Waste or source group	Radionuclide emission rates (curies per year)											
	Hydrogen-3/ carbon-14	Cobalt-60	Krypton-85	Xenon-131m/ xenon-133	Strontium-90[a]	Antimony-125	Iodine-129/ iodine-131	Cesium-134/ cesium-135	Uranium	Plutonium	Americium-241	Other
Alternative A (No Action)												
Spent nuclear fuel	9.6×10^{2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.9×10^{-2}	0.0×10^{0}	3.4×10^{-2}	0.0×10^{0}	0.0×10^{0}	6.6×10^{-4}	2.2×10^{-4}	0.0×10^{0}
Transuranic	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.7×10^{-5}	9.3×10^{-6}	0.0×10^{0}
Environmental restoration	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	8.5×10^{-3}	4.4×10^{-3}	0.0×10^{0}
Total[b]	9.6×10^{2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.9×10^{-2}	0.0×10^{0}	3.4×10^{-2}	0.0×10^{0}	0.0×10^{0}	9.2×10^{-3}	4.6×10^{-3}	0.0×10^{0}
Alternative B (Ten-Year Plan)												
Spent nuclear fuel	2.0×10^{3}	2.0×10^{-6}	1.9×10^{4}	1.8×10^{2}	2.9×10^{-2}	2.4×10^{-3}	3.9×10^{-2}	2.7×10^{-5}	0.0×10^{0}	6.6×10^{-4}	2.2×10^{-4}	8.4×10^{-6}
High-level waste[c]	4.2×10^{2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	9.4×10^{-4}	0.0×10^{0}	1.5×10^{-1}	1.1×10^{-2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	1.0×10^{-3}
Transuranic	0.0×10^{0}	1.7×10^{-5}	0.0×10^{0}	0.0×10^{0}	3.5×10^{-4}	0.0×10^{0}	0.0×10^{0}	3.8×10^{-4}	1.7×10^{-4}	4.7×10^{-2}	1.6×10^{-2}	1.3×10^{-4}
Low-level	1.3×10^{0}	7.3×10^{-2}	0.0×10^{0}	0.0×10^{0}	1.2×10^{-2}	2.7×10^{-2}	0.0×10^{0}	3.1×10^{-1}	2.5×10^{-3}	1.8×10^{-3}	3.2×10^{-4}	6.1×10^{-1}
Greater-than-Class-C	3.2×10^{-8}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	1.4×10^{-5}	0.0×10^{0}	0.0×10^{0}	5.3×10^{-2}	8.6×10^{-8}	7.8×10^{-4}	5.1×10^{-5}	1.2×10^{-5}
Mixed low-level	1.7×10^{3}	7.3×10^{-2}	1.6×10^{3}	0.0×10^{0}	1.2×10^{-2}	2.7×10^{-2}	0.0×10^{0}	3.1×10^{-1}	2.9×10^{-3}	1.8×10^{-3}	3.2×10^{-4}	6.2×10^{-1}
Hazardous	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.3×10^{-7}	1.6×10^{-7}	9.4×10^{-10}	7.6×10^{-10}
Environmental restoration	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	8.5×10^{-3}	4.4×10^{-3}	0.0×10^{0}
Total[b,c]	4.1×10^{3}	7.3×10^{-2}	2.1×10^{4}	1.8×10^{2}	4.2×10^{-1}	2.9×10^{-2}	1.9×10^{-1}	3.8×10^{-1}	3.1×10^{-3}	5.8×10^{-2}	2.1×10^{-2}	6.2×10^{-1}

Table 5.7-1. (continued).

Waste or source group	Radionuclide emission rates (curies per year)											
	Hydrogen-3/ carbon-14	Cobalt-60	Krypton-85	Xenon-131m/ xenon-133	Strontium-90[a]	Antimony-125	Iodine-129/ iodine-131	Cesium-134/ cesium-135	Uranium	Plutonium	Americium-241	Other
Alternative C (Minimum Treatment, Storage, and Disposal)												
Spent nuclear fuel	8.4×10^{2}	1.9×10^{-6}	1.4×10^{4}	1.3×10^{2}	1.8×10^{-5}	2.2×10^{-3}	4.2×10^{-3}	6.8×10^{-7}	0.0×10^{0}	2.6×10^{-7}	0.0×10^{0}	1.9×10^{-6}
High-level waste[d]	4.2×10^{2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	1.6×10^{-1}	0.0×10^{0}	1.5×10^{-1}	3.8×10^{-2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	3.0×10^{-1}
Transuranic	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.7×10^{-5}	9.3×10^{-6}	0.0×10^{0}
Environmental restoration	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	8.5×10^{-3}	4.4×10^{-3}	0.0×10^{0}
Total[b,d]	2.2×10^{3}	1.9×10^{-6}	1.4×10^{4}	1.3×10^{2}	1.9×10^{-1}	2.2×10^{-3}	1.9×10^{-1}	3.8×10^{-2}	0.0×10^{0}	9.2×10^{-3}	4.6×10^{-3}	3.0×10^{-1}
Alternative D (Maximum Treatment, Storage, and Disposal)												
Spent nuclear fuel	5.1×10^{3}	3.9×10^{-6}	5.2×10^{5}	1.8×10^{2}	8.7×10^{-2}	1.6×10^{1}	4.8×10^{-1}	1.8×10^{-1}	0.0×10^{0}	8.4×10^{-3}	2.2×10^{-4}	2.1×10^{-1}
High-level waste[d]	4.2×10^{2}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	1.6×10^{-1}	2.0×10^{-8}	1.5×10^{-1}	3.8×10^{-2}	0.0×10^{0}	2.2×10^{-7}	0.0×10^{0}	3.0×10^{-1}
Transuranic	0.0×10^{0}	1.9×10^{-5}	0.0×10^{0}	0.0×10^{0}	4.0×10^{-4}	0.0×10^{0}	0.0×10^{0}	4.4×10^{-4}	1.9×10^{-4}	5.4×10^{-2}	1.8×10^{-2}	1.5×10^{-4}
Low-level	1.3×10^{0}	2.2×10^{-1}	0.0×10^{0}	0.0×10^{0}	2.6×10^{-2}	8.0×10^{-2}	0.0×10^{0}	6.7×10^{-1}	7.5×10^{-3}	4.6×10^{-3}	6.5×10^{-4}	1.3×10^{0}
Greater-than-Class C	3.2×10^{-8}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	1.4×10^{-5}	0.0×10^{0}	0.0×10^{0}	5.3×10^{-2}	8.6×10^{-8}	7.8×10^{-4}	5.1×10^{-5}	1.2×10^{-5}
Mixed low-level	1.7×10^{3}	2.2×10^{-1}	1.6×10^{5}	0.0×10^{0}	2.6×10^{-2}	8.0×10^{-2}	0.0×10^{0}	6.7×10^{-1}	7.9×10^{-3}	4.6×10^{-3}	6.5×10^{-4}	1.3×10^{0}
Hazardous	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.3×10^{-7}	1.6×10^{-7}	9.4×10^{-10}	7.6×10^{-10}
Environmental restoration	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	8.5×10^{-3}	4.4×10^{-3}	0.0×10^{0}
Total[b,d]	7.2×10^{3}	2.2×10^{-1}	5.2×10^{5}	1.8×10^{2}	2.8×10^{-1}	1.6×10^{1}	6.3×10^{-1}	9.4×10^{-1}	8.1×10^{-3}	7.5×10^{-2}	2.3×10^{-2}	1.8×10^{0}

a. An equal amount of yttrium-90 is assumed to accompany all strontium-90 emissions.
b. Totals may differ from the sum of waste streams since some projects are associated with more than one waste stream.
c. Total assuming Waste Immobilization Facility direct vitrification.
d. Total assuming Waste Immobilization Facility direct separation.

Table 5.7-2. Summary of criteria pollutant emission rates at the Idabo National Engineering Laboratory site by alternative and source group.

Waste or source group[a]	Carbon monoxide[b] Max. hr. (g/hr)	Carbon monoxide[b] Annual (kg/yr)	Nitrogen dioxide Max. hr. (g/hr)	Nitrogen dioxide Annual (kg/yr)	Sulfur dioxide Max. hr. (g/hr)	Sulfur dioxide Annual (kg/yr)	Particulate matter Max. hr. (g/hr)	Particulate matter Annual (kg/yr)	Volatile organic compounds[c] Max. hr. (g/hr)	Volatile organic compounds[c] Annual (kg/yr)	Lead Max. hr. (g/hr)	Lead Annual (kg/yr)
Alternative A (No Action)												
Transuranic waste	3,360	17,950	10,330	44,500	415	3,640	145	1,270	626	5,388	0.16	1.4
Low-level waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Mixed low-level waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Hazardous waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Remediation	4,668	20,281	34,480	143,507	5,724	49,440	141	1,206	341	2,972	2.8	12
D&D[e]	7,091	13,368	2,243	3,306	170	262	6,531	12,158	75	65	(d)	(d)
Infrastructure	14	118	66	580	7	60	3	29	4	130	(d)	(d)
Total[f]	15,254	51,741	47,683	191,904	6,353	53,409	6,860	14,672	1,045	8,555	2.9	13
Alternative B (Ten-Year Plan)												
Spent nuclear fuel	5	0.17	25	0.82	0.26	0.008	1.3	0.041	1.4	0.044	(d)	(d)
High-level waste	0.044	0.39	190,000	1,630,000	130	1,100	420	3,700	84	740	1.5×10^{-6}	1.3×10^{-5}
Transuranic waste	19,027	48,251	66,215	116,149	14,542	39,927	3,857	6,695	2,149	10,319	2,419	180
Low-level waste	14,919	21,225	51,349	24,960	14,455	36,795	3,399	2,203	845	344	2,421	191
Mixed low-level waste	15,001	21,482	53,549	31,810	14,473	36,852	3,399	2,203	845	344	2,421	191
Hazardous waste	204	280	2,764	6,861	56	64	40	8	(d)	(d)	0.14	0.42
Remediation	4,668	20,281	34,480	143,507	5,724	49,440	141	1,206	341	2,972	2.8	12
D&D[e]	17,027	31,968	5,449	9,306	426	742	33,774	63,158	75	65	(d)	(d)
Infrastructure	14	118	66	580	7	60	3	29	4	130	(d)	(d)
Total[f]	41,275	102,800	299,398	1,908,704	21,545	95,133	38,283	75,067	2,655	14,239	2,424	208

Table 5.7-2. (continued).

Waste or source group[a]	Carbon monoxide[b] Max. hr. (g/hr)	Carbon monoxide[b] Annual (kg/yr)	Nitrogen dioxide Max. hr. (g/hr)	Nitrogen dioxide Annual (kg/yr)	Sulfur dioxide Max. hr. (g/hr)	Sulfur dioxide Annual (kg/yr)	Particulate matter Max. hr. (g/hr)	Particulate matter Annual (kg/yr)	Volatile organic compounds[c] Max. hr. (g/hr)	Volatile organic compounds[c] Annual (kg/yr)	Lead Max. hr. (g/hr)	Lead Annual (kg/yr)
Alternative C (Minimum Treatment, Storage, and Disposal)												
High-level waste	1,300	420	190,000	1,650,000	6.5	57	530	4,600	7.8	68	3.3×10^{-6}	2.4×10^{-5}
Transuranic waste	3,600	17,950	10,330	44,500	415	3,640	145	1,270	626	5,388	0.16	1.4
Low-level waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Mixed low-level waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Hazardous waste	122	23	564	11	38	7	40	8	(d)	(d)	(d)	(d)
Remediation	4,668	20,281	34,480	143,507	5,724	49,440	141	1,206	341	2,972	2.8	12
D&D[e]	7,091	13,368	2,243	3,306	170	262	6,531	12,158	75	65	(d)	(d)
Infrastructure	14	118	66	580	7	60	3	29	4	130	(d)	(d)
Total[f]	16,554	52,161	237,683	1,841,904	6,359	53,466	7,390	19,272	1,053	8,623	2.9	13
Alternative D (Maximum Treatment, Storage, and Disposal)												
Spent nuclear fuel	5	0.17	25	0.82	0.26	0.008	1.3	0.041	1.4	0.044	(d)	(d)
High-level waste	1,300	420	190,000	1,650,000	6.5	57	530	4,600	7.8	68	3.3×10^{-6}	2.4×10^{-5}
Transuranic waste	20,046	50,899	68,980	117,230	14,641	40,005	3,857	6,695	2,153	10,320	2,781	205
Low-level waste	20,022	24,220	73,146	28,349	15,871	37,327	4,739	2,273	15,073	2,499	2,788	245
Mixed low-level waste	20,104	24,477	75,346	35,199	15,889	37,384	4,739	2,273	15,073	2,499	2,789	245
Hazardous waste	204	280	2,764	6,861	56	64	40	8	(d)	(d)	0.14	0.42
Remediation	4,668	20,281	34,480	143,507	5,724	49,440	141	1,206	341	2,972	2.8	12
D&D[e]	17,027	31,968	5,449	9,306	426	742	33,774	63,158	75	65	(d)	(d)
Infrastructure	14	118	66	580	7	60	3	29	4	130	(d)	(d)
Total[f]	47,677	106,215	321,195	1,932,063	22,838	94,623	39,733	76,037	16,808	15,723	2,792	262

a. Only those sources with projected criteria pollutant emissions are listed.
b. Max. hr. = maximum hourly; kg/yr = kilograms per year; g/hr = grams per hour.
c. Volatile organic compounds (VOCs) are not designated as criteria pollutants; however, they can lead to the formation of ozone, which is a criteria pollutant.
d. No projected emissions reported.
e. D&D = decontamination and decommissioning; includes fugitive emissions associated with short-term (temporary) demolition activities.
f. Totals may differ from the sum of waste streams since some projects are associated with more than one waste stream. Also, totals conservatively assume that all projects operate over the same period of time.

pollutants that were either (a) included in the baseline assessment and emitted by any proposed project or (b) emitted by proposed projects in a cumulative quantity that exceeds the screening level emission rate prescribed by the State of Idaho (IDHW 1994), even if the toxic air pollutant was not assessed in the baseline. The emission rates of toxic air pollutants considered in this assessment are listed by alternative in Table 5.7-3.

A visual comparison of maximum hourly and annual average emission rates for the four alternatives is presented in Figure 5.7-1. As can be seen, these emissions are dominated by nitrogen dioxide emissions, which are primarily attributable to the Waste Immobilization Facility, a high-level waste treatment facility at the Idaho Chemical Processing Plant proposed under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The significance of these emissions, including potential means for reduction, is discussed in Sections 5.12, Health and Safety, and Subsection 5.19.4 of Section 5.19, Mitigation.

5.7.3 Air Resource Impacts from Alternatives Due to Radiological Sources

This section describes the effects that the proposed alternatives would have on the radiological air quality in the Eastern Snake River Plain. Sources of airborne radionuclide emissions from INEL site facilities associated with the alternative actions are described, emissions are estimated, and their impacts on the prevailing conditions are assessed and described.

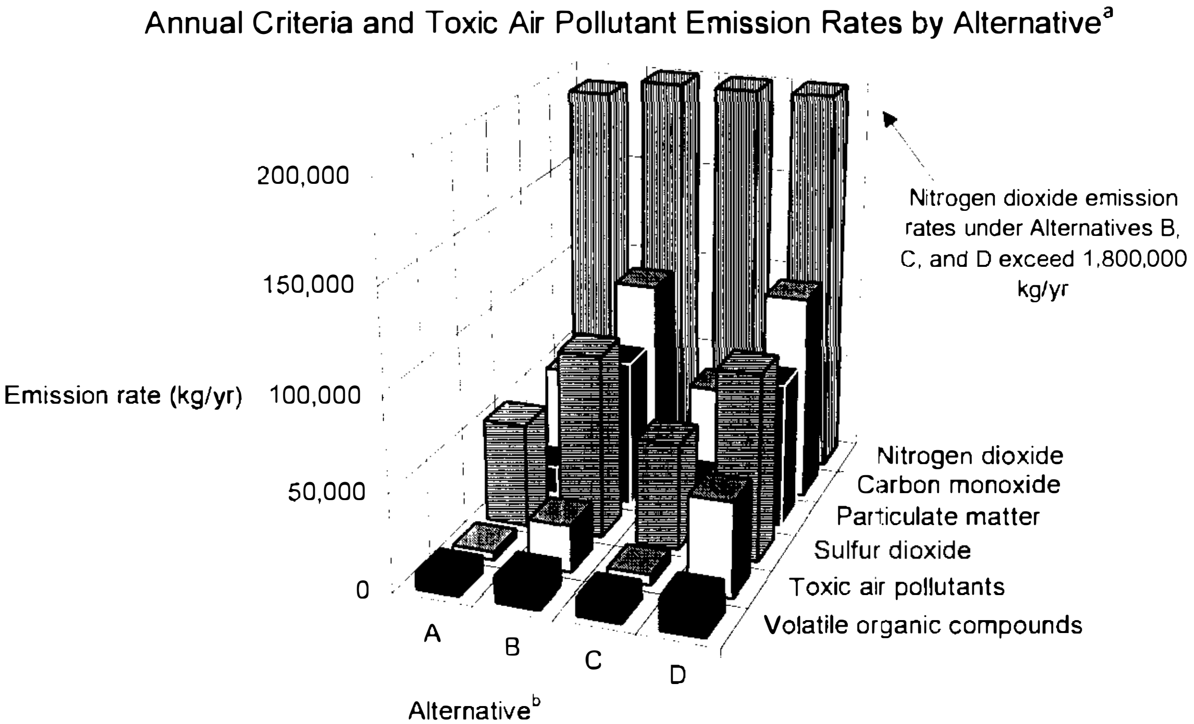
5.7.3.1 Radiological Impacts. Radiation doses associated with emissions from environmental restoration and waste management alternatives have been calculated for (a) a worker at the location of highest predicted radioactivity level, (b) the maximally exposed individual (MEI) at an offsite location (see Glossary for definition), and (c) the entire population (adjusted for future growth) within an 80-kilometer (50-mile) radius of each source of emission within the INEL site. These doses, which are presented in Table 5.7-4, represent the maximum amount of radiation dose received as a result of radioactivity released to the air over a one-year period.

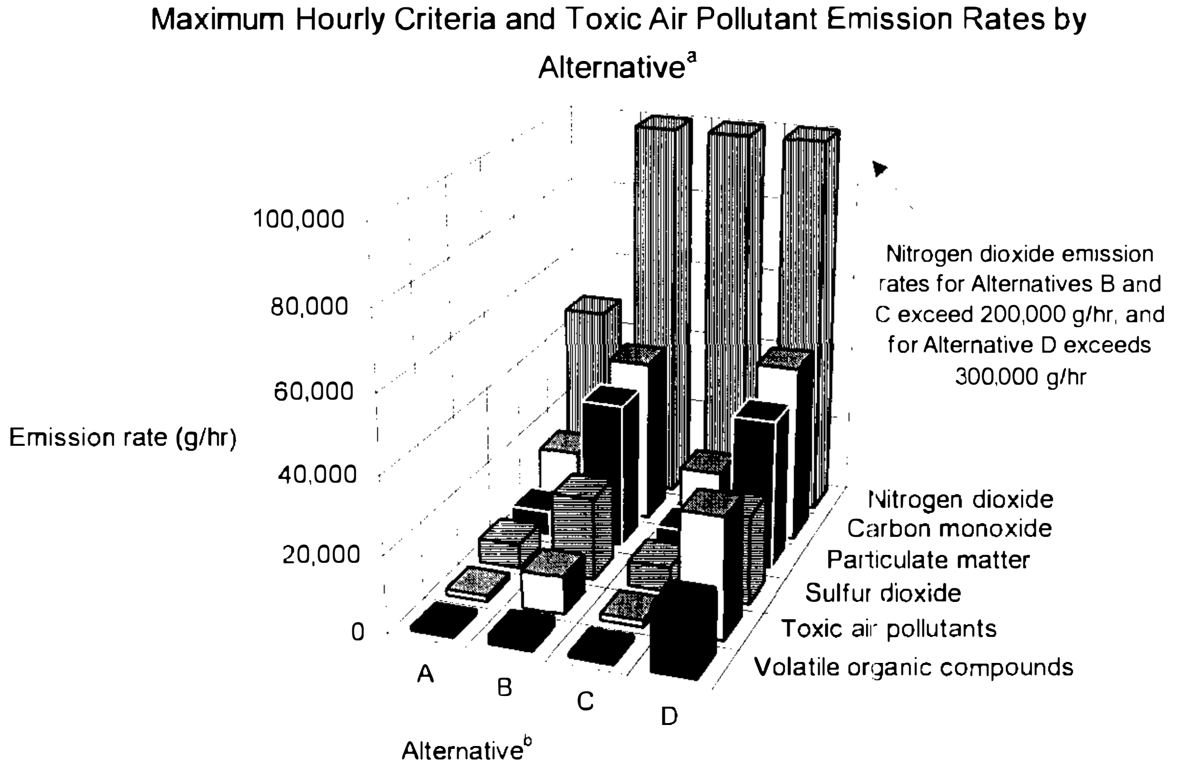
Projects associated with Alternative A (No Action) projected to have radiological emissions include the spent nuclear fuel dry cask storage project and radioactive waste characterization, retrieval, and cleanup activities at the Radioactive Waste Management Complex (RWMC). The

Table 5.7-3. Maximum hourly and annual average emissions of toxic air pollutants at the Idaho National Engineering Laboratory site by alternative.

Toxic air pollutant	Emission rate: Grams per hour	Emission rate: Kilograms per year	Toxic air pollutant	Emission rate: Grams per hour	Emission rate: Kilograms per year
Alternative A (No Action)			**Alternative C (Minimum Treatment, Storage, and Disposal)**		
Ammonia	1.1×10^{2}	1.6×10^{0}	Ammonia	1.1×10^{2}	1.6×10^{0}
Asbestos	1.1×10^{-1}	4.4×10^{-1}	Asbestos	1.1×10^{-1}	4.4×10^{-1}
Benzene	1.6×10^{1}	1.2×10^{2}	Benzene	1.6×10^{1}	1.2×10^{2}
Beryllium	9.8×10^{-3}	3.8×10^{-2}	Beryllium	9.8×10^{-3}	3.8×10^{-2}
Cadmium compounds	1.4×10^{-11}	4.1×10^{-11}	Cadmium compounds	3.4×10^{-6}	3.0×10^{-5}
Carbon tetrachloride	3.4×10^{1}	2.4×10^{2}	Carbon tetrachloride	3.4×10^{1}	2.4×10^{2}
Chloroform	2.2×10^{0}	9.6×10^{0}	Chloroform	2.2×10^{0}	9.6×10^{0}
Chromium compounds	1.3×10^{-1}	1.2×10^{0}	Chromium compounds	1.3×10^{-1}	1.2×10^{0}
Formaldehyde	1.5×10^{2}	1.3×10^{3}	Formaldehyde	1.5×10^{2}	1.3×10^{3}
Hydrochloric acid	3.6×10^{1}	1.1×10^{2}	Hydrochloric acid	3.6×10^{1}	1.1×10^{2}
Hydrofluoric acid [a]	3.0×10^{0}	6.9×10^{0}	Hydrofluoric acid [a]	1.2×10^{2}	1.1×10^{3}
Mercury	9.3×10^{-1}	3.6×10^{0}	Mercury	2.8×10^{1}	2.4×10^{2}
Methylene chloride	1.1×10^{3}	2.0×10^{3}	Methylene chloride	1.1×10^{3}	2.0×10^{3}
Nickel	1.5×10^{0}	1.3×10^{1}	Nickel	1.5×10^{0}	1.3×10^{1}
Nitric acid	1.1×10^{2}	1.9×10^{2}	Nitric acid	1.1×10^{2}	1.9×10^{2}
Polychlorinated biphenyl	9.0×10^{-9}	1.8×10^{-8}	Polychlorinated biphenyl	9.0×10^{-9}	1.8×10^{-8}
Perchloroethylene	2.4×10^{0}	1.2×10^{1}	Perchloroethylene	2.4×10^{0}	1.2×10^{1}
Sulfuric acid	3.4×10^{1}	6.5×10^{1}	Sulfuric acid	3.4×10^{1}	6.5×10^{1}
Trichloroethylene	6.9×10^{0}	4.3×10^{1}	Tributyl phosphate	1.1×10^{2}	9.5×10^{2}
Trichloro-trifluoroethane	4.2×10^{-1}	9.9×10^{-1}	Trichloroethylene	6.9×10^{0}	4.3×10^{1}
			Trichloro-trifluoroethane	4.2×10^{-1}	9.9×10^{-1}
Alternative B (Ten-Year Plan)			**Alternative D (Maximum Treatment, Storage, and Disposal)**		
Ammonia	1.1×10^{2}	1.6×10^{0}	Ammonia [b]	1.8×10^{4}	1.6×10^{5}
Arsenic	8.9×10^{-2}	4.9×10^{-1}	Arsenic	2.3×10^{-1}	1.3×10^{0}
Asbestos	2.9×10^{-1}	4.4×10^{-1}	Asbestos	3.2×10^{-1}	4.4×10^{-1}
Benzene	6.0×10^{1}	1.9×10^{2}	Benzene	1.2×10^{2}	1.9×10^{2}
Beryllium	5.6×10^{-2}	1.8×10^{-1}	Beryllium	6.0×10^{-2}	1.8×10^{-1}
Cadmium compounds	2.5×10^{-1}	1.3×10^{0}	Cadmium compounds	4.5×10^{1}	2.4×10^{0}
Carbon tetrachloride	3.8×10^{1}	2.4×10^{2}	Carbon tetrachloride	3.8×10^{1}	2.4×10^{2}
Chloroform	2.2×10^{0}	9.6×10^{0}	Chloroform	2.2×10^{0}	9.6×10^{0}
Chromium compounds	1.1×10^{0}	6.9×10^{0}	Chromium compounds	1.1×10^{0}	6.9×10^{0}
Formaldehyde	3.4×10^{2}	2.0×10^{3}	Formaldehyde	4.6×10^{2}	2.0×10^{3}
Hydrochloric acid	4.5×10^{3}	1.6×10^{4}	Hydrochloric acid	4.9×10^{3}	1.7×10^{4}
Hydrofluoric acid [a]	1.4×10^{2}	1.1×10^{3}	Hydrofluoric acid [a]	1.8×10^{2}	1.2×10^{3}
Mercury	6.6×10^{2}	4.4×10^{2}	Mercury	7.6×10^{2}	4.5×10^{2}
Methylene chloride	1.1×10^{3}	2.0×10^{3}	Methyl isobutyl ketone	2.7×10^{3}	2.3×10^{4}
Nickel	6.9×10^{0}	4.3×10^{1}	Methylene chloride	1.1×10^{3}	2.0×10^{3}
Nitric acid	1.1×10^{2}	1.9×10^{2}	Nickel	6.9×10^{0}	4.3×10^{1}
Polychlorinated biphenyl	3.7×10^{1}	3.0×10^{0}	Nitric acid	1.1×10^{2}	1.9×10^{2}
Perchloroethylene	5.9×10^{0}	1.2×10^{1}	Polychlorinated biphenyl	4.3×10^{1}	3.4×10^{0}
Sulfuric acid	3.4×10^{1}	6.5×10^{1}	Perchloroethylene	6.4×10^{0}	1.3×10^{1}
			Sulfuric acid	3.4×10^{1}	6.5×10^{1}
Trichloroethylene	1.9×10^{1}	5.5×10^{1}	Tributyl phosphate	8.6×10^{0}	5.5×10^{1}
Trichloro-trifluoroethane	4.3×10^{0}	4.0×10^{0}	Trichloroethylene	1.2×10^{2}	1.0×10^{3}
			Trichloro-trifluoroethane	4.8×10^{0}	4.2×10^{0}

a. Hydrofluoric acid is not listed as a toxic air pollutant by IDHW (1994), but is included and evaluated as a fluoride, which is listed.
b. Includes emissions of ammonium hydroxide.





a. Toxic air pollutants include lead emissions.
b. A = No Action; B = Ten-Year Plan; C = Minimum Treatment, Storage, and Disposal; D = Maximum Treatment, Storage, and Disposal.

Figure 5.7-1. Comparison of criteria and toxic air pollutant emission rates at the Idaho National Engineering Laboratory site for alternatives. (Toxic air pollutants include lead emissions.)

Table 5.7-4. Cumulative dose from airborne emissions at the Idaho National Engineering Laboratory site by alternative and source group.

	Dose to maximally exposed worker (millirem per year)			Dose to maximally exposed individual (millirem per year)			Collective population dose (person-rem per year)[a]		
Source group	Baseline[b]	Increment[c]	Cumulative	Baseline[b]	Increment[c]	Cumulative	Baseline[b]	Increment[c]	Cumulative
Alternative A (No Action)									
Spent nuclear fuel	0.32	0.00033	0.32	0.05	0.0035	0.05	0.3	0.1	0.40
Transuranic waste	0.32	0.000042	0.32	0.05	0.00034	0.05	0.3	0.0011	0.30
Environmental restoration	0.32	0.014	0.33	0.05	0.088	0.14	0.3	0.3	0.60
Total[d]	0.32	0.014	0.33	0.05	0.092	0.14	0.3	0.37	0.67
Alternative B (Ten-Year Plan)									
Spent nuclear fuel	0.32	0.0033	0.32	0.05	0.008	0.06	0.3	0.19	0.49
High-level waste	0.32	0.0021	0.32	0.05	0.018	0.07	0.3	0.097	0.40
Transuranic waste	0.32	0.11	0.43	0.05	0.42	0.47	0.3	1.6	1.9
Low-level waste	0.32	0.026	0.35	0.05	0.034	0.08	0.3	0.25	0.55
Greater-than-Class-C waste	0.32	0.00019	0.32	0.05	0.00063	0.05	0.3	0.021	0.32
Mixed low-level waste	0.32	0.076	0.4	0.05	0.052	0.1	0.3	0.53	0.83
Hazardous waste	0.32	2.4×10^{-8}	0.32	0.05	5.7×10^{-7}	0.05	0.3	7.5×10^{-6}	0.30
Environmental restoration	0.32	0.014	0.33	0.05	0.088	0.14	0.3	0.3	0.60
Total[d]	0.32	0.14	0.46	0.05	0.58	0.63	0.3	2.6	2.9
Alternative C (Minimum Treatment, Storage, and Disposal)									
Spent nuclear fuel	0.32	0.00007	0.32	0.05	0.0039	0.05	0.3	0.083	0.38
High-level waste	0.32	0.00014	0.32	0.05	0.018	0.07	0.3	0.099	0.40
Transuranic waste	0.32	0.000042	0.32	0.05	0.00034	0.05	0.3	0.0011	0.30
Environmental restoration	0.32	0.014	0.33	0.05	0.088	0.14	0.3	0.3	0.60
Total[d]	0.32	0.014	0.33	0.05	0.11	0.16	0.3	0.49	0.79
Alternative D (Maximum Treatment, Storage, and Disposal)									
Spent nuclear fuel	0.32	0.0042	0.32	0.05	0.048	0.10	0.3	0.39	0.69
High-level waste	0.32	0.0033	0.32	0.05	0.018	0.07	0.3	0.099	0.40
Transuranic waste	0.32	0.13	0.45	0.05	0.48	0.53	0.3	1.8	2.1
Low-level waste	0.32	0.10	0.42	0.05	0.14	0.19	0.3	0.58	0.88
Greater-than-Class-C waste	0.32	0.00019	0.32	0.05	0.00063	0.05	0.3	0.021	0.32
Mixed low-level waste	0.32	0.10	0.42	0.05	0.16	0.21	0.3	0.86	1.2
Hazardous waste	0.32	2.4×10^{-8}	0.32	0.05	5.7×10^{-7}	0.05	0.3	7.5×10^{-6}	0.30
Environmental restoration	0.32	0.014	0.33	0.05	0.088	0.14	0.3	0.3	0.60
Total[d]	0.32	0.17	0.49	0.05	0.79	0.84	0.3	3.5	3.8

a. Highest population dose between the years 2000 and 2010.
b. Location of maximum onsite baseline dose is Test Reactor Area; dose includes emissions from existing and foreseeable facilities.
c. Incremental dose specified is for highest predicted area (not necessarily the same location as maximum baseline dose).
d. Totals may differ from the sum of sources since some projects are associated with more than one source and the maximum doses may be for different years or locations.

doses for Alternative A would result from emissions from projects associated with the management of spent nuclear fuel and transuranic waste and from environmental restoration activities. All doses estimated for Alternative A would be a very small fraction of that received from natural background sources and are well below applicable standards.

Projects associated with Alternative B (Ten-Year Plan) projected to have radiological emissions include spent nuclear fuel and high-level waste activities at the Idaho Chemical Processing Plant, transuranic waste processing and mixed and low-level waste treatment (assumed to be located at a new site east of the Radioactive Waste Management Complex), mixed low-level waste incineration at the Waste Experimental Reduction Facility, treatment of nonincinerable mixed waste at the Special Power Excursion Reactor Test area, spent fuel conditioning and mixed low-level and hazardous waste treatment at Argonne National Laboratory-West, and storage of greater-than-Class-C forms of low-level waste at Test Area North. In addition, the projects specified above for Alternative A (No Action) are also included in Alternative B. The doses for Alternative B are due mainly to transuranic waste processing and are somewhat higher than those for Alternative A. The estimated dose to the maximally exposed offsite individual is 0.58 millirem per year (0.63 millirem per year when the baseline dose is added), which is still very low with respect to applicable standards and the natural background dose. The dose to the maximally exposed worker is 0.14 millirem per year (0.46 millirem per year including baseline), which is a small fraction of the occupational dose limit of 5,000 millirem per year. (The offsite dose can be higher than the worker dose since workers may not receive any dose by the food ingestion pathway.)

Doses resulting from airborne emissions from projects associated with Alternative C (Minimum Treatment, Storage, and Disposal) are essentially the same as Alternative A (No Action) for the highest worker dose and slightly higher than Alternative A for offsite dose. This small increase is mainly due to the inclusion of the Waste Immobilization Facility with Alternative C.

The type and number of projects assumed for Alternative D (Maximum Treatment, Storage, and Disposal) are similar to Alternative B (Ten-Year Plan). Three important differences, however, are (a) the assumption that processing of spent nuclear fuel at the Idaho Chemical Processing Plant will occur in Alternative D but not in Alternative B, (b) increased processing of transuranic and mixed low-level wastes at either of two proposed incineration facilities—the Idaho Waste Processing Facility or the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, and

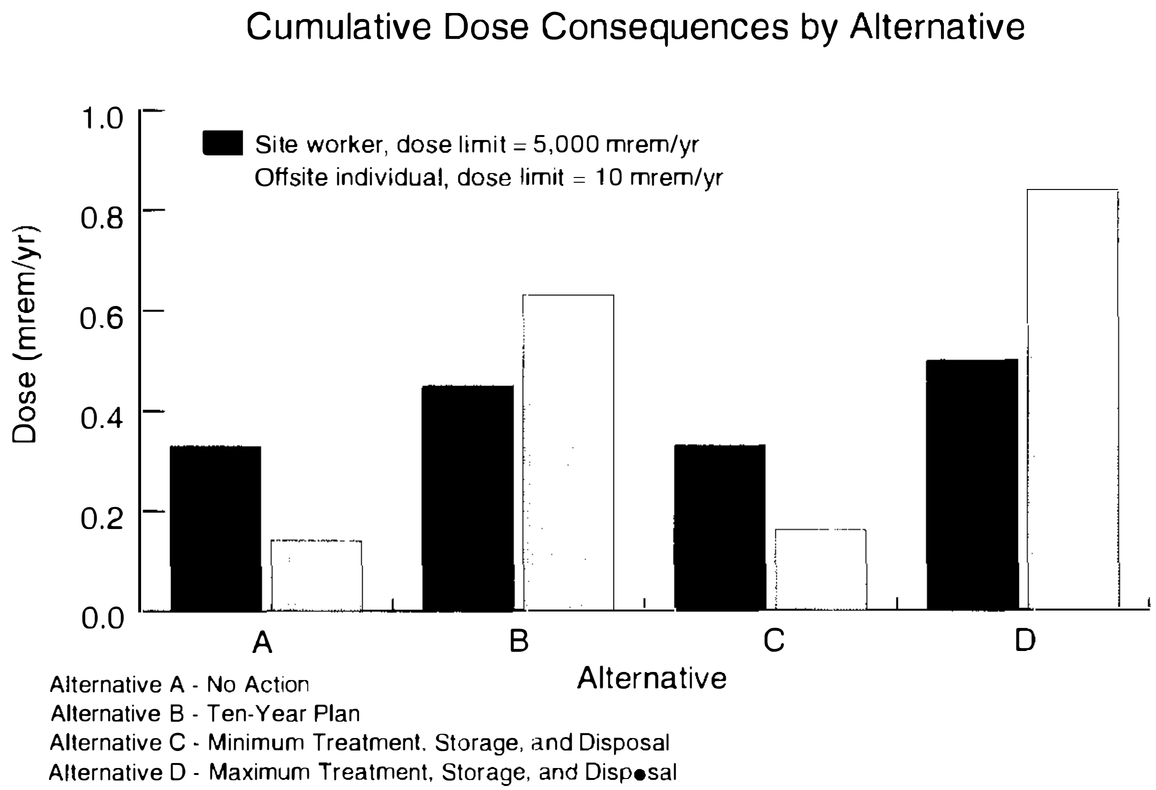
(c) the addition of the Mixed Low-Level Waste Treatment Facility. These activities would increase the maximum offsite individual dose to about 0.79 millirem per year (0.84 millirem, including baseline). Worker and collective population doses would also be somewhat higher than those for Alternative B. Nevertheless, these doses would still be very low with respect to applicable standards and the natural background dose. The relative magnitude of the doses for the four alternatives is illustrated by the comparisons presented in Figure 5.7-2.

5.7.3.2 Regulatory Compliance Evaluation. In all cases assessed, the dose to the maximally exposed worker would be well below radiation dose limits set for protection of workers. The highest worker dose would result from Alternative D (Maximum Treatment, Storage, and Disposal) and is estimated at 0.17 millirem per year. When added to the baseline dose (that is, the dose of 0.32 millirem per year from existing and projected emissions, as reported in Section 4.7, Air Resources), the cumulative result of about 0.5 millirem per year remains a small fraction of the annual occupational dose limit. This dose is low even with respect to offsite dose limits, which are much more stringent than occupational limits.

The highest dose estimated for the maximally exposed individual is associated with Alternative D (Maximum Treatment, Storage, and Disposal). This dose (0.79 millirem per year), when added to the baseline dose of 0.05 millirem per year, remains well below the dose limit of 10 millirems per year specified in the National Emission Standards for Hazardous Air Pollutants (NESHAP).

The baseline population dose as a result of existing INEL site facilities is about 0.3 person-rem. The maximum dose projected as a result of alternative courses of action would be 3.5 person-rem, more than half of which is due to large-scale incineration of transuranic wastes under Alternative D (Maximum Treatment, Storage, and Disposal). The maximum cumulative population dose of about 3.8 person-rem, which would be distributed over about 132,000 people,[a] represents a very small fraction of the dose that the population would receive over the same period of time from natural background sources (about 46,000 person-rem). No applicable standards exist for collective population dose; however, DOE policy requires that doses resulting from radioactivity in effluents be

a. This number represents the current population of about 120,000 increased by 10 percent to account for future growth.



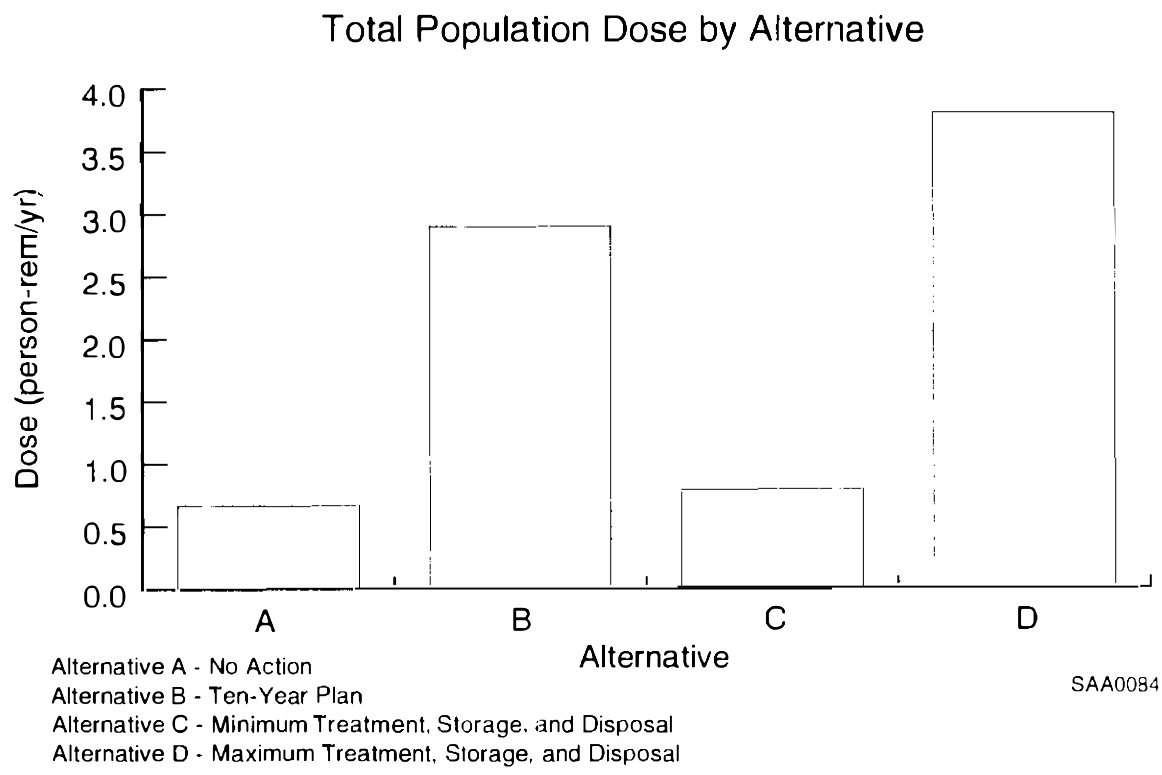


Figure 5.7-2. Cumulative dose for the maximally exposed offsite individual, worker, and total population due to Idaho National Engineering Laboratory site emissions by alternative.

reduced to the lowest levels reasonably achievable. The radiological health effects associated with these doses are presented in Section 5.12, Health and Safety.

5.7.4 Air Resource Impacts from Alternatives Due to Nonradiological Sources

This section presents results of the air quality assessments for sources of nonradiological air pollutants. Results are presented with the goal of facilitating comparisons of relative impacts between alternatives. The importance of the results as they apply to specific alternatives and the regulatory compliance aspects of predicted consequences are also discussed.

For both criteria and toxic air pollutants, consequences would be notably similar for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal), despite the large differences in the alternatives in terms of spent nuclear fuel and other wastes to be managed. For some of the candidate alternatives and waste management options, the amount of emissions (hourly or annual average) is not always highly dependent on the volume of waste to be managed. Increases in projected facility operating life, for example, may offset increases in hourly or annual average emission rates. Also, impacts are sometimes dominated by emissions from a single facility, which may be included in more than one alternative. With the exception of nitrogen dioxide emissions from high-level waste processing, the dominant sources of nonradiological emissions and impacts would be associated with the management of transuranic, low-level, and mixed low-level waste streams, and with remediation and decontamination and decommissioning activities.

5.7.4.1 Concentrations of Pollutants in Ambient Air at Offsite Locations. Maximum concentrations of criteria pollutants in ambient air (that is, at locations of public access) are presented in Table 5.7-5. Results are presented for the maximum levels predicted to occur at INEL site boundary locations, along public roads, and at the Craters of the Moon Wilderness Area. In all cases, these results would be well within the National Ambient Air Quality Standards. At INEL site boundary locations, the cumulative impacts (that is, the predicted concentrations from sources related to the respective alternatives added to the maximum baseline) differ little between alternatives. This is not due so much to the fact that emissions from the alternatives would be similar, but rather that in all cases the incremental impacts would be small with respect to the maximum baseline. This condition is illustrated by the INEL site boundary impacts presented in Figure 5.7-3. It should be

Table 5.7-5. Maximum concentrations of criteria pollutants at public access locations at the Idaho National Engineering Laboratory site by alternative.

Pollutant	Averaging time	Maximum baseline concentration (micrograms per cubic meter)			Baseline plus alternative (micrograms per cubic meter)			Applicable standard[a] (micrograms/cubic meter)	Percent of standard		
		Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon		Site boundary	Public roads	Craters of the Moon
Alternative A (No Action)											
Carbon monoxide	1-hour	362	614	134	379	1140	136	40,000	<1	3	<1
	8-hour	104	284	28	117	284	29	10,000	1	3	<1
Sulfur dioxide	3-hour	168	579	60	168	580	61	1,300	13	45	5
	24-hour	43	135	10	44	135	10	365	12	37	3
	Annual	2	6	0.3	2	6	0.3	80	2	7	<1
Particulate matter	24-hour	50	80	10	50	80	10	150	33	53	7
	Annual	2	5	1	2	5	1	50	4	10	2
Nitrogen dioxide	Annual	1	4	0.2	2	4	0.2	100	2	4	<1
Lead	Quarterly	0.0002	0.001	<0.0001	0.0002	0.001	<0.0001	1.5	<1	<1	<1
Alternative B (Ten-Year Plan)											
Carbon monoxide	1-hour	362	614	134	418	1219	137	40,000	1	3	<1
	8-hour	104	284	28	122	285	29	10,000	1	3	<1
Sulfur dioxide	3-hour	168	579	60	180	580	61	1,300	14	45	5
	24-hour	43	135	10	45	135	11	365	12	37	3
	Annual	2	6	0.3	2	6	0.3	80	3	8	<1
Particulate matter	24-hour	50	80	10	53	86	10	150	35	57	7
	Annual	2	5	1	2	5	1	50	4	10	2
Nitrogen dioxide	Annual	1	4	0.2	7	11	0.6	100	7	11	<1
Lead	Quarterly	0.0002	0.001	<0.0001	0.002	0.005	0.0001	1.5	<1	<1	<1
Alternative C (Minimum Treatment, Storage, and Disposal)											
Carbon monoxide	1-hour	362	614	134	379	1140	136	40,000	<1	3	<1
	8-hour	104	284	28	117	284	29	10,000	1	3	<1
Sulfur dioxide	3-hour	168	579	60	168	580	61	1,300	13	45	5
	24-hour	43	135	10	44	135	11	365	12	37	3
	Annual	2	6	0.3	2	6	0.3	80	2	7	<1
Particulate matter	24-hour	50	80	10	50	80	10	150	33	53	7
	Annual	2	5	1	2	5	1	50	4	10	2
Nitrogen dioxide	Annual	1	4	0.2	4	9	0.5	100	4	9	<1
Lead	Quarterly	0.0002	0.001	<0.0001	0.0002	0.001	<0.0001	1.5	<1	<1	<1
Alternative D (Maximum Treatment, Storage, and Disposal)											
Carbon monoxide	1-hour	362	614	134	433	1219	136	40,000	1	3	<1
	8-hour	104	284	28	124	284	29	10,000	1	3	<1
Sulfur dioxide	3-hour	168	579	60	181	580	61	1,300	14	45	5
	24-hour	43	135	10	45	135	11	365	12	37	3
	Annual	2	6	0.3	2	6	0.3	80	3	8	<1
Particulate matter	24-hour	50	80	10	54	88	10	150	36	59	7
	Annual	2	5	1	2	5	1	50	4	10	2
Nitrogen dioxide	Annual	1	4	0.2	7	11	0.6	100	7	11	<1
Lead	Quarterly	0.0002	0.001	<0.0001	0.003	0.006	0.0001	1.5	<1	<1	<1

a. Applicable standards are National Ambient Air Quality Standards.

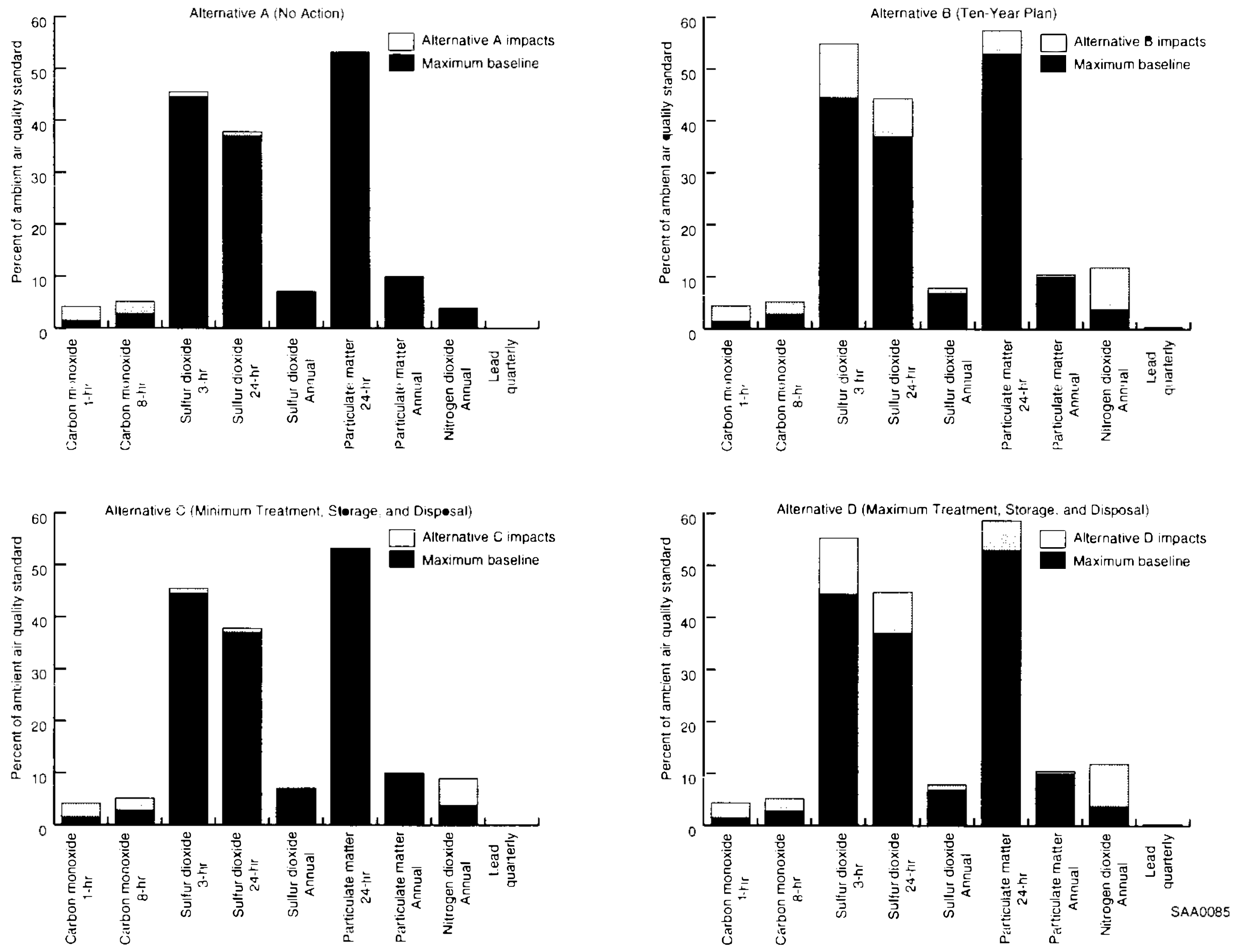


Figure 5.7-3. Maximum estimated criteria pollutant impacts at the Idaho National Engineering Laboratory site boundary locations by alternative as percentages of the National Ambient Air Quality Standards.

noted that the scale of these graphs does not extend to 100 percent (which facilitates comparison) and the sum of the maximum baseline plus alternative impacts is much less than 100 percent of the applicable standards in all cases.

Concentrations at public road locations within the INEL site boundary could increase significantly from the baseline, especially if a major combustion or fugitive source is located relatively close to a public road. Increases in baseline concentrations at the Craters of the Moon would be very minor in all cases, although potential impacts on visibility in this area need further assessment (see Section 5.7.4.3.3).

The concentration results reflect the cumulative impact of alternative sources; that is, the conditions associated with the maximum baseline and the effects of projected increases to the baseline have been taken into account. Since maximum baseline concentrations are much greater than baseline conditions that actually exist, these results are conservative and likely overstate the consequences that would actually result by a substantial margin. Background concentrations have not been added because (a) reliable data on background levels in the INEL environs are not available for most pollutants and (b) background levels are low and are more than offset by the use of the maximum (as opposed to actual) baseline. Some pollutants have been monitored onsite, but those results reflect INEL site facility contributions and are not indicative of actual background. (INEL site facility contributions are accounted for in the current assessment by application of dispersion modeling.) Concentrations of particulate matter have been monitored by the State of Idaho at the Craters of the Moon (IDHW 1991). The maximum 24-hour result for total suspended particulates was 48 micrograms per cubic meter. Even if this concentration is taken into account, the predicted consequences would remain well below the standard.

Results of assessments for toxic air pollutants at offsite locations are presented separately for carcinogenic (that is, capable of inducing cancer) and noncarcinogenic toxic air pollutants in Tables 5.7-6 and 5.7-7, respectively. As described in Section 4.7.4.2.2, Offsite Conditions, toxic air pollutant increments have been recently promulgated by the State of Idaho for the control of toxic pollutants in ambient air. These increments, however, apply only to new or modified sources and would only require the evaluation of cumulative impacts for those sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pollutant impacts to these increments.

Table 5.7-6. Projected annual average ambient air impacts of carcinogenic air pollutant emissions at the Idaho National Engineering Laboratory site boundary and public roads by alternative.[a]

Carcinogenic air pollutant	Concentration in $\mu g/m^3$			Site boundary impact as percent of standard	Public roads impact as percent of standard
	Standard[b]	Impact of alternative at INEL site boundary	Impact of alternative at public roads		
Alternative A (No Action)					
Arsenic	2.3×10^{-4}	0.0×10^{0}	0.0×10^{0}	<1	<1
Asbestos[c]	1.2×10^{-4}	2.0×10^{-6}	1.9×10^{-6}	2	2
Benzene	1.2×10^{-1}	5.8×10^{-4}	6.4×10^{-4}	<1	<1
Beryllium	4.2×10^{-3}	2.0×10^{-7}	2.0×10^{-7}	<1	<1
Cadmium compounds	5.6×10^{-4}	$<1.0 \times 10^{-8}$	$<1.0 \times 10^{-8}$	<1	<1
Carbon tetrachloride	6.7×10^{-2}	2.4×10^{-3}	2.2×10^{-3}	4	3
Chloroform	4.3×10^{-2}	8.9×10^{-5}	8.3×10^{-5}	<1	<1
Formaldehyde	7.7×10^{-2}	6.3×10^{-3}	6.3×10^{-3}	8	8
Hexavalent chromium	8.3×10^{-5}	2.6×10^{-7}	2.6×10^{-7}	<1	<1
Methylene chloride	2.4×10^{-1}	1.4×10^{-2}	1.3×10^{-2}	6	5
Nickel	4.2×10^{-3}	6.0×10^{-5}	5.9×10^{-5}	1	1
Perchloroethylene	2.1×10^{0}	1.1×10^{-4}	1.0×10^{-4}	<1	<1
Polychlorinated biphenyls	1.0×10^{-2}	$<1.0 \times 10^{-8}$	$<1.0 \times 10^{-8}$	<1	<1
Trichloroethylene	7.7×10^{-2}	4.4×10^{-4}	4.1×10^{-4}	<1	<1
Alternative B (Ten-Year Plan)					
Arsenic	2.3×10^{-4}	9.0×10^{-7}	3.9×10^{-6}	<1	2
Asbestos[c]	1.2×10^{-4}	2.0×10^{-6}	2.0×10^{-6}	2	2
Benzene	1.2×10^{-1}	4.5×10^{-3}	4.5×10^{-3}	4	4
Beryllium	4.2×10^{-3}	4.0×10^{-7}	1.0×10^{-6}	<1	<1
Cadmium compounds	5.6×10^{-4}	2.5×10^{-6}	1.0×10^{-5}	<1	2
Carbon tetrachloride	6.7×10^{-2}	2.4×10^{-3}	2.2×10^{-3}	4	3
Chloroform	4.3×10^{-2}	8.9×10^{-5}	8.3×10^{-5}	<1	<1
Formaldehyde	7.7×10^{-2}	5.0×10^{-2}	4.9×10^{-2}	65	64
Hexavalent chromium	8.3×10^{-5}	5.5×10^{-6}	5.5×10^{-6}	7	7
Methylene chloride	2.4×10^{-1}	1.4×10^{-2}	1.3×10^{-2}	6	5
Nickel	4.2×10^{-3}	1.3×10^{-3}	1.2×10^{-3}	31	29
Perchloroethylene	2.1×10^{0}	1.1×10^{-4}	1.0×10^{-4}	<1	<1
Polychlorinated biphenyls	1.0×10^{-2}	1.5×10^{-5}	3.0×10^{-5}	<1	<1
Trichloroethylene	7.7×10^{-2}	4.7×10^{-4}	4.3×10^{-4}	<1	<1

Table 5.7-6. (continued).

Carcinogenic air pollutant	Concentration in $\mu g/m^3$: Standard[b]	Concentration in $\mu g/m^3$: Impact of alternative at INEL site boundary	Concentration in $\mu g/m^3$: Impact of alternative at public roads	Site boundary impact as percent of standard	Public roads impact as percent of standard
Alternative C (Minimum Treatment, Storage, Disposal)					
Arsenic	2.3×10^{-4}	0.0×10^{0}	0.0×10^{0}	<1	<1
Asbestos[c]	1.2×10^{-4}	2.0×10^{-6}	1.9×10^{-6}	2	2
Benzene	1.2×10^{-1}	5.8×10^{-4}	6.4×10^{-4}	<1	<1
Beryllium	4.2×10^{-3}	2.0×10^{-7}	2.0×10^{-7}	<1	<1
Cadmium compounds	5.6×10^{-4}	$<1.0 \times 10^{-8}$	$<1.0 \times 10^{-8}$	<1	<1
Carbon tetrachloride	6.7×10^{-2}	2.4×10^{-3}	2.2×10^{-3}	4	3
Chloroform	4.3×10^{-2}	8.9×10^{-5}	8.3×10^{-5}	<1	<1
Formaldehyde	7.7×10^{-2}	6.3×10^{-3}	6.3×10^{-3}	8	8
Hexavalent chromium	8.3×10^{-5}	2.6×10^{-7}	2.6×10^{-7}	<1	<1
Methylene chloride	2.4×10^{-1}	1.4×10^{-2}	1.3×10^{-2}	6	5
Nickel	4.2×10^{-3}	6.0×10^{-5}	5.9×10^{-5}	1	1
Perchloroethylene	2.1×10^{0}	1.1×10^{-4}	1.0×10^{-4}	<1	<1
Polychlorinated biphenyls	1.0×10^{-2}	$<1.0 \times 10^{-8}$	$<1.0 \times 10^{-8}$	<1	<1
Trichloroethylene	7.7×10^{-2}	4.4×10^{-4}	4.1×10^{-4}	<1	<1
Alternative D (Maximum Treatment, Storage, and Disposal)					
Arsenic	2.3×10^{-4}	3.2×10^{-6}	6.1×10^{-6}	1	2
Asbestos[c]	1.2×10^{-4}	2.0×10^{-6}	2.0×10^{-6}	2	<1
Benzene	1.2×10^{-1}	4.6×10^{-3}	4.5×10^{-3}	4	<1
Beryllium	4.2×10^{-3}	4.0×10^{-7}	1.0×10^{-6}	<1	<1
Cadmium compounds	5.6×10^{-4}	8.2×10^{-6}	1.6×10^{-5}	1	3
Carbon tetrachloride	6.7×10^{-2}	2.4×10^{-3}	2.2×10^{-3}	4	<1
Chloroform	4.3×10^{-2}	8.9×10^{-5}	8.3×10^{-5}	<1	8
Formaldehyde	7.7×10^{-2}	5.0×10^{-2}	4.9×10^{-2}	65	64
Hexavalent chromium	8.3×10^{-5}	6.0×10^{-6}	6.0×10^{-6}	7	5
Methylene chloride	2.4×10^{-1}	1.4×10^{-2}	1.3×10^{-2}	6	1
Nickel	4.2×10^{-3}	1.3×10^{-3}	1.2×10^{-3}	31	<1
Perchloroethylene	2.1×10^{0}	1.1×10^{-4}	1.1×10^{-4}	<1	<1
Polychlorinated biphenyls	1.0×10^{-2}	1.7×10^{-5}	3.5×10^{-5}	<1	<1
Trichloroethylene	7.7×10^{-2}	4.7×10^{-4}	4.3×10^{-4}	<1	0

a. Includes contributions from projected increases to baseline not associated with specific alternatives.
b. Acceptable ambient concentration for carcinogens (AACCs) listed in Rules for the Control of Air Pollution in Idaho (IDHW 1994).
c. Asbestos AACC is listed in IDHW (1994) as 4.0×10^{-6} fibers per milliliter; a conversion factor of 0.003 micrograms per 100 fibers is used here to convert the AACC to units of micrograms per cubic meter.

Table 5.7-7. Projected incremental impact of noncarcinogenic toxic air pollutant emissions at the Idaho National Engineering site boundary and public roads by alternative.[a]

Noncarcinogenic air pollutant	Concentration in $\mu g/m^3$			Site boundary impact as percent of standard	ublic roads impact as percent of st dard
	Standard[b]	Average nual concentration at INEL site boundary	Average nual concentration at public roads		
Alternative A (No Action)					
Ammonia[c]	1.8×10^2	1.1×10^{-5}	6.7×10^{-5}	<1	<1
Freon[d]	7.6×10^4	1.1×10^{-4}	1.9×10^{-4}	<1	<1
Hydrochloric acid	7.5×10^0	4.2×10^{-4}	6.0×10^{-4}	<1	<1
Hydrofluoric acid[e]	2.5×10^1	2.4×10^{-5}	1.3×10^{-4}	<1	<1
Mercury	1.0×10^0	1.7×10^{-5}	1.7×10^{-5}	<1	<1
Methyl isobutyl ketone	2.05×10^3	0.0×10^0	0.0×10^0	<1	<1
Nitric acid	5.0×10^1	1.3×10^{-3}	1.2×10^{-3}	<1	<1
Sulfuric acid	1.0×10^1	2.6×10^{-4}	8.5×10^{-4}	<1	<1
Tributyl phosphate	2.5×10^1	0.0×10^0	0.0×10^0	<1	<1
Trivalent chromium	5.0×10^0	4.9×10^{-6}	4.8×10^{-6}	<1	<1
Alternative B (Ten-Year Plan)					
Ammonia[c]	1.8×10^2	1.1×10^{-5}	6.7×10^{-5}	<1	<1
Freon[d]	7.6×10^4	1.1×10^{-4}	1.9×10^{-4}	<1	<1
Hydrochloric acid	7.5×10^0	4.4×10^{-2}	9.2×10^{-2}	<1	1.2
Hydrofluoric acid[e]	2.5×10^1	1.5×10^{-3}	3.6×10^{-3}	<1	<1
Mercury	1.0×10^0	7.7×10^{-4}	1.4×10^{-3}	<1	<1
Methyl isobutyl ketone	2.05×10^3	0.0×10^0	0.0×10^0	<1	<1
Nitric acid	5.0×10^1	1.3×10^{-3}	1.2×10^{-3}	<1	<1
Sulfuric acid	1.0×10^1	2.6×10^{-4}	8.5×10^{-4}	<1	<1
Tributyl phosphate	2.5×10^1	1.1×10^{-3}	2.7×10^{-3}	<1	<1
Trivalent chromium	5.0×10^0	1.0×10^{-4}	1.0×10^{-4}	<1	<1
Alternative C (Minimum Treatment, Storage, Disposal)					
Ammonia[c]	1.8×10^2	1.1×10^{-5}	6.7×10^{-5}	<1	<1
Freon[d]	7.6×10^4	1.1×10^{-4}	1.9×10^{-4}	<1	<1
Hydrochloric acid	7.5×10^0	4.2×10^{-4}	6.0×10^{-4}	<1	<1
Hydrofluoric acid[e]	2.5×10^1	1.2×10^{-3}	3.0×10^{-3}	<1	<1
Mercury	1.0×10^0	2.7×10^{-4}	6.9×10^{-4}	<1	<1
Methyl isobutyl ketone	2.05×10^3	0.0×10^0	0.0×10^0	<1	<1
Nitric acid	5.0×10^1	1.3×10^{-3}	1.2×10^{-3}	<1	<1
Sulfuric acid	1.0×10^1	2.6×10^{-4}	8.5×10^{-4}	<1	<1
Tributyl phosphate	2.5×10^1	0.0×10^0	0.0×10^0	<1	<1
Trivalent chromium	5.0×10^0	4.9×10^{-6}	4.8×10^{-6}	<1	<1

Table 5.7-7. (continued).

Noncarcinogenic air pollutant	Concentration in $\mu g/m^3$ Standard[b]	Average annual concentration at INEL site boundary	Average annual concentration at public roads	Site boundary impact as percent of standard	Public roads impact as percent of standard
Alternative D (Maximum Treatment, Storage, and Disposal)					
Ammonia[c]	1.8×10^{2}	9.2×10^{-4}	1.9×10^{-3}	<1	<1
Freon[d]	7.6×10^{4}	1.1×10^{-4}	1.9×10^{-4}	<1	<1
Hydrochloric acid	7.5×10^{0}	4.9×10^{-2}	9.3×10^{-2}	<1	1.2
Hydrofluoric acid[e]	2.5×10^{1}	1.4×10^{-3}	3.3×10^{-3}	<1	<1
Mercury	1.0×10^{0}	8.0×10^{-4}	1.5×10^{-3}	<1	<1
Methyl isobutyl ketone	2.05×10^{3}	1.3×10^{-2}	2.6×10^{-2}	<1	<1
Nitric acid	5.0×10^{1}	1.3×10^{-3}	1.2×10^{-3}	<1	<1
Sulfuric acid	1.0×10^{1}	2.6×10^{-4}	8.5×10^{-4}	<1	<1
Tributyl phosphate	2.5×10^{1}	3.0×10^{-5}	6.1×10^{-5}	<1	<1
Trivalent chromium	5.0×10^{0}	1.1×10^{-4}	1.1×10^{-4}	<1	<1

a. Includes contributions from projected increases to baseline not associated with specific alternatives.
b. Acceptable ambient concentration for noncarcinogens (AACs) listed in Rules for the Control of Air Pollution in Idaho (IDHW 1994).
c. Includes emissions of ammonium hydroxide.
d. Modeled as 1,1,2-trichloro-1,2,2-trifluoroethane.
e. Hydrofluoric acid is not listed as a toxic air pollutant by IDHW (1994) but is included and evaluated as a fluoride, which is listed.

In all cases, the incremental impacts of carcinogenic and noncarcinogenic air pollutants would be well below the applicable standards. Incremental impacts would be about 1 percent of the standard or less for all noncarcinogenic substances. Carcinogenic substances would also be below allowable increments in all cases. The highest levels are projected for formaldehyde and nickel; however, these levels result from extremely conservative assumptions regarding the expansion of combustion sources for the Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste project under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

5.7.4.2 Concentrations of Pollutants at Onsite Locations. Onsite concentrations of toxic air pollutants are presented in Table 5.7-8. These levels reflect maximum predicted levels averaged over an eight-hour period to which workers might be exposed. These results are compared with occupational standards recommended by either the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration, whichever is lower. The incremental impacts at onsite locations of toxic air pollutant emissions would be well below occupational exposure limits in all cases. When the cumulative effect of maximum baseline levels is considered, the highest predicted level of benzene (near gasoline storage tanks at the Central Facilities Area) is slightly above the occupational exposure limit. However, this condition would be due almost entirely to maximum baseline emissions.

5.7.4.3 Regulatory Compliance Evaluation. The Clean Air Act and the State of Idaho have established ambient air quality standards for designated criteria air pollutants. Proposed major projects or modifications must demonstrate that project emissions would not cause an established ambient air quality standard to be exceeded. While cumulative annual emission rates associated with many pollutants do not exceed the threshold level to be designated as major according to the State of Idaho Rules for the Control of Air Pollution in Idaho (IDHW 1994), the impact of each criteria pollutant has been assessed.

In addition to the comparison of ambient air standards presented in Section 5.7.4.1, evaluations have been performed for (a) potential for ozone formation, (b) Prevention of Significant Deterioration increment consumption, (c) degradation of visibility at Craters of the Moon Wilderness Area, (d) impacts to soil and vegetation and impacts due to secondary growth, (e) stratospheric ozone

Table 5.7-8. Highest predicted concentrations of toxic air pollutants on the Idaho National Engineering Laboratory site from total emissions by alternative.

Toxic air pollutant	Maximum 8-hour concentration[a] (micrograms per cubic meter) Baseline[b]	A	B	C	D	Cumulative impacts of D[a]	Occupational exposure limit ($\mu g/m^3$)[c]	Percent of standard (D)
Carcinogens								
Arsenic	2.8×10^{-1}	0.0×10^{0}	1.4×10^{-3}	0.0×10^{0}	1.4×10^{-3}	2.8×10^{-1}	1.0×10^{1}	3
Asbestos[d]	(e)	5.3×10^{-4}	5.3×10^{-4}	5.3×10^{-4}	5.3×10^{-4}	5.3×10^{-4}	3.0×10^{0}	<1
Benzene	3.1×10^{3}	1.1×10^{0}	1.6×10^{0}	1.1×10^{0}	4.6×10^{0}	3.1×10^{3}	3.0×10^{3}	103
Beryllium	(e)	4.6×10^{-5}	2.8×10^{-4}	4.6×10^{-5}	2.8×10^{-4}	2.8×10^{-4}	2.0×10^{0}	<1
Cadmium compounds	(e)	0.0×10^{0}	3.4×10^{-3}	1.8×10^{-7}	3.4×10^{-3}	3.4×10^{-3}	2.0×10^{0}	<1
Carbon tetrachloride	2.5×10^{2}	1.4×10^{0}	1.4×10^{0}	1.4×10^{0}	1.4×10^{0}	2.5×10^{2}	1.3×10^{4}	2
Chloroform	1.7×10^{1}	4.6×10^{-2}	4.6×10^{-2}	4.6×10^{-2}	4.6×10^{-2}	1.7×10^{1}	9.8×10^{3}	<1
Formaldehyde	5.7×10^{1}	2.2×10^{0}	9.3×10^{0}	2.2×10^{0}	9.3×10^{0}	6.6×10^{1}	9.0×10^{2}	7
Hexavalent chromium	2.4×10^{0}	2.9×10^{-5}	8.0×10^{-4}	2.9×10^{-5}	8.0×10^{-4}	2.4×10^{0}	5.0×10^{1}	5
Methylene chloride	3.2×10^{0}	1.1×10^{1}	1.1×10^{1}	1.1×10^{1}	1.1×10^{1}	1.5×10^{1}	1.7×10^{5}	<1
Nickel	4.1×10^{1}	6.7×10^{-3}	1.8×10^{-1}	6.7×10^{-3}	1.8×10^{-1}	4.1×10^{1}	1.0×10^{2}	41
Perchloroethylene	4.3×10^{2}	5.4×10^{-2}	5.4×10^{-2}	5.4×10^{-2}	5.4×10^{-2}	4.3×10^{2}	1.7×10^{5}	<1
Trichloroethylene	4.0×10^{1}	2.4×10^{-1}	2.4×10^{-1}	2.4×10^{-1}	2.4×10^{-1}	4.0×10^{1}	2.7×10^{5}	<1
Noncarcinogens								
Ammonia	9.7×10^{2}	2.3×10^{2}	2.3×10^{2}	2.3×10^{2}	2.3×10^{2}	1.2×10^{3}	1.7×10^{4}	7
Hydrochloric acid	1.1×10^{2}	9.9×10^{-2}	3.1×10^{1}	9.9×10^{-2}	3.1×10^{1}	1.4×10^{2}	7.0×10^{3}	2
Hydrofluoric acid	(e)	0.0×10^{0}	2.5×10^{-1}	2.5×10^{-1}	5.1×10^{-1}	5.1×10^{-1}	2.5×10^{3}	<1
Lead	(e)	7.0×10^{-3}	5.8×10^{0}	7.0×10^{-2}	6.6×10^{0}	6.8×10^{0}	5.0×10^{1}	13
Mercury	3.0×10^{0}	4.4×10^{-3}	3.2×10^{0}	5.8×10^{-2}	3.8×10^{0}	6.8×10^{0}	5.0×10^{1}	14
Methyl isobutyl ketone	(e)	0.0×10^{0}	0.0×10^{0}	0.0×10^{0}	2.4×10^{0}	2.4×10^{0}	2.1×10^{5}	<1
Nitric acid	7.7×10^{2}	1.0×10^{0}	1.0×10^{0}	1.0×10^{0}	1.0×10^{0}	7.7×10^{2}	5.0×10^{3}	15
Sulfuric acid	(e)	1.4×10^{-1}	1.4×10^{-1}	1.4×10^{-1}	1.4×10^{-1}	1.4×10^{-1}	1.0×10^{3}	<1
1,1,2-trichloro-1,2,2-trifluoroethane	(e)	1.0×10^{2}	1.0×10^{2}	1.0×10^{2}	1.0×10^{2}	1.0×10^{2}	7.6×10^{6}	<1
Trivalent chromium	6.3×10^{0}	5.5×10^{-4}	1.5×10^{-2}	5.5×10^{-4}	1.5×10^{-2}	6.3×10^{0}	5.0×10^{2}	1
Tributyl phosphate	(e)	0.0×10^{0}	2.4×10^{-1}	2.4×10^{-1}	2.4×10^{-1}	2.4×10^{-1}	2.2×10^{3}	<1

a. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).
b. Baseline includes projected increases.
c. Occupational exposure limits are 8-hour, time-weighted averages established by either the American Conference of Government Industrial Hygienists (ACGIH) or Occupational Safety and Health Administration (OSHA); the lower of the two is used.
d. Value reported for asbestos standard is mass equivalent of most restrictive National Institute of Occupational Safety and Health standard of 0.1 fibers per cubic centimeter.
e. Baseline was not assessed for this toxic air pollutant.

depletion, (f) acidic deposition, and (g) global warming. These analyses are summarized in the following subsections.

5.7.4.3.1 Ozone Formation—In addition to the previously mentioned criteria pollutants, the Clean Air Act designates ozone as a criteria air pollutant and establishes a National Ambient Air Quality Standard (NAAQS) of 235 micrograms per cubic meter for a one-hour averaging period. Ozone, unlike the other criteria pollutants, is not emitted directly from facility sources but is formed in the atmosphere through photochemical reactions involving nitrogen oxides and volatile organic compounds, referred to as nonmethane hydrocarbons. Therefore, the regulation of ozone is effected by the control of emissions of ozone-producing compounds or precursors, that is, nitrogen oxides and volatile organic compounds. The Idaho Division of Environmental Quality has no ozone monitoring data from the vicinity but is not aware of problematic ozone levels in the area (Andrus 1994). The State, therefore, does not require evaluation of projected increases in ambient ozone concentrations under application procedures for major stationary sources, unless a new or modified major facility will result in a net increase in volatile organic compounds of 100 tons per year or greater (IDHW 1994). Part of the reason for the lack of required analysis at lesser emittant levels is because no simple, well-defined methods exist to evaluate ozone generation potential (Wilson 1993).

Emissions of volatile organic compounds have been estimated to establish the need to perform detailed ozone generation modeling. The maximum cumulative emission rates for the environmental restoration and waste management alternatives range from 9 tons per year [for Alternative A (No Action)] to 18 tons per year [Alternative D (Maximum Treatment, Storage, and Disposal)]. The maximum value is well below the threshold emission level of 100 tons per year for which analyses are required by the State and the 40-ton-per-year threshold for designation as a major source. Therefore, ozone precursor emissions of volatile organic compounds are expected to be a small contribution to ozone generation and no further analyses have been conducted.

5.7.4.3.2 Prevention of Significant Deterioration Increment Consumption—Prevention of Significant Deterioration (PSD) regulations require that proposed major projects or modifications, together with minor sources that become operational after Prevention of Significant Deterioration baseline dates are established, be assessed for their incremental contribution to increases of ambient pollutant levels. A proposed major project, together with the sum of other major and minor net emissions increases that occur after the specified baseline date in the same impact area, may not contribute to an increase in attainment pollutants above an allowable increment. The baseline date is triggered by regulation or the submittal of a permit application. Increments have been established for specific averaging times associated with nitrogen dioxide, sulfur dioxide, and particulate matter.

The INEL site is in a Class II area as designated by Prevention of Significant Deterioration regulations. Previous Prevention of Significant Deterioration permits for INEL site projects have consumed a portion of the available Class I and II increments (see Section 4.7, Air Resources, Tables 4.7-5 and 4.7-6). Proposed project emissions associated with each alternative would contribute to further increment consumption. The amount of increment consumption for existing (baseline) sources and environmental restoration and waste management alternatives at the Craters of the Moon Wilderness Area has been assessed, and the results are presented in Table 5.7-9. These results indicate that maximum consumption would not exceed 76 percent of the allowable increment for 3-hour sulfur dioxide concentrations, with lesser amounts for all other averaging times and pollutants. This maximum would occur under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal), with slightly lesser increment consumption amounts for other alternatives. Sixty-eight percent of the 24-hour increment for sulfur dioxide would be consumed with Alternative D, with slightly lesser increment consumption for Alternative B (Ten-Year Plan). All other short-term increments would be less than 50 percent. On an annual basis, increment consumption for Class I areas would be 16 percent or less for all pollutants. The maximum Class II increment consumption (Table 5.7-10) would be about 50 percent for 24-hour respirable particulate matter for each alternative, with lower values for all other pollutants and averaging times. Annual increment consumption in Class II areas would be 33 percent or less for all pollutants and alternatives.

5.7.4.3.3 Visibility Degradation—Conservative visibility screening analysis indicates that a potential exists for visual impacts at the Craters of the Moon Wilderness Area. While contrast evaluations show no potential for objectionable impact, the criterion for acceptable color shift would be exceeded for each alternative as proposed. This excess shift (delta E) would be due mainly to nitrogen dioxide emissions. The Waste Immobilization Facility at the Idaho Chemical Processing Plant and a thermal treatment project (Pit 9 Waste Retrieval) at the Radioactive Waste Management Complex each would exceed the criterion alone. In combination with other projects, the Idaho Waste Processing Facility (which has not been sited but was modeled at the reference location approximately

Table 5.7-9. Prevention of significant deterioration (PSD) increment consumption at the Craters of the Moon Wilderness (Class I) Area by emissions from baseline and proposed sources, listed by alternative.[a]

			Alternative A (No Action)		Alternative B (Ten-Year Plan)		Alternative C (Minimum Treatment, Storage, and Disposal)		Alternative D (Maximum Treatment, Storage, and Disposal)	
Pollutant	Averaging time	Allowable PSD increment[b] ($\mu g/m^3$)	Increment consumption ($\mu g/m^3$)	Percent of allowable	Increment consumption ($\mu g/m^3$)	Percent of allowable	Increment consumption ($\mu g/m^3$)	Percent of allowable	Increment consumption ($\mu g/m^3$)	Percent of allowable
Sulfur dioxide	3-hour	25	15	60	19	76	15	60	19	76
	24-hour	5	2.3	46	3.3	66	2.3	46	3.4	68
	Annual	2	0.09	5	0.11	6	0.09	5	0.11	6
Respirable particulates[c]	24-hour	8	1.1	14	1.3	16	1.1	14	1.4	18
	Annual	4	0.02	< 1	0.03	< 1	0.02	< 1	0.03	< 1
Total suspended particulates	24-hour	10	1.1	11	1.3	13	1.1	11	1.4	14
	Annual	5	0.02	<1	0.03	< 1	0.02	<1	0.03	< 1
Nitrogen dioxide	Annual	2.5	0.05	2	0.39	16	0.26	10	0.39	16

a. Source: Belanger et al. (1995b).

b. All increments specified are State of Idaho standards except those for respirable particulates, which were recently promulgated by the U.S. Environmental Protection Agency.

c. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).

Table 5.7-10. Prevention of Significant Deterioration (PSD) increment consumption at Class II areas at the Idaho National Engineering Laboratory site by emissions from baseline and proposed sources, listed by alternative.[a]

Pollutant	Averaging time	Allowable PSD increment[b] ($\mu g/m^3$)	Maximum predicted concentration at site boundary ($\mu g/m^3$)	Maximum predicted concentration along public roads ($\mu g/m^3$)	Amount of PSD increment consumed[c] ($\mu g/m^3$)	Percent of PSD increment consumed
			Alternative A (No Action)			
Sulfur dioxide	3-hour	512	46	80	80	16
	24-hour	91	8.4	24	24	26
	Annual	20	0.58	1.9	1.9	9
Respirable particulates[d]	24-hour	30	4.1	15	15	49
	Annual	17	0.11	0.9	0.9	5
Total suspended particulates	24-hour	37	4.1	15	15	40
	Annual	19	0.11	0.9	0.9	5
Nitrogen dioxide	Annual	25	1.1	1.1	1.1	4
			Alternative B (Ten-Year Plan)			
Sulfur dioxide	3-hour	512	135	147	147	29
	24-hour	91	29	32	32	35
	Annual	20	0.99	2.4	2.4	12
Respirable particulates[d]	24-hour	30	7.4	15	15	50
	Annual	17	0.32	0.92	0.92	5
Total suspended particulates	24-hour	37	7.4	15	15	41
	Annual	19	0.32	0.92	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	8.2	33
			Alternative C (Minimum Treatment, Storage, and Disposal)			
Sulfur dioxide	3-hour	512	46	81	81	16
	24-hour	91	8.4	24	24	26
	Annual	20	0.56	1.9	1.9	10
Respirable particulates[d]	24-hour	30	4.1	15	15	50
	Annual	17	0.12	0.91	0.91	5
Total suspended particulates	24-hour	37	4.1	15	15	41
	Annual	19	0.12	0.91	0.91	5
Nitrogen dioxide	Annual	25	2.7	5.3	5.3	21
			Alternative D (Maximum Treatment, Storage, and Disposal)			
Sulfur dioxide	3-hour	512	142	152	152	30
	24-hour	91	30	33	33	36
	Annual	20	0.99	2.4	2.4	12
Respirable particulates[d]	24-hour	30	8.8	15	15	50
	Annual	17	0.32	0.92	0.92	5
Total suspended particulates	24-hour	37	8.8	15	15	41
	Annual	19	0.32	0.92	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	8.2	33

a. Source: Belanger et al. (1995b).
b. All increments specified are State of Idaho standards except those for respirable particulates, which were recently promulgated by the U.S. Environmental Protection Agency.
c. The highest value of either the site boundary or public road locations is used.
d. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is,10 microns or less in diameter).

one to two miles west of the Radioactive Waste Management Complex) and boilers associated with the Waste Characterization Facility and the Radioactive Waste Management Facility Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste would contribute significantly to the total. The potential for visibility degradation would be lessened by use of emission control equipment to reduce nitrogen dioxide emissions or by relocation of projects to areas more distant from the Craters of the Moon. Also, the use of more refined visibility models such as PLUVUE-2 (in place of the more conservative screening methods) could result in lower predicted impacts. Emission controls would be required if more refined modeling still predicts visibility impacts and may, in fact, be required by other regulations, even if visibility degradation criteria are not exceeded.

Further screening analyses have been performed to evaluate the level of nitrogen oxide emissions reduction required for the cumulative impacts of each alternative to pass the screening criterion for color shift. Analyses were performed both with a minimum (70 percent on each of the aforementioned projects) and maximum (70 percent on the two boilers and 90 percent on all others) level of control. Under this screening analysis, the maximum level of control would be required for cumulative emissions to result in an acceptable level of visibility degradation at the Craters of the Moon under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). Only Alternative A (No Action) would achieve an acceptable level of visibility degradation under the minimum control scenario. For comparison, the screening results for the uncontrolled, minimum, and maximum control cases are depicted in Figure 5.7-4.

5.7.4.3.4 Impacts to Soils and Vegetation and Impacts Due to Secondary Growth—Due to the projected minor increase in ambient criteria pollutant concentrations, no impacts to local soils or vegetation, including the local sagebrush vegetation community, grazing habitats, or distant agricultural areas, are expected. Similarly, the alternatives would be associated with a minor growth in employee population and would not result in any air quality impacts due to general commercial, residential, industrial, or other growth.

5.7.4.3.5 Stratospheric Ozone Depletion—The 1990 amendments to the Clean Air Act address the protection of stratospheric ozone through a phaseout of the production and sale of

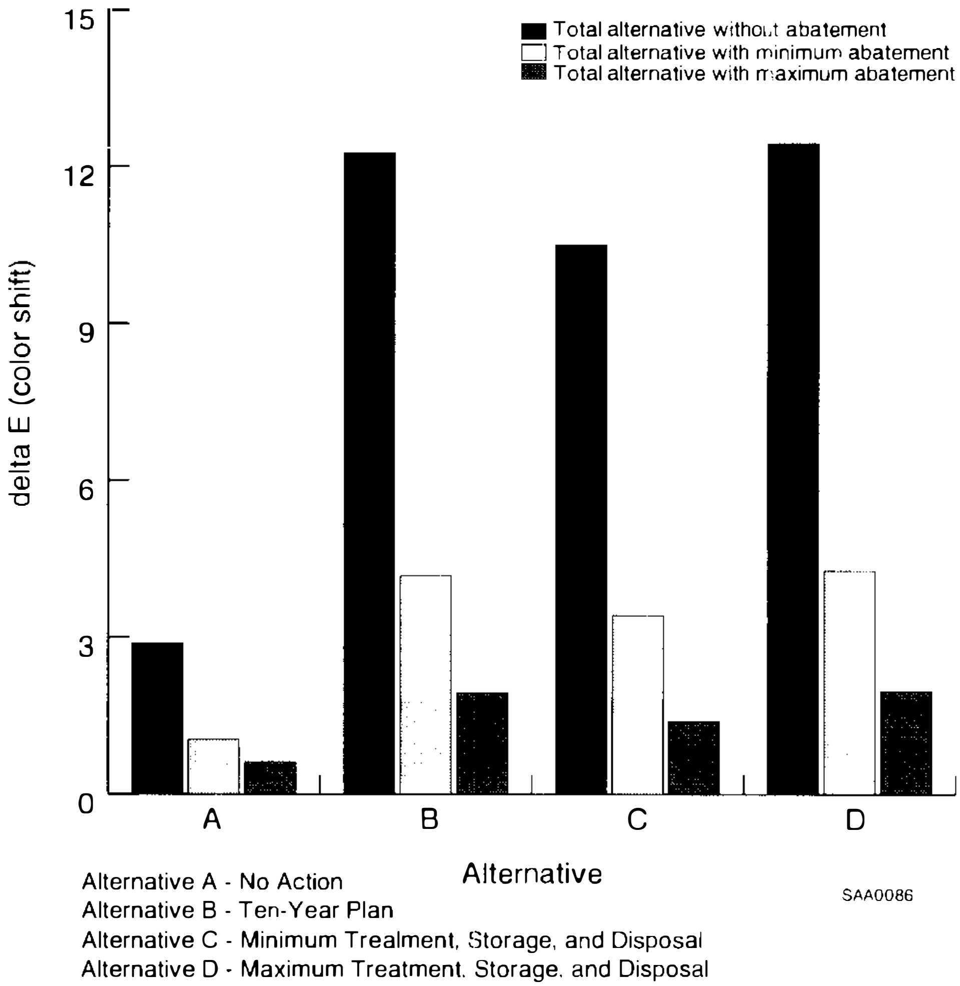


Figure 5.7-4. Summary of modeling results for visual degradation at the Craters of the Moon Wilderness Area by alternative.

stratospheric ozone-depleting substances. While environmental restoration and waste management alternatives do not involve production or use of ozone-depleting substances, waste management activities can release some substances of concern. A review of projected emissions indicates that the only ozone-depleting substances identified are carbon tetrachloride, chloroform, freon, and methyl chloroform, which would be emitted under each alternative. The combined annual emissions would be about 290 kilograms (0.3 tons) for each alternative and would be due almost entirely to environmental remediation activities. These releases would be extremely small compared with global loading and can be considered to have small effects.

5.7.4.3.6 *Acidic Deposition*—Emissions of sulfur and nitrogen compounds and, to a lesser extent, other pollutants, including volatile organic compounds, contribute to a phenomenon known as acidic deposition.[a] Under Alternative D (Maximum Treatment, Storage, and Disposal), emissions of sulfur compounds from proposed projects could reach levels of up to 95,700 kilograms (100 tons) per year, while emissions of nitrogen compounds could reach almost 2 million kilograms (about 2,100 tons) per year. However, these emission rates are likely overstated, because controls would be incorporated on a number of projects to meet the Best Available Control Technology requirements of State and Federal regulations. Nevertheless, emissions of these levels are not expected to contribute significantly to acidity levels in precipitation in the region, nor will they have effects over greater distances, such as may occur with tall stacks associated with large utility power plants.

5.7.4.3.7 *Global Warming*—Emissions of carbon dioxide, methane, nitrous oxides, and chlorofluorocarbons (commonly known as greenhouse gases) are associated with potential for atmospheric global warming. Project alternatives would result in emissions of greenhouse gases through the combustion of fossil fuels (carbon dioxide and methane) and management of certain waste streams that contain small amounts of chlorofluorocarbons. New or increased use of chlorofluorocarbons is not proposed. There are currently no requirements that limit emissions of carbon dioxide or methane from the sources associated with project alternatives. In terms of the global emission of these gases, emissions associated with the implementation of these alternatives are exceedingly small and would not have any detectable effect.

5.7.5 Air Resource Impacts from Alternatives Due to Mobile Sources

The ambient air quality impacts at offsite receptor locations due to the INEL bus fleet operations, INEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEL site facilities have been predicted. For the most part, alternatives would realize minor increases in employment, which can be absorbed by the existing bus fleet. Alternatives would result in some minor increase in service vehicles and employee vehicles, especially during construction activities. The peak cumulative impacts (in other words, baseline plus alternative impacts) are predicted to occur at the INEL site Main Gate. These maximum impacts

a. One form of acidic deposition is commonly referred to as acid rain.

would be just a few (approximately 5 to 30) percent of applicable standards and are due almost entirely to existing traffic conditions. The alternatives are expected to have no or very little impact on traffic volume at the INEL site and provide only a small increase in vehicular-induced air quality impacts.

5.7.6 Air Resource Impacts from Alternatives Due to Construction

Construction activities would occur intermittently throughout the period of implementation. The primary impact related to construction activities would be the generation of fugitive dust, which includes respirable particulate matter. While dust generation would be mitigated by the application of water, relatively high levels of particulates could still occur in localized areas. Emissions of other criteria pollutants from construction-related combustion equipment may also result in impacts to air quality. Impacts have been assessed, taking into account the proposed construction schedule, in order to estimate maximum impacts. The impacts reported below are for the highest single year over the period 1995 through 2005.

For any of the alternatives, annual average concentrations of particulate matter (both respirable and total particulates) would not exceed one and three percent of the applicable standard at the maximum INEL site boundary and public road locations, respectively. Over shorter periods (24-hour averaging time), respirable and total particulate levels would be one percent or less of the standards at the INEL site boundary. However, it is typical of major construction activities to intermittently produce relatively high levels of fugitive dust in the vicinity of the activity. For each of the alternatives assessed, the construction of associated facilities is estimated to result in short-term, localized levels of particulate matter that exceed applicable standards.

The maximum 24-hour levels of particulate matter at the highest predicted public road locations would be approximately the same for Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). These are 210 micrograms per cubic meter for respirable particulates and 330 micrograms per cubic meter for total suspended particulates. These values exceed the Federal and Idaho primary air quality standards of 150 micrograms per cubic meter for respirable particulates and the Idaho primary standard of 260 micrograms per cubic meter for total suspended particulates. For Alternative D (Maximum Treatment, Storage, and Disposal), the maximum impacts are estimated at 390 micrograms per cubic meter for respirable particulates and 610 micrograms per cubic meter for total suspended particulates.

All levels of other criteria pollutants are predicted to be a small fraction of applicable standards. For Alternative D (Maximum Treatment, Storage, and Disposal), carbon monoxide levels are not expected to exceed three and eight percent of the standards at the INEL site boundary and public road locations, respectively. All other criteria pollutant levels are one percent or less of applicable standards at INEL site boundary locations and three percent or less of the standards at public roads. Impacts from other alternatives are slightly less.

5.8 Water Resources

This section discusses potential environmental consequences to water resources inside and outside the INEL site boundaries under each of the four environmental restoration and waste management alternatives during the implementation period (1995 to 2005) and beyond. Because conclusions on future contaminant fate and transport are based in part on past contamination and existing plume migration, computer modeling of contaminant transport has been done through 2035. Modeling beyond the implementation period adds assurance to the conclusions reached.

Each alternative was evaluated with respect to its impacts on water quality (both surface and subsurface water) and water use. Computer modeling of vadose zone and saturated zone contaminant transport shows that existing plumes would not greatly affect the regional groundwater quality because no contaminants would migrate offsite in concentrations above U.S. Environmental Protection Agency drinking water standards. Additional technical details on assessment methods, assumptions, and results are presented in Appendix F, Section F-2, Geology and Water.

5.8.1 Methodology

The methodology used to assess the impacts to water resources from treatment, storage, and disposal practices and environmental restoration activities identified under the alternatives was to integrate available studies and technical information with computer modeling to evaluate aquifer contaminant transport and predict future trends in water quality during the implementation period. The steps involved in computer modeling were (a) a literature review to determine the source terms, (b) a determination of the water level contours, (c) an evaluation of the subsurface geology, (d) the development of a conceptual model, (e) a selection of appropriate codes, (f) a calibration of the codes, (g) a computer simulation for prediction purposes, and (h) a parameter sensitivity analysis. The assessment includes an evaluation of the types and volumes of liquid effluent discharges and airborne releases, associated waste management practices, and their subsequent effect on water resources.

The primary assumption used to evaluate consequences to water resources under any of the alternatives was that no future intentional discharge of radioactive liquid effluents to the subsurface and natural water resources would occur exceeding the standards established in DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Environmental restoration and waste management projects proposed under the alternatives have been reviewed to identify potential waste streams and water usage. No project would intentionally discharge radioactive liquid effluents to the vadose zone but rather would use other technologies, such as waste evaporators or lined evaporation basins. There are no radioactive discharges directly to the Snake River Plain Aquifer from existing operations. Deep well injection of radioactive waste was discontinued in 1985. Some trace quantities of radioactive discharges to the vadose zone still exist via infiltration ponds; however, samples collected from these discharges show that radionuclide concentrations are below the U.S. Environmental Protection Agency Primary Drinking Water Standards (Bennett 1994). Efforts are being made to eliminate sources by implementing system design upgrades or repairs, as applicable. Liquid effluent discharges from INEL site activities to the surface and subsurface via infiltration ponds are monitored for the presence of radioactive and chemical constituents and determined suitable for land disposal, as required under applicable Federal and State regulations (Lehto 1993).

Any liquid effluents from spent nuclear fuel facilities proposed under the alternatives would be contained in tanks, sumps, or lined evaporation basins; and, under normal operating conditions, radioactive discharges to the soil or directly to the aquifer would not occur. Some existing storage pools may have leakage. However, these pools are being phased out during the implementation period.

Analysis was performed to determine the consequences from a hypothetical leak at a new spent nuclear fuel storage facility proposed for construction under the alternatives (Arnett 1994). A new facility would be similar in design to the Fluorinel and Storage Facility at the Idaho Chemical Processing Plant. This type of facility would be built using state-of-the-art technologies, including leak detection and water balance monitoring equipment. Monitoring and surveillance are performed daily and weekly. The analysis assumes leakage to the environment of 1.9×10^{-2} cubic meters (5 gallons) per day left undetected for a month. This volume is more than that which would be detected with monitoring equipment and surveillance. This release and analysis is for comparison purposes only and should not be construed as a planned or operational release.

Based on the bounding accident scenario for high-level waste tank failure, the impacts to water resources are expected to be negligible from this leakage rate (see Section 5.14, Facility

Accidents). Potential release of hazardous or radioactive materials as a result of accidents is discussed in Section 5.14 of Volume 2 of this EIS.

Constant process monitoring and mass-balance and design to current standards, including double-wall confinement of all vessels and piping, would be included in design and operating standards by DOE to limit potential operational releases from a new spent nuclear fuel processing facility to essentially zero. Any operational releases postulated would result from degraded equipment. Design data for a proposed new spent nuclear fuel processing facility have not evolved sufficiently to allow for detailed analysis of potential operational releases to groundwater.

5.8.2 Water Resource Impacts from Alternative A (No Action)

Under Alternative A (No Action), environmental restoration and waste management facilities, including existing spent fuel-related facilities, would continue, but under the assumption of no unallowable discharge of hazardous or radioactive wastes to the vadose zone, as specified under Federal and State regulations. The evaluation of water resources consequences for Alternative A involves looking at the impact from past activities and predicting what might occur in the future.

5.8.2.1 Surface Water. No direct impacts would result to the Big and Little Lost Rivers and Birch Creek from continuation of existing activities and normal operations at the INEL site because liquid effluent discharges (with the exception of cooling water and storm water) are not directly discharged to natural surface water bodies. Commingling of operational liquid effluents with storm water is minimized by separating process water from storm water and directing process water to onsite treatment and disposal systems. As of 1993, any previous detections of contaminants in water samples collected from the Big and Little Lost Rivers and Birch Creek have not exceeded U.S. Environmental Protection Agency Primary Drinking Water Standards (Mann 1994). Wastewaters discharged via land disposal systems would be monitored to ensure that any levels of contaminants present are suitable for land application, as specified under Federal and State requirements [for example, DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993), and State land application permit requirements]. Discharge limits for wastewater discharges to the ground surface and percolation ponds are currently under development and proposed to be finalized in 1995. Additionally, release limits are currently being developed and are under negotiation as part of the State wastewater land application permit process.

The INEL site flood diversion system, which diverts flow from the Big Lost River to four spreading areas (along with associated dikes, culverts, and bridges constructed at the facilities) is believed to effectively prevent flooding from the Big Lost River into facility areas. Gates also control the release of water from Playa 2 to Playa 3 (Bennett 1990). However, in localized areas where the plain is very wide and flat, shallow water depths with low flow velocities could occur under maximum flood conditions combined with a hypothetical failure of Mackay Dam (Koslow and Van Haaften 1986).

The local basin snowmelt study [Appendix A of Koslow and Van Haaften (1986)] indicates a low potential for flooding from heavy rains and snowmelt runoff at the INEL site facilities. The peak maximum combined rain and snowmelt occurring every 25 years was determined to produce approximately 7 centimeters per day (2.74 inches per day) of available water. This runoff could be diverted from the facilities with properly installed culverts, channels, and the use of flood control basins.

Floodwaters outside the banks of the Big Lost River channel would spread and pond in low-lying areas on the flood plain. Pumping of these ponded waters to other settling basins away from facilities would reduce the impact of standing water.

5.8.2.2 Subsurface Water. Under Alternative A (No Action), negligible impacts would result to subsurface water resources from potential future sources of contamination compared with sources from previous practices (for example, deep well injection) that have been discontinued by DOE. Analyses showing the impacts to be negligible indicate the following:

- Projects would not intentionally discharge radioactive liquid effluent to the vadose zone and, currently, there are no radioactive discharges directly to the Snake River Plain Aquifer (Lehto 1993, DOE 1993)

- Only contaminant concentrations below U.S. Environmental Protection Agency maximum contaminant levels and DOE derived concentration guides would migrate beyond the INEL site boundary, resulting in negligible impact to the quality of groundwater leaving the INEL site (Arnett and Rohe 1993, Golder 1994)

- Adverse effects to groundwater quality have occurred in localized areas within the INEL site (that is, contaminant plumes), but downgradient groundwater monitoring results indicate these plumes have not affected the regional quality of water (Golder 1994) and contaminant plumes are generally decreasing in size (Bishop 1993)

- Computer modeling of vadose zone and saturated zone contaminant transport indicates that contaminant plumes with concentrations above the primary maximum contaminant levels would continue to decrease at least through 2030 and the overall quality of the groundwater would be improving (Arnett and Rohe 1993)

- Groundwater quality monitoring data by independent agencies show that improved waste management and disposal practices have resulted in the further reduction of contaminants existing in water resources and improved water quality (Golder 1994)

- Water use at the INEL site would have a minimal effect on the quality of water within the aquifer.

The remainder of this section gives more details on the modeling, analyses, monitoring data, and other information that supports the conclusion of negligible impacts to subsurface water resources.

Modeling performed by Arnett and Rohe (1993, 1994) for predicting contaminant migration considered the following radionuclides: tritium, iodine-129, and strontium-90. These radionuclides were considered because they appear to have had the greatest impact on the aquifer from previous disposal activities and are the main constituents within contaminant plumes. These contaminants, as well as others (for example, cesium-137), are also present in the vadose zone in substantial quantities. The Idaho Chemical Processing Plant and the Test Reactor Area were considered because they are the two largest facilities that have contributed to the plumes in the aquifer. Isolated radionuclide contamination has occurred at the other facilities but has not been detected consistently in monitoring wells to constitute plumes. Contaminant transport modeling was performed for the period from 1990 through 2035 (30 years beyond the implementation period) or until the contaminant dropped below the U.S. Environmental Protection Agency maximum contaminant level in the aquifer (Arnett and Rohe 1993, 1994).

The vadose zone has a beneficial effect on consequences to water resources because it helps buffer contaminants from the regional aquifer by sorption and restricted migration pathways. The surficial sediments and sedimentary interbeds sorb some radionuclides and allow them to decay within the vadose zone. Results of a simple vadose zone transport model are presented in Arnett and Rohe (1993) and were incorporated into the aquifer transport model as input data.

A brief summary of the results will help illustrate what effects vadose zone transport would have in the future. Modeling was performed for potential transport of contaminants from the perched water zones beneath the deactivated radioactive waste pond at the Test Reactor Area and the perched water zones beneath the percolation ponds at the Idaho Chemical Processing Plant. In addition, discharge of effluents to the cold waste pond was included in the model and treated as a continuing source at the Test Reactor Area, whereas no effluent discharges were assumed to continue at the Idaho Chemical Processing Plant. In both cases, the amount of water entering and exiting the perched water zones took a few years to reach a steady state (that is, amount in equals amount out). The amounts of tritium released from the vadose zone to the regional aquifer increased from 1962 to the mid-1970s and decreased slightly from the mid-1970s to the present at the Test Reactor Area. Discharges of tritium and iodine-129 at the Idaho Chemical Processing Plant have decreased since 1984. Assuming no new radioactive liquid effluent waste discharges, the code predicts for both facility areas that levels of iodine-129 and tritium would continue to migrate from the vadose zone but concentrations would decrease over time due to natural dispersion/dilution and radioactive decay. By 2010, most of the water in the perched water zones beneath the Idaho Chemical Processing Plant percolation ponds would have migrated to the aquifer and only very small quantities (1×10^{-4} curies per day) of the remaining radionuclides would continue to enter the aquifer after 2010. The same results are predicted for the Test Reactor Area perched zones but here discharges of effluents meeting the DOE standards would continue. The perched water zones would remain and existing contaminants would continue to migrate into the aquifer, but in trace quantities.

Strontium-90 is not predicted to migrate to the regional aquifer in significant quantities from either source because of retardation within the vadose zone. Predictions in studies by Arnett and Rohe (1993) were the same as those of Robertson (1977). Tritium was predicted to migrate from the vadose zone unretarded, whereas strontium-90 would not migrate.

Predictions of groundwater modeling indicate that current plumes will continue to migrate but concentrations within the plume would continue to decrease and decay with time. By the year 2000, the maximum concentrations of tritium would be reduced by one-half and fall below the current maximum contaminant level. By 2010, the maximum concentration in the plume is predicted to be about one-fourth of the maximum contaminant level. Iodine-129 behaves similarly to tritium but has a much longer half-life. The predicted plume does not have a large decrease in concentration by 2030, but it is not expected to migrate offsite, except for very small concentrations less than 1 picocurie per liter (the maximum contaminant level). The existing strontium-90 plume resulted from previous releases directly to the aquifer from the Idaho Chemical Processing Plant disposal well. (Routine injection well use was discontinued in 1985.) Results of transport modeling predict that by 2000, strontium-90 would decrease slightly in concentration and would remain relatively stationary because of retardation. By 2030, the highest levels of strontium-90 within the plume would decrease in concentration to approximately one-half of the maximum contaminant level for strontium-90. By 2030, the plume front is predicted to migrate approximately one kilometer (0.62 miles) beyond the 1990 position, far short of the INEL site boundary. In summary, modeling results by Arnett and Rohe (1993) show that iodine-129 is the only radionuclide predicted to migrate past the INEL site boundary. Iodine-129 concentrations are predicted at low concentrations below the maximum contaminant level, and the dose would not exceed the nominal value of 4 millirem per year used to determine maximum contaminant levels for man-made beta-gamma activity.

Arnett and Rohe (1993) performed a study similar to Robertson (1974) to evaluate the potential migration of tritium and strontium-90 through 2000. The results by Robertson (1974) showed that tritium could migrate southward and extend about 1 mile south of the INEL site boundary by 2000, but would be below U.S. Environmental Protection Agency maximum contaminant levels. Predictions for strontium-90 using estimates of contaminant releases to the aquifer for the period beyond 1972 indicate migration a few miles south of the Idaho Chemical Processing Plant, but not offsite. Results reported by Arnett and Rohe (1993) are consistent for strontium-90, but not for tritium. Most of the tritium differences can be attributed, however, to estimated versus actual tritium discharges used for the 1971-1990 period, as actual data were unavailable to Robertson in 1974. Results are consistent in the sense that neither predicts offsite contamination in excess of maximum contaminant levels. Field monitoring observations show decreasing concentrations of tritium, iodine-129, and strontium-90 within the contaminant plumes for the past seven years and are consistent with the prediction of continued decrease in plume concentrations.

Organic contamination is a concern at Test Area North and the Radioactive Waste Management Complex. Water sampling performed by the U.S. Geological Survey at the Radioactive Waste Management Complex after 1980 has shown that the perched water zones beneath the Subsurface Disposal Area have some level of organic contamination; however, radionuclides have not been detected above the method detection limits (Cecil et al. 1991). Contaminant migration modeling of volatile organic compounds by Dames & Moore (1993) shows a potential for the migration of carbon tetrachloride, trichloroethene, trichloroethane, and 1,1,1-trichloroethane, with peak concentrations to the aquifer occurring in 2070. The modeling was performed under conservative conditions because the mitigation effects of a remediation program were not incorporated. Vapor vacuum extraction wells used to remove volatile organic compounds from the subsurface have been installed and tested at the Radioactive Waste Management Complex with positive results (Sisson and Ellis 1990). However, full-scale remediation efforts have not yet begun. With the extraction system operational, volatile organic compounds would pose a negligible impact to the groundwater or vadose zone.

Test Area North also has volatile organic compounds within the subsurface, resulting from the disposal of organic-rich sludge into the Test Area North injection well (TSF-05). Much of the sludge was removed from the well in 1990. A modeling study was performed by Schafer-Perini (1993) to predict the potential for residual contaminant migration. This study was based on two alternative assumptions: (a) that the residual sludge would consist of a constant infinite source or (b) that the amount of sludge would be limited and free to migrate and act as a dissolved source. Results under the two assumptions both predict that the organics would be likely to migrate a minimum of 12 kilometers (7.5 miles) southward to the boundary of the model grid by 2024 and would continue to migrate southward at about 0.33 meters per day (one foot per day). The difference in the assumptions is that concentrations would be higher under the first assumption everywhere in the plume. The radionuclides were not affected by the choice of assumptions. Tritium would not migrate very far and would never be in concentrations above the maximum contaminant level. Strontium-90 would continue to have elevated concentrations but would not migrate more than 1 kilometer (0.6 miles) away from Test Area North. Organics could pose a problem, but a planned remediation project would pump and treat the groundwater to remove the source of contamination to the extent possible and ensure that no one is exposed to groundwater contaminated above Federal drinking water standards. Even if no further remedial action were taken, the location of Test Area North relative to the regional aquifer system makes it highly unlikely that contamination would ever reach the INEL site boundary at concentrations approaching U.S. Environmental Protection Agency maximum contaminant levels.

A preliminary scoping risk assessment of radioactive waste disposal practices during the time period from 1952 to 1996 is currently being performed as part of a Comprehensive Environmental Response, Compensation, and Liability Act investigation. Results of the preliminary risk assessment indicate that contaminants would not reach the INEL site boundary exceeding Federal primary drinking water standards through 2005 (Loehr et al. 1994).

A radiological performance assessment was also conducted for low-level waste buried at the Radioactive Waste Management Complex from 1984 through present operations and projected to be disposed through 2020 (Maheras et al. 1994). The results of the assessment indicate that the maximum total pathway exposure occurring by 2060 at the INEL site boundary would be less than 0.60 millirem per year (Maheras et al. 1994). No significant impacts are expected to occur within the implementation period of this EIS

Other facilities at the INEL site contain some levels of contamination above maximum contaminant levels (for example, chromium at Test Reactor Area), but the contaminants are isolated to INEL site facility areas and do not occur consistently in monitoring wells. Radionuclides of chromium-51, cesium-137, and cobalt-60 have also been detected above maximum contaminant levels in isolated areas, but typically they are sorbed in the soil or subsurface sediments and would not migrate to the saturated zone. These isolated areas of contamination impact the local ground and vadose water near the INEL site facilities but do not pose a threat to the regional aquifer system.

Although no contamination of the aquifer can be attributed to air emissions, precipitation may have an effect of flushing contaminants that have settled to the ground out of air emissions down into the vadose zone. Any subsequent effect to the aquifer would be negligible for the following reasons:

- Because the annual precipitation is 22 centimeters (8.62 inches) per year and the evaporation rate is 125 centimeters (49.0 inches) per year, very little of the precipitation would reach the aquifer during the summer and fall. Increased filtration would occur after thawing of snow during the spring. However, the amount of water reaching the aquifer would still be small. Robertson et al. (1974) estimates that overall only 15 percent of the annual precipitation would recharge the aquifer.

- The vadose zone ranges from approximately 61 meters (200 feet) to 270 meters (890 feet) and has a large capacity for sorbing contaminants (Cecil et al. 1992). Therefore, for sorbed isotopes that have short half-lives, most of the radioactivity may decay before migrating through the vadose zone.

- The wide area distribution of radionuclides resulting from atmospheric dispersion in precipitation would result in concentrations of contaminants in precipitation less than maximum contaminant levels at land surface.

- Under highly unsaturated conditions with low moisture content in the vadose zone, water migration is very slow and would require several decades to reach the aquifer, allowing for radioactive decay.

The increased consumption of water from the Snake River Plain Aquifer under Alternative A (No Action) would be 106,900 cubic meters (28.2 million gallons) per year above average annual consumption (Hendrickson 1995). Of this total, 99,000 cubic meters (26 million gallons) would be associated with the Remediation of Groundwater Contamination Project. Since total consumption of water at the INEL site averages 7.36 million cubic meters (1.94 billion gallons) per year, the increased use represents a 1.4 percent increase above the average annual consumption. This increase would have a negligible impact on the Snake River Plain Aquifer. Given that 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974) of water flow under the INEL site each year, the total volume of water consumed under this alternative would only be 0.42 percent of that passing under the site. The total consumption of water under Alternative A is much less than the INEL site's consumptive use water right of 43 million cubic meters (11.4 billion gallons) per year.

5.8.3 Water Resource Impacts from Alternative B (Ten-Year Plan)

Impacts to water resources would essentially be the same for Alternative B (Ten-Year Plan) as for Alternative A (No Action) except for water consumption. Water consumption under Alternative B would be the greatest of any alternative through the implementation period (2005). The increased consumption is estimated at 298,600 cubic meters (79 million gallons), which represents an increase of 4.0 percent above average annual consumption (Hendrickson 1995). Most of this increase would be associated with the Waste Immobilization Facility and the Idaho Waste Processing Facility. The total increase in water use would have a negligible impact on the quantity of water in the Snake River Plain Aquifer. Given that 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974) of water flow under the INEL site each year, the total volume of water consumed under this alternative would only be 0.43 percent of that passing under the INEL site.

Continued shipments of spent nuclear fuel would not affect the quality of water resources because it is stored in contained storage pools or above-grade and below-grade dry storage containers and isolated from the environment. Additional activities under Alternative B would not discharge liquid effluents to the subsurface above levels suitable for land application; therefore, any impacts would be negligible.

5.8.4 Water Resource Impacts from Alternative C (Minimum Treatment, Storage and Disposal)

Impacts to surface and subsurface water would be the same for Alternative C (Minimum Treatment, Storage, and Disposal) as for Alternatives A (No Action) and B (Ten-Year Plan), with the exception of water consumption. Less water would be used than for either Alternatives B (Ten-Year Plan) or D (Maximum Treatment, Storage, and Disposal). A total of 158,600 cubic meters (41.9 million gallons) would be consumed above average annual water consumption, representing an increase of 2.1 percent (Hendrickson 1995). Most of this increase would be associated with the Waste Immobilization Facility. Given that 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974) of water flow under the INEL site each year, the total volume of water consumed under this alternative would only be 0.42 percent of that passing under the site. The effects on the quantity of water in the aquifer would be negligible.

The impacts to the saturated zone, vadose zone, and surface water would be negligible because liquid effluents would not be discharged to the surface or subsurface above levels suitable for land application. Other wastewater disposal methods that could degrade groundwater beyond designated beneficial uses are controlled by Federal and State regulations.

5.8.5 Water Resource Impacts from Alternative D (Maximum Treatment, Storage and Disposal)

Impacts to water resources would be the same for Alternative D (Maximum Treatment, Storage, and Disposal) as for Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal) with the exception of water consumption. Alternative D represents the second largest volume of water consumed of all the alternatives—254,000 cubic meters (67.0 million gallons) through 2005 (Hendrickson 1995). The increased water usage represents only a 3.4 percent increase above average annual water consumption and is negligible when compared with volume of water in the aquifer. Most of this increase would be associated with the Waste Immobilization Facility and the Spent Fuel Processing Project. Given that 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974) of water flow under the INEL site each year, the total volume of water consumed under this alternative would only be 0.43 percent of that passing under the site.

The impacts to the saturated zone, vadose zone, and surface water would be negligible because liquid effluents would not be discharged to the surface or subsurface above levels suitable for land application. Other wastewater disposal methods that could degrade groundwater beyond designated beneficial uses are controlled by Federal and State regulations.

5.9 Ecology

This section discusses the potential effects of the four environmental restoration and waste management alternatives on ecology at the INEL site and the surrounding area. Technical support for this section is provided in Rope et al. (1993). Effects from the alternatives are tabulated in this section for ease of comparison.

5.9.1 Methodology

Potential effects on biological resources from each alternative were qualitatively assessed. The potentially affected areas (sites and facilities to be used, constructed, or remediated and surrounding habitat where effluents, emissions, light, or noise may be present) were identified in Chapter 3, Alternatives, Appendix C, Information Supporting the Alternatives, and Section 4.9, Ecological Resources. Biological attributes found or that may be found on the site were identified and characteristics were discussed in Section 4.9, Ecology.

The assessment of potential effects is based on an evaluation of the location of activities in relation to the location of the biological attributes. Information about the potential effects was developed from studies evaluating effects from similar types of activities on biota similar to those found at the INEL site. Also, the potential effects associated with Alternative A (No Action) serve as the basis of comparison for the other alternatives.

Disturbance of various types (for example, earthmoving and noise) would constitute the primary source of impacts such as loss of productivity, displacement of individuals, and habitat fragmentation. Table 5.9-1 summarizes land disturbance associated with general activities for each alternative.

5.9.2 Ecological Impacts from Alternative A (No Action)

A variety of general activities would occur under Alternative A (No Action) that may affect biological resources. Sources of disturbance that may affect ecological resources include loss or change of habitat from construction of new facilities; mortality from land clearing or facility removal operations; mortality from vehicular traffic; human presence; noise; night lights; and exposure to

Table 5.9-1. Acres disturbed by alternative from proposed projects to manage or conduct waste stream, spent nuclear fuel, environmental restoration, or infrastructure activities at the Idaho National Engineering Laboratory site.

	Alternatives[a]											
	A			B			C			D		
	N[b]	PD[b]	R[b]	N	PD	R	N	PD	R	N	PD	R
Spent nuclear fuel	0	0.8	0	0	19.3	0	0	0	0	0	30.8	0
Remediation	3	7.3	0	3	7.3	0	3	7.3	0	3	7.3	0
Decommissioning and decontamination	0	6.7	6.7	0	16.1	6.7	0	6.7	6.7	0	16.1	6.7
High-level waste	0	2.8	0	0	14.1	0	0	33.6	0	0	34.6	0
Mixed low-level waste	0	0.3	0	240	1.3	0	5	0.3	0	640	1.3	0
Low-level waste[c]	0	0.3	0	240	0.3	0	5	0.3	0	640	0.3	0
Transuranic[c]	2	12.5	0	202	13.5	0	7	12.5	0	202	13.5	0
Greater-than-Class C low-level waste	0	0	0	0	1.7	0	0	0	0	0	1.7	0
Hazardous Waste	0	0.3	0	0	0.3	0	0	0.3	0	5	0.3	0
Infrastructure	0	4.1	0	132	172.1	225	112	172.1	225	211.6	172.1	225
Total	5	34.5	6.7	577	245	231.7	122	232.5	231.7	1061.6	277	231.7

a. A = No Action; B = Ten-Year Plan; C = Minimum Treatment, Storage, and Disposal; D = Maximum Treatment, Storage, and Disposal.

b. N = Acres not previously disturbed
PD = Acres previously disturbed
R = Acres disturbed during proposed action that will be revegetated.
To convert from acres to hectares, multiply by 0.4047.

c. Totals do not equal summation of columns because many projects are found in two or more waste streams. (As an example, all proposed projects for low-level waste are also found in the mixed low-level waste stream.) Therefore, the impacts of the projects were counted only once in the total. See Appendix C, Information Supporting the Alternatives, in Volume 2 of this EIS for project-specific information and waste stream-project associations.

radionuclides and hazardous contaminants and wastes. A potential beneficial effect from these activities would be revegetation of disturbed areas once any remediation activities are completed.

Approximately 16 hectares (40 acres) would be disturbed under Alternative A (No Action)—2 hectares (5 acres) of undisturbed habitat and 14 hectares (35 acres) of previously disturbed habitat. All but 0.8 hectares (2 acres) of the 2 hectares (5 acres) of previously undisturbed habitat would be within the fence lines or boundaries of existing facilities and currently disturbed acres. The 14 hectares (35 acres) of previously disturbed habitat would be within the boundaries of existing facilities. The projects with the largest land disturbance under Alternative A would be the Transuranic Storage Area Enclosure and Storage Project, the Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning Project, and the Pit 9 Retrieval Project. These projects are described in Appendix C, Information Supporting the Alternatives.

The potential short-term effects of the disturbance of the 2 hectares (5 acres) of previously undisturbed habitat would include a loss of plant productivity, localized loss of biodiversity, displacement of animals occupying the areas, and direct mortality of less mobile species (for example, nesting birds) and species using burrows. The plant productivity and localized biodiversity loss would be the result of the loss of species common to the shrub-steppe vegetation that covers over 90 percent of the INEL site. The majority of animal species that would be displaced include insects, reptiles, and small mammals. Displaced/dispersing animals tend to have low survivorship (Emlen 1984, Ralls et al. 1986), especially if surrounding areas are at or near carrying capacity. Direct mortality of the previously listed animals plus nesting birds and their nests may occur during land disturbance activities. An additional potential effect would be the establishment of Russian thistle and cheatgrass, which are non-native annual species. These species, less desirable than native species, at times can establish in undisturbed native vegetation and competitively exclude less vigorous native species that are important food or cover sources for insects, small mammals, and birds.

The potential short-term effects of the disturbance of the 14 hectares (35 acres) of previously disturbed habitat would be similar to the effects discussed for the 2 hectares (5 acres) of previously undisturbed habitat with the exception that biodiversity loss, plant productivity loss, animal displacement, and animal mortality would be less. This is because previously disturbed habitats are less diverse, primarily dominated by landscaped vegetation (such as lawns), Russian thistle and cheatgrass, or non-native, perennial crested wheatgrass. These vegetation types are less diverse and provide less cover and food for animals compared with undisturbed native vegetation.

Other potential short-term effects include increased traffic noise, human presence, night lights, removal of contaminated ponds, and deposition of radionuclide air emissions from waste treatment and remediation operations (see Section 5.9.2.3 for discussion of potential effects). Potential mortality associated with increased vehicle traffic would be small because the increased number of trips and miles anticipated under Alternative A (No Action) would be similar (a maximum increase of two per day) to the current traffic levels. Potential mortality associated with increased rail shipments would be the smallest for this alternative because it involves the smallest number of shipments by train. Train collisions with wildlife can involve individuals or large numbers of animals because of the tendency of large game animals to bed down on the tracks in winters with high snow accumulation. No, or limited, effects to plants and animals are anticipated from human presence, noise, or night lights. About eight new generators would be used during the day and lights would be used at night on seven projects. All generators and noise sources (both night and day) would produce noise levels similar to existing sources. Also, all activities would be within or immediately adjacent to existing activities that have existing night lights, noise, human presence, and air emissions. Therefore, exposure of animal populations near facilities to these disturbances and resulting effects would increase slightly under Alternative A. In addition, species using areas near existing facilities (hawks, songbirds, small mammals, elk, and pronghorn) demonstrate tolerance to human presence and activities. Night lights may serve as an attractant to insects and, thus, to nocturnal insect-feeders such as bats. Conversely, some nocturnal small mammal species may alter activity periods or be displaced from areas adjacent to night lights. This effect may alter success of hunting by nocturnal predators such as owls. Ponds and lagoons that are removed may reduce availability of drinking water or food sources for bats, birds, rodents, and small mammals. However, removal of these ponds would reduce the likelihood of exposure to contaminants.

Long-term effects of construction and operation would include loss of plant and animal productivity on the 16 hectares (40 acres) occupied by facilities, attraction or avoidance of structures, and effects to habitat immediately surrounding facilities. These potential long-term effects to habitat surrounding facilities would be from noise, human presence, night lights, and deposition of air emissions from operations. With the exception of air emissions, effects associated with the sources of disturbance would be localized to areas immediately surrounding the new activities and probably would affect biota in the same manner as described for potential short-term effects.

5.9.2.1 Protected, Candidate, and Sensitive Species. It is not likely that Federal protected and candidate species and State and agency sensitive species would be affected under Alternative A (No Action). Preactivity surveys would be conducted on areas before initiation of projects to ensure that impacts to protected species would not occur and that appropriate mitigations would be implemented as needed (see Section 5.19, Mitigation).

5.9.2.2 Wetlands. Wetlands and aquatic resources likely would not be affected under Alternative A (No Action). Based on recent surveys (Hampton et al. 1995), no jurisdictional wetlands are known to exist on or near any of the facilities. However, an area north of the Test Reactor Area is being evaluated as a potential jurisdictional wetland. See Section 5.19, Mitigation, for additional steps to ensure that no adverse effects would occur to jurisdictional wetlands.

5.9.2.3 Radioecology. Under Alternative A (No Action), biota would continue to be exposed to radionuclides and contaminants in water and soil that would not be treated, removed, or remediated. This exposure would continue beyond the year 2035. In addition, short-term exposure may increase because of contaminant resuspension during soil removal and treatment (for example, air stripper, bioremediation) operations. However, soil removal and treatment operations would reduce long-term contaminant exposure levels for biota in some locations of the INEL site. Contaminated areas at the site are small, relative to the INEL as a whole, and are not increasing in size or contamination levels (Morris 1993a, b). As discussed in Section 4.9, Ecology, observable effects to individual small animals have been noted at small isolated areas on the INEL site; however, no effects on population were observed. Therefore, effects to populations are not likely under Alternative A (No Action).

With respect to Federal endangered and candidate species, it is unlikely that the bald eagle, peregrine falcon, northern goshawk, burrowing owl, ferruginous hawk, long-billed curlew, and pygmy rabbit are consuming harmful concentrations of radiological contaminants through feeding. This is because these species rarely use areas near exposed contaminants. It is unknown whether individuals of the other candidate species (Townsend's western big-eared bat, long-eared myotis, and small-footed myotis) use contaminated areas for a sufficiently long time or consume a sufficient amount of prey to receive radiation doses that would have a measurable effect on the individuals. A survey of these species is underway at the INEL site. Removal of contaminated ponds and lagoons would have a beneficial effect of further minimizing the potential for Townsend's big-eared bats to be exposed to contaminants.

5.9.3 Ecological Impacts from Alternative B (Ten-Year Plan)

Generally, potential nonradiological and radiological effects to biota from Alternative B (Ten-Year Plan) are similar in nature, but larger in scale, to those described under Alternative A (No Action). About 333 hectares (823 acres) would be disturbed under Alternative B, 233 hectares (577 acres) of undisturbed habitat and 100 hectares (246 acres) of previously disturbed habitat. To minimize the potential short-term effects of the disturbances described above, about 94 hectares (232 acres) of the 333 hectares (823 acres) to be disturbed would be revegetated. Consequently, there would be a long-term net loss of 239 hectares (591 acres). The majority of the long-term acreage loss would be from the construction and operation of a new facility (either the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility or the Idaho Waste Processing Facility) several kilometers from existing facilities and the expansion of the landfill. Each of these new facilities would encompass about 81 hectares (200 acres), while the landfill expansion would encompass about 113 hectares (280 acres).

When possible, revegetation would be accomplished using native perennial grasses and forbs. Plant productivity and diversity on revegetated areas that were part of the 64 hectares (158 acres) of previously disturbed habitat probably would become more productive and diverse compared with the preexisting habitat. Previously undisturbed habitat that would be revegetated probably would not provide cover, food, or biodiversity similar to undisturbed habitats during the first three to five years after seeding. Cover probably would be similar to undisturbed vegetation about five years after reseeding. Composition of plant species (and, therefore, diversity and animal food supplies) would continue to be lower compared with undisturbed habitat ten years after reseeding. This is because slower growing seeded species such as some shrub species and less competitive forb species require more time to become established. In addition, many species found in undisturbed areas would not be part of the seed mixture because commercial seed is not available.

Over a longer period, diversity and animal food supplies may more closely approximate native vegetation. Animal species probably would reestablish in reseeded areas as vegetation success occurred. Animal species preferring open areas and using annual plants would be the first species to reestablish in revegetated areas. As seeded species became productive, species requiring greater cover or perennial grasses and shrubs would begin to use the areas. Similar to the vegetation community, the reestablished animal communities may remain less diverse than undisturbed animal communities. In addition, revegetation of the 94 hectares (232 acres) would limit the ability of Russian thistle, cheatgrass, and other less desirable species to establish or dominate vegetation communities.

An additional potential effect that may be a result of Alternative B (Ten-Year Plan) that would not be associated with Alternative A (No Action) would be habitat fragmentation resulting from the construction and operation of the two facilities outside of existing facilities (see above). Fragmentation probably would alter the movement of individual mobile species such as pronghorn and elk in, and through, the area. Effects of fragmentation from the proposed facilities probably would not eliminate or severely restrict movements of animals. Historical data show that elk and pronghorn continue to use and move through areas immediately adjacent to developed areas similar to the proposed facilities (Rope et al. 1993). Also, habitat adjacent to new facilities may be avoided by species because of human presence, night lighting, or noise. After construction is completed, additional habitat disturbance would not occur and human activity and presence would be minimal in surrounding undisturbed habitat.

Potential mortality associated with vehicular traffic would be similar to Alternative A (four more trucks per day compared with Alternative A). The number of rail shipments per day for this alternative could be up to 6 times that for Alternative A (assuming 100 percent rail transport), thereby increasing the likelihood of train/wildlife collisions.

Other sources of potential effects would include the addition of about 20 temporary and 7 permanent generators during the day, 24 night lights, and the addition of 2 artificial surface water sources. These additions (with the exception of two generators and two night lights) would be within the boundaries of existing facilities where similar facilities are present. The ponds would be fenced and have no vegetation surrounding them to minimize access and to make them less attractive to wildlife.

5.9.3.1 Protected, Candidate, and Sensitive Species. Implementation of Alternative B (Ten-Year Plan) likely would not affect protected, candidate, or sensitive species. Proposed locations for the new two, 81-hectare (200-acre) area facilities would not affect protected, candidate, or sensitive species. As discussed in Section 5.9.2.1, locations of existing facilities do not affect these species. However, preactivity surveys would be conducted before construction to identify any protected or sensitive resources in the specific areas proposed for the facilities. Mitigations, including relocating the facilities, would be considered and implemented as needed based on the findings of the surveys and appropriate consultation with the U.S. Fish and Wildlife Service.

5.9.3.2 Wetlands. Potential wetlands and aquatic resources would not be affected under Alternative B (Ten-Year Plan). Currently, no jurisdictional wetlands are known to exist on or near any of the facilities. However, an area north of the Test Reactor Area is being evaluated as a potential jurisdictional wetland. Projects that would disturb habitat (especially outside of facility boundaries) would be evaluated to determine if jurisdictional wetlands are present. Activities would be modified to avoid affecting any identified wetlands. If avoidance is not possible, DOE would consult with the U.S. Corps of Engineers to obtain permits and develop any needed mitigation plans (for example, construction of new wetlands, enhancement of existing wetlands).

5.9.3.3 Radioecology. During the remediation period, potential radionuclide exposure and uptake by plants and animals in and near affected areas may increase compared with current exposure and uptake. Potential long-term exposure and uptake would be lower compared with Alternative A (No Action) as additional sites and facilities are remediated. A positive effect of Alternative B (Ten-Year Plan) would be that radionuclide uptake and accumulation by animals and plants would decrease toward background levels after cleanup activities have taken place. Biotic populations and communities exposed to current radionuclide levels do not appear to be different in abundance or species composition compared with populations in similar nearby habitat that are not exposed to elevated radionuclides (Morris 1993b).

5.9.4 Ecological Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Effects to biological resources would be similar to those described under Alternative B (Ten-Year Plan); however, the scale of impact would be lower (see Section 5.9.3). About 144 hectares (355 acres) would be disturbed under Alternative C (Minimum Treatment, Storage, and

Disposal), 49 hectares (122 acres) of previously undisturbed habitat and 94 hectares (233 acres) of previously disturbed habitat. About 94 hectares (232 acres) would be revegetated under this alternative. Consequently, there would be a long-term net loss of 50 hectares (123 acres). Also, two new artificial water sources would be created, fewer than twenty new night lights would be installed, and three temporary and two permanent generators would be operated during the day. The project with the largest land disturbance under Alternative C would be the Industrial/Commercial Landfill Expansion Project. This project is described in Appendix C, Information Supporting the Alternatives.

Potential mortality associated with vehicular traffic would be similar to Alternatives A and B (four more trucks per day compared with Alternative A). The number of yearly train shipments for Alternative C (assuming 100 percent rail transport) could be as much as 6 times that for Alternative A, thereby increasing the likelihood of train/wildlife collisions.

5.9.5 Ecological Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Effects to biological resources including protected species and wetlands would be similar to those described under Alternative B (Ten-Year Plan), but larger in scale because of the increase in area disturbed. About 542 hectares (1,339 acres) of land would be disturbed under Alternative D (Maximum Treatment, Storage, and Disposal), 430 hectares (1,062 acres) of undisturbed habitat and 112 hectares (277 acres) of previously disturbed habitat. To minimize the potential short-term effects of the disturbance described above, about 94 hectares (232 acres) of the 542 hectares (1,339 acres) to be disturbed would be revegetated. Consequently, there would be a long-term net loss of 448 hectares (1,107 acres). The majority of the long-term loss of the 448 hectares (1,107 acres) would be from construction and operation of either the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility or the Idaho Waste Processing Facility and the Mixed Low-Level Waste Treatment and Disposal facilities, all three to be located several kilometers from existing facilities. Additional acres to be disturbed are primarily associated with the expansion of the gravel pits [about 40 hectares (100 acres)] and the expansion of the landfill [about 113 hectares (280 acres)]. Alternative D has the largest increase in both vehicular and rail shipment. Up to 20 more trucks per day (assuming no transport by rail) as compared with Alternative A could be expected, resulting in a slightly higher potential wildlife mortality to individuals from collisions with trucks. Rail shipments could increase by a maximum of 12 times (assuming 100 percent train transport) over Alternative A, increasing the likelihood of train/wildlife collisions for both individuals and large numbers of animals potentially bedded down on the tracks. The number and type of other effects would be similar to those described in Alternative B (Ten-Year Plan) except air emissions would be greater. Mitigations would be used as needed (see Section 5.19, Mitigation).

5.10 Noise

This section discusses the potential effects of the four environmental restoration and waste management alternatives on noise at the INEL site and in the surrounding area.

5.10.1 Methodology

As discussed in Section 4.10, noises generated on the INEL site do not propagate offsite at levels that impact the general population. Therefore, INEL noise impacts for each alternative come from noises generated during the transportation of personnel and materials to and from the site and within nearby communities. These noises are largely a function of the size of the workforce. The INEL operations workforce is expected to decrease from the 8,620 job level in 1995 for all alternatives and all years through the year 2004 (see Section 5.3, Socioeconomics). Approximately one-half of the total workforce is stationed at the INEL site and one-half is stationed in facilities in Idaho Falls. The increase in the number of construction workers during some years for Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) were not considered relevant to noise impacts, since these workers would be driving private vehicles to and from work, and, as mentioned in Section 4.10, buses are the primary source of roadway noise.

Roadway, aircraft, and railroad noises have been considered. The roadway noises considered are noises caused by busing personnel to and from site work stations and transporting waste and spent nuclear fuel by truck.

5.10.2 Noise Impacts from Alternatives

Because the operations workforce stationed at the INEL site is expected to be less than the baseline for all years for all alternatives, the overall noise level resulting from site transportation would be expected to be generally lower than the baseline. The lower noise level would probably not be detectable by the average individual in most cases. Because there is no evidence of substantial resistance to current noise levels, there is no anticipated impact on noise due to personnel transportation. The number of trucks carrying waste and spent nuclear fuel under any alternative is expected to be, at most, a few per day (see Section 5.11, Traffic and Transportation). These trucks would be virtually undetectable from a noise perspective and certainly would not represent an environmental impact compared with the several hundred buses (about 300 routes) that travel to and from the INEL each day.

With regard to aircraft noises, the modest changes in the workforce for each alternative would be insufficient to change the combined number of aircraft landings in the Idaho Falls and Pocatello airfields. Likewise, regional freight trains would not be expected to increase or decrease in number as a result of any alternative. Rail shipments of spent nuclear fuel, regardless of alternative, are a small fraction of the rail traffic on the Mackay Branch of the Union Pacific System that traverses the INEL site and services the site via the Scoville spur.

In summary, no environmental impact due to noise is expected from any of the alternatives being considered.

5.11 Traffic and Transportation

Environmental restoration and waste management activities included in the scope of this Environmental Impact Statement involve the transportation of hazardous and radioactive materials within the boundaries of the INEL (onsite) and on highways and rail systems outside the boundaries of the INEL (offsite). Hazardous materials include commercial chemical products and hazardous wastes that are nonradioactive and are regulated and controlled based on their chemical toxicity. Four main categories of radioactive materials are associated with environmental restoration and waste management activities: spent nuclear fuel, transuranic wastes, mixed low-level wastes, and low-level wastes. High-level wastes are stored at the INEL, but shipments of high-level wastes are not planned within the timeframe of this EIS.

This section summarizes the methods of analysis, potential impacts, and mitigative actions related to transportation of these materials under normal (incident-free) and accident conditions. The impacts are presented by alternative and include doses and health effects. Impacts of transportation on wildlife are discussed in Section 5.9, Ecology, of this EIS.

5.11.1 Methodology

The effects discussed in this section are presented for the entire shipping campaign of 10 years for waste and 40 years for spent nuclear fuel. Because the shipment schedule for spent nuclear fuel is not known, it is not possible to isolate the impacts for the period 1995 through 2005. However, the impacts over 40 years would bound the potential impacts over 10 years for each alternative.

This section summarizes the methods of analysis used in determining the environmental consequences of transporting these materials under normal (incident-free) and accident conditions.

5.11.1.1 Methodology for Incident-Free Transportation. Radiological impacts were determined for two groups of people during normal, incident-free transportation: (a) crewmen and (b) general population. For truck shipments, the crewmen were the drivers of the shipment. For rail shipments, the crewmen were workers in close proximity to the shipping containers during the inspection or classification of railcars. The general population was persons within 2,625 feet

(800 meters) of the transport link (off-link), persons sharing the transport link (on-link), and persons at stops. Off-link doses, on-link doses, and doses at stops were evaluated for offsite shipments. Because the general population does not reside on the INEL and the INEL facilities are located far from major roads, no off-link doses or doses at stops were calculated for onsite shipments. However, on-link doses were evaluated for onsite shipments because the general population does have access to the majority of the roads on the INEL. Radiological impacts were calculated using the RADTRAN 4 computer code (Neuhauser and Kanipe 1992) and the RISKIND computer code (Yuan et al. 1993).

Each category of material to be transported was assigned a dose rate based on its radiological characteristics, and all shipments were made by exclusive use vehicle. Remote-handled transuranic waste and remote-handled low-level waste were assigned a dose rate of 5 millirem per hour at 3.28 feet (1 meter) from the shipping container (DOE 1990); contact-handled transuranic waste and contact-handled low-level waste were assigned a dose rate of 1 millirem per hour at 3.28 feet (1 meter) from the shipping container (DOE 1990); and spent nuclear fuel was assigned a dose rate of 14 millirem per hour at 3.28 feet (1 meter) from the shipping container. A dose rate of 14 millirem per hour at 3.28 feet (1 meter) from the shipping container yielded a dose rate of 10 millirem per hour at 6.56 feet (2 meters) from the edge of the transport vehicle, the regulatory limit for an exclusive use vehicle (Madsen et al. 1986). A dose rate of 1 millirem per hour at 3.28 feet (1 meter) was used for naval-type spent nuclear fuel shipments, which was based on measured dose rates from previous naval spent nuclear fuel shipments.

The calculation of the doses was based on the development of unit risk factors. Unit risk factors provide an estimate of the dose to an exposure group from transporting one shipment of radioactive material over a unit distance of travel in a given population density zone (rural, suburban, and urban). Unit risk factors have units of person-rem per kilometer and may be combined with routing information, such as the shipment distances in various population density zones and the total number of shipments, to determine the dose for a series of shipments between a given origin and destination. Using RADTRAN 4, unit risk factors were developed based on travel within rural, suburban, and urban population zones. Truck routes were determined using the HIGHWAY computer code (Johnson et al. 1993a), and train routes were determined using the INTERLINE computer code (Johnson et al. 1993b). Table 5.11-1 contains the route data for waste shipments, and Appendix I of Volume 1 of this EIS contains the route data for spent nuclear fuel. The routes were chosen to be representative and to conform to Department of Transportation routing practices and

Table 5-11.1. Transportation distances between facilities for waste shipments.

Route		Miles	Percent rural	Percent suburban	Percent urban
		Truck routes			
INEL	Rocky Flats, Golden, CO	730.0	90.2	8.4	1.4
INEL	Waste Isolation Pilot Plant, Carlsbad, NM	1396.0	90.5	8.3	1.1
INEL	Engineering Technology Engineering Center, Ventura County, CA	965.0	77.2	15.8	7.0
INEL	Inhalation Toxicology Research Institute, Albuquerque, NM	1181.0	88.7	9.7	1.6
INEL	PANTEX, Amarillo, TX	1472.0	89.8	8.6	1.6
INEL	Argonne National Laboratory-East, Argonne, IL	1586.0	91.2	8.2	0.6
INEL	Los Alamos National Laboratory, Los Alamos, NM	1148.0	88.8	9.8	1.4
INEL	Sandia National Laboratories, Albuquerque, NM	1172.0	88.7	9.8	1.5
INEL	Nevada Test Site, NV	716.0	82.9	13.6	3.5
INEL	Hanford Site, WA	603.0	91.3	7.6	1.1
INEL	Private Sector Facility, (Southeastern United States)	2513.0	81.4	17.3	1.3
		Train routes			
INEL	Rocky Flats, Golden, CO	756.2	87.4	10.9	1.7
INEL	Waste Isolation Pilot Plant, Carlsbad, NM	1447.1	91.1	8.0	0.9
INEL	Engineering Technology Engineering Center, Ventura County, CA	1005.6	84.2	10.1	5.7
INEL	Inhalation Toxicology Research Institute, Albuquerque, NM	1250.0	90.8	7.8	1.4
INEL	PANTEX, Amarillo, TX	1154.6	92.1	6.6	1.2
INEL	Argonne National Laboratory-East, Argonne, IL	1561.8	89.4	8.2	2.3
INEL	Los Alamos National Laboratory, Los Alamos, NM	1182.0	91.9	7.1	1.0
INEL	Sandia National Laboratories, Albuquerque, NM	1250.0	90.8	7.8	1.4
INEL	Nevada Test Site, NV	756.1	92.8	5.9	1.3
INEL	Hanford Site, WA	675.6	91.7	6.9	1.4
INEL	Private Sector Facility (Southeastern United States)	2661.1	81.4	15.6	3.0

guidelines. The unit risk factors for waste shipments are presented in Tables 5.11-2 and 5.11-3. The unit risk factors for spent nuclear fuel shipments are presented in Appendix I of Volume 1 of this EIS.

Radiological doses were converted to cancer fatalities using risk conversion factors of 5.0×10^{-4} fatal cancers per person-rem for members of the public and 4.0×10^{-4} fatal cancers per person-rem for workers. These risk conversion factors are from Publication 60 of the International Commission on Radiological Protection (ICRP 1991).

Incident-free nonradiological fatalities were also estimated using unit risk factors. These unit risk factors account for the fatalities associated with exhaust emissions, but the distances used to estimate the impacts must be doubled to reflect the round trip distance because these impacts occur whether or not the shipment contains radioactive material. Two sets of data were evaluated: (a) data from the *Non-radiological Impacts of Transporting Radioactive Material* (Rao et al. 1982), and (b) data from the *Motor Vehicle-Related Air Toxics Study* (EPA 1993). In Rao et al. (1982), the nonradiological unit risk factor for trucks was 1.0×10^{-7} fatalities per kilometer and the nonradiological unit risk factor for trains was 1.3×10^{-7} fatalities per kilometer. These unit risk factors are applicable only in urban areas. In EPA (1993), the unit risk factor was calculated to be 7.2×10^{-11} fatalities per kilometer; this unit risk factor is applicable in all areas (that is, rural, suburban, and urban). Based on the routes analyzed in this EIS, the unit risk factors from Rao et al. (1982) were found to overestimate impacts by about 20 to 30 times relative to the unit risk factors from EPA (1993). Therefore, the unit risk factors from Rao et al. (1982) were used as a conservative estimate of the incident-free nonradiological fatalities presented in this EIS. It should be noted that the unit risk factors from Rao et al. (1982) account for all fatalities, not just cancer fatalities. Other effects of chronic exposure to diesel exhaust emissions have been followed in occupationally exposed workers, but these data are insufficient to make a correlation between the effects and the exposure experienced (EPA 1993). Therefore, these impacts were not estimated in this EIS.

Maximum individual doses were calculated using the RISKIND computer code (Yuan et al. 1993). The maximum individual doses for the routine transport offsite were estimated for transportation workers, as well as members of the general population. For rail shipments, the three general population scenarios were (a) a railyard worker who might be working at a distance of 32.8 feet (10 meters) from the shipping container for two hours, (b) a resident who might live 98.4 feet

Table 5.11-2. Incident-free unit risk factors for truck and rail shipments of remote-handled transuranic waste and low-level waste.

Mode	Exposure group	Unit risk factors (person-rem per kilometer)[a]		
		Rural	Suburban	Urban
Truck				
	Occupational	7.4×10^{-5}	1.6×10^{-4}	2.7×10^{-4}
	General population			
	Off-link[b]	4.4×10^{-8}	5.8×10^{-6}	3.9×10^{-5}
	On-link[c]	1.8×10^{-6}	5.2×10^{-6}	5.3×10^{-5}
	Stops	4.3×10^{-5}	4.3×10^{-5}	4.3×10^{-5}
	General population total	4.5×10^{-5}	5.4×10^{-5}	1.3×10^{-4}
Rail				
	Occupational[d]	3.6×10^{-6}	3.6×10^{-6}	3.6×10^{-6}
	General population			
	Off-link[b]	6.1×10^{-8}	1.2×10^{-5}	1.0×10^{-4}
	On-link[c]	2.4×10^{-8}	3.0×10^{-7}	8.4×10^{-7}
	Stops[e]	1.7×10^{-6}	1.7×10^{-6}	1.7×10^{-6}
	General population total	1.8×10^{-6}	1.4×10^{-5}	1.1×10^{-4}

a. The methodology, equations, and data used to develop the unit risk factors are discussed in Madsen et al. (1986) and Neuhauser and Kanipe (1992). Cashwell et al. (1986) contains a detailed explanation of the use of unit risk factors.

b. Off-link general population was persons within 800 meters (2,625 feet) of the road or railway.

c. On-link general population was persons sharing the road or railway.

d. The nonlinear component of incident-free rail dose for crew workers because of railcar inspections and classifications is 0.0040 person-rem per shipment. Ostmeyer (1986) contains a detailed explanation of the rail exposure model.

e. The nonlinear component of incident-free rail dose for the general population because of railcar inspections and classifications is 0.0031 person-rem per shipment. Ostmeyer (1986) contains a detailed explanation of the rail exposure model.

Table 5.11-3. Incident-free unit risk factors for truck and rail shipments of contact-handled transuranic waste, low-level waste, and mixed low-level waste.

		Unit risk factors (person-rem per kilometer)[a]		
Mode	Exposure group	Rural	Suburban	Urban
Truck				
	Occupational	1.5×10^{-5}	3.3×10^{-5}	5.4×10^{-5}
	General population			
	Off-link[b]	8.8×10^{-9}	1.2×10^{-6}	7.7×10^{-6}
	On-link[c]	3.6×10^{-7}	1.0×10^{-6}	$1.1\ 10^{-5}$
	Stops	8.6×10^{-6}	8.6×10^{-6}	8.6×10^{-6}
	General population total	9.0×10^{-6}	1.1×10^{-5}	2.7×10^{-5}
Rail				
	Occupational[d]	7.2×10^{-7}	7.2×10^{-7}	7.2×10^{-7}
	General population			
	Off-link[b]	1.2×10^{-8}	2.3×10^{-6}	2.1×10^{-5}
	On-link[c]	4.7×10^{-9}	6.1×10^{-8}	1.7×10^{-7}
	Stops[e]	3.4×10^{-7}	3.4×10^{-7}	3.4×10^{-7}
	General population total	3.6×10^{-7}	2.7×10^{-6}	2.1×10^{-5}

a. The methodology, equations, and data used to develop the unit risk factors are discussed in Madsen et al. (1986) and Neuhauser and Kanipe (1992). Cashwell et al. (1986) contains a detailed explanation of the use of unit risk factors.

b. Off-link general population was persons within 800 meters (2,625 feet) of the road or railway.

c. On-link general population was persons sharing the road or railway.

d. The nonlinear component of incident-free rail dose for crew workers because of railcar inspections and classifications is 0.00080 person-rem per shipment. Ostmeyer (1986) contains a detailed explanation of the rail exposure model.

e. The nonlinear component of incident-free rail dose for the general population because of railcar inspections and classifications is 0.00062 person-rem per shipment. Ostmeyer (1986) contains a detailed explanation of the rail exposure model.

(30 meters) from the rail line where the shipping container was being transported, and (c) a resident who could be living 656.2 feet (200 meters) from a rail stop where the shipping container was sitting for 20 hours. For train shipments, the maximum exposed transportation worker was an individual in a railyard who spent a time- and distance-weighted average of 0.16 hours inspecting, classifying, and repairing railcars (Wooden 1986).

For offsite truck shipments, the three scenarios for the general population were: (a) a person who might be caught in traffic and located 3.28 feet (1 meter) away from the surface of the shipping container for one-half hour, (b) a resident who might be living 98.4 feet (30 meters) from the highway used to transport the shipping container, and (c) a service station worker who might be working at a distance of 65.6 feet (20 meters) from the shipping container for two hours. The hypothetical maximum exposed individual radiological doses were accumulated over the 10-year period. However, for the situation involving an individual who might be caught in traffic next to a truck, the radiological exposures were only calculated for one event because it was considered unlikely that the same individual would be caught in traffic next to all containers for all shipments. For truck shipments, the maximum exposed transportation worker is the driver, who was assumed to drive shipments for up to 2,000 hours per year.

The hypothetical maximally exposed individual scenarios for the general population described above were not applicable for onsite shipments for two reasons. First, there is essentially no traffic during the onsite shipments and an obstruction, if encountered, would be safely avoided by the driver. Second, there are no residents or businesses onsite. Two alternate scenarios were developed. They were: (a) a site employee in a disabled vehicle along the transport route, located 3.28 feet (1 meter) from the container, and (b) a site employee traveling behind the slow-moving transport vehicle for the entire trip. These scenarios were considered to be single-event occurrences.

5.11.1.2 Methodology for Onsite Transportation Accident Analysis. The onsite transportation accident analysis considers the impacts of accidents during the transportation of spent nuclear fuel and radioactive waste by truck, which is the primary mode of transport onsite. This analysis addresses only shipments within the boundaries of the INEL that originate at one INEL facility and terminate at another INEL facility. The onsite portions of offsite shipments that originate or terminate at the INEL are included in the offsite transportation accident analysis.

Within the boundaries of the INEL, spent nuclear fuel is transported in specially designed casks that have been approved by the DOE. In most cases, these casks have not been approved for transport of spent nuclear fuel over public highways and, therefore, use of these casks is restricted to onsite. Onsite transportation of radioactive wastes is normally conducted using U.S. Department of Transportation Type A containers. In some cases, transuranic wastes are required to be transported onsite using a U.S. Department of Transportation Type B container, for example, the TRUPACT-II shipping container.

A maximum reasonably foreseeable assessment was performed for potential spent nuclear fuel and radioactive waste transportation accidents. Impacts are assessed for areas within a 50-mile (80-kilometer) radius. Because of the extensive land area occupied by the INEL and the distances between facilities, the potential impacts to surrounding communities from an onsite transportation accident are highly dependent on where the accident occurs.

Because it is not possible to predict where on the INEL an accident might occur and the specific public areas that might be affected, the accident analysis assesses impacts in terms of generic rural and suburban population areas. The generic rural population area has an average population density of six persons per square kilometer and is typical of most areas within 30 miles (48 kilometers) of the geographical center of the INEL site. The generic suburban population area has an average population density of 7.19 persons per hectare and bounds the most densely populated areas within 50 miles (80 kilometers) of the INEL.

The consequences of the maximum reasonably foreseeable onsite transportation accident were calculated using the RISKIND computer code (Yuan et al. 1993). Consequences were assessed under both neutral and stable atmospheric conditions. Neutral conditions are typical of average conditions that result in good dispersion and dilution of atmospheric contaminants. Stable atmospheric conditions occur less than 5 percent of the time and result in low dispersion and dilution of atmospheric contaminants. Calculated radiation doses were used to estimate the potential for fatal cancers in the exposed populations using risk factors developed by the International Commission on Radiological Protection (ICRP 1991).

The maximum reasonably foreseeable onsite transportation accidents are extremely unlikely events, with estimated probabilities of occurrence ranging from 1×10^{-7} to 3.9×10^{-5} per year.

The impacts of maximum reasonably foreseeable accidents are represented by an estimate of risk obtained by multiplying the consequences (fatal cancers) by the probability of the accident.

5.11.1.3 Methodology for Offsite Transportation Accident Analysis. For offsite spent nuclear fuel and radioactive waste transportation accidents, accident risk assessment was performed using methodology developed by the U.S. Nuclear Regulatory Commission for calculating the probabilities and consequences from a spectrum of unlikely accidents. Although it is not possible to predict where along the transport route such accidents might occur, the accident risk assessment used route-specific information for accident rates and population densities. Radiation doses for population zones (rural, suburban, and urban) were weighted by the accident probabilities to yield "dose risk" using the RADTRAN 4 computer code. To represent the maximum reasonably foreseeable impacts to individuals and populations should an accident occur, radiological consequences were calculated for an accident of maximum reasonably foreseeable severity in each population zone using the RISKIND computer code.

Accident analyses for spent nuclear fuel and radioactive waste shipments are performed similarly except for the methodology used in the assessment of accident severity categories, conditional probabilities, and radioactive material release characteristics. For spent nuclear fuel shipments, the methodology contained in a U.S. Nuclear Regulatory Commission report commonly known as the Modal Study (Fischer et al. 1987) was used. For radioactive waste shipments, the methodology derives from NUREG-0170 (NRC 1977). Accident rates, atmospheric conditions, population density zones, and health risk conversion factors are the same for both sets of analyses.

Differences in spent nuclear fuel types translate into different radioactive material release characteristics under accident conditions; thus, analyses were performed for each of nine representative spent nuclear fuel types. Characterization data for the representative spent nuclear fuel types were developed based on published reports and computer calculations using the ORIGEN2 computer code (Croff 1980). Similarly, an important variable in the assessment of impacts from radioactive waste transportation accidents is the type and amount of radioactive and other hazardous material in radioactive waste. Transuranic waste characterization data were derived from the Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (DOE 1990). Low-level waste characterization data were derived from DOE waste management databases and computational models (Cornelius 1993). The radiological component of mixed low-level waste was characterized the same as low-level waste. The nonradiological component of mixed low-level waste was characterized based on data from the DOE Integrated Data Base (DOE 1992).

Accident severity categories for all potential spent nuclear fuel transportation accidents and radioactive waste transportation accidents are described in the Modal Study (Fischer et al. 1987) and NUREG-0170 (NRC 1977), respectively. Severity is a function of the magnitudes of the mechanical forces (impact) and thermal forces (fire) to which a cask may be subjected during an accident. The accident severity scheme takes into account all reasonably foreseeable transportation accidents. Spent nuclear fuel transportation accidents are grouped into 20 accident severity categories, ranging from high-probability events with low consequences to low-probability events with high consequences. The accident severity scheme for radioactive waste shipments is similar, but only eight severity categories are assigned. Each accident severity category is assigned a conditional probability, which is the probability, given that an accident occurs, that the accident will be of the indicated severity.

Radioactive material releases from transportation accidents were calculated by assigning release fractions (the fraction of the radioactivity in the shipment that could be released in a given severity of accident) to each accident severity category for each chemically and physically distinct radioisotope. Representative release fractions were developed for each of the representative spent nuclear fuel types based on the Modal Study and other published reports. Release fractions for transuranic waste were derived from the Waste Isolation Pilot Plant Supplemental Environmental Impact Statement (DOE 1990), which based its analysis on the accident severity model in NUREG-0170. Representative release fractions for low-level and mixed low-level waste were derived from NUREG-0170 and recommended values from Elder et al. (1986).

Radioactive material released to the atmosphere is transported by wind. The amount of dispersion, or dilution, of the radioactive material concentrations in the air depends on the meteorological conditions at the time of the accident. Neutral meteorological conditions are the most frequently occurring atmospheric stability conditions in the United States and, therefore, are most likely to be present in the event of an accident involving a spent nuclear fuel or radioactive waste shipment. For accident risk assessment, neutral weather conditions (Pasquill Stability Class D) were assumed (Doty et al. 1976). For the accident consequence assessment, doses were assessed under both neutral (Class D) and stable (Class F) atmospheric conditions, representing the most likely consequences and a worst-case weather situation, respectively.

Radiological doses were calculated for an individual located near the scene of the accident and for populations within 50 miles (80 kilometers) of the accident. Three population density zones (rural, suburban, and urban) were assessed. Dose calculations considered a variety of exposure pathways, including inhalation and direct exposure (cloudshine) from the passing cloud, ingestion from contaminated crops, direct exposure (groundshine) from radioactivity deposited on the ground, and inhalation of resuspended radioactive particles from the ground. Human health effects that could result from the radiation doses received were estimated using risk factors recommended by the International Commission on Radiological Protection (ICRP 1991).

The transportation of spent nuclear fuel and radioactive waste also results in nonradiological accident risks, such as injuries or fatalities sustained by physical impact with the transport vehicle. Nonradiological fatal accident risks for truck transportation were calculated for each postulated transport route, using state-specific accident fatality rates for interstate highways in urban and rural areas (Saricks and Kvitek 1991). Accident fatality risks for rail transportation were calculated using a nationwide average rate of 2.64×10^{-8} fatalities per rail-kilometer (Cashwell et al. 1986).

5.11.1.4 Methodology for Hazardous Material Transportation Accident Analysis. This section describes the analysis of the maximum reasonably foreseeable accident for the planned transportation of hazardous materials to and from the INEL during the period covered by this EIS. The information in this section has been summarized from Wierman (1994).

The accident analysis assesses only truck transportation because all of the hazardous materials transported to or from the INEL are transported by truck. The accident scenario postulates a truck accident leading to a breach of chemical containers and release of chemicals to the environment. The resulting spill either evaporates (liquid spill) or escapes directly to the atmosphere (gas release). Extenuating circumstances, such as an accompanying fire or explosion, are not analyzed. The accident consequences are assessed for rural, suburban, and urban population density zones.

The HIGHWAY computer code was used to generate distances, population densities, and correlation of distance and population densities. The probability of a releasing accident is calculated based on the type of region the truck is traveling through and the type of truck. A cross-classification study conducted in California matched accident data and corresponding exposures (shipment-miles) for selected sites statewide to generate accident involvement rates by category of highway and truck configuration. The probability of hazardous material release given an accident was derived from an evaluation of Highway Patrol accident reports from the State of Missouri. The accident reports contained data identifying whether each vehicle involved in an accident was carrying hazardous materials, what type(s) of material were carried, and whether or not a hazardous material release occurred.

In the maximum reasonably foreseeable case truck accident scenario, the hazardous chemical of interest is nitric acid, because it has the capability to affect the largest number of persons in a population due to the relatively high toxicity of nitric acid and the large quantities in which it is transported. The release is modeled as a total release of the nitric acid inventory for a shipment [15,900 liters (4,200 gallons)].

The consequences of the offsite hazardous material transportation accidents are expressed in terms of Emergency Response Planning Guidelines. Emergency Response Planning Guidelines have been developed to provide estimates of concentration ranges above which one could reasonably anticipate observing adverse effects as described in the definitions for Emergency Response Planning Guideline-1, Emergency Response Planning Guideline-2, and Emergency Response Planning Guideline-3. The Emergency Response Planning Guidelines are the maximum airborne concentrations below which it is believed that nearly all individuals could be exposed for up to one hour (a) without adverse health effects or perceiving a clearly defined objectionable odor (Emergency Response Planning Guideline-1), (b) without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (Emergency Response Planning Guideline-2), or (c) without experiencing or developing life-threatening health effects (Emergency Response Planning Guideline-3).

5.11.1.5 Methodology for Regional Traffic Impact Analysis. Transportation by road of people and materials that are required because of increased construction and operational activities due to the various alternatives could impact the regional traffic system around the INEL and result in increases in traffic accidents, injuries, and fatalities. These impacts, such as increased vehicle mileage, accidents, and traffic congestion, are measured using the level of service for road segments.

The level-of-service concept is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and passengers. A level of service is defined for each roadway or section of roadway in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. The six levels of service are defined below (TRB 1994).

- Level-of-Service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

- Level-of-Service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level-of-Service A. The level of comfort and convenience provided is somewhat less than at Level-of-Service A because the presence of others in the traffic stream begins to affect individual behavior.

- Level-of-Service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

- Level-of-Service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

- Level-of-Service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform, value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

- Level-of-Service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-Service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases, operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and Level-of-Service F is an appropriate designation for such points.

For purposes of evaluating impacts of increased traffic and usage, the capacity of the roadway in terms of vehicles per hour for a given level of service is first established using the procedures in TRB (1985). The level of service based on existing traffic flow is then established. A new level of service is then calculated, based on the number of shipments of waste, spent nuclear fuel, and construction materials, and the number of workers associated with each alternative. These levels of service are then compared to determine if the capacity of the highway is exceeded or if the level of service has changed.

5.11.2 Traffic and Transportation Impacts from Alternatives

This section summarizes the impacts on traffic and transportation for the various environmental restoration and waste management alternatives being considered.

5.11.2.1 Shipments. The waste shipments associated with Alternatives A through D are summarized in Table 5.11-4. For Alternative A (No Action), no transuranic waste would be transported to the INEL, but the INEL potentially would transport transuranic waste to the Waste

Table 5.11-4. Shipments of radioactive waste and hazardous materials for Alternatives A through D (1995 to 2005).[a]

	Alternative A[b]		Alternative B[b]		Alternative C[b]		Alternative D[b]	
Material	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail
Transuranic waste								
INEL to WIPP	1,823	716	4,317	1,695	1,823	716	4,699	1,845
Rocky Flats to INEL	0	0	830	326	0	0	1,567	616
ANL-E to INEL	0	0	207	104	0	0	207	104
INEL to PSF	0	0	5,434	2,206	0	0	6,713	2,708
PSF to INEL	0	0	2,495	980	0	0	2,877	1,130
INEL to Hanford	0	0	0	0	4,604	1,880	0	0
NTS to INEL	0	0	0	0	0	0	74	29
SNL to INEL	0	0	0	0	0	0	2	2
LANL to INEL	0	0	0	0	0	0	1,261	495
Total	1,823	716	13,283	5,311	6,427	2,596	17,400	6,929
Low-level waste								
INEL to PSF	710	355	710	355	0	0	0	0
PSF to INEL	23	12	23	12	0	0	0	0
INEL to NTS	0	0	0	0	1,360	680	0	0
Rocky Flats to INEL	0	0	0	0	0	0	3,626	1,813
LANL to INEL	0	0	0	0	0	0	12,806	6,403
PANTEX to INEL	0	0	0	0	0	0	4,283	2,142
SNL to INEL	0	0	0	0	0	0	17	9
ITRI to INEL	0	0	0	0	0	0	88	44
Total	733	367	733	367	1,360	680	20,820	10,411

Table 5.11-4. (continued).

Material	Alternative A[b]		Alternative B[b]		Alternative C[b]		Alternative D[b]	
	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail
Mixed low-level waste								
INEL to NTS or Hanford	0	0	0	0	447	224	0	0
Rocky Flats to INEL	0	0	0	0	0	0	4,203	2,102
LANL to INEL	0	0	0	0	0	0	176	88
PANTEX to INEL	0	0	0	0	0	0	56	28
ETEC to INEL	0	0	0	0	0	0	44	22
Total	0	0	0	0	447	224	4,479	2,240
Onsite radioactive waste	100	0	1,365	0	100	0	1,365	0

a. Shipment counts represent 100 percent by truck or 100 percent by rail, except for onsite shipments that only use truck.

b. Alternative A (No Action); Alternative B (Ten-Year Plan); Alternative C (Minimum Treatment, Storage, and Disposal); Alternative D (Maximum Treatment, Storage, and Disposal).

Note: INEL = Idaho National Engineering Laboratory, WIPP = Waste Isolation Pilot Plant, ANL-E = Argonne National Laboratory-East, PSF = Private Sector Facility, NTS = Nevada Test Site, SNL = Sandia National Laboratories-Albuquerque, LANL = Los Alamos National Laboratory, ITRI = Inhalation Toxicology Research Institute, ETEC = Engineering Technology Engineering Center.

Isolation Pilot Plant. Low-level waste would be transported offsite for treatment, and the treated waste would be transported back to the INEL. No offsite shipment of mixed low-level waste is expected to occur. The INEL would continue to make periodic shipments of hazardous waste to offsite disposal facilities, and shipments of bulk hazardous chemicals used by INEL operations would continue.

For Alternative B (Ten-Year Plan), offsite shipments of low-level waste and mixed low-level waste would be the same as Alternative A (No Action). Increased transuranic waste shipment activity would occur with Rocky Flats and Argonne National Laboratory-East shipments to the INEL, shipments of INEL waste to and from offsite treatment facilities, and potentially increased shipments to the Waste Isolation Pilot Plant. The INEL would make increased shipments of hazardous waste to offsite disposal facilities as a result of increased environmental restoration activities. Shipments of bulk hazardous chemicals to the INEL would be similar to Alternative A.

For Alternative C (Minimum Treatment, Storage, and Disposal), the INEL potentially would transport all stored transuranic waste to the Waste Isolation Pilot Plant and the Hanford Site. The INEL would transport stored low-level and mixed low-level waste to the Nevada Test Site. Shipments of hazardous waste for offsite disposal and shipments of bulk hazardous chemicals to the INEL would be similar to Alternative A (No Action).

For Alternative D (Maximum Treatment, Storage, and Disposal), the INEL would receive increased shipments of transuranic, low-level, and mixed low-level waste from various DOE sites. Increased shipments of transuranic waste to private-sector treatment facilities would be made. Shipments of hazardous waste to offsite disposal facilities and shipments of bulk hazardous chemicals to the INEL site would be similar to Alternative B (Ten-Year Plan).

The spent nuclear fuel shipments associated with Alternatives A through D are summarized in Table 5.11-5. Alternative A addresses impacts under No Action. Under Alternative B, impacts are addressed separately under 1992/1993 Planning Basis and Regionalization by fuel type. Alternative C addresses impacts separately under Centralization at the Hanford Site, Savannah River Site, Oak Ridge Reservation, or the Nevada Test Site, and Alternative D addresses impacts under Centralization at the INEL (see Volume 1 of this EIS). Heiselmann (1995) and Attachment A to Appendix D of Volume 1 of this EIS contain detailed descriptions of the shipments that occur for each alternative.

Table 5.11-5. Shipments of spent nuclear fuel for Alternatives A through D (1995 to 2035).[a]

Shipments of spent nuclear fuel	Alternative A[a]	Alternative B[a]		Alternative C[a]				Alternative D[a]
		Planning basis	Fuel type	Hanford[b]	SRS[b]	ORR[b]	NTS[b]	INEL[b]
Naval[c]								
Truck and rail	568	3,024	3,024	3,056	3,056	3,056	3,056	3,024
University[d]								
Truck	0	519	519	519	519	519	519	519
Rail	0	519	519	519	519	519	519	519
Foreign[d]								
Truck	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Rail	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008
DOE[d]								
Truck	0	743	1,554	3,575	4,427	5,171	5,291	3,373
Rail	0	297	399	848	1,321	1,468	1,494	1,128
Onsite[e]								
Truck	1,758	1,764	1,764	1,758	1,758	1,758	1,758	1,764
Rail	0	0	0	0	0	0	0	0
Total truck[f]	2,326	7,058	7,869	9,916	10,768	11,512	11,632	9,688
Total rail[g]	568	4,848	4,950	5,431	5,904	6,051	6,077	5,679

a. Source: Maheras (1995d). Alternative A addresses impacts under No Action; Alternative B addresses impacts separately under 1992/1993 Planning Basis and Regionalization by fuel type; Alternative C addresses impacts under Centralization at the Hanford Site, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site; and Alternative D addresses impacts under Centralization at the INEL.

h. Hanford = Hanford Site, SRS = Savannah River Site, ORR = Oak Ridge Reservation, NTS = Nevada Test Site, INEL = Idaho National Engineering Laboratory.

c. Includes offsite and onsite shipments. Naval shipments would be made using a combination of truck and rail transport.

d. Shipments based on 100 percent transport by truck or 100 percent transport by rail.

e. Onsite shipments generally are made by truck only.

f. Shipments based on total Naval shipments plus 100 percent truck shipments for university, foreign, DOE, and onsite spent nuclear fuel.

g. Shipments based on total Naval shipments plus 100 percent rail shipments for university, foreign, and DOE spent nuclear fuel.

For Alternative A, there would be no offsite shipments except for limited naval spent nuclear fuel and test specimen shipments.

For Alternative B, the Navy would resume shipments of spent nuclear fuel from the shipyards to the INEL and shipments of irradiated test specimens from the INEL to offsite locations. All of the Fort Saint Vrain spent nuclear fuel in storage in Colorado and all commercial-type spent nuclear fuel stored at the West Valley Demonstration Project in New York would be transported to the INEL site. The INEL site would receive shipments of some of the DOE research and test reactor spent nuclear fuel stored at other DOE sites with a greater amount received under Alternative B, Regionalization by fuel type. In addition, the INEL site would receive spent nuclear fuel shipments from various domestic university and foreign research reactors and other non-DOE U.S. government reactors.

For Alternative C (Minimum Treatment, Storage, and Disposal), all spent nuclear fuel currently stored at the INEL site would be transported offsite to one of four DOE sites: Hanford, Savannah River Site, Oak Ridge, or Nevada Test Site. No shipments of spent nuclear fuel would be made to the INEL site.

For Alternative D (Maximum Treatment, Storage, and Disposal), all spent nuclear fuel currently stored at other DOE sites, Fort Saint Vrain, university, and foreign research reactors, and other non-DOE U.S. government reactors would be transported to the INEL.

5.11.2.2 Incident-Free Transportation. The impacts of incident-free transport of waste (transuranic, low-level, and mixed low-level) are summarized in Table 5.11-6, and the impacts for spent nuclear fuel are summarized in Tables 5.11-7 and 5.11-8. For truck shipments of waste, it can be seen that Alternative D (Maximum Treatment, Storage, and Disposal) yielded the largest collective doses (1,700 person-rem occupational, 940 person-rem general population), and Alternative A (No Action) yielded the smallest collective doses (120 person-rem occupational, 66 person-rem general population). Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal) yielded lower collective doses, 870 and 180 person-rem occupational and 460 and 100 person-rem general population, respectively. For Alternative D, approximately one cancer fatality was estimated. Train shipments yielded doses that were much less than truck shipments, ranging from 3.2 to 38 person-rem for workers and 4.1 to 58 for the general population. Nonradiological fatalities from

Table 5.11-6. Cumulative doses and fatalities from incident-free transport of waste for Alternatives A through D (1995 to 2005).[a]

	Alternative[a]							
	A		B		C		D	
Exposure group	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail
Estimated maximum individual dose (rem)								
Occupational	2.7	0.17	2.7	0.91	2.7	0.56	2.7	3.1
General population	0.049	0.086	0.27	0.45	0.16	0.28	0.81	1.5
Estimated collective dose (person-rem)								
Occupational								
Low-level waste	54	1.4	54	1.4	29	1.1	650	22
Mixed low-level waste	0	0	0	0	9.6	0.38	92	3.8
Transuranic waste	69	1.8	810	18	140	4.8	1,000	23
Onsite	0.072	0	1.0	0	0.072	0	1.0	0
Total	120	3.2	870	20	180	6.3	1700	48
General population								
Low-level waste	28	2.4	28	2.4	15	1.1	360	21
Mixed low-level waste	0	0	0	0	5.1	0.35	51	4.1
Transuranic waste	38	1.7	430	27	80	4.5	530	33
Onsite	0.00038	0	0.0054	0	0.00038	0	0.0054	0
Total	66	4.1	460	29	100	5.9	940	58
Estimated cancer fatalities								
Occupational								
Low-level waste	0.022	0.00056	0.022	0.00056	0.012	0.00044	0.26	0.0088
Mixed low-level waste	0	0	0	0	0.0038	0.00015	0.037	0.0015
Transuranic waste	0.028	0.00072	0.32	0.0072	0.056	0.0019	0.40	0.0092
Onsite	2.9×10^{-5}	0	0.00040	0	2.9×10^{-5}	0	0.00040	0
Total	0.048	0.0013	0.35	0.0080	0.072	0.0025	0.68	0.019

Table 5.11-6. (continued).

Exposure group	A Truck	A Rail	B Truck	B Rail	C Truck	C Rail	D Truck	D Rail
	Alternative[a]							
General population								
Low-level waste	0.014	0.0012	0.014	0.0012	0.0075	0.00055	0.18	0.011
Mixed low-level waste	0	0	0	0	0.0026	0.00018	0.026	0.0021
Transuranic waste	0.019	0.00085	0.22	0.014	0.040	0.0023	0.27	0.017
Onsite	1.9×10^{-7}	0	2.7×10^{-6}	0	1.9×10^{-7}	0	2.7×10^{-6}	0
Total	0.033	0.0021	0.23	0.015	0.050	0.0030	0.47	0.029
	Estimated nonradiological fatalities							
General population[b]								
Low-level waste	0.0099	0.015	0.0099	0.015	0.011	0.0027	0.11	0.055
Mixed low-level waste	0	0	0	0	0.0036	0.00089	0.016	0.013
Transuranic waste	0.0093	0.0040	0.13	0.14	0.019	0.011	0.17	0.17
Onsite[c]	0	0	0	0	0	0	0	0
Total	0.019	0.019	0.14	0.16	0.034	0.015	0.29	0.24

a. Source Maheras (1994) and Jones (1994). Alternative A (No Action); Alternative B (Ten-Year Plan); Alternative C (Minimum Treatment, Storage, and Disposal); Alternative D (Maximum Treatment, Storage, and Disposal).

b. Occupational incident-free nonradiological fatalities are included with the general population incident-free nonradiological fatalities.

c. Nonradiological incident-free fatalities are not applicable onsite because the INEL is not an urban area.

Table 5.11-7. Cumulative doses and fatalities from incident-free transport of spent nuclear fuel hy truck for Alternatives A through D (1995 to 2035).

	Alternatives[a,b]							
	A	B		C				D
Exposure group	A	Planning basis	Fuel type	Hanford[c]	SRS[c]	ORR[c]	NTS[c]	INEL[c]
Estimated maximum individual dose (rem)								
Occupational	0.35	160	160	160	160	160	160	160
General population	0.039	0.92	1.3	2.1	2.4	2.7	2.8	2.0
Estimated collective dose (person-rem)								
Occupational								
Naval	1.5	7.3	7.3	9.8	15	14	11	7.3
Foreign	0	130	150	220	140	130	230	190
University	0	59	54	100	53	42	94	86
DOE	0	66	150	430	840	750	590	380
Onsite	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Total	4.9	270	360	760	1000	940	930	670
General population								
Naval	0.34	2.1	2.1	4.7	12	11	6.0	2.1
Foreign	0	310	350	560	330	310	540	490
University	0	140	120	250	110	91	230	210
DOE	0	140	340	990	1900	1800	1400	880
Onsite	0.087	0.088	0.088	0.087	0.087	0.087	0.087	0.088
Total	0.43	590	810	1800	2400	2200	2200	1600

Table 5.11-7 (continued)

Exposure group	A	B		C				D
	Alternatives[a,b]							
	A	Planning basis	Fuel type	Hanford[c]	SRS[c]	ORR[c]	NTS[c]	INEL[c]
Estimated cancer fatalities								
Occupational								
Total	0.0020	0.11	0.14	0.30	0.40	0.38	0.37	0.27
General population								
Total	0.00022	0.30	0.41	0.90	1.2	1.1	1.1	0.80
Estimated nonradiological fatalities								
General population[d]								
Naval	0.059	0.025	0.025	0.035	0.033	0.028	0.037	0.025
Foreign	0	0.010	0.012	0.016	0.012	0.0097	0.016	0.015
University	0	0.0050	0.0051	0.0057	0.0050	0.0042	0.0066	0.0049
Onsite[e]	0	0	0	0	0	0	0	0
DOE	0	0.0054	0.0098	0.026	0.057	0.043	0.059	0.022
Total	0.059	0.045	0.052	0.083	0.11	0.085	0.12	0.067

a. Alternative A addresses impacts under No Action; Alternative B addresses impacts separately under 1992/1993 Planning Basis and Regionalization by fuel type; Alternative C addresses impacts separately under Centralization at the Hanford Site, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site; and Alternative D addresses impacts under Centralization at the INEL.

b. Doses and fatalities include shipments of naval spent nuclear fuel (offsite and onsite, see Attachment A to Appendix B of Volume 1 of this EIS), DOE spent nuclear fuel (offsite and onsite, see Maheras 1995a and Maheras 1995d), university research reactor spent nuclear fuel (see Maheras 1995b), and foreign research reactor spent nuclear fuel (see Maheras 1995c).

c. Hanford = Hanford Site, SRS = Savannah River Site, ORR = Oak Ridge Reservation, NTS = Nevada Test Site, INEL = Idaho National Engineering Laboratory.

d. Occupational incident-free nonradiological fatalities are included with public incident-free nonradiological fatalities.

e. Nonradiological incident-free fatalities are not applicable onsite because the INEL is not an urban area.

Table 5.11-8. Cumulative doses and fatalities from incident-free transport of spent nuclear fuel by train for Alternatives A through D (1995 to 2035).

	Alternatives[a,b]							
	A	B		C				D
Exposure group	A	Planning basis	Fuel type	Hanford[c]	SRS[c]	ORR[c]	NTS[c]	INEL[c]
Estimated maximum individual dose (rem)								
Occupational	0.35	6.2	6.5	8.1	9.7	10	10	9.0
General population	0.039	3.1	3.2	4.0	4.8	5.1	5.1	4.5
Estimated collective dose (person-rem)								
Occupational								
Naval	1.5	7.3	7.3	9.8	15	14	11	7.3
Foreign	0	37	41	56	40	36	54	49
University	0	16	15	26	15	13	25	22
DOE	0	7.3	11	32	60	58	52	36
Onsite	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Total	4.9	71	78	130	130	120	150	120
General population								
Naval	0.34	2.1	2.1	4.7	12	11	6.0	2.1
Foreign	0	43	54	56	54	39	56	49
University	0	29	33	38	34	25	37	33
DOE	0	12	17	45	85	68	64	49
Onsite	0.087	0.088	0.088	0.087	0.087	0.087	0.087	0.088
Total	0.43	86	110	140	190	140	160	130

Table 5.11-8 (continued)

	Alternatives[a,b]							
	A	B		C				D
Exposure group	A	Planning basis	Fuel type	Hanford[c]	SRS[c]	ORR[c]	NTS[c]	INEL[c]
Estimated cancer fatalities								
Occupational								
Total	0.0020	0.028	0.031	0.052	0.052	0.048	0.060	0.048
General population								
Total	0.00022	0.043	0.055	0.070	0.095	0.070	0.080	0.065
Estimated nonradiological fatalities								
General population[d]								
Naval	0.059	0.025	0.025	0.035	0.033	0.028	0.037	0.025
Foreign	0	0.027	0.037	0.035	0.037	0.023	0.037	0.031
University	0	0.012	0.014	0.014	0.014	0.0091	0.013	0.012
Onsite[e]	0	0	0	0	0	0	0	0
DOE	0	0.0065	0.0081	0.024	0.032	0.023	0.028	0.023
Total	0.059	0.071	0.084	0.11	0.12	0.083	0.12	0.091

a. Alternative A addresses impacts under No Action, Alternative B addresses impacts separately under 1992/1993 Planning Basis and Regionalization by fuel type, Alternative C addresses impacts separately under Centralization at the Hanford Site, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site, and Alternative D addresses impacts under Centralization at the INEL.

b. Doses and fatalities include shipments of naval spent nuclear fuel (offsite and onsite, see Attachment A to Appendix B of Volume 1 of this EIS), DOE spent nuclear fuel (offsite and onsite, see Maheras 1995a and Maheras 1995d), university research reactor spent nuclear fuel (see Maheras 1995b), and foreign research reactor spent nuclear fuel (see Maheras 1995c).

c. Hanford = Hanford Site, SRS = Savannah River Site, ORR = Oak Ridge Reservation, NTS = Nevada Test Site, INEL = Idaho National Engineering Laboratory.

d. Occupational incident-free nonradiological fatalities are included with public incident-free nonradiological fatalities.

e. Nonradiological incident-free fatalities are not applicable onsite because the INEL is not an urban area.

vehicular emissions were about one-third of the total cancer fatalities for truck shipments and about five times the number of total cancer fatalities for train shipments.

For spent nuclear fuel, it can be seen that Alternative C (Centralization at Savannah River) yielded the largest collective doses (1000 person-rem occupational, 2,400 person-rem general population). Alternative A (No Action) yielded the smallest collective doses (4.9 person-rem occupational, 0.43 person-rem general population). Alternative B (1992/1993 Planning Basis and Regionalization by fuel type) yielded approximately equal collective doses; 270 and 360 person-rem (occupational) and 590 and 810 person-rem (general population).

5.11.2.3 Onsite Transportation Accidents. Tables 5.11-9 and 5.11-10 summarize the bounding impacts for onsite transportation of spent nuclear fuel and radioactive wastes, respectively.

The maximum reasonably foreseeable onsite spent nuclear fuel transportation accident involves the inadvertent shipment of a short-cooled fuel element (fuel out of the reactor for 10 to 25 days) from the Advanced Test Reactor to the Idaho Chemical Processing Plant. For this accident to occur, errors must occur to allow loading the wrong fuel element into the shipping cask, and radiation surveys of the loaded cask must fail to detect abnormally high radiation levels. In addition, the transport vehicle must break down or roll over during the short transit between the Advanced Test Reactor and the Idaho Chemical Processing Plant. Finally, operators must fail to maintain adequate cooling water inside the cask. The probability of this accident is, therefore, extremely unlikely with an annual frequency on the order of one in one million years for neutral meteorology to one in ten million years for stable meteorology. Because the estimated number of spent nuclear fuel shipments is expected to be the same for all alternatives, the annual frequency and consequences of the maximum reasonably foreseeable accident are identical for all alternatives. Table 5.11-9 shows that the fatal cancer risk for the population within 50 miles (80 kilometers) is on the order of one in one million years for a rural population zone and about one in 90,000 years for a suburban population zone.

Onsite transuranic waste shipments are expected to be dominated by shipments between the INEL Radioactive Waste Management Complex and Argonne National Laboratory-West as part of the characterization and certification program required for shipments of INEL transuranic waste to the Waste Isolation Pilot Plant. The maximum reasonably foreseeable accident is sufficient to breach a

Table 5.11-9. Maximum reasonably foreseeable accident doses and health effects for onsite transport of spent nuclear fuel for Alternatives A through D (1995 to 2035).

Population density category[a]	Meteorology[b]	Accident frequency[c] (events/year)	Dose to MEI[d] (rem)	Offsite population dose (person-rem)	Risk of fatal cancer per year[e]	
					MEI[d]	Population
Rural	Neutral	1×10^{-6}	76	1,500	6.1×10^{-8} (0.061)	7.5×10^{-7} (0.75)
Rural	Stable	1×10^{-7}	250	12,000	2.0×10^{-8} (0.20)	6.0×10^{-7} (6)
Suburban	Neutral	1×10^{-6}	76	21,000	6.1×10^{-8} (0.061)	1.1×10^{-5} (11)
Suburban	Stable	1×10^{-7}	250	170,000	2.0×10^{-8} (0.20)	8.5×10^{-6} (85)

a. Results are presented for generic rural and suburban population densities. The generic rural population density has an average population of 6 persons per square kilometer; the generic suburban population density has an average population of 7.19 persons per hectare. For comparison, the sector with the highest population density within 50 miles (80 kilometers) is due east of the Idaho Chemical Processing Plant-Test Reactor Area at the INEL with an average population density of 0.53 persons per hectare.

b. Neutral meteorology is characterized by Stability Class D, 4 meters (13 feet) per second wind speed, and occurs approximately 50 percent of the time. Stable meteorology is characterized by Stability Class F, 1 meter (3.28 feet) per second wind speed, and occurs approximately 5 percent of the time.

c. Accident frequency includes both the event frequency and the frequency of the meteorology. The frequency of stable meteorology is approximately one-tenth the frequency of neutral meteorology.

d. Maximally Exposed Individual located at the point of maximum exposure to the airborne release approximately 525 to 1,280 feet (160 to 390 meters) downwind, depending on meteorology. For onsite accidents, the MEI is assumed to be an INEL worker.

e. Fatal cancer risk = dose $\times$ accident frequency $\times$ (ICRP 60 risk factor for fatal cancers). The ICRP 60 risk factor is 5×10^{-4} fatal cancers per rem for the public, 4×10^{-4} fatal cancers per rem for workers. For doses $\geq$20 rem, the ICRP 60 conversion factor is doubled. Numbers in parentheses indicate likelihood of fatal cancer for the MEI or total number of fatal cancers in the population if the accident occurs.

Table 5.11-10. Maximum reasonably foreseeable accident doses and health effects for onsite transport of waste for Alternatives A through D (1995 to 2005).

Waste type	Population density category[a]	Meteorology[b]	Accident frequency[c] (events/year)	Dose to MEI[d] (rem)	Offsite population dose (person-rem)	Risk of fatal cancer per year[e]	
						MEI[d]	Population
Transuranic	Rural	Neutral	5.4×10^{-6}	0.41	0.75	8.9×10^{-10} (0.00016)	2.0×10^{-9} (0.00038)
	Rural	Stable	5.4×10^{-7}	1.4	6	3.0×10^{-10} (0.00056)	1.6×10^{-9} (0.003)
	Suburban	Neutral	5.4×10^{-6}	0.41	86	8.9×10^{-10} (0.00016)	2.3×10^{-7} (0.043)
	Suburban	Stable	5.4×10^{-7}	1.4	680	3.0×10^{-10} (0.00056)	1.8×10^{-7} (0.34)
Low-level and mixed-low-level	Rural	Neutral	3.9×10^{-5}	0.02	0.10	3.1×10^{-10} (8.0×10^{-6})	1.9×10^{-9} (4.8×10^{-5})
	Rural	Stable	3.9×10^{-6}	0.07	0.77	1.1×10^{-10} (2.7×10^{-5})	1.5×10^{-9} (0.00039)
	Suburban	Neutral	3.9×10^{-5}	0.02	4.9	3.1×10^{-10} (8.0×10^{-6})	9.6×10^{-8} (0.0025)
	Suburban	Stable	3.9×10^{-6}	0.07	39	1.1×10^{-6} (2.7×10^{-5})	7.6×10^{-8} (0.02)

a. Results are presented for generic rural and suburban population densities. The generic rural population density has an average population of 0.06 persons per hectare; the generic suburban population density has an average population of 7.19 persons per hectare. For comparison, the sector with the highest population density within 50 miles (80 kilometers) is due east of the Idaho Chemical Processing Plant-Test Reactor Area at the INEL with an average population density of 0.53 persons per hectare.

b. Neutral meteorology is characterized by Stability Class D, 4 meters (13 feet) per second wind speed, and occurs approximately 50 percent of the time. Stable meteorology is characterized by Stability Class F, 1 meter (3.28 feet) per second wind speed, and occurs approximately 5 percent of the time.

c. Accident frequency includes both the event frequency and the frequency of the meteorology. The frequency of stable meteorology is approximately one-tenth the frequency of neutral meteorology.

d. Maximally Exposed Individual located at the point of maximum exposure to the airborne release approximately 525 to 1,280 feet (160 to 390 meters) downwind, depending on meteorology. For onsite accidents, the MEI is assumed to be an INEL worker.

e. Fatal cancer risk = dose × accident frequency × (ICRP 60 risk factor for fatal cancers). The ICRP 60 risk factor is 5×10^{-4} fatal cancers per rem for the public, 4×10^{-4} fatal cancers per rem for workers. For doses ≥20 rem, the ICRP 60 conversion factor is doubled. Numbers in parentheses indicate likelihood of fatal cancer for the MEI or total number of fatal cancers in the population if the accident occurs.

f. Maximum reasonably foreseeable accident results for transuranic waste are the same for Alternatives A-D. For low-level and mixed low-level wastes, maximum reasonably foreseeable accident doses are the same for all alternatives, but the accident frequencies (and, therefore, the fatal cancer risks) for Alternatives B and D (shown in table) are about 40 percent higher than Alternatives A and C.

Type B shipping container and release its contents. Because of the rigorous safety standards required for Type B containers, the probability of the maximum reasonably foreseeable accident is extremely unlikely, with an annual frequency on the order of one accident in 200,000 years for neutral meteorology to one accident in two million years for stable meteorology. Because the estimated number of onsite transuranic waste shipments is expected to be approximately the same for all alternatives, the annual frequency and consequences of the maximum reasonably foreseeable accident are identical for all alternatives. Table 5.11-10 shows that the fatal cancer risk for the population within 50 miles (80 kilometers) is on the order of one in 500 million years for a rural population zone and about one in four million years for a suburban population zone.

Onsite low-level and mixed low-level waste shipments are expected to be dominated by shipments of routine operational waste from INEL facilities to INEL treatment, storage, and disposal facilities. Some variability in the number of shipments, and consequently the probability of accidents, is seen as a result of environmental restoration and decontamination and decommissioning activities. Total waste shipment mileage for Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) is about 40 percent higher than Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal). Consequently, the maximum reasonably foreseeable accident doses are the same for all alternatives, but the annual frequencies are highest for Alternatives B and D. The results shown in Table 5.11-10 reflect the higher accident frequencies for Alternatives B and D. Table 5.11-10 shows that the fatal cancer risk for the population within 50 miles (80 kilometers) is on the order of one in two million years for a rural population zone and about one in 18,000 years for a suburban population zone.

5.11.2.4 Offsite Transportation Accidents. Tables 5.11-11 and 5.11-12 summarize accident risks for offsite transportation of radioactive wastes and spent nuclear fuel, respectively, for all alternatives. Tables 5.11-13 and 5.11-14 summarize maximum reasonably foreseeable accident consequences for the radioactive waste and spent nuclear fuel shipments under all alternatives.

5.11.2.5 Hazardous Material Transportation Accidents. Table 5.11-15 shows the results of the analysis of the maximum reasonably foreseeable-case truck accident scenario for all alternatives. Meteorological conditions were specified at 50 and 95 percent to develop plumes for each Emergency Response Planning Guideline using the EPIcode™. The probability of a releasing accident is summed over shipments originating with each contractor for each population density. This

Table 5.11-11. Accident risks for offsite transport of waste for Alternatives A through D (1995 to 2005).

	Alternatives[a]							
	A		B		C		D	
Waste type	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail
Estimated collective dose risk (person-rem)[b]								
Transuranic	0.0024	5.2×10^{-5}	0.12	0.0081	0.011	0.0016	0.15	0.0087
Low-level	5.5	0.67	5.5	0.67	1.2	0.09	3.7	0.13
Mixed low-level	0.0	0.0	0.0	0.0	0.35	0.027	0.046	0.0017
Total	5.5	0.67	5.6	0.68	1.6	0.12	3.9	0.14
Estimated risk of cancer fatalities[c]								
Transuranic	1.2×10^{-6}	2.6×10^{-8}	6.0×10^{-5}	4.1×10^{-6}	5.5×10^{-6}	8.0×10^{-7}	7.5×10^{-5}	4.4×10^{-6}
Low-level	0.0028	0.00034	0.0028	0.00034	0.0006	4.5×10^{-5}	0.0019	6.5×10^{-5}
Mixed low-level	0.0	0.0	0.0	0.0	0.00018	1.4×10^{-5}	2.3×10^{-5}	8.5×10^{-7}
Total	0.0028	0.00034	0.0029	0.00034	0.00078	5.9×10^{-5}	0.002	7.0×10^{-5}
Estimated risk of nonradiological fatalities[d]								
Transuranic	0.24	0.0022	1.9	0.024	0.39	0.0049	2.4	0.029
Low-level	0.059	0.001	0.059	0.001	0.021	0.00048	0.84	0.012
Mixed low-level	0.0	0.0	0.0	0.0	0.0068	0.00016	0.11	0.0018
Total	0.30	0.0032	2.0	0.025	0.42	0.0055	3.4	0.043

a. Alternative A (No Action); Alternative B (Ten-Year Plan); Alternative C (Minimum Treatment, Storage, and Disposal); Alternative D (Maximum Treatment, Storage, and Disposal).

b. Collective dose risk is a probabilistic dose estimate that represents the product of population dose and accident probability summed over the entire range of potential transportation accidents.

c. Increased risk of cancer fatalities in excess of normal incidence. Fatal cancer risk = dose risk (person-rem) x 5 x 10^{-4} fatal cancers per rem - ICRP 60 risk factor (ICRP 1991).

d. Risk of fatality resulting from physical impacts associated with a transportation accident.

Table 5.11-12. Accident risks for offsite transport of spent nuclear fuel for Alternatives A through D (1995 to 2035).

	Alternatives[a,b]							
	A	B		C				D
Transport mode	A	Planning basis	Fuel type	HS	SRS	ORR	NTS	INEL
				Estimated collective dose risk (person-rem)[c]				
Truck	0.0082	2.0	2.1	10	3.9	3.4	10	9.6
Rail	0.0082	0.69	0.73	2.6	1.6	1.1	2.7	2.5
				Estimated risk of cancer fatalities[d]				
Truck	4.1×10^{-6}	0.0010	0.0011	0.0050	0.0020	0.0017	0.0050	0.0048
Rail	4.1×10^{-6}	0.00035	0.00037	0.0013	0.00080	0.00055	0.0014	0.0013
				Estimated risk of nonradiological fatalities[e]				
Truck	0.047	0.70	0.77	1.1	1.4	1.4	1.3	1.0
Rail	0.047	0.73	0.76	1.1	1.1	1.0	1.2	1.0

a. Alternative A addresses impacts under No Action; Alternative B addresses impacts separately under 1992/1993 Planning Basis and Regionalization by fuel type; Alternative C addresses impacts separately under Centralization at the Hanford Site, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site; and Alternative D addresses impacts under Centralization at the INEL.

b. Doses and health effects include offsite shipments of naval spent nuclear fuel (see Attachment A to Appendix D of Volume 1 of this Environmental Impact Statement), Department of Energy spent nuclear fuel, university research reactor spent nuclear fuel, and foreign research reactor spent nuclear fuel.

c. Collective dose risk is a probabilistic dose estimate that represents the product of population dose and accident probability summed over the entire range of potential transportation accidents.

d. Increased risk of cancer fatalities in excess of normal incidence.

e. Risk of fatality resulting from physical impacts associated with a transportation accident.

Table 5.11-13. Maximum reasonably foreseeable accident doses and health effects for offsite transport of waste for Alternatives A through D (1995 to 2005).

Waste type	A		B		C		D	
	Neutral	Stable	Neutral	Stable	Neutral	Stable	Neutral	Stable
Maximum reasonably foreseeable accident probability (per year)[b]								
Transuranic	3.3×10^{-6}	3.3×10^{-7}	3.4×10^{-4}	3.4×10^{-5}	6.1×10^{-5}	6.1×10^{-6}	4.1×10^{-4}	4.1×10^{-5}
Low-level	3.8×10^{-3}	3.8×10^{-4}	3.8×10^{-3}	3.8×10^{-4}	8.8×10^{-5}	8.8×10^{-6}	1.6×10^{-3}	1.6×10^{-4}
Mixed low-level	0.0	0.0	0.0	0.0	5.9×10^{-4}	5.9×10^{-5}	2.7×10^{-4}	2.7×10^{-5}
Estimated maximum individual dose (rem)								
Transuranic	1.0	3.5	3.6	12	2.1	6.9	10	34
Low-level	0.10	0.34	0.10	0.34	0.04	0.14	6.5	22
Mixed low-level	0.0	0.0	0.0	0.0	0.04	0.12	4.2	14
Estimated collective dose (person-rem)[c]								
Transuranic	1,200	9,300	4,000	32,000	2,300	19,000	11,000	92,000
Low-level	130	1,100	130	1,100	53	420	7,200	58,000
Mixed low-level	0.0	0.0	0.0	0.0	48	380	4,700	38,000
Estimated cancer fatalities[d]								
Transuranic	0.6	4.7	2.0	16	1.2	9.5	5.5	46
Low-level	0.07	0.55	0.07	0.55	0.03	0.21	3.6	29
Mixed low-level	0.0	0.0	0.0	0.0	0.02	0.19	2.4	19

Column group heading: Alternatives[a]

a. Alternative A (No Action); Alternative B (Ten-Year Plan); Alternative C (Minimum Treatment, Storage, and Disposal); Alternative D (Maximum Treatment, Storage, and Disposal).

b. Annual accident probability, 1995 through 2005. Rail transportation accidents are bounding for all alternatives.

c. Collective dose based on urban population density. Corresponding doses for suburban and rural population zones would be approximately 19 percent and 0.3 percent, respectively, of the urban doses.

d. Estimated cancer fatalities = collective dose (person-rem) x 5×10^{-4} fatal cancers per rem - ICRP 60 risk factor (ICRP 1991).

Table 5.11-14. Maximum reasonably foreseeable accident doses and health effects for offsite transport of spent nuclear fuel for Alternatives A through D (1995 to 2035).

	Alternatives[a,b]							
	A	B		C				D
Atmospheric conditions	A	Planning basis	Fuel type	HS	SRS	ORR	NTS	INEL
Maximum reasonably foreseeable accident probability (per year)[c]								
Neutral	1.4×10^{-6}	2.0×10^{-7}	2.8×10^{-7}	5.1×10^{-7}	1.7×10^{-7}	1.1×10^{-7}	1.0×10^{-7}	4.7×10^{-7}
Stable	2.4×10^{-7}	1.0×10^{-7}	1.1×10^{-7}	3.6×10^{-7}	1.2×10^{-7}	5.7×10^{-7}	5.0×10^{-7}	3.3×10^{-7}
Estimated maximum individual dose (rem)								
Neutral	0.0034	54	54	54	54	54	54	54
Stable	0.014	180	180	180	180	180	180	180
Estimated collective dose (person-rem)[d]								
Neutral	13[u]	13,000[s]	13,000[s]	13,000[s]	72,000[u]	72,000[u]	72,000[u]	13,000[s]
Stable	25[u]	3,500[r]	3,500[r]	3,500[r]	110,000[s]	3,500[r]	3,500[r]	3,500[r]
Estimated cancer fatalities								
Neutral	0.0065	7	7	7	36	36	36	7
Stable	0.013	2	2	2	55	2	2	2

a. Alternative A addresses impacts under No Action; Alternative B addresses impacts separately under 1992/1993 Planning Basis and Regionalization by fuel type; Alternative C addresses impacts under Centralization at the Hanford Site (HS), Savannah River Site (SRS), Oak Ridge Reservation (ORR), or Nevada Test Site (NTS); and Alternative D addresses impacts under Centralization at the Idaho National Engineering Laboratory (INEL).

b. Doses and health effects include offsite shipments of naval spent nuclear fuel (see Attachment A to Appendix D of Volume 1 of this Environmental Impact Statement), Department of Energy spent nuclear fuel, university research reactor spent nuclear fuel, and foreign research reactor spent nuclear fuel.

c. Annual accident probability for 1995 through 2035. Rail transportation accidents are bounding for all alternatives except A.

d. Collective doses presented for the highest population density zone where the probability of the maximum reasonably foreseeable accident is greater than or equal to 1×10^{-7} per year. Urban zone doses denoted by "u"; suburban zone doses denoted by "s"; rural zone doses denoted by "r".

Table 5.11-15. Summary of releasing accident probability and consequences for nitric acid.

Population area	Probability and affected population	Meteorological conditions	
		Neutral	Stable
Rural population	Probability of releasing accident	0.00047	0.000047
	Emergency Response Planning Guideline-1 maximum affected population	11	0
	Emergency Response Planning Guideline-2 maximum affected population	1	0
	Emergency Response Planning Guideline-3 maximum affected population	1	0
Suburban population	Probability of releasing accident	0.00025	0.000025
	Emergency Response Planning Guideline-1 maximum affected population	683	28,420
	Emergency Response Planning Guideline-2 maximum affected population	81	1,626
	Emergency Response Planning Guideline-3 maximum affected population	38	668
Urban population	Probability of releasing accident	0.000047	0.0000047
	Emergency Response Planning Guideline-1 maximum affected population	3,445	143,338
	Emergency Response Planning Guideline-2 maximum affected population	410	8,203
	Emergency Response Planning Guideline-3 maximum affected population	190	3,368

shows the probability per year of a particular population being exposed to a certain chemical. The maximum affected population is the maximum number of receptors to all possible accident events.

In this assessment, it has been assumed that anyone residing within an Emergency Response Planning Guideline contour would experience an adverse effect. In other words, 100 percent probability of effect was assumed. This is a conservative assumption, because the adverse effect levels have incorporated uncertainty factors to account for sensitive human subpopulations. It is more likely that only a portion of the exposed population would experience adverse effects.

5.11.2.6 Regional Traffic Impacts. Using the methodology described in Section 5.11.1.5 and TRB (1994), the baseline level of service for the road system surrounding the INEL is Level-of-Service A or free flowing (Lehto 1994). This was based on data for U.S. Highway 20, the regional highway with the highest use around the INEL and a likely route for materials that are transported to the INEL. In addition, the peak number of vehicles per hour would have to increase from 122 to 291 to transform U.S. Highway 20 from Level-of-Service A to Level-of-Service B. The peak number of vehicles per hour on U.S. Highway 20 would have to increase from 122 to 2,126 to exceed the capacity of the highway.

Using the shipment counts outlined in Lehto (1994), the increased movements of materials and people due to all alternatives would increase the maximum number of vehicles per hour to 150, which is still within the range of Level-of-Service A and would result in no change to the level of service associated with US Highway 20. This maximum number of vehicles per hour is associated with Alternative D (Maximum Treatment, Storage, and Disposal). In addition, the number of vehicles per hour would have to increase by a factor of over 10 to exceed the capacity of the highway. Based on these results, the impacts to the regional traffic system around the INEL would be minimal for all alternatives.

5.12 Health and Safety

The purpose of this section is to present the potential health effects to both workers and the public as a result of the environmental restoration and waste management alternatives under consideration at the INEL. The potential health effects in this section are estimated to result from operations at the INEL from 1995 to 2005.

This section provides estimates of health impacts to workers and the public from releases of radioactive and nonradioactive contaminants to the atmosphere and groundwater. It also estimates injury, illness, and occupational fatalities based on observed rates for DOE and its contractors. Radiological impacts to workers are estimated using the average dose rate per year for INEL employees. A detailed explanation of the health effects methodology is contained in Appendix F, Section F-4, Health and Safety, of this EIS.

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

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

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

The maximum annual allowable radiation dose to the members of the public from DOE-operated nuclear facilities is 100 millirem per year, as stated in DOE Order 5400.5. All DOE and naval facilities covered by this EIS operate well below this limit. It is estimated that the average individual in the United States receives a dose of about 300 millirem (0.3 rem) per year from all sources combined, including natural and medical sources of radiation. For perspective, a chest x-ray results in an approximate dose of 8 millirem, while a diagnostic hip x-ray results in an approximate dose of 83 millirem. A person must receive an acute (short-term) dose of approximately 600,000 millirem before there is a high probability of near-term death (NAS/NRC 1990).

Radiation can also cause a variety of ill-health effects in people. The most significant ill-health effect to depict the consequences of environmental and occupational radiation exposures is induction of latent cancer fatalities. This effect is referred to as latent cancer fatalities because it may take many years for cancer to develop and for death to occur, and cancer may never actually be the cause of death.

The collective (or population) dose to an exposed population is calculated by summing the estimated doses received by each member of the exposed population. This total dose received by the exposed population is measured in person-rem. For example, if 1,000 people each received a dose of 1 millirem (0.001 rem), the collective dose would be 1,000 persons $\times$ 0.001 rem $=$ 1.0 person-rem. Alternatively, the same collective dose (1.0 person-rem) would result from 500 people each of whom received a dose of 2 millirem.

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

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

Sometimes, calculations of the number of latent cancer fatalities associated with radiation exposure do not yield whole numbers, and, especially in environmental applications, may yield numbers less than 1.0. For example, if a population of 100,000 were exposed as above, but to a total dose of only 0.001 rem, the collective dose would be 100 person-rem, and the corresponding estimated number of latent cancer fatalities would be 0.05 (100,000 persons × 0.001 rem × 0.0005 latent cancer fatalities/person-rem = 0.05 fatal cancers).

How should one interpret a noninteger number of latent cancer fatalities, such as 0.05? The answer is to interpret the result as a statistical estimate. That is, 0.05 is the *average* number of deaths that would be expected if the same exposure situation were applied to many different groups of 100,000 people. In most groups, no one (zero people) would incur a latent cancer fatality from the 1 millirem dose each member would have received. In a small fraction of the groups, one fatal cancer would result; in exceptionally few groups, two or more fatal cancers would occur. The *average* number of deaths over all the groups would be 0.05 fatal cancers (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome is zero latent cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on a single individual. Consider the effects, for example, of exposure to background radiation over a lifetime. The "number of latent cancer fatalities" corresponding to a single individual's exposure over a (presumed) 72-year lifetime to 0.3 rem per year is the following:

1 person × 0.3 rem/year × 72 years × 0.0005 latent cancer fatalities/person-rem
= 0.011 latent cancer fatalities.

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

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

In addition to latent cancer fatalities, other health effects could result from environmental and occupational exposures to radiation. These effects include nonfatal cancers among the exposed population and genetic effects in subsequent generations. For clarity and to allow ready comparison with health impacts from other sources, such as those from chemical carcinogens, this EIS presents estimated effects of radiation only in terms of latent cancer fatalities. The nonfatal cancers and genetic effects are less probable consequences of radiation exposure, and in some respects less serious. Further discussion on this topic is provided in Appendix F, Section F-4, Health and Safety, of this EIS.

5.12.1 Health Effects to the Public and Workers from Releases to the Environment

In general, health impacts are estimated for releases of radioactive and nonradioactive contaminants to air and groundwater. The impact analysis and discussion focuses on those contaminants and exposure pathways that have the potential to contribute to adverse environmental consequences. For example, there are no permanent surface waters on the INEL and no surface drainage from the INEL to offsite locations. Therefore, Volume 2 of this EIS does not include a detailed analysis of this exposure pathway.

Health risks from air emissions to workers and the public are estimated by modeling worst-case emission scenarios for the various alternatives. These health effects are presented and compared with baseline health effects originally presented in Section 4.12 of this EIS. These modeled emissions are used to postulate maximum potential exposure levels in the onsite and offsite environments over the period of evaluation. Health effects calculated using this type of information provide an extremely conservative "worst-case" estimate of potential health effects.

Health risks from water for onsite workers were made using either modeled groundwater data (described in Appendix F of this EIS) or, where current levels represent the highest projected contaminant levels, drinking water distribution sample data reported by Anderson and Peterson-Wright (1993). Health effects estimates from offsite groundwater contaminants were calculated using the highest of either modeled or reported groundwater concentrations. These concentration estimates are based on those discussed in Section 5.8, Water Resources, of this EIS.

5.12.1.1 Health Effects Resulting from Atmospheric Releases. For routine airborne releases from facilities, health effects were assessed for the following three categories of exposed individuals: (a) the maximally exposed individual located at the INEL site boundary, (b) the population within 50 miles (80 kilometers) of the operating facilities, and (c) the maximally exposed onsite worker.

5.12.1.1.1 Radiological Health Risk—The human health risk associated with radiological air emissions is assessed based on risk factors contained in *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991). The measure of impact used for evaluating potential radiation exposures is risk of fatal cancers. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in millirem) and the estimated lifetime probability of fatal cancer.

For the calculation of health effects from exposure to airborne radionuclides, the modeled doses provided in Section 5.7 of this EIS were multiplied by the appropriate risk factors from ICRP (1991). The risk for individuals is expressed as the increased lifetime risk of developing fatal cancer. The risk for the public is expressed as the number of estimated fatal cancers in the affected population. For both the individual and the public, the estimated risk, as presented in this section, is calculated from the ten-year dose; that is, the total radiation dose received during the ten-year period from 1995 to 2005. A detailed explanation of the health effects methodology is contained in Appendix F, Section F-4, Health and Safety, of this EIS.

Tables 5.12-1 and 5.12-2 provide summaries of the ten-year dose, risk factor, and estimated increased lifetime risk of developing fatal cancer based on the exposure associated with the four alternatives and the baseline exposure (Sections 4.7 and 4.12 of this EIS). These data are presented for the maximally exposed onsite worker, the maximally exposed individual at the site boundary, and the surrounding population for the period from 1995 to 2005. Incremental doses are those that result from activities conducted under the alternatives. Baseline doses result from other activities at the INEL. They assume all permitted sources of the INEL release pollutants to the maximum allowed by operating permits or applicable regulation.

INEL Worker. The risks to an INEL worker at the location of highest dose from airborne radionuclide emissions would vary between the alternatives. As shown in Table 5.12-1, the maximum risk would be for Alternative D (Maximum Treatment, Storage, and Disposal)—about one occurrence in 500,000 for fatal cancer. The minimum risk would be for Alternative A (No Action)—about 1 occurrence in 769,000 for fatal cancer.

Maximally Exposed Individual. As shown in Table 5.12-1, the risk to the maximally exposed individual in the vicinity of the INEL would be highest for Alternative D (Maximum Treatment, Storage, and Disposal). The fatal cancer risk would be about 1 occurrence in 238,000. These risks, while very low, are somewhat higher than the other alternatives because of the release of radionuclides associated with spent nuclear fuel processing on a large scale. The risk to the maximally exposed individual would be lowest for Alternative A (No Action)—about 1 occurrence in 1 million.

Public. As shown in Table 5.12-2, the risk of a fatal cancer effect among the entire surrounding population would be highest for Alternative D. For this alternative, based on the total ten-year exposure, there would be 0.02 fatal cancers expected over the next 70 years. The lowest risk is for Alternative A. For this alternative, based on the total ten-year exposure, there would be 0.003 fatal cancers expected over the next 70 years.

Table 5.12-1. Ten-year dose and resulting lifetime fatal cancer risk for maximally exposed individuals by Idaho National Engineering Laboratory alternative.

	Baseline ten-year dose (millirem)[a]	Risk of fatal cancer[b]	Incremental ten-year dose (millirem)[c]	Risk of fatal cancer[b]	Cumulative ten-year dose (millirem)	Risk of fatal cancer[b]
Alternative A (No Action)						
Site worker	3.2×10^{0}	1.3×10^{-6}	1.4×10^{-1}	5.6×10^{-8}	3.3×10^{0}	1.3×10^{-6}
Offsite individual	5.0×10^{-1}	2.5×10^{-7}	9.2×10^{-1}	4.6×10^{-7}	1.4×10^{0}	7.1×10^{-7}
Alternative B (Ten-Year Plan)						
Site worker	3.2×10^{0}	1.3×10^{-6}	1.4×10^{0}	5.6×10^{-7}	4.6×10^{0}	1.9×10^{-6}
Offsite individual	5.0×10^{-1}	2.5×10^{-7}	5.8×10^{0}	2.9×10^{-6}	6.3×10^{0}	3.2×10^{-6}
Alternative C (Minimum Treatment, Storage, and Disposal)						
Site worker	3.2×10^{0}	1.3×10^{-6}	1.4×10^{-1}	5.6×10^{-8}	3.3×10^{0}	1.3×10^{-6}
Offsite individual	5.0×10^{-1}	2.5×10^{-7}	1.1×10^{0}	5.5×10^{-7}	1.6×10^{0}	8.0×10^{-7}
Alternative D (Maximum Treatment, Storage, and Disposal)						
Site worker	3.2×10^{0}	1.3×10^{-6}	1.7×10^{0}	6.8×10^{-7}	4.9×10^{0}	2.0×10^{-6}
Offsite individual	5.0×10^{-1}	2.5×10^{-7}	7.9×10^{0}	4.0×10^{-6}	8.4×10^{0}	4.2×10^{-6}

a. Location of maximum onsite baseline dose is Test Reactor Area; dose includes emissions from existing and foreseeable facilities, but not from temporary operations or natural background radiation.

b. Estimated increased lifetime chance of developing fatal cancer from ten-year dose.

c. Incremental dose specified is for highest predicted area (not necessarily the same location as maximum baseline dose).

Table 5.12-2. Ten-year population dose and estimated resulting fatal cancers by Idaho National Engineering Laboratory alternative.[a]

	Ten-year dose (person-rem)	Total fatal cancers[b]	Ten-year dose (person-rem)	Total fatal cancers[b]	Ten-year dose (person-rem)	Total fatal cancers[b]	Ten-year dose (person-rem)	Total fatal cancers[b]
	Alternative A[c]		Alternative B[d]		Alternative C[e]		Alternative D[f]	
Baseline	3.0×10^{0}	1.5×10^{-3}	3.0×10^{0}	1.5×10^{-3}	3.0×10^{0}	1.5×10^{-3}	3.0×10^{0}	1.5×10^{-3}
Increment	3.7×10^{0}	1.9×10^{-3}	2.6×10^{1}	1.3×10^{-2}	4.9×10^{0}	2.5×10^{-3}	3.5×10^{1}	1.8×10^{-2}
Cumulative	6.7×10^{0}	3.4×10^{-3}	2.9×10^{1}	1.5×10^{-2}	7.9×10^{0}	4.0×10^{-3}	3.8×10^{1}	1.9×10^{-2}

a. Cumulative radiation dose (person-rem) to the population within 50 miles (80 kilometers) of site facilities resulting from INEL operaations from 1995 to 2005.

b. Total number of fatal cancers over the lifetime of all individuals in the exposed population.

c. Alternative A (No Action).

d. Alternative B (Ten-Year Plan).

e. Alternative C (Minimum Treatment, Storage, and Disposal).

f. Alternative D (Maximum Treatment, Storage, and Disposal).

5.12.1.1.2 Nonradiological Health Risk—An assessment has been performed to estimate the potential effects on human health associated with each of the environmental restoration and waste management alternatives. All of the risks presented in this section are cumulative in that they include risks associated with the maximum baseline, foreseeable increases to the baseline, and the actions. Criteria pollutants, carcinogens, and noncarcinogenic toxic air pollutants were evaluated for potential health effects utilizing the methodology outlined in Appendix F, Section F-4, Health and Safety, of this EIS.

Estimated onsite levels of toxic air pollutants reflect maximum predicted levels averaged over an eight-hour period to which site workers might be exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration, whichever is lower. The results indicate that the onsite hazard quotients for carcinogenic and noncarcinogenic toxic air pollutants, with the exception of benzene, from any alternative are less than 1. As described in Section 4.12 of this EIS, the onsite baseline hazard quotient for benzene is approximately 1. Benzene contributions from Alternative D (Maximum Treatment, Storage, and Disposal), the highest of the alternatives, represent a very small increase (about one-tenth of 1 percent) to the baseline hazard quotient. The hazard quotients of all other toxic air pollutants are well below 1.

Hazard quotients, at the site boundary and public roads, associated with the various alternatives are presented in Table 5.12-3. The air concentrations producing these hazard quotients are presented in Section 4.7, Table 4.7-8 and Section 5.7, Table 5.7-7, of this EIS. The locations of these modeled concentrations are dependent on different points and times of release, so that no individual could be exposed to all of these chemicals at once. The hazard quotients for these chemicals are less than one for all chemicals under all alternatives. This indicates that no adverse health effects are projected as a result of noncarcinogenic emissions.

Lifetime cancer risks from offsite concentration of carcinogenic air pollutants are presented in Table 5.12-4. The human health risk for carcinogens is assessed for individuals offsite at areas with the highest estimated carcinogen air concentrations. The offsite cancer risk is less than 2.0×10^{-6} for each alternative. This corresponds to about 1 occurrence in 500,000 of developing cancer. For each alternative, the majority (greater than 90 percent) of the total risk is attributable to emissions

Table 5.12-3. Hazard quotients from noncarcinogenic toxic air pollutants at the site boundary and public roads on the Idaho National Engineering Laboratory site by alternative.[a]

Toxic air pollutant	Location	Baseline hazard quotient	Hazard quotient (alternative + baseline)			
			Alternative A[b]	Alternative B[c]	Alternative C[d]	Alternative D[e]
Ammonia	Public road	0.03	0.03	0.03	0.03	0.03
	Site boundary	<0.01	<0.01	<0.01	<0.01	<0.01
Freon	Public road	<0.01	<0.01	<0.01	<0.01	<0.01
	Site boundary	<0.01	<0.01	<0.01	<0.01	<0.01
Hydrochloric acid	Public road	0.13	0.13	0.14	0.13	0.14
	Site boundary	0.01	0.01	0.02	0.01	0.02
Hydrofluoric acid	Public road	NA	<0.01	<0.01	<0.01	<0.01
	Site boundary	NA	<0.01	<0.01	<0.01	<0.01
Mercury	Public road	0.04	0.04	0.04	0.04	0.04
	Site boundary	0.01	0.01	0.01	0.01	0.01
Methyl isobutyl ketone	Public road	NA	NA	NA	NA	<0.01
	Site boundary	NA	NA	NA	NA	<0.01
Nitric acid	Public road	0.01	0.01	0.01	0.01	0.01
	Site boundary	0.01	0.01	0.01	0.01	0.01
Sulfuric acid	Public road	NA	<0.01	<0.01	<0.01	<0.01
	Site boundary	NA	<0.01	<0.01	<0.01	<0.01
Toluene	Public road	0.10	0.10	0.10	0.10	0.10
	Site boundary	<0.01	<0.01	<0.01	<0.01	<0.01
Tributyl phosphate	Public road	NA	NA	<0.01	NA	<0.01
	Site boundary	NA	NA	<0.01	NA	<0.01
Trivalent chromium	Public road	0.01	0.01	0.01	0.01	0.01
	Site boundary	<0.01	<0.01	<0.01	<0.01	<0.01

a. Highest predicted eight-hour concentrations.

b. Alternative A (No Action).

c. Alternative B (Ten-Year Plan).

d. Alternative C (Minimum Treatment, Storage, and Disposal).

e. Alternative D (Maximum Treatment, Storage, and Disposal).

Table 5.12-4. Estimated lifetime cancer risk for offsite individuals from carcinogenic air pollutants by Idaho National Engineering Laboratory alternative.[a]

Toxic air pollutant	Total baseline cancer risk[b]	Total cancer risk (alternative + baseline)			
		Alternative A[c]	Alternative B[d]	Alternative C[e]	Alternative D[f]
Arsenic	3.9×10^{-7}	3.9×10^{-7}	3.9×10^{-7}	3.9×10^{-7}	4.0×10^{-7}
Asbestos	0.0×10^{0}	4.6×10^{-10}	4.6×10^{-10}	4.6×10^{-10}	4.6×10^{-10}
Benzene	2.4×10^{-7}	2.5×10^{-7}	2.8×10^{-7}	2.5×10^{-7}	2.8×10^{-7}
Beryllium	0.0×10^{0}	4.8×10^{-10}	9.6×10^{-10}	4.8×10^{-10}	9.6×10^{-10}
Cadmium compounds	0.0×10^{0}	1.8×10^{-11}	4.5×10^{-9}	1.8×10^{-11}	1.5×10^{-8}
Carbon tetrachloride	9.0×10^{-8}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}
Chloroform	9.2×10^{-9}	1.1×10^{-8}	1.1×10^{-8}	1.1×10^{-8}	1.1×10^{-8}
Formaldehyde	1.6×10^{-7}	2.4×10^{-7}	8.1×10^{-7}	2.4×10^{-7}	8.1×10^{-7}
Hexavalent chromium	7.2×10^{-7}	7.2×10^{-7}	7.9×10^{-7}	7.2×10^{-7}	7.9×10^{-7}
Methylene chloride	2.8×10^{-9}	9.4×10^{-9}	9.4×10^{-9}	9.4×10^{-9}	9.4×10^{-9}
Nickel	1.1×10^{-5}	1.2×10^{-5}	1.7×10^{-5}	1.2×10^{-5}	1.7×10^{-5}
Perchloroethylene	5.3×10^{-8}	5.3×10^{-8}	5.3×10^{-8}	5.3×10^{-8}	5.3×10^{-8}
Polychlorinated biphenyls	NA	NA	NA	NA	NA
Trichloroethylene	1.6×10^{-9}	2.4×10^{-9}	2.4×10^{-9}	2.4×10^{-9}	2.4×10^{-9}
Total	1.3×10^{-5}	1.3×10^{-5}	1.9×10^{-5}	1.3×10^{-5}	1.9×10^{-5}

a. Based on continuous exposure to the highest predicted concentration at the INEL site boundary.

b. Includes foreseeable increases to the baseline.

c. Alternative A (No Action).

d. Alternative B (Ten-Year Plan).

e. Alternative C (Minimum Treatment, Storage, and Disposal).

f. Alternative D (Maximum Treatment, Storage, and Disposal).

associated with the maximum baseline. The incremental impacts due to the alternatives make only small additions to the baseline.

For all criteria pollutants, both onsite and offsite, the calculated hazard quotients, both onsite and offsite, were less than one. This indicates that no additional adverse health effects are projected as a result of criteria pollutant emissions from any of the alternatives. For carcinogenic emissions associated with all alternatives, calculated hazard quotients, both onsite and offsite, were less than one. This indicates that no adverse health effects are expected as a result of criteria pollutant emissions from these alternatives.

5.12.1.2 Health Effects Resulting from Groundwater Releases. This section summarizes potential health effects to both onsite and offsite populations due to radionuclides and carcinogenic and noncarcinogenic chemicals in water. More detailed information on concentrations of these pollutants is contained in Section 5.8, Water Resources, of this EIS. Discussion of health effects calculations are contained in Appendix F, Section F-4, Health and Safety.

5.12.1.2.1 Potential Health Effects to the Worker—Estimates of potential health effects for onsite workers were made using either modeled groundwater data (described in Appendix F, Section F-4, of this EIS) or, where current levels represent the highest projected contaminant levels, drinking water distribution sample data reported by Anderson and Peterson-Wright (1993).

The highest average radionuclide concentration in a site drinking water distribution system occurred at the Central Facilities Area (Anderson and Peterson-Wright 1993). The radionuclide measured was tritium, at a concentration of approximately 16,000 picocuries per liter. This concentration also represents the highest projected tritium concentration to reach a drinking water distribution system. This level is below U.S. Environmental Protection Agency drinking water standard of 20,000 picocuries per liter and is projected to decrease because of changes in facility procedures, dilution in the aquifer, and radioactive decay.

Consumption of this water for 50 years would result in an estimated dose equivalent of 14 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 180,000.

Iodine-129, at a concentration of 0.75 picocuries per liter (maximum contaminant level = 1 picocurie per liter), is projected to reach Well No. 2 at the Central Facilities Area in the year 2010. Consumption of this water for 50 years would result in an estimated dose equivalent of 2.7 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 929,000.

Groundwater with a strontium-90 concentration of 1.5 picocuries per liter (maximum contaminant level of 8 picocuries per liter) and an iodine-129 concentration of 0.65 picocuries per liter is projected to reach Well No. 2 at the Central Facilities Area in the year 2030. Consumption of this water for 50 years would result in an estimated dose equivalent of 5.1 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 489,000.

Trichloroethylene at concentrations above the U.S. Environmental Protection Agency standards is projected to reach Test Area North drinking water supply wells. The maximum concentration of 0.058 milligrams per liter is projected to occur at the Water Reactor Research Test Facility Well (TAN-644) in the year 2024. However, if concentrations exceed maximum contaminant levels, then either a sparging system would be installed or the well would no longer be used for drinking water. Trichloroethylene concentrations in drinking water below the maximum contaminant level (0.005 milligrams per liter) would indicate an excess incidence of cancer risk of less than 1 occurrence in 1 million.

For all reported noncarcinogenic chemical contaminants, the calculated hazard quotients (that is, the ratio of contaminant to reference dose) were less than 1. This indicates that no adverse health effects are expected as a result of these contaminants.

5.12.1.2.2 Potential Health Effects to the Public—For the public, health effects were estimated using an iodine-129 concentration of 0.00083 picocuries per liter, measured at the site boundary in 1992 (Mann 1994). Consumption of this water for the lifetime of an individual would result in an estimated dose equivalent of 0.012 millirem, with a corresponding estimated fatal cancer risk of about 1 occurrence in 170 million.

5.12.2 Occupational Health and Safety

All of the activities to be performed by workers under each of the alternatives are similar to those currently performed at the INEL. Some of the workers involved in the alternatives would be engaged in activities that may expose them to radiation and other workplace hazards at levels greater than current averages. However, other workers will be engaged in activities that are much less hazardous. Therefore, for all alternatives, the potential hazards encountered in the workplace will be similar to those that currently exist at the INEL. Furthermore, these hazards will be mitigated by occupational and radiological safety programs operating under the same regulatory standards and limits that currently apply at the INEL. For these reasons, the average radiation dose and the number of reportable cases of injury and illness are anticipated to be proportional to the number of workers at the INEL under each alternative.

The estimated occupational impacts reported in this section are based on the current average occupational radiation dose rates and injury/illness and workplace fatality incidence rates presented in Section 4.12, Health and Safety, of this EIS. These rates have been applied to the estimated number of INEL workers under each alternative as presented in Appendix F-1, Socioeconomics, Tables F-1-2 and F-1-7, of this EIS. A more complete discussion of health and safety analysis methods appears in Appendix F, Section F-4, Health and Safety.

5.12.2.1 Radiological Exposure and Health Effects. Estimated radiological impacts to workers are presented in Table 5.12-5. The average dose rate per year for each employee is based on actual monitoring data for the INEL over the period 1987 to 1991 (Appendix F). The table distinguishes between those workers involved in activities under each alternative (incremental workforce) and those INEL workers engaged in other activities (baseline workforce). Negative values in Table 5.12-5 indicate a reduction in employment relative to 1995 levels.

The measures of impact in Table 5.12-5 are: (a) average annual collective dose over the workforce, (b) total collective dose to the workforce over the time period addressed by this EIS (1995 to 2005), and (c) total number of excess fatal cancers expected over the lifetimes of the workers due to radiation received during the period covered by this EIS.

Table 5.12-5. Estimated radiological impacts to workers at the Idaho National Engineering Laboratory site by alternative [a,b,c] (annual averages and totals for the years 1995 through 2005).

		Alternative A[d]		Alternative B[e]		Alternative C[f]		Alternative D[g]	
	Baseline workers	Incremental workers[h]	All workers	Incremental workers	All workers	Incremental workers	All workers	Incremental workers	All workers
Annual average workers	7,650	-120	7,530	464	8,114	23	7,673	677	8327
Annual average collective radiation dose (person-rem)	207	-3.2	203	13	219	0.62	207	18	225
Total collective radiation dose (person-rem)	2,066	-32	2,033	125	2,191	6.2	2,072	183	2,248
Total fatal cancers	0.83	-0.01	0.81	0.05	0.88	0.00	0.83	0.07	0.90

a. Numbers in this table may not add exactly because of rounding effects.

b. Incremental workers are INEL employees participating directly in proposed activities under each alternative. Baseline workers are employees engaged in other activities at the INEL.

c. The average dose rate of 0.027 rem/worker/year is based on measured radiation doses over the INEL work force from 1987 to 1991.

d. Alternative A (No Action).

e. Alternative B (Ten-Year Plan).

f. Alternative C (Minimum Treatment, Storage, and Disposal).

g. Alternative D (Maximum Treatment, Storage, and Disposal).

h. Negative Values indicate a decrease in employment from 1995 levels.

There is a potential for small increments of additional radiation dose to some workers from exposure to atmospheric emissions from INEL facilities or drinking water from production wells on the site. The maximum potentials for impacts from atmospheric releases are presented in Table 5.12-1. Impacts from onsite drinking water supplies are presented in Section 5.12.1.2.1. The average impact to workers exposed by these pathways cannot be estimated precisely but will be much smaller than the maximum potential amounts reported above. These exposure pathways are not expected to make a significant contribution to the values presented in Table 5.12-5.

Collective radiation dose and resulting health effects are expected to be less than current levels for all alternatives. This is because, for all alternatives, total employment at the INEL is expected to decline from the current number of about 11,000. Furthermore, the total average workforce at the INEL for the period from 1995 to 2005 is similar for all alternatives so that the differences in radiological impacts to the workforce are small.

5.12.2.2 Nonradiological Occupational Hazards. Estimated nonradiological impacts to workers are presented in Table 5.12-6. The rates for injury and illness and occupational fatalities are based on observed rates for DOE and its contractors over the period from 1988 to 1992 (Appendix F, Section F-4, Health and Safety, of this EIS). The table distinguishes between those workers involved in activities under each alternative and those INEL workers engaged in other activities. The table also presents separate estimates of potential hazards to construction workers under each alternative. This is because construction work is considerably more hazardous than other activities under the alternatives.

The measures of impact in Table 5.12-6 are: (a) average annual cases of reportable injury and illness, (b) average annual number of fatalities, (c) total cases of reportable injury and illness over the time period addressed by this EIS (1995 to 2005), and (d) the total number of occupational fatalities during the period covered by this EIS. Negative values in Table 5.12-6 indicate a reduction in employment from 1995 levels.

There is a potential for small increments of additional exposure to toxic materials due to atmospheric emissions from INEL facilities or drinking water from production wells on the site. The

Table 5.12-6. Estimated nonradiological impacts to workers at the Idaho National Engineering Laboratory site by alternative[a,b] (annual averages and totals for the years 1995 through 2005).

		Alternative A[c]			Alternative B[d]			Alternative C[e]			Alternative D[f]		
	Baseline workers	Incremental non-construction[g]	Incremental construction	All workers	Incremental non-construction	Incremental construction	All workers	Incremental non-construction	Incremental construction	All workers	Incremental non-construction	Incremental construction	All workers
Annual average workers	7,650	-245	125	7,530	51	436	8,137	-245	275	7,680	51	660	8,361
Annual average injury/illness	245	-7.8	7.8	245	1.6	27	273	-7.8	17	254	1.6	41	287
Annual average fatalities	0.24	-0.01	0.01	0.25	0.00	0.05	0.29	-0.01	0.03	0.27	0.00	0.07	0.32
Total injury/illness	2,448	-78	78	2,447	16	270	2,735	-78	171	2,540	16	409	2,874
Total fatalities	2.5	-0.08	0.14	2.5	0.02	0.48	2.9	-0.08	0.30	2.7	0.02	0.73	3.2

a. Numbers in this table may not add exactly because of rounding effects.

b. Incremental workers are INEL employees participating directly in proposed activities under each alternative. Baseline workers are employees engaged in other activities at the INEL.

c. Alternative A (No Action).

d. Alternative B (Ten-Year Plan).

e. Alternative C (Minimum Treatment, Storage, and Disposal).

f. Alternative D (Maximum Treatment, Storage, and Disposal).

g. Negative values indicate a decrease in employment from 1995 levels.

maximum potentials for these impacts are presented in Sections 5.12.1.1.2 and 5.12.1.2.1, respectively. The average impact to workers exposed by these pathways cannot be estimated precisely, but will be much smaller than the maximum potential amounts reported above. These exposure pathways are not expected to make a significant contribution to the values presented in Table 5.12-6.

The number of reportable injury and illness cases is expected to be less than current levels for all alternatives. This is because, for all alternatives, total employment at the INEL is expected to decline from the current number of about 11,000. For those injuries and illnesses of an occupational nature, the current proportions of different types of health impacts are expected to apply to all alternatives. These are repeated trauma disorders, 48 percent; skin disorders, 30 percent; respiratory conditions, 11 percent; and other impacts, 11 percent.

The total average workforce at the INEL for the period from 1995 to 2005 is similar for all alternatives so that the differences in impacts from nonradiological hazards to the workforce are small. Most of the differences are a result of the different proportion of construction workers for each alternative.

5.13 Idaho National Engineering Laboratory Services

This section discusses the potential effects of the four environmental restoration and waste management alternatives on utilities and energy and security and emergency services at the INEL. The consumption of water, electrical energy, and fossil-based fuels and wastewater discharges at the INEL site and the Idaho Falls support facilities is considered.

5.13.1 Methodology

To determine the potential impacts of the alternatives on the INEL site utilities and energy systems, the projected usage rates for water, electricity, fuel, and wastewater treatment and discharge systems required by new facilities were evaluated and compared. In addition, the total demands, composed of baseline plus new facilities, were compared with supply capabilities. Since increased use of services is normally associated with new buildings, the total number of new buildings and the total area occupied by new buildings is shown in Figure 5.13-1 for each alternative. The project descriptions given in Appendix C and the project distribution by alternative (given in Chapter 3, Alternatives) were used to evaluate the alternative-dependent increases in demand. The potential impact on Idaho Falls facilities depends on any change in workforce at these facilities.

5.13.2 Idaho National Engineering Laboratory Services Impacts from Alternative A (No Action)

Alternative A (No Action) encompasses 12 new projects. Nine projects include construction and operation of 13 new buildings on the INEL site, having about 50,000 square meters (540,000 square feet) of floor space, and three projects include substantial construction of other facilities, such as concrete pads and vaults. The estimated increases in utility and energy usage rates resulting from these projects are 20,000 megawatt-hours per year of electricity, 106,900 cubic meters (28.2 million gallons) per year of water, and 3.8 million liters (1.0 million gallons) per year of wastewater discharge (sewage water only) (Hendrickson 1995). These represent small increases ranging from 0.7 percent to 10 percent above the baseline and are well within system capabilities and usage limits (see Section 4.13, Idaho National Engineering Laboratory Services).

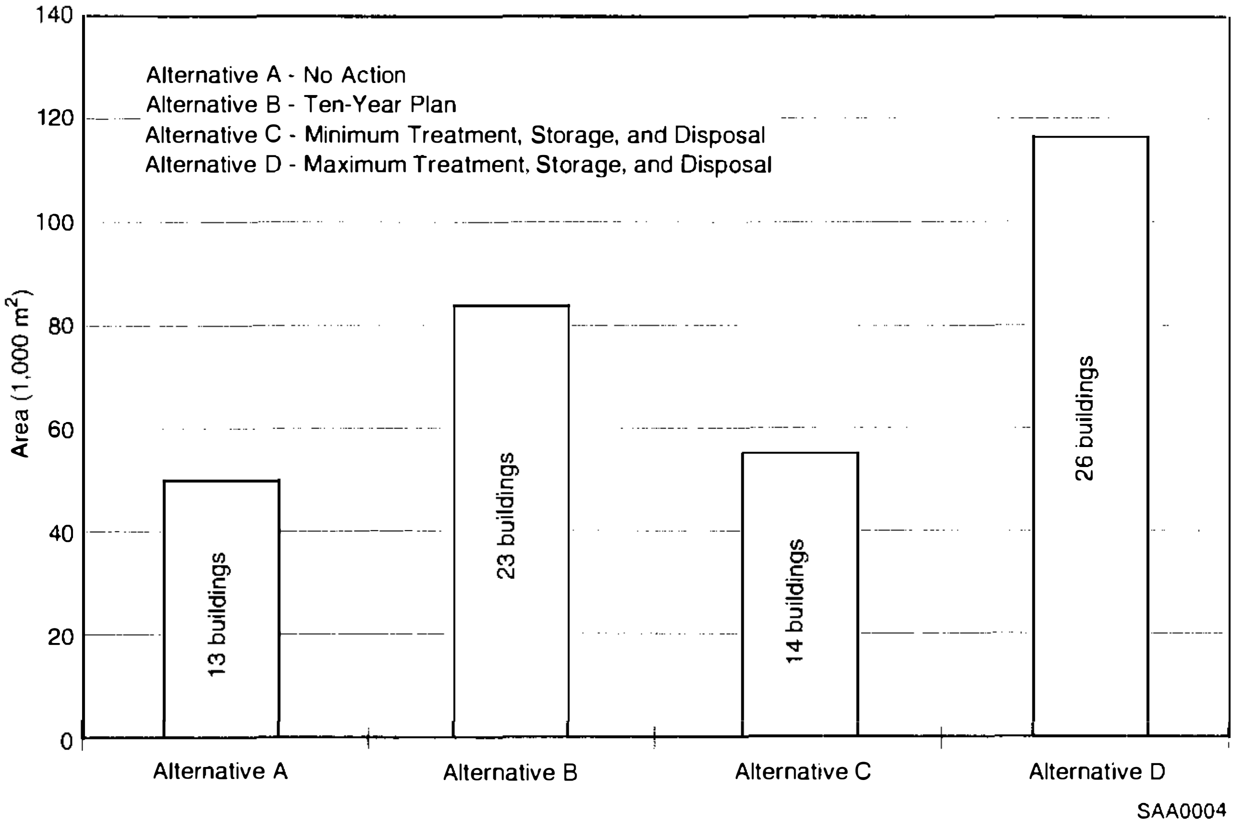


Figure 5.13-1. Total area of new buildings at the Idabo National Engineering Laboratory under all the alternatives.

Fossil fuel usage would increase by 910,000 liters (240,000 gallons) of heating oil, 362,000 liters (96,000 gallons) of diesel fuel, and 1,190,000 liters (314,000 gallons) of propane annually (Hendrickson 1995). These increases in heating oil and diesel fuel are less than 8 percent above the baseline, but propane usage increases by over 200 percent to support building heating for new projects. The available supply of fossil fuels at the INEL site should support these usage levels.

The primary construction materials are concrete and steel. The buildings and related construction projects for Alternative A (No Action) are estimated to include about 25,000 cubic meters (32,700 cubic yards) of concrete. The amount of steel is not defined but is considered recyclable when the project is decommissioned.

Alternative A (No Action) is not expected to require increases in INEL site fire, security, or emergency services.

5.13.3 Idaho National Engineering Laboratory Services Impacts from Alternative B (Ten-Year Plan)

Alternative B (Ten-Year Plan) encompasses 41 new projects. Seventeen projects include construction and operation of 23 new buildings on the INEL site, having about 83,000 square meters (890,000 square feet) of floor space, and six projects include substantial construction of other facilities. The estimated increases in utility and energy usage rates above baseline resulting from these projects are 95,200 megawatt-hours per year of electricity (46 percent increase), 298,600 cubic meters (79 million gallons) per year of water (5 percent increase), and 7.2 million liters (1.9 million gallons) per year of wastewater discharge (1 percent increase) (Hendrickson 1995). The increase in usage rate for electricity is about 46 percent of the baseline usage but is within the contracted supply level. Increases in water and wastewater are 5 percent or less and are very moderate increases, well within INEL site capabilities.

Fossil fuel usage would increase by 5,485,000 liters (1,449,000 gallons) of heating oil, 1,110,000 liters (293,000 gallons) of diesel fuel, and 2,700,000 liters (713,000 gallons) of propane annually (Hendrickson 1995). These increases in usage rates range from increases of 20 percent for diesel fuel, 50 percent for heating oil, and 480 percent for propane. The large increase in propane results from both facility heating and incineration. Fossil fuel supply to the INEL site is adequate to meet these demands.

The quantity of concrete estimated for construction of Alternative B (Ten-Year Plan) buildings and facilities is 60,000 cubic meters (78,500 cubic yards).

Alternative B (Ten-Year Plan) may result in the need for expanded INEL site fire protection, security, and emergency services.

5.13.4 Idaho National Engineering Laboratory Services Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Alternative C (Minimum Treatment, Storage, and Disposal) encompasses 19 new projects. Eleven projects include construction and operation of 14 new buildings on the INEL site, having about 57,000 square meters (610,000 square feet) of floor space, and three projects include substantial construction of other facilities. The estimated increases above baseline in utility and energy usage rates resulting from these projects are 62,000 megawatt-hours per year of electricity (30 percent increase), 158,600 cubic meters (41.9 million gallons) per year of water (2.5 percent increase), and 5.8 million liters (1.5 million gallons) per year of wastewater discharge (1 percent increase) (Hendrickson 1995). These usage rates lie between those of Alternatives A (No Action) and B (Ten-Year Plan) and are within system capabilities and usage limits.

Fossil fuel usage would increase by 1,210,000 liters (320,000 gallons) of heating oil, 415,000 liters (110,000 gallons) of diesel fuel, and 1,246,000 liters (329,000 gallons) of propane annually (Hendrickson 1995). The increase in heating oil is about 11 percent above baseline, diesel fuel is about 7 percent above baseline, and propane use increases about 220 percent to support facility heating. These increases are very similar to increases associated with Alternative A (No Action) and are expected to be within INEL supply capability.

The construction associated with Alternative C (Minimum Treatment, Storage, and Disposal) projects is expected to require about 35,000 cubic meters (45,800 cubic yards) of concrete.

Alternative C (Minimum Treatment, Storage, and Disposal) is not expected to require increases in INEL site fire, security, or emergency services.

5.13.5 Idaho National Engineering Laboratory Services Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Alternative D (Maximum Treatment, Storage, and Disposal) includes all of the projects in Alternative B (Ten-Year Plan) plus five additional projects with three additional new buildings. In addition, the scope of three of the projects is expanded under Alternative D to accommodate the increased quantities of materials. The new buildings constructed on the INEL would have 116,000 square meters (1,250,000 square feet) of floor space. Accordingly, Alternative D increases in usage rates above baseline for utilities are estimated to be 114,000 megawatt-hours per year of electricity (55 percent increase), 254,000 cubic meters (67 million gallons) per year of water (3.9 percent increase), and 10.6 million liters (2.8 million gallons) per year of wastewater discharge (2 percent increase) (Hendrickson 1995). These usage rates represent the maximum increases for all the alternatives and, when added to the baseline usage rates, are still below existing system capabilities and use limits.

Fossil fuel usage would increase by 6,255,000 liters (1,653,000 gallons) of heating oil, 1,223,000 liters (323,000 gallons) of diesel fuel, and 2,732,000 liters (720,000 gallons) of propane annually (Hendrickson 1995). Alternative D (Maximum Treatment, Storage, and Disposal) heating oil usage is 56 percent above baseline, diesel fuel usage is 21 percent above baseline, and propane usage is 480 percent above baseline. These increases are comparable to Alternative B (Ten-Year Plan) and are within the INEL supply capability.

The construction associated with Alternative D (Maximum Treatment, Storage, and Disposal) projects is expected to require about 100,000 cubic meters (130,000 cubic yards) of concrete.

Alternative D (Maximum Treatment, Storage, and Disposal) may result in the need for expanded INEL site fire protection, security, and emergency services.

5.13.6 Summary of Impacts from Alternatives

Alternative D (Maximum Treatment, Storage, and Disposal) would put the greatest demand on INEL site services. For Alternative D, electrical consumption was estimated to be 114,000 megawatt-hours per year, which is an increase of about 55 percent above baseline usage. The expected total usage (baseline plus expected increase) is about 322,000 megawatt-hours per year, which is just over 82 percent of the existing supply and 29 percent of system capacity; thus, the existing INEL site electrical system could accommodate the electrical load for Alternative D. All the other alternatives create less electrical demand, so all alternatives could be accommodated without exceeding about 82 percent of contracted supply for average load.

The corresponding increases in water usage and wastewater discharge for Alternative D (Maximum Treatment, Storage, and Disposal) were less than about 5 percent above baseline. A comparison of the increases in electrical usage, water usage, and wastewater discharge for all four alternatives is shown graphically in Figure 5.13-2.

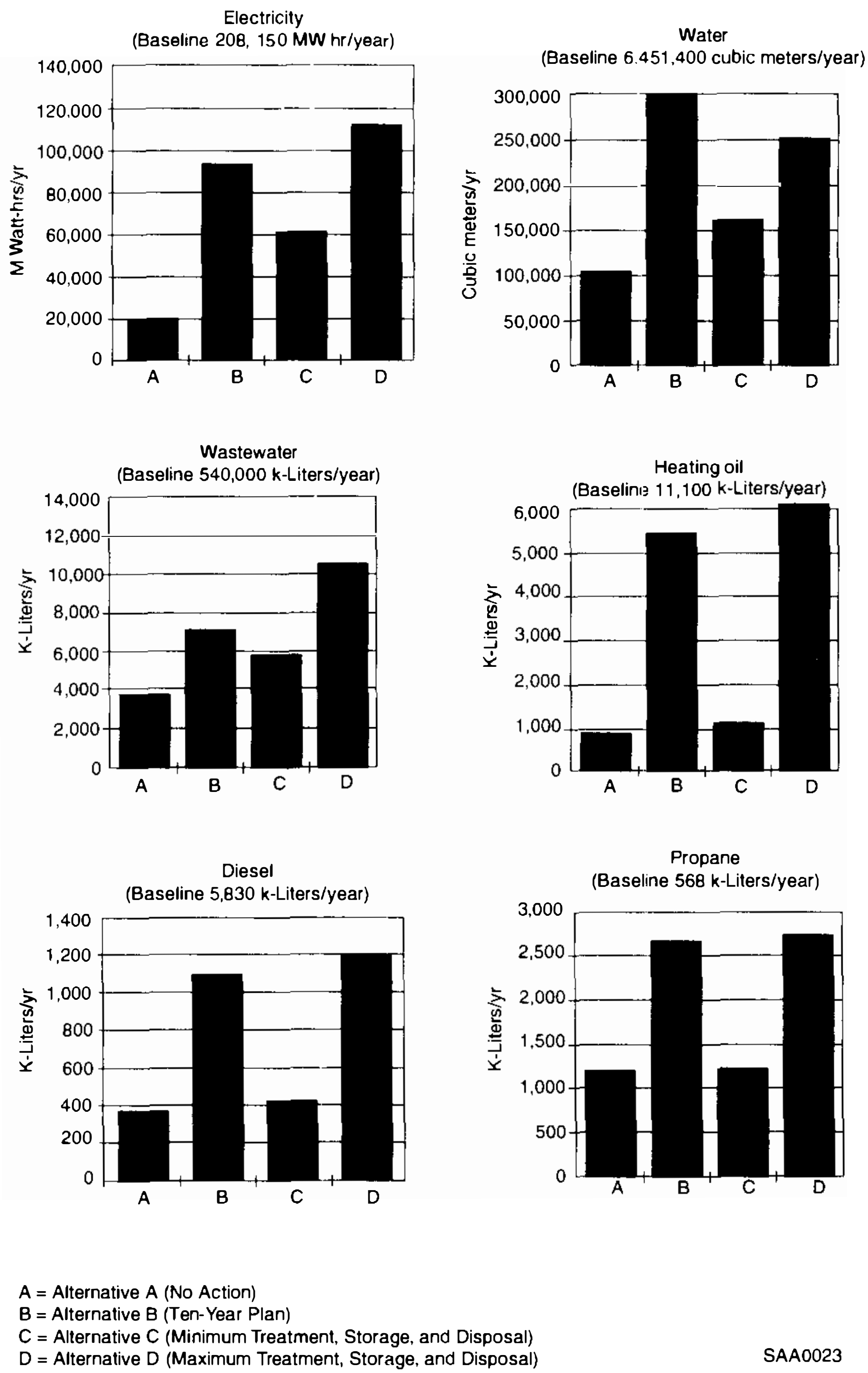


Figure 5.13-2. A summary of peak utility usage increases above baseline at the Idaho National Engineering Laboratory for all alternatives.

The corresponding increases in fossil fuel usage are also shown graphically in Figure 5.13-2. The fossil fuel usage increases for Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) are very comparable, as are those for Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

The facilities at the INEL site are the major consideration in evaluating the potential impact on utilities and energy; however, some minor impact could also be expected from staff housed in Idaho Falls facilities. City of Idaho Falls services and natural gas supplies accommodate current staff adequately. Since the overall INEL workforce is expected to decline, no staff increases in Idaho Falls offices are anticipated and there would be no negative impact on city services or natural gas supplies. The City of Idaho Falls provides fire, police, and emergency services to the INEL facilities in town and would not be impacted by any of the alternatives.

5.14 Facility 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 a facility was designed to withstand, and events a facility is not designed to withstand. These categories are termed *abnormal*, *design basis*,[a] and *beyond design basis* accidents, respectively. Summarized here are consequences of possible facility accidents in these categories for a member of the public at the nearest site boundary, for the collective population within 80 kilometers (50 miles), for workers, and for the environment. Details of assessments of the accidents are in Slaughterbeck et al. (1995). Section 5.11 (Traffic and Transportation) summarizes the assessment of transportation accidents.

An accident is a series of unexpected or undesirable "initiating" events leading to a release of radioactive or hazardous materials within a facility or to the environment. This analysis defines initiating events that can lead to a facility accident in three broad categories: external initiators, internal initiators, and natural phenomena initiators. *External initiators* originate outside the facility and may impact the ability of the facility to confine radioactive or hazardous material. These initiators may be related to fires and explosions nearby, or caused by events at nearby facilities. *Internal initiators* originate within a facility (for example, equipment failures or human error) and usually are the result of the facility's operation. Sabotage and terrorist activities (that is, intentional human initiators) may be classified as either external or internal initiators. *Natural phenomena initiators* include weather-related (for example, floods and tornadoes) and seismic events. For this analysis, initiators are defined in terms of those events that cause, directly or indirectly, a release of radioactive or hazardous materials within a facility or to the environment by failure or bypass of confinement.

The historical record of accidents at the INEL is summarized in the following section. Methods used to assess potential future events are summarized in Section 5.14.2. Evaluations of accident impacts by alternative are summarized in Sections 5.14.3 through 5.14.6. A summary comparison of accident impacts by alternative is given in Section 3.3, Comparison of Impacts.

a. For facilities where design basis accident analyses were unavailable, evaluation basis accidents (postulated accidents used where documented design basis accidents do not exist) were considered per DOE-DP-STD-3005-93 (DOE 1993a).

5.14.1 Historical Perspective

Many of the INEL actions proposed under the alternatives are continuations or variations of past practices. Injuries, illnesses, and the potential for increased cancer risk for workers are addressed in Section 5.12, Health and Safety. Most historical accidents, such as the April 15, 1994, release of chlorine gas at Argonne National Laboratory-West, are less severe than the postulated accidents discussed here. As discussed below, the primary historical cause of fatalities to INEL workers has been industrial accidents, and risks to the public from INEL accidents have been analyzed in detail and have been determined to be very low (DOE-ID 1991).

Consequences of accidents can involve fatalities, injuries, or illnesses. Fatalities can be prompt (immediate), such as in construction accidents, or latent (delayed), such as cancer caused from radiation exposure. While public comments received in scoping meetings for Volume 2 of this EIS included many concerns about potential accidents, the historical record shows DOE facilities have had a very good safety record. Figure 5.14-1 illustrates the rate of worker fatalities at the INEL (Millet 1993) compared to the rate in the overall DOE complex (DOE 1993b) as well as national-average rates compiled for various industry groups by the National Safety Council (NSC 1993) and Idaho averages compiled from State statistics by Hendrix (1994). All statistics apply to the period 1983 through 1992. The worker accident fatality rate for the INEL is very low compared to the rates from industry groups such as agriculture and construction and is comparable to those for trade and services groups. None of the INEL fatalities in this ten-year period resulted from exposure to radiation or hazardous material. While past accident rates are not necessarily indicative of future rates, the historical record reflects DOE's emphasis on safe operations.

For accidents involving radiation exposure, a total of three prompt worker fatalities have occurred in the 40-year history of INEL facilities. These workers were killed by a steam explosion resulting from a nuclear criticality (uncontrolled chain reaction) in an experimental reactor (Stationary Low-Power Reactor No. 1) in 1961. The workers were manually moving reactor control elements when the accident occurred. The dose from this accident to an individual at the nearest site boundary has been estimated at approximately 3 millirem (DOE-ID 1991). A number of nonfatal accidental radiation exposures have occurred to INEL workers. Neither prompt nor delayed fatalities are known to have occurred to members of the public from radiation exposure accidents at the INEL.

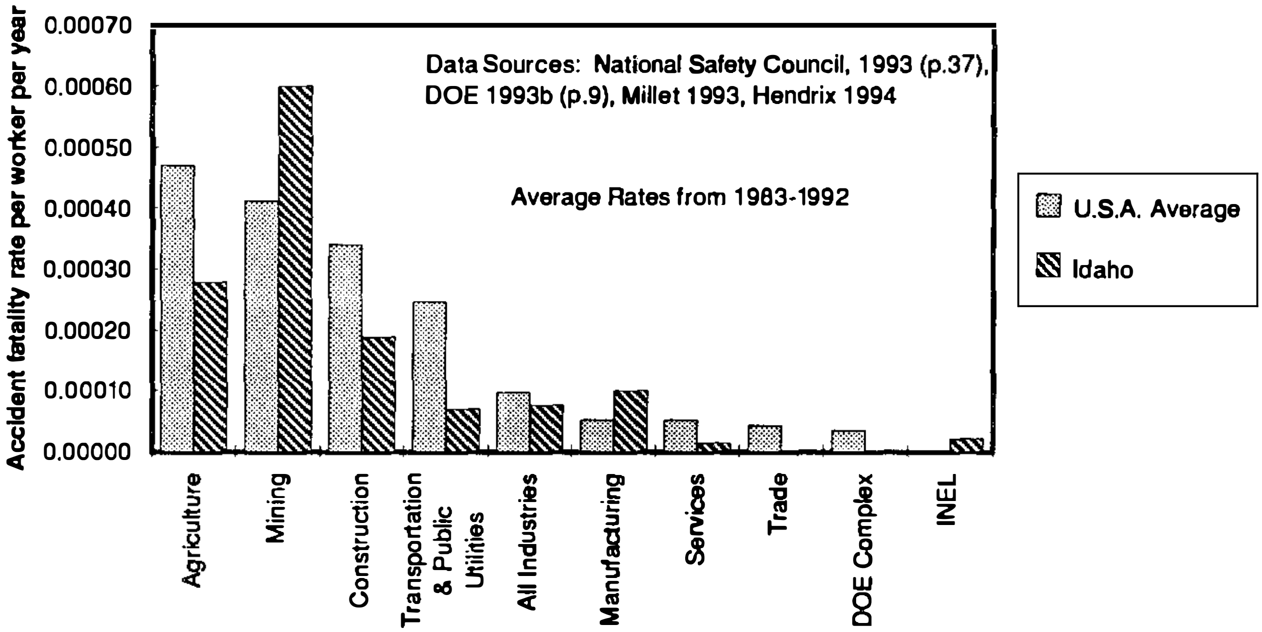


Figure 5.14-1. Comparison of fatality rates among workers in various industry groups.

Accidents have caused radiological contamination of equipment and land on the site that has required cleanup. Irreversible impacts to the environment have been negligible.

5.14.2 Methodology

Possible accidents involving spent nuclear fuel and waste management and environmental restoration operations at the INEL were analyzed for Volume 2 of this EIS. To obtain a perspective on potential accidents, the approach was to

- Summarize accidents that have occurred at the INEL (historical accidents)
- Review previous accident analyses for spent nuclear fuel, waste management, and environmental restoration activities
- Identify potential internal, external, and natural phenomena events that could initiate accidents other than those previously analyzed
- Perform independent analyses of the accidents with the greatest consequences.

To characterize potential impacts at INEL facilities and operations, accidents with a range of frequencies are reported for each proposed alternative. Three broad frequency ranges are used: abnormal events with frequencies greater than 10^{-3} per year, design (or evaluation) basis accidents with frequencies in the range from 10^{-6} to 10^{-3} per year, and beyond design basis events with frequencies in the range from 10^{-7} to 10^{-6} per year. Within each frequency range, a bounding accident is determined so that any other reasonably foreseeable accident within a frequency range would be expected to have smaller consequences (see Appendix F-5, Facility Accidents). The results are point estimates of maximum reasonably foreseeable accidents by frequency category rather than a cumulative assessment of all possible accidents in each category.

Possible causes, assumptions, likelihood of occurrence, and consequences are discussed for the bounding accident within each frequency category analyzed. Some accidents in the abnormal and design basis frequency ranges are based on existing analyses (for example, facility safety analysis reports). Because these analyses generally evaluate only consequences to an individual at the nearest site boundary, population health risks are unavailable for most such events. For accidents for which independent analyses were performed, as reported in Slaughterbeck et al. (1995), population health risks were analyzed and are reported in this section. Fatal cancer effects are reported for these accidents; other health effects such as nonfatal cancer and hereditary effects from radiation exposure occur at a rate approximately 50 percent more often for a given exposure than fatal cancer (ICRP 1991). Ecological impacts are assessed qualitatively. Details on the analyses, including supporting references, are given in Slaughterbeck et al. (1995).

Most of the accidents analyzed herein relate to existing INEL facilities or projections based on existing facilities. These evaluations are appropriate to characterize accident impacts at the INEL but do not provide meaningful comparisons among different sites. Because some of the existing facilities manage fuel that recently has been removed from INEL reactors, accidents for existing facilities bound the impacts associated with fuel that could be transported to Idaho from other DOE facilities, universities, and foreign research reactors.

5.14.2.1 Accident Screening and Selection Process. Many types of postulated events could lead to an accidental release of radioactive or hazardous material or both. Some of these postulated events have the potential for only local (within the INEL site boundaries) consequences with no potential for a release that would have consequences for a member of the public at the nearest site boundary.

Internal and external initiators associated with a wide range of activities not necessarily covered in existing safety analyses were considered. For example, potential radiological accident scenarios initiated by construction activities associated with constructing new facilities or modifying existing facilities (as proposed under the various alternatives) were postulated. Typically, events involved in the construction of new facilities would act as external initiators while events involved in modifying existing facilities would act as internal initiators. Examples of construction or industrial-type events considered included fires, confinement impacts or puncture events, equipment failure, terrorism, and human error. The potential consequences of acts of terrorism are believed to be bounded by the consequences of the evaluated accidents.

The INEL site has nine major operating areas within the site boundaries. These areas are listed in Table 5.14-1. Each area was screened for quantities of spent nuclear fuel, radioactive waste, and hazardous material (including materials in inventory) that have the potential for being involved in a substantive release and thus worthy of consideration.

- Spent nuclear fuel or irradiated fuel is stored in substantial quantities at the Idaho Chemical Processing Plant, Argonne National Laboratory-West, Test Reactor Area, Test Area North, and Naval Reactors Facility. Some spent nuclear fuel remains at the Auxiliary Reactor Area/Power Burst Facility but is scheduled to be removed to the Idaho Chemical Processing Plant in 1996. No spent nuclear fuel is located in other areas.

- High-level waste is stored in substantial quantities at the Idaho Chemical Processing Plant in the form of liquids (liquid waste storage tanks), solid calcines (calcine storage bins), residual liquid and calcine waste (New Waste Calcining Facility), and residual high-level contaminants on high-efficiency particulate air filters (Atmospheric Protection System). Only small quantities, if any, are located in other areas.

- Transuranic waste is stored in large quantities at the Radioactive Waste Management Complex only. Other areas may have small quantities insufficient to result in consequences to the public.

Table 5.14-1. Idaho National Engineering Laboratory locations with sufficient quantities of radioactive or hazardous material to cause consequences to a member of the public under accident conditions.

Spent nuclear fuel, waste, and activity types	Idaho National Engineering Laboratory locations[a]								
	ICPP	ANL-W	TRA	TAN	RWMC	CFA	ARA/PBF	IRC	NRF
Spent nuclear fuel	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
High-level waste	Yes	No	No	No	No	No	No	No	No
Transuranic waste	No	No	No	No	Yes	No	No	No	No
Low-level waste	No	No	No	No	Yes	No	Yes	No	No
Mixed low-level waste	No	Yes	No	No	Yes	No	Yes	No	No
Hazardous waste and toxic material	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No
Decontamination and decommissioning	Yes	Yes	Yes	No	No	No	Yes	No	No
Remediation	No	No	No	No	Yes	No	No	No	No

a. Location acronyms:

ANL-W - Argonne National Laboratory-West
ARA - Auxiliary Reactor Area
CFA - Central Facilities Area
ICPP - Idaho Chemical Processing Plant
IRC - INEL Research Center
NRF - Naval Reactors Facility
PBF - Power Burst Facility
RWMC - Radioactive Waste Management Complex
TAN - Test Area North
TRA - Test Reactor Area

- Low-level waste is stored in substantial quantities at the Radioactive Waste Management Complex and at the Auxiliary Reactor Area/Power Burst Facility area.

- Mixed low-level waste is stored in substantial quantities at the Argonne National Laboratory-West (contaminated sodium reactor coolant), Radioactive Waste Management Complex, and Auxiliary Reactor Area/Power Burst Facility area (Mixed Low-Level Waste Facilities).

- Hazardous waste and material is stored in substantial quantities at the Idabo Chemical Processing Plant (chlorine, acids), Argonne National Laboratory-West (chlorine, sodium), Test Area North (depleted uranium), Central Facilities Area (Hazardous Waste Storage Facility), INEL Research Center (various chemicals), and Auxiliary Reactor Area/Power Burst Facility (waste storage facilities).

- Decontamination and decommissioning activities with potential for consolidation of substantial quantities of radioactive and hazardous materials could occur at the Idabo Chemical Processing Plant (Fuel Processing Complex, CPP-601, and Waste Calcining Facility), Argonne National Laboratory-West (Central Liquid Waste Processing), Test Reactor Area (Engineering Test Reactor and Materials Test Reactor), and Auxiliary Reactor Area (Auxiliary Reactor Area-II).

- Remediation activities with potential for consolidation of substantial quantities of radioactive and hazardous materials will occur at the Radioactive Waste Management Complex (buried waste retrieval). Other remediation activities may occur as future site investigations warrant.

Initiating events were defined in three broad categories: external initiators, internal initiators, and natural phenomena initiators. *External initiators* originate outside the facility and may impact the ability of the facility to maintain confinement of radioactive or hazardous material. These may be related to fires and explosions nearby, or caused by events at co-located facilities. *Internal initiators* (for example, equipment failures or human error) originate within a facility and are a result of operating the facility. *Natural phenomena initiators* include weather-related and seismic events. All types of initiators were defined in terms of those events that cause or may lead to a release of materials by failure of confinement or a bypass of confinement.

Seismic events (see Section 4.6.3) were found to be the most likely common-cause initiators with the potential to cause releases at more than one facility and involve more than one waste type. Thus, some individual impacts presented herein for seismically initiated accidents could be additive. However, because the screening methods focused on facilities with the largest inventories rather than all possible facilities, summing impacts from the assessed seismic accidents could be misleading and was not attempted. No cases were found where an accident in one facility could cause an accident in a co-located facility.

Each facility area was screened for initiating events with the potential to cause consequences to the worker, the environment, and the public at the nearest site boundary. Only those locations identified with substantial quantities of materials and listed in Table 5.14-1 were considered. The initiating event screening results are summarized in Table 5.14-2 for the six waste and material types and two types of environmental restoration activities. Accidents with bounding consequences from this table were assessed as discussed below.

5.14.2.2 Analysis of Accident Consequences. For health effects to occur, an accident must involve (a) a direct radiation exposure such as in a criticality, or (b) a loss of confinement of the hazardous and/or radioactive material and a release of some fraction of the material to the immediate environment. For the latter, the material must then be transported to human beings. Emergency Preparedness Plans (DOE 1993c) and Protective Action Guides (EPA 1991) can be invoked to reduce human exposures for scenarios where time is available to take action. The quantities of materials that reach people and the ways the materials interact with human beings are important factors in determining health effects.

In determining the consequences (radiological and toxicological) associated with the postulated maximum reasonably foreseeable accidents, the following definitions were used:

- *Facility Worker*. The facility worker is defined as an individual located 100 meters (328 feet) downwind of the facility location where the release occurs.

Table 5.14-2. Potential initiating events for accidents at the Idaho National Engineering Laboratory by estimated frequency range and material type.

Spent nuclear fuel, waste, and activity types							
Spent nuclear fuel	High-level waste	Transuranic waste	Low-level waste	Mixed low-level waste	Hazardous waste and toxic material	Decontamination/ decommissioning	Remediation
			Abnormal Events[a]				
•Fuel handling accident	Upsets with localized impacts only[b]	Upsets with localized impacts only[b]	•WWSB fire •RWMC SDA fire	•WWSB fire	Movement/ handling accident	Upsets with localized impact only[b]	•Pit 9 stack/vent release
			Design Basis Accidents[a]				
•Fuel handling criticality •HFEF seismic •Cask failure	•NWCF stack release •APS seismic stack failure •HLW tank seismic •Calcine bin seismic •APS filter fire stack release •HLW tank criticality •HLW tank fire/ explosion •NWCF seismic or fire/explosion	•RWMC TSA explosion •RWMC TSA seismic •RWMC WCF vent release •RWMC lava flow •RWMC TSA fire	•RWMC TSA explosion •RWMC TSA seismic •WERF seismic •RWMC WCF vent release •WERF stack release •WERF fire/explosion •RWMC lava flow •RWMC TSA fire	•RWMC TSA explosion •RWMC TSA seismic •WERF seismic •RWMC WCF vent release •WERF stack release •WERF fire/explosion •RWMC lava flow •RWMC TSA fire	•CFA HWSF fire •ANL-W chlorine release •CFA chlorine release •ICPP chlorine release •ICPP nitric acid release •IRC handling failure •IRC fire	•Stack vent release •Movement/ handling accident •Fire/explosion	•Pit 9 fire/ explosion •Pit 9 container handling outside •Pit 9 major fire •Pit 9 high winds •Pit 9 seismic
			Beyond Design Basis Accidents[a]				
•ICPP 603 seismic pool drain criticality •Aircraft impact	•Aircraft impact	•Aircraft impact •RWMC external fire/explosion •RWMC criticality	•Aircraft impact •RWMC external fire/explosion •RWMC criticality	•Aircraft impact •RWMC external fire/ explosion •RWMC criticality •WWSB major fire	•Aircraft impact •TAN SMC depleted uranium fire	•Aircraft impact	•Pit 9 aircraft impact

a. Abnormal events are in the frequency range of 10^{-3} per year or greater. Design basis accidents are generally in the range from 10^{-6} to 10^{-3} per year. Beyond design basis accidents are generally in the range of 10^{-7} to 10^{-6} per year.

b. Family of incidents involving spills, drops, seal failures, etc. that could have an impact in the immediate vicinity only.

Definition of acronyms:

ANL-W - Argonne National Laboratory-West
APS - Atmospheric Protection System
CFA - Central Facilities Area
HFEF - Hot Fuel Experimental Facility
HLW - high-level waste
HWSF - Hazardous Waste Storage Facility
ICPP - Idaho Chemical Processing Plant
IRC - INEL Research Center
NWCF - New Waste Calcining Facility
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
SMC - Specific Manufacturing Capability
TAN - Test Area North
TSA - Transuranic Storage Area
WCF - Waste Characterization Facility
WERF - Waste Experimental Reduction Facility
WWSB - WERF Waste Storage Building

- *Nearest Public Access.* The nearest public access is the location of the nearest public highway where members of the public could be present.

- *Maximally Exposed Individual (MEI).* The MEI is defined as a hypothetical individual located at the nearest site boundary from the facility location where the release occurs.

- *Offsite Population.* The offsite population is defined as the collective sum of individuals located within an 80-kilometer (50-mile) radius of the INEL facility and within the path of the plume with the wind blowing in the most populous direction.

The ways radioactive material reaches human beings, how it is absorbed and retained in the body, and the resulting health effects have been studied in great detail. The International Commission on Radiological Protection has made specific recommendations for quantifying these health effects. This organization is the recognized body for establishing standards for protecting workers and the public from the effects of radiation exposure. Health effects include acute damage (up to and including death) and latent effects, including cancers and genetic damage. An INEL-developed computer code, RSAC-5 (Wenzel 1993), estimates potential radiation doses to maximally exposed individuals or population groups from accidental releases of radionuclides. This code, which is adapted to INEL conditions, uses well-established scientific and engineering principles as the basis for the various calculational steps. The code has been validated to accepted standards for this kind of computer software.

For hazardous materials, several government agencies recommend quantifying health effects as threshold values of concentrations in air or water that cause short-term effects. The long-term health consequences of exposure to hazardous materials are not as well understood as those for radiation. Thus, the potential health effects reported here for hazardous materials are more qualitative than for radioactive materials. EPIcode™ (Homann 1988) was the computer code chosen for most releases of hazardous materials.

5.14.3 Impacts from Alternative A (No Action)

Impacts from accidents under Alternative A (No Action) are described in this section, and changes from these impacts under other alternatives are evaluated in subsequent sections.

5.14.3.1 Spent Nuclear Fuel. Spent nuclear fuel is managed at the following facility areas at the INEL site: Idaho Chemical Processing Plant, Naval Reactors Facility, Test Reactor Area, Auxiliary Reactor Area/Power Burst Facility, Argonne National Laboratory-West, and Test Area North. In addition, irradiated nuclear fuels (whether "spent" or "in-process") are managed in association with the reactor operations at the Advanced Test Reactor in the Test Reactor Area and the Experimental Breeder Reactor-II in the Argonne National Laboratory-West facility area.[a] In-process fuels include fuel elements being staged or recycled to return to reactor systems. For this analysis, both spent and in-process fuels were included in the assessment. Fuels within reactors were considered only after discharge to storage, processing, or examination areas. Maximum reasonably foreseeable accidents associated with transporting, receiving, handling, and storing naval spent nuclear fuel at the Naval Reactors Facility have been identified and are analyzed in Appendix D of Volume 1 of this EIS.

In November 1993, DOE issued a report (DOE-ID 1993) discussing vulnerabilities associated with various spent nuclear fuel-related facilities across the DOE complex. One INEL facility, the CPP-603 Underwater Fuel Storage Facility, was identified as requiring immediate management attention to avoid unnecessary increases in worker exposures, cleanup costs, and postulated accidents. Although activities have already been initiated to stabilize inventories of spent nuclear fuel in CPP-603 and relocate the fuel to CPP-666, these activities will continue for several years after the scheduled 1995 Record of Decision for this EIS. Therefore, postulated accident scenarios associated with stabilizing and relocating CPP-603 spent nuclear fuel inventories were considered in determining potential accident initiators and the maximum reasonably foreseeable radiological accidents summarized in this EIS.

Activities historically associated with spent nuclear fuel at the INEL site include transportation (see Section 5.11), handling, inspection, storage, and reprocessing. Handling includes moving spent nuclear fuel within facility areas, cutting and removing nonfuel components attached to fuel elements, cask loading, and cask unloading. Inspections include destructive and nondestructive testing and characterization of elements for research and development of improved fuels. Handling and

a. Continued operation of the Experimental Breeder Reactor-II in support of Integral Fast Reactor research was assumed when environmental impacts analysis for this EIS was performed (see Chapter 5 and Appendix F). However, since that time, funding for Integral Fast Reactor research has been curtailed and reactor operations have ceased.

inspection activities are performed both in underwater and dry environments. Storage of spent nuclear fuel occurs underwater in pools, aboveground in dry storage casks, and underground in dry storage vaults. All of these activities, except reprocessing, are ongoing and apply to Alternative A (No Action). New activities include handling and stabilization of degraded fuel in CPP-603 and removal of fuels from pool storage at Test Area North.

Using existing safety analysis reports and independent calculations, accidents selected from the screening process were assessed for risks to the public, workers, and the environment. Based on quantity of fuel present, storage configuration (wet/dry), and cooling time in the various fuel-handling and storage facilities, the accidents given in Table 5.14-3 were determined to have maximum radiological consequences within the abnormal, design basis, and beyond design basis frequency categories (see Appendix F-5). Also listed in the table are the estimated frequency of occurrence, exposures to hypothetical individuals at the nearest public access and nearest site boundary, point estimates of the annualized risk[a] of this individual contracting a fatal cancer during his or her lifetime as a result of this radiation exposure, and point estimates of risk and the expected number of fatal cancers to members of the public for each postulated accident in the most populous wind direction from the accident. The estimates for fatal cancers are listed for average (50 percent) and conservative (95 percent) meteorological conditions. The average condition (50 percent) is defined as that for which more severe conditions with respect to accident consequences occur 50 percent of the time. The conservative condition (95 percent) is defined as weather conditions unfavorable to atmospheric dispersion of contaminants, which are not exceeded more than five percent of the time.

Radiation doses that a hypothetical member of the public at the nearest site boundary could receive as a result of the spent nuclear fuel accidents are illustrated in Figure 5.14-2 along with impacts from accidents involving other radioactive waste streams. Each symbol represents the dose from a discrete accident from Table 5.14-3. Illustrated for perspective is the natural background dose persons receive from natural radiation (NAS/NRC 1990). Slaughterbeck et al. (1995) lists doses in nearby communities.

a. For these analyses, point estimate of risk (fatal cancers per year) is defined as accident frequency (events per year) multiplied by the resulting dose (person-rem), and then multiplied by the likelihood that the dose causes a fatal cancer (fatal cancers per person rem).

Table 5.14-3. Impacts from selected maximum reasonably foreseeable radiological accidents at the Idaho National Engineering Laboratory site[a] - Alternative A (No Action).

Accident	Frequency (events/yr)	Facility worker dose (rem)[c]	Dose at nearest public access (rem)[d]	Dose to MEI[c] (rem)	Offsite population dose (person-rem) 95% meteorology	Risk of fatal cancer per year[b]: MEI	Risk of fatal cancer per year[b]: Population, 50% meteorology	Risk of fatal cancer per year[b]: Population, 95% meteorology
Spent Nuclear Fuel Accidents								
Fuel-handling accident, fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel-handling accident)	1×10^{-2}	(f)	(f)	2.0×10^{-3}	(f)	1.0×10^{-8}	(f)	(f)
Uncontrolled chain reaction (criticality) accident at ICPP	[g]1×10^{-3}	9.7×10^{-2}	1.4×10^{-3}	1.0×10^{-3}	5.9×10^{-1}	5.0×10^{-10}	6.5×10^{-9} (6.5×10^{-6})	3.0×10^{-7} (3.0×10^{-4})
Severe seismic event, cell breach, and fuel melting at ANL-W HFEF	1×10^{-5}	6.2×10^{-1}	6.5×10^{-1}	5.0×10^{0}	1.4×10^{4}	2.5×10^{-8}	4.5×10^{-7} (4.5×10^{-2})	7.0×10^{-5} (7.0×10^{0})
Aircraft crash into HFEF at ANL-W	1×10^{-7}	4.6×10^{0}	3.2×10^{-1}	5.0×10^{0}	2.0×10^{3}	2.5×10^{-10}	3.6×10^{-8} (3.6×10^{-1})	1.0×10^{-7} (1.0)
High-Level Waste Accidents[h]								
ICPP main stack toppling[i]	3×10^{-4}	8.3×10^{2}	2.8×10^{-1}	9.1×10^{-2}	1.7×10^{1}	1.4×10^{-8}	7.2×10^{-7} (2.4×10^{-3})	2.6×10^{-6} (8.5×10^{-3})
Severe seismic event, calcine storage bin failure	1×10^{-5}	1.2×10^{0}	2.3×10^{-2}	7.6×10^{-2}	4.3×10^{2}	3.8×10^{-10}	3.0×10^{-8} (3.0×10^{-3})	2.2×10^{-6} (2.2×10^{-1})
Fire in ICPP atmospheric protection system filters	3×10^{-5}	1.3×10^{-3}	8.2×10^{-5}	1.2×10^{-5}	1.3×10^{-1}	1.8×10^{-13}	3.9×10^{-10} (1.3×10^{-5})	2.0×10^{-9} (6.5×10^{-5})
ICPP New Waste Calcining Facility explosion	3×10^{-6}	(f)	(f)	2.0×10^{-1}	(f)	3.0×10^{-10}	(f)	(f)
Aircraft crash into calcine bin set	2×10^{-7}	4.1×10^{0}	3.0×10^{-1}	1.1×10^{0}	1.0×10^{4}	1.1×10^{-10}	1.9×10^{-7} (9.5×10^{-1})	1.0×10^{-6} (5.0)
Transuranic Waste Accidents								
Explosion at RWMC TSA	2×10^{-4}	(f)	(f)	2.0×10^{-7}	(f)	2.0×10^{-14}	(f)	(f)
Lava flow over RWMC	2×10^{-5}	Evacuate	Evacuate	9.4×10^{-2}	9.6×10^{1}	9.4×10^{-10}	2.4×10^{-7} (1.2×10^{-2})	9.6×10^{-7} (4.8×10^{-2})
Fire in RWMC TSA	4×10^{-6}	(f)	(f)	1.0×10^{-6}	(f)	2.0×10^{-15}	(f)	(f)
Aircraft impact at RWMC TSA	1×10^{-7}	(f)	(f)	6.0×10^{-4}	(f)	3.0×10^{-14}	(f)	(f)

Table 5.14-3. (continued)

Accident	Frequency (events/yr)	Facility worker dose (rem)[c]	Dose at nearest public access (rem)[d]	Dose to MEI[e] (rem)	Offsite population dose (person-rem) 95% meteorology	Risk of fatal cancer per year[b] MEI	Population, 50% meteorology	Population, 95% meteorology
Mixed Low-Level/Low-Level Waste Accidents								
Fire in RWMC SDA	1×10^{-3}	(f)	(f)	4.0×10^{-4}	(f)	2.0×10^{-10}	(f)	(f)
Design basis fire at WERF Waste Storage Building	1×10^{-3}	(f)	(f)	2.8×10^{-3}	(f)	1.4×10^{-9}	(f)	(f)
Beyond design basis fire at WERF Waste Storage Building	1×10^{-7}	(f)	(f)	1.4×10^{-2}	(f)	7.0×10^{-13}	(f)	(f)
Environmental Remediation/Decontamination and Decommissioning Accidents								
Pit 9 fire/vent release	2×10^{-3}	(f)	(f)	5.1×10^{-2}	(f)	5.1×10^{-8}	(f)	(f)
Pit 9 design basis fire	9×10^{-5}	(f)	(f)	8.0×10^{-1}	(f)	3.6×10^{-8}	(f)	(f)
Pit 9 earthquake and release	1×10^{-5}	(f)	(f)	3.3×10^{-1}	(f)	1.7×10^{-9}	(f)	(f)

a. Accidents involving hazardous materials for Alternative A (No Action) are summarized in Table 5.14-5 (Section 5.14.3.5).
b. Fatal cancer risk = dose × accident frequency × (5.0×10^{-4} fatal cancers/rem) (ICRP-60 conversion factor) if dose is <20 rem. For doses ≥20 rem, the ICRP-60 conversion factor (ICRP 1991) is doubled, or 1.0×10^{-3}. Numbers in parentheses indicate total number of fatal cancers in the population if the accident occurs.
c. A facility worker is defined as a worker located 100 meters (328 feet) from the point of release.
d. Member of the public on a highway at the nearest point to the facility within the site boundary.
e. MEI = maximally exposed hypothetical individual whose residence is located at the nearest site boundary.
f. The safety analysis report utilized for this accident does not provide this information because it was developed before DOE orders specifically required this information. As demonstrated by the dose to the MEI, consequences to the public from this accident are assumed to be less than or comparable to the consequences from the spent nuclear fuel and high-level waste accidents with population doses calculated.
g. Frequency lowers to 1×10^{-4} per year when all CPP-603 fuel is moved to the Fluorinel and Storage Facility (CPP-666).
h. A high-level waste tank failure with complete draining was evaluated to determine potential impacts on groundwater. The limiting radionuclide, strontium-90, was calculated to reach a peak concentration in the aquifer of 2 picocuries per liter 300 years after tank failure. The current drinking water standard for strontium-90 is 8 picocuries per liter. This accident is discussed in more detail in Slaughterbeck et al. (1995).
i. The dose to a facility worker is from a puff release of respirable particles.

Definition of acronyms:
ANL-W - Argonne National Laboratory-West
HFEF - Hot Fuel Examination Facility
ICPP - Idaho Chemical Processing Plant
MEI - maximally exposed individual at the nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
TSA - Transuranic Storage Area
WERF - Waste Experimental Reduction Facility

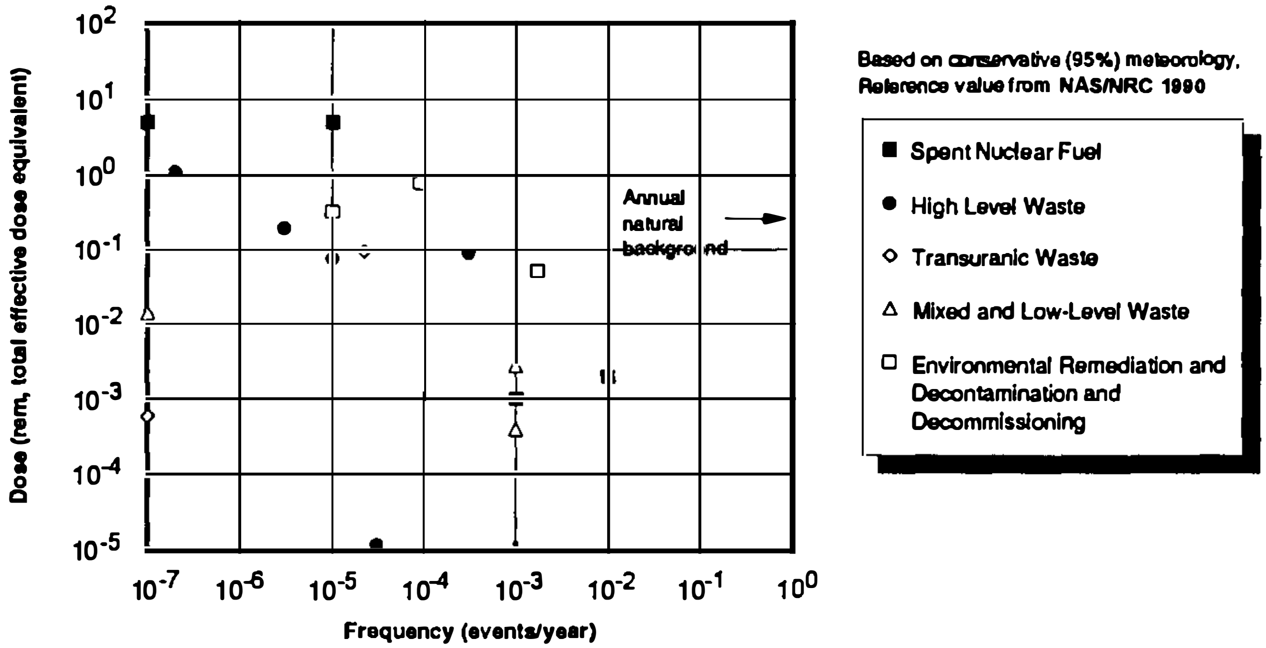


Figure 5.14-2. Potential radiation exposures from accidents to individual at nearest Idaho National Engineering Laboratory site boundary for Alternative A (No Action).

The incremental risk of tbe hypothetical individual developing a fatal cancer as a result of these exposures is illustrated in Figure 5.14-3. For reference, the figure shows the annual likelihood of a fatal cancer from all otber causes (NAS/NRC 1990) and the DOE National Safety Policy Goal SEN-35-91 (DOE 1991), as derived in Slaughterbeck et al. (1995). The policy states tbat the cancer fatality risk to the population within one mile of the site boundary of a DOE nuclear facility should not exceed 0.1 percent of tbe sum of all cancer fatality risks resulting from all other causes. This goal represents the integrated operational and accident aiming point for DOE facilities and does not represent an acceptance criterion. Illustration of the goal allows the reader to see the contribution of tbe maximum foreseeable accidents to the integrated goal. Excess cancer fatality rates in the population from the analyzed accidents are illustrated in Figure 5.14-4.

From an assessment of a maximum reasonably foreseeable accident for an exposed population of 33 workers, the risk of cancer fatalities as a result of an eartbquake-induced criticality at the Test Area Nortb Hot Shop is about 8.1×10^{-5} per year (Slaughterbeck et al. 1995). If a criticality were to occur in an unshielded area, fatal doses could occur up to 40 meters from the source. Table 5.14-4 lists tbe potential secondary environmental impacts of accidents (that is, impacts other tban possible human health effects).

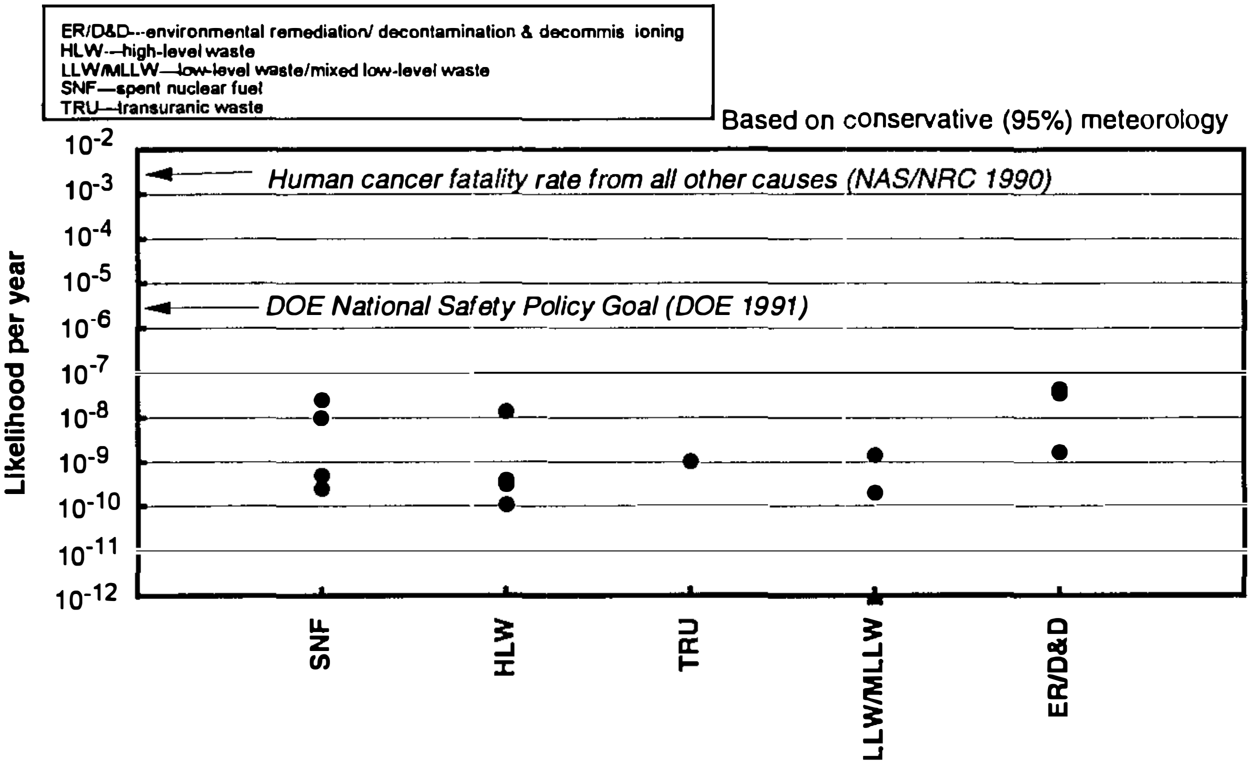


Figure 5.14-3. Risk of fatal cancer to individual at nearest Idaho National Engineering Laboratory site boundary from radiation accidents for Alternative A (No Action).

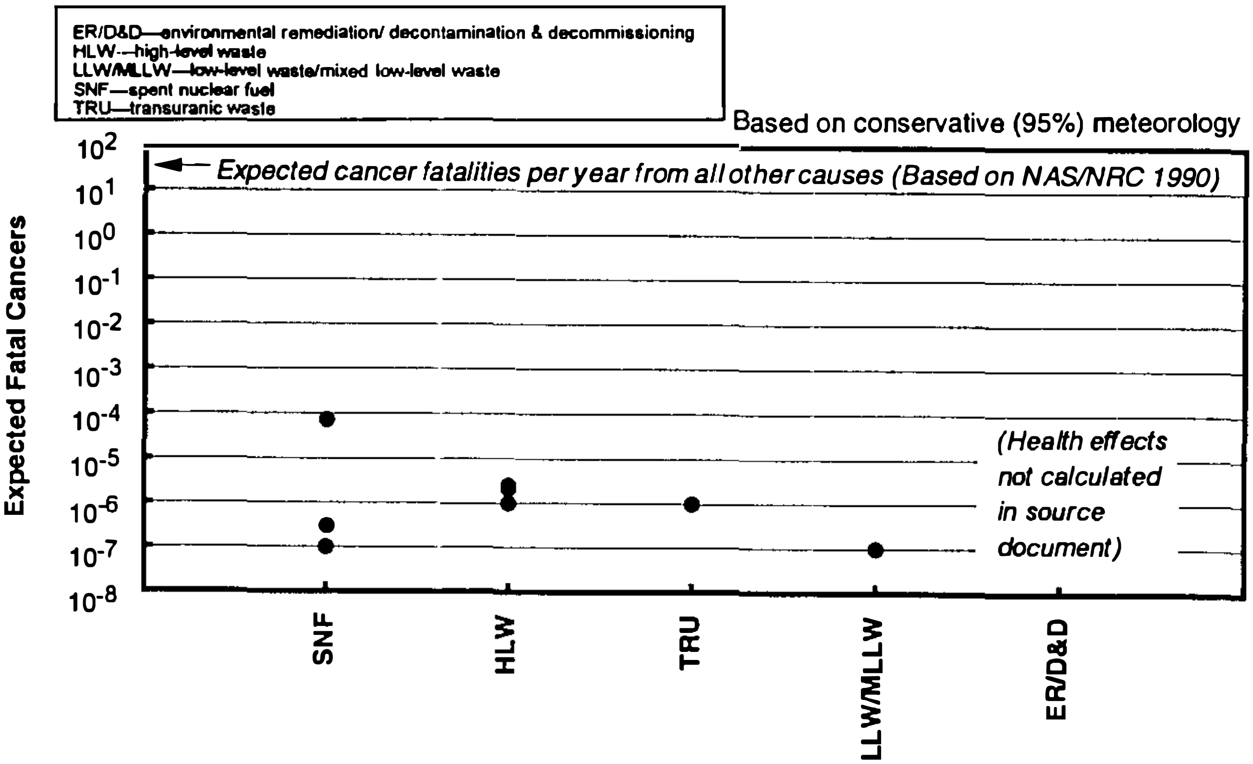


Figure 5.14-4. Excess fatal cancers in exposed population from radiation accidents at Idaho National Engineering Laboratory facilities for Alternative A (No Action).

Table 5.14-4. Assessment of potential secondary impacts of accidents at the Idaho National Engineering Laboratory site (applicable to all alternatives).[a]

	Environmental or social factor							
Accident	Biotic resources	Water resources	Economic impacts[b]	National defense	Environmental contamination	Endangered species	Land use	Tribal resources
Spent Nuclear Fuel Accidents								
Severe earthquake at Hot Fuel Examination Facility (HFEF)	Limited adverse effects expected to vegetation or wildlife	Limited adverse effects expected to surface water or groundwater	Potential interdiction of affected agricultural products on nearby land. Local cleanup in the vicinity of HFEF	No effect on national defense	Local contamination requiring cleanup expected around site of accident	No impacts expected to endangered or threatened species	Potential for one year agricultural land withdrawal of up to 10,000 acres or 4,000 hectares (on and off INEL)[c]	Potential for temporary restricted access to affected public land (less than 10,000 acres or 4,000 hectares)[c]
Aircraft crash into HFEF	Limited adverse effects expected to vegetation or wildlife	Limited adverse effects expected to surface water or groundwater	Potential interdiction of affected agricultural products on nearby land. Local cleanup in the vicinity of HFEF	No effect on national defense	Local contamination requiring cleanup expected around site of accident	No impacts expected to endangered or threatened species	Potential for one year agricultural land withdrawal of up to 10,000 acres or 4,000 hectares (on and off INEL)[c]	Potential for temporary restricted access to affected public land (less than 10,000 acres or 4,000 hectares)[c]
High-Level Waste Accidents								
Aircraft crash into calcine bin set	Limited adverse effects expected to vegetation or wildlife	Limited adverse effects expected to surface water or groundwater	Potential interdiction of affected agricultural products on nearby land. Local cleanup in the vicinity of Calcined Solids Storage Facility (CSSF)	No effect on national defense	Local contamination requiring cleanup expected around site of accident	No impacts expected to endangered or threatened species	Potential for one year agricultural land withdrawal of up to 4,000 acres or 1,600 hectares (on and off INEL)[c]	Potential for temporary restricted access to affected public land (less than 4,000 acres or 1,600 hectares)[c]
Transuranic Waste Accidents								
Lava flow over Radioactive Waste Management Complex (RWMC)	Potential biotic concentration of heavy metals	Limited adverse effects expected to surface water or groundwater	Local cleanup in the vicinity of RWMC	No effect on national defense	Local contamination requiring cleanup expected around site of accident	No impacts expected to endangered or threatened species	No change in land use expected	No impacts to tribal resources expected

a. Accidents other than those listed are expected to have secondary impacts limited to the immediate facility area.
b. In addition to economic impacts listed, facility repair or replacement costs may be incurred.
c. Estimated area of land contaminated with radioactivity greater than 100 millirem per year.

5.14.3.2 High-Level Waste. High-level waste results as a byproduct of the reprocessing of spent nuclear fuel. During the past several decades at the INEL, fuel reprocessing at the Idaho Chemical Processing Plant produced high-level waste in a liquid form that is stored in underground tanks. Much of this liquid has been immobilized through a high-temperature calcine process that converts the liquid to a granular solid that is stored in bins inside concrete storage vaults. Both the liquid and granular solid are high-level waste, but the granular solid is less susceptible to leakage than liquid. Although reprocessing of spent nuclear fuel at the INEL has terminated, inventories of liquid and granular high-level waste remain. The accident analysis considers the potential for release of both the liquid and granular high-level waste forms. The process to convert the liquid high-level waste to granular calcine is ongoing and applies to Alternative A (No Action). Construction associated with upgrades to underground storage tanks could result in construction accidents.

Using existing safety analysis reports and independent calculations, the accidents selected in the screening process were assessed for risks to the public, workers, and the environment. The DOE did not consider high-level waste tank explosions as reasonably foreseeable because the chemicals in the tanks do not generate hydrogen or other explosive gases. On the basis of the quantity of high-level waste present, and handling in the calcine process, the accidents with airborne releases given in Table 5.14-3 were determined to have bounding radiological consequences within the abnormal, design basis, and beyond design basis frequency categories (Appendix F-5). Impacts from these accidents are illustrated in Figures 5.14-2, 5.14-3, and 5.14-4. For an earthquake-caused collapse of the main stack at the Idaho Chemical Processing Plant, the risk of fatal cancer to a population of 50 workers is estimated to be 1.1×10^{-2} per year (Slaughterbeck et al. 1995). Workers near the source of the release have a potential risk of injury or death.

A high-level waste tank failure with complete draining was evaluated to determine potential impacts on groundwater. Assuming no other liquid discharges to the tank failure area, infiltration to the aquifer would occur over approximately 200 years, and the concentration of the limiting radionuclide, strontium-90, would reach a peak concentration of 2 picocuries per liter 300 years after tank rupture. The current drinking water maximum contaminant level for strontium-90 is 8 picocuries per liter.

Table 5.14-4 lists the potential secondary environmental impacts of accidents (that is, impacts other than possible human health effects). The hazardous constituents of high-level waste were analyzed

(Slaughterbeck et al. 1995) and found to be bounded by the hazardous material releases considered in Section 5.14.3.5.

5.14.3.3 Transuranic Waste. Transuranic waste is stored and buried at the Radioactive Waste Management Complex at the INEL site. Transuranic waste activities under Alternative A (No Action) would be continued storage and characterization, and continued retrieval of stored and buried wastes. If the Waste Isolation Pilot Plant is available, retrived and stored waste that is certified to the Waste Isolation Pilot Plant acceptance criteria would be shipped to the Waste Isolation Pilot Plant. If the Waste Isolation Pilot Plant is unavailable, the total inventory of transuranic waste would change very little in the 1995-to-2005 time period; however, the storage configuration would change for some waste. The waste retrieved in environmental remediation activities at Pit 9 would change from disposed of to stored status. On the basis of the quantity of transuranic waste present and storage configuration (stored or buried), the accidents given in Table 5.14-3 were determined to have maximum reasonably foreseeable consequences (see Appendix F-5). Radiological impacts from these accidents are illustrated in Figures 5.14-2, 5.14-3, and 5.14-4. Hazardous constituents in transuranic waste are evaluated in Section 5.14.3.5.

For a fire at the Radioactive Waste Management Complex, the risk of fatal cancer to an estimated population of 20 exposed workers is estimated to be 7.7×10^{-4} per year (Slaughterbeck et al. 1995). Workers near the source of the release have a potential risk of injury or death. Table 5.14-4 lists the potential secondary impacts of accidents (that is, economics and land use, biotic and water resources, tribal resources, national defense capability, and environmental contamination).

5.14.3.4 Mixed and Low-Level Waste. Under Alternative A (No Action), low-level waste would continue to be buried at the Radioactive Waste Management Complex, and mixed low-level waste would continue to be stored at the Mixed Waste Storage Facility and the Waste Experimental Reduction Facility Waste Storage Building in the Power Burst Facility area. On the basis of the quantity of mixed low-level waste/low-level waste present and the storage configuration, the accidents given in Table 5.14-3 were determined to have maximum radiological consequences within the abnormal, design basis, and beyond design basis frequency categories (Appendix F-5). Radiological impacts from these accidents are illustrated in Figures 5.14-2, 5.14-3, and 5.14-4. Worker risk of fatal cancers is less than that for the materials considered above; workers near the source of the release have a potential risk of injury or death. No secondary impacts would be expected from mixed or low-level waste accidents. The hazardous constituents of mixed low-level waste were analyzed (Slaughterbeck et al. 1995) and found to be bounded by the releases considered in Section 5.14.3.5.

5.14.3.5 Hazardous Materials. The scope of the accident assessment of hazardous materials includes hazardous wastes and hazardous constituents of radioactive waste streams. Under Alternative A (No Action), hazardous waste would continue to be stored at the Hazardous Waste Storage Facility, the Hazardous and Radioactive Mixed Waste Staging Area, and the Hazardous Chemical/Radioactive Waste Facility. In addition, for the purposes of accident analysis, materials that are not considered hazardous waste by the Resource Conservation and Recovery Act, but are toxic to humans, are also assessed for accidents. Such materials at the INEL include chlorine, sodium, acids and bases, laboratory chemicals, and depleted uranium used at Test Area North for the manufacture of military tank armor. Hazardous constituents of other waste streams involve materials such as cadmium in high-level waste and mercury in transuranic wastes.

On the basis of the screening of threshold quantities of toxic and flammable materials (EPA 1990, FR 1994) and the quantities of materials present and their storage configuration, the accidents given in Table 5.14-5 were determined to have maximum reasonably foreseeable consequences. Also listed in the table are the estimated frequency of occurrence, and maximum exposure to a hypothetical individual at the nearest site boundary in terms of percentage of Emergency Response Planning Guide Level 3 values. The Emergency Response Planning Guide 3 values represent the concentration where, without evacuation, one would experience or develop life-threatening health effects. Concentrations that a hypothetical member of the public at the INEL site boundary could be exposed to as a result of accidents are illustrated in Figure 5.14-5. Concentrations at the nearest public access and in nearby communities are given in Slaughterbeck et al. (1995). The risk of prompt fatalities to an estimated population of 100 exposed workers as a result of a chlorine release at Argonne National Laboratory-West is estimated to be 1.0×10^{-3} per year (Slaughterbeck et al. 1995). Impacts to workers would range from minor irritation to eyes and lungs to death. No secondary impacts would result from hazardous waste accidents.

5.14.3.6 Environmental Remediation and Decontamination and Decommissioning. Approved environmental remediation and decontamination and decommissioning projects would continue under Alternative A (No Action). Activities would include remediation of Pit 9 and the vadose zone at the Radioactive Waste Management Complex and decontamination and decommissioning of the Auxiliary Reactor Area-II and Boiling Water Reactor Experiment-V.

Table 5.14-5. Impacts from selected maximum reasonably foreseeable accidents involving hazardous materials at the Idaho National Engineering Laboratory for Alternative A (No Action).

Accident	Frequency (events/yr)	MEI chemical concentration[a] (mg/m^3)	MEI chemical concentration (percentage of ERPG3)[b]
Chlorine release at Argonne National Laboratory-West (ANL-W)[c]	1×10^{-5}	20	35
Chlorine release at Central Facilities Area (CFA)[c]	1×10^{-4}	6.0	10
Chlorine release at Idaho Chemical Processing Plant (ICPP)[c]	5×10^{-6}	4.2	7
Nitric acid release at ICPP[c]	1×10^{-5}	0.12	0.05
Lava flow over Radioactive Waste Management Complex (RWMC)[d]	2×10^{-5}	Mercury: 3.0 Nitric acid: 20 Phosgene gas: 0.10	Mercury: 30 Nitric acid: 6 Phosgene gas: 3
Fire in depleted uranium scrap at Test Area North[c]	1×10^{-7}	0.20	1
Handling accident involving existing quantities of sulfur dioxide at INEL Research Center[c]	1×10^{-4}	13	33

a. MEI - maximally exposed individual at the nearest site boundary.
b. ERPG3 - Emergency Response Planning Guide Level 3 (immediately dangerous to life and health).
c. Hazardous materials in inventory.
d. Hazardous constituents of transuranic and products of combustion.

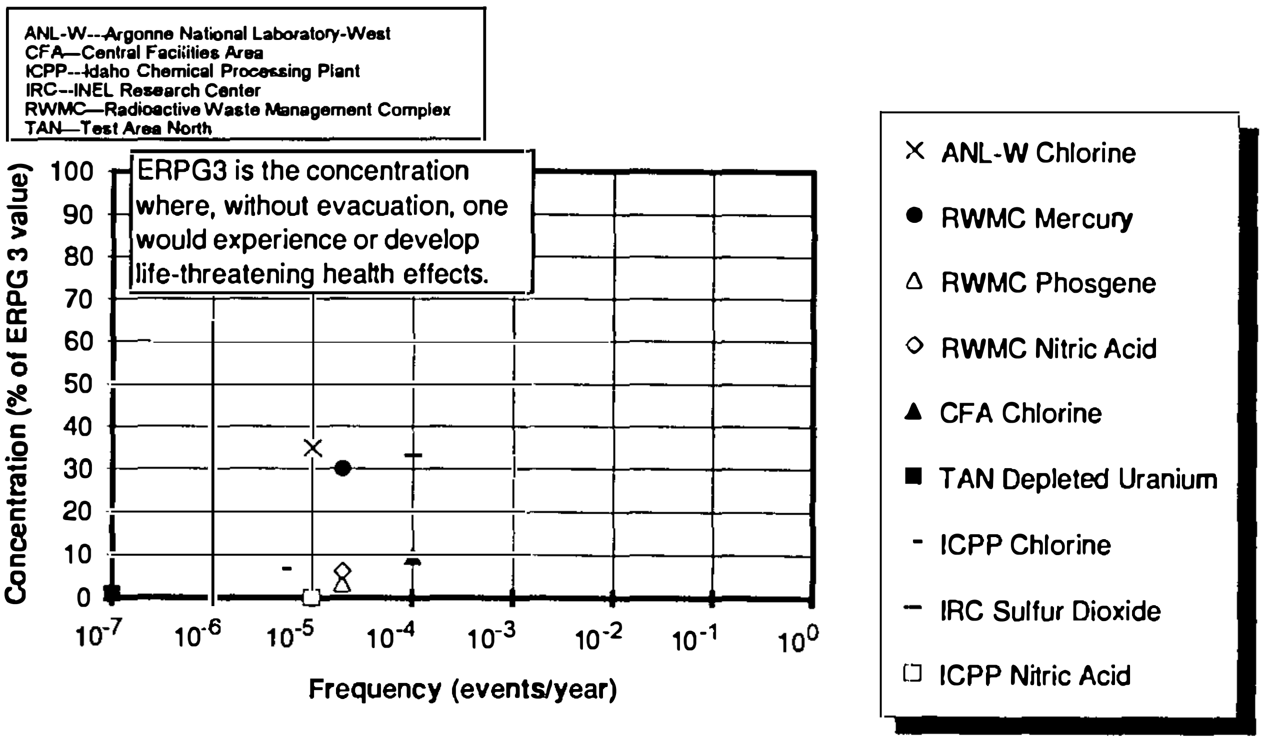


Figure 5.14-5. Potential maximum hazardous chemical concentrations at nearest Idaho National Engineering Laboratory site boundary as a percentage of ERPG3 concentration for Alternative A (No Action).

Based on quantities of radioactive material present, the accidents given in Table 5.14-3 were determined to have bounding consequences within the abnormal, design basis, and beyond design basis frequency categories. Impacts from these accidents are illustrated in Figures 5.14-2 and 5.14-3. While excess fatal cancers in the exposed population were not calculated in the source document (Slaughterbeck et al. 1995), excess fatal cancers would be similar to those of the other waste streams based on similar risks to the maximum exposed individual at the nearest site boundary. No secondary impacts or worker fatalities would be expected.

5.14.4 Impacts from Alternative B (Ten-Year Plan)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to those characterized in Alternative A (No Action); workers near the source of releases have a potential risk of injury or death. The accident impacts from several Alternative B (Ten-Year Plan) projects are evaluated.

5.14.4.1 Spent Nuclear Fuel. The incremental risk of accidents over those assessed in Alternative A (No Action) (Section 5.14.3.1) would be related to construction activities and the receipt of additional offsite spent nuclear fuel shipments (including Fort St. Vrain fuels) at the INEL site. The increased quantity of relatively long-cooled fuel would be managed and stored in the Fluorinel and Storage (FAST) Facility (CPP-666) basins, the CPP-749 Underground Storage Facility, and a proposed new dry storage/canning and characterization facility at the Idaho Chemical Processing Plant. On the basis of the estimated changes in spent fuel-handling activities under Alternative B, the frequency of a fuel-handling accident is increased by a factor of 4.8. The offsite consequences would not increase over those analyzed for Alternative A. For a criticality accident at the CPP-603 Underwater Fuel Storage Facility resulting from a handling accident associated with degraded spent nuclear fuel, the estimated frequency considered under Alternative A (1×10^{-3} or 0.001 events per year) is based on the number of handling activities associated with relocating the CPP-603 spent nuclear fuel inventories to CPP-666. Because handling events associated with relocating spent nuclear fuel from CPP-603 to CPP-666 are unaffected by proposed changes in INEL inventories under the different alternatives, the estimated frequency for this event would not change.

Adding storage racks to CPP-666, as proposed under this alternative, would allow more wet fuel storage capacity at the INEL site. The increased handling of spent fuel necessary to add racks may increase the probability of a mechanical damage or criticality accident. The construction activities would increase the likelihood of an industrial accident and worker injury or death. For analysis purposes, operations at Argonne National Laboratory-West were assumed to continue as in Alternative A (No Action), and because of the short-cooled fuel handled at this facility, the Alternative A accidents would continue to bound the design basis and beyond design basis accident frequency categories under Alternative B (Ten-Year Plan). The bounding accident characteristics within each frequency category that differ from those specified in Alternative A (Section 5.14.3.1) are summarized in Table 5.14-6. The Alternative B accident impacts for spent nuclear fuel and other radioactive waste streams are illustrated in Figures 5.14-6, 5.14-7, and 5.14-8.

5.14.4.2 High-Level Waste. The frequency of construction accidents and minor radiological accidents would increase as a result of proposed actions. However, the consequences of accidents associated with high-level waste facilities under Alternative B (Ten-Year Plan) are bounded by those analyzed under Alternative A (No Action).

One Alternative B project includes technology selection for processing sodium-bearing liquid waste and calcined high-level waste. Accidents associated with current storage of sodium-bearing liquid waste and with calcining activities bound chosen technologies because the chosen technology would use current design requirements and best available treatment technologies. The resultant waste form would be more safe than the current high-level waste form stored at the INEL site.

5.14.4.3 Transuranic Waste. Construction accidents and minor radiological accidents could occur as a result of proposed actions under Alternative B (Ten-Year Plan). Additional transuranic waste would be received for storage. The frequency of a fire in the Radioactive Waste Management Complex transuranic storage area is assumed to increase by approximately a factor of five on the basis of estimated handling requirements. The consequences of a lava flow accident would increase by approximately 10 percent on the basis of the projected change in inventory of transuranic waste at the Radioactive Waste Management Complex.

5.14.4.4 Mixed and Low-Level Waste. Under Alternative B (Ten-Year Plan), additional mixed and low-level waste would be generated on the INEL site by proposed projects and by decontamination and decommissioning activities. The frequency of fires in mixed waste storage and the Radioactive Waste Management Complex subsurface disposal area is estimated to increase by

Table 5.14-6. Characteristics of radiological accidents at the Idaho National Engineering Laboratory site under Alternative B (Ten-Year Plan) that differ from those under Alternative A (No Action).[a]

Accident	Frequency (events/yr)	Facility worker dose (rem)[c]	Dose at nearest public access (rem)[d]	Dose to MEI (rem)[e]	Offsite population dose (person-rem) 95% meteorology	Risk of fatal cancer per year[b]		
						MEI	Population, 50% meteorology	Population, 95% meteorology
Spent Nuclear Fuel Accidents								
Fuel handling accident, fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel handling accident)	4.8×10^{-2}	(f)	(f)	2.0×10^{-3}	(f)	4.8×10^{-8}	(f)	(f)
High-Level Waste Accidents - ***No Change from Alternative A***								
Transuranic Waste Accidents								
Lava flow over RWMC	2×10^{-5}	Evacuate	Evacuate	1.0×10^{-1}	1.1×10^{2}	1.0×10^{-9}	2.6×10^{-7} (1.3×10^{-2})	1.1×10^{-6} (5.3×10^{-2})
Fire in RWMC TSA	2×10^{-5}	(f)	(f)	1.0×10^{-6}	(f)	1.0×10^{-14}	(f)	(f)
Mixed Low-Level/Low-Level Waste Accidents								
Fire in RWMC SDA	2×10^{-3}	(f)	(f)	4.0×10^{-4}	(f)	4.0×10^{-10}	(f)	(f)
Design basis fire at WERF Waste Storage Building	2×10^{-3}	(f)	(f)	2.8×10^{-3}	(f)	2.8×10^{-9}	(f)	(f)
Environmental Remediation/Decontamination and Decommissioning Accidents - ***No Change from Alternative A***								

a. Accidents involving hazardous materials for Alternative A are summarized in Table 5.14-5 (Section 5.14.3.5).

b. Fatal cancer risk = dose × accident frequency × (5.0×10^{-4} fatal cancers per rem) (ICRP-60 conversion factor) if dose is <20 rem (ICRP 1991). For doses ≥20 rem, the ICPR-60 conversion factor is doubled, or 1.0×10^{-3}. Numbers in parentheses indicate total number of fatal cancers in the population if the accident occurs.

c. A facility worker is defined as a worker located 100 m (330 ft) from the point of release.

d. Member of the public on a highway at the nearest point to the facility within the site boundary.

e. MEI = maximally exposed hypothetical individual whose residence is located at the nearest site boundary.

f. The safety analysis report utilized for this accident does not provide this information because it was developed before DOE orders specifically required this information. As demonstrated by the dose to the MEI, consequences to the public from this accident are less than or comparable to the consequences from the spent nuclear fuel and high-level waste accidents in Table 5.14-3 with calculated population doses.

Definition of acronyms:
HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at the nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
WERF - Waste Experimental Reduction Facility
TSA - Transuranic Storage Area

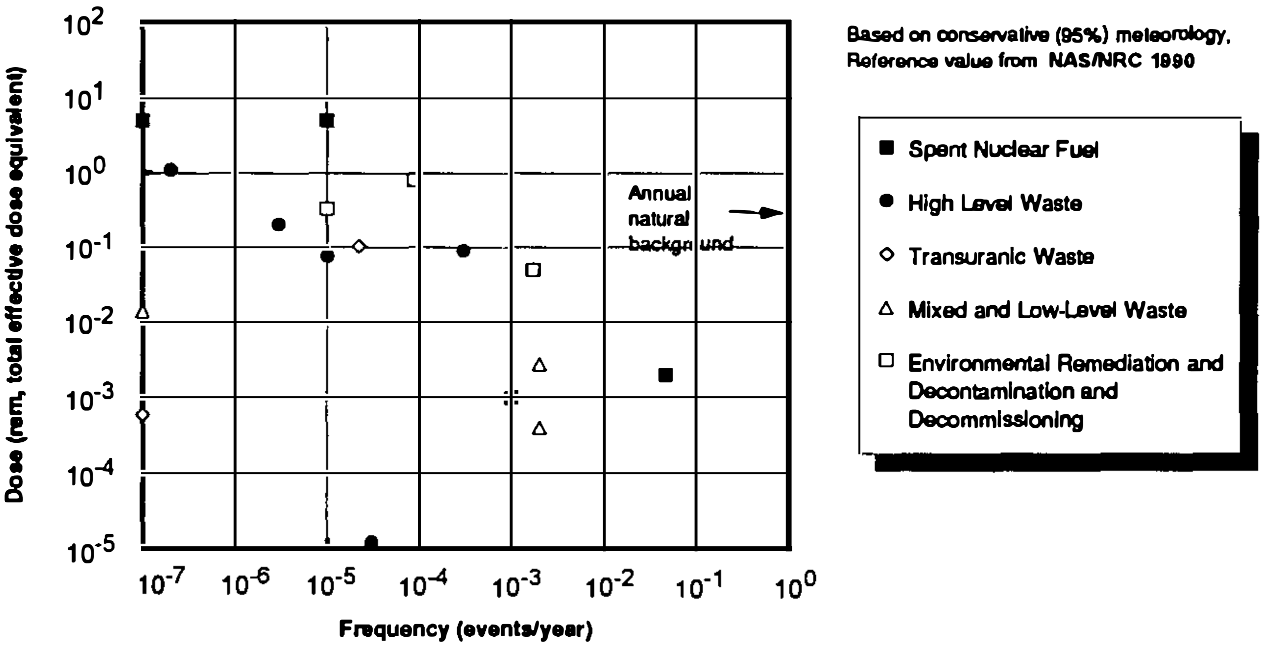


Figure 5.14-6. Potential radiation exposures from accidents to individual at nearest Idaho National Engineering Laboratory site boundary for Alternative B (Ten-Year Plan).

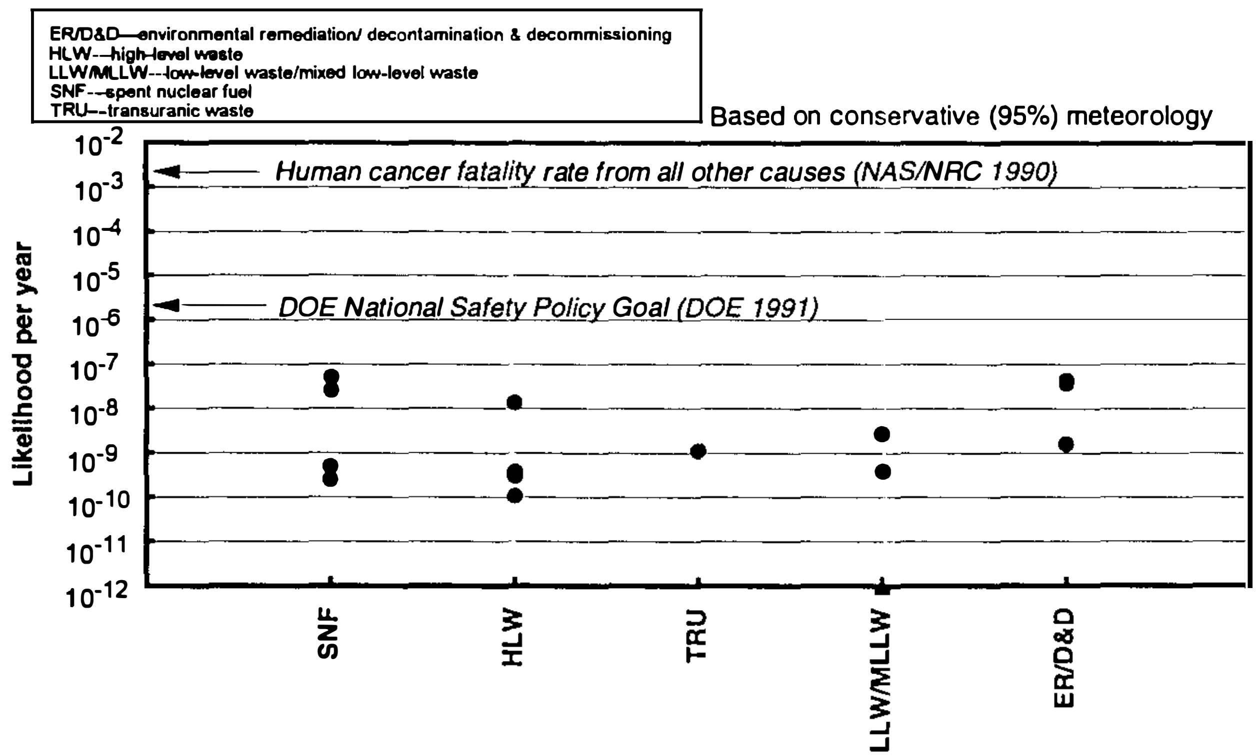


Figure 5.14-7. Risk of fatal cancer to individual at nearest Idaho National Engineering Laboratory site boundary from radiation accidents for Alternative B (Ten-Year Plan).

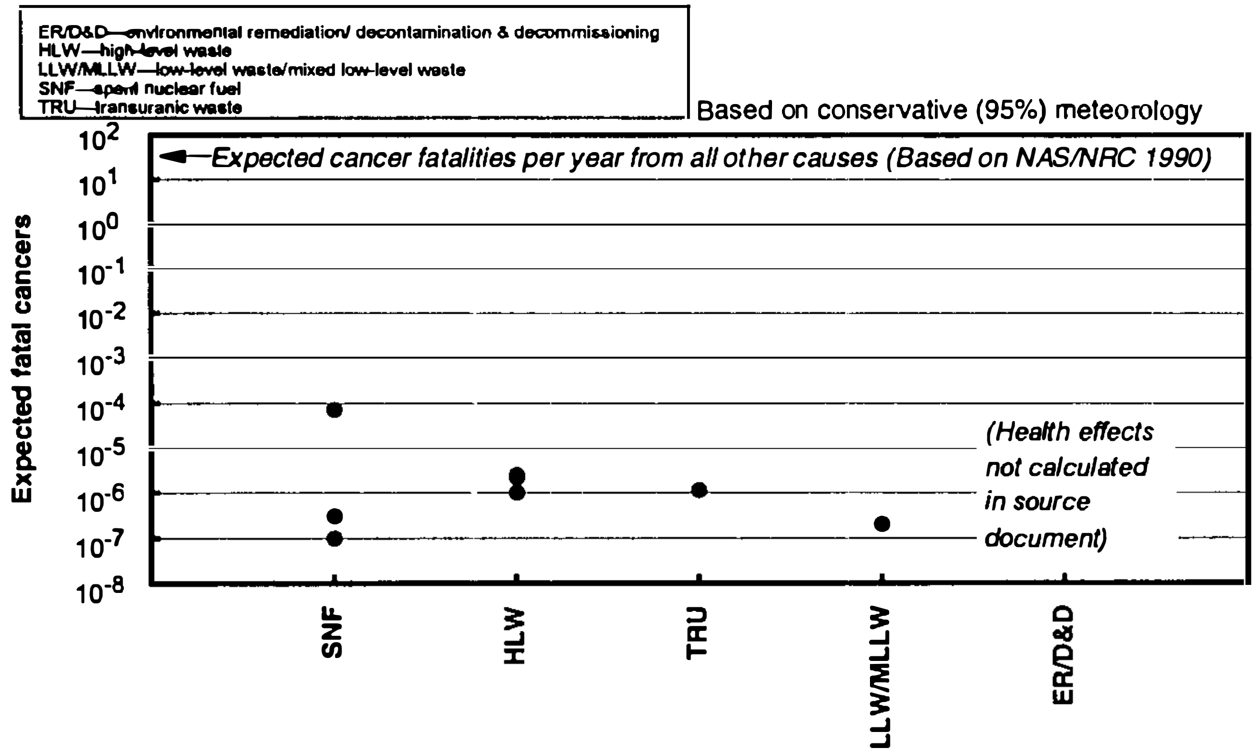


Figure 5.14-8. Excess fatal cancers in exposed population from radiation accidents at Idaho National Engineering Laboratory facilities for Alternative B (Ten-Year Plan).

a factor of two on tbe basis of projected waste-handling requirements. Accidents witb lower consequences and construction accidents could occur as a result of proposed actions, for example, tbe Alternative B project, incineration of low-level and mixed low-level waste at tbe Waste Experimental Reduction Facility.

5.14.4.5 Hazardous Materials. The consequences of maximum reasonably foreseeable accidents associated with hazardous waste or chemicals would be the same under Alternative B (Ten-Year Plan) as those analyzed under Alternative A (No Action). Lower consequence accidents could occur as a result of proposed actions.

5.14.4.6 Environmental Remediation and Decontamination and Decommissioning. The incremental risk of accidents over tbose assessed in Alternative A (No Action) would be related to expanded environmental remediation and decontamination and decommissioning activities (including construction) on the basis of current plans. However, accidents associated with environmental remediation at Pit 9 at the Radioactive Waste Management Complex would bound consequences of accidents at other activities on the INEL site. Therefore, the consequences of maximum reasonably foreseeable accidents associated with environmental remediation and decontamination and decommissioning activities would be the same under Alternative B (Ten-Year Plan) as those analyzed under Alternative A (No Action).

5.14.5 Impacts from Alternative C (Minimum Treatment, Storage, and Disposal)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to those characterized in Alternative A (No Action); workers near the source of releases have a potential risk of injury or death. The accident impacts from several Alternative C (Minimum Treatment, Storage, and Disposal) projects are evaluated.

5.14.5.1 Spent Nuclear Fuel. The incremental risk of accidents over those assessed in Alternative A (No Action) (Section 5.14.3.1) would be related to the eventual shipment offsite of the majority of spent nuclear fuel stored at the INEL. During the shipment phase, the additional fuel-handling activities may increase the frequency (8.6 times Alternative A), but not the offsite consequences, of fuel handling-type accidents. The decrease in total spent nuclear fuel at the INEL would decrease the frequency of accidents associated with storing spent nuclear fuel. For analysis purposes, operations at Argonne National Laboratory-West were assumed to continue as in Alternative A, and because of the short-cooled fuel handled at this facility, Alternative A accidents would continue to bound the design basis and beyond design basis accident frequency categories under Alternative C (Minimum Treatment, Storage, and Disposal). The bounding accidents within each frequency category that differ from those specified in Alternative A characteristics (Section 5.14.3.1) are summarized in Table 5.14-7. The Alternative C accident consequences for spent nuclear fuel and other radioactive waste streams are illustrated in Figures 5.14-9, 5.14-10, and 5.14-11. After shipment of all spent nuclear fuel offsite, only impacts associated with spent nuclear fuel at reactor operations would continue.

5.14.5.2 High-Level Waste. The consequences of maximum reasonably foreseeable accidents associated with high-level waste facilities would be the same under Alternative C (Minimum Treatment, Storage, and Disposal) as those analyzed under Alternative A (No Action). Lower

Table 5.14-7. Characteristics of radiological accidents at the Idaho National Engineering Laboratory site under Alternative C (Minimum Treatment, Storage, and Disposal) that differ from those under Alternative A (No Action).

Accident	Frequency (events/yr)	Facility worker dose (rem)[c]	Dose at nearest public access (rem)[d]	Dose to MEI[e] (rem)	Offsite population dose (person-rem) 95% meteorology	Risk of fatal cancer per year[b] MEI	Population, 50% meteorology	Population, 95% meteorology
Spent Nuclear Fuel Accidents								
Fuel-handling accident, fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel-handling accident)	8.6×10^{-2}	(f)	(f)	2.0×10^{-3}	(f)	8.6×10^{-8}	(f)	(f)
High-Level Waste Accidents - *No Change from Alternative A*								
Transuranic Waste Accidents								
Fire in RWMC TSA	4×10^{-5}	(f)	(f)	1.0×10^{-6}	(f)	2.0×10^{-14}	(f)	(f)
Mixed Low-Level/Low-Level Waste Accidents								
Design basis fire at WERF Waste Storage Building	2×10^{-3}	(f)	(f)	2.8×10^{-3}	(f)	2.8×10^{-9}	(f)	(f)
Environmental Remediation/Decontamination and Decommissioning Accidents - *No Change from Alternative A*								

a. Accidents involving hazardous materials for Alternative A are summarized in Table 5.14-5 (Section 5.14.3.5).

b. Fatal cancer risk = dose × accident frequency × (5.0×10^{-4} fatal cancers per rem) (ICRP-60 conversion factor) if dose is < 20 rem (ICRP 1991). For doses ≥ 20 rem, the ICPR-60 conversion factor is doubled, or 1.0×10^{-3} (ICRP 1991). Numbers in parentheses indicate total number of fatal cancers in the population if the accident occurs.

c. A facility worker is defined as a worker located 100 m (330 ft) from the point of release.

d. Member of the public on a highway at the nearest point to the facility within the site boundary.

e. MEI = maximally exposed hypothetical individual whose residence is located at the nearest site boundary.

f. The safety analysis report used for this accident does not provide this information because it was developed before DOE orders specifically required this information. As demonstrated by the dose to the MEI, consequences to the public from this accident are less than or comparable to the consequences from the spent nuclear fuel and high-level waste accidents in Table 5.14-3 with calculated population doses.

Definition of acronyms:

HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at the nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
WERF - Waste Experimental Reduction Facility
TSA - Transuranic Storage Area

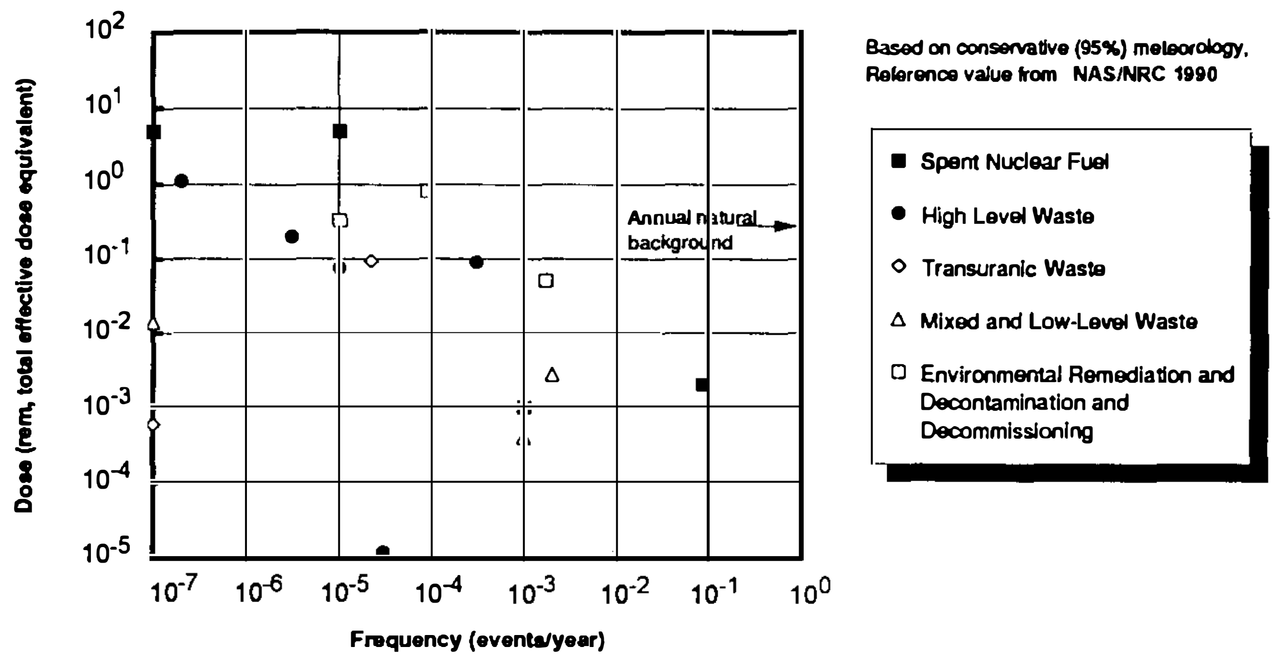


Figure 5.14-9. Potential radiation exposures from accidents to individual at nearest Idaho National Engineering Laboratory site boundary for Alternative C (Minimum Treatment, Storage, and Disposal).

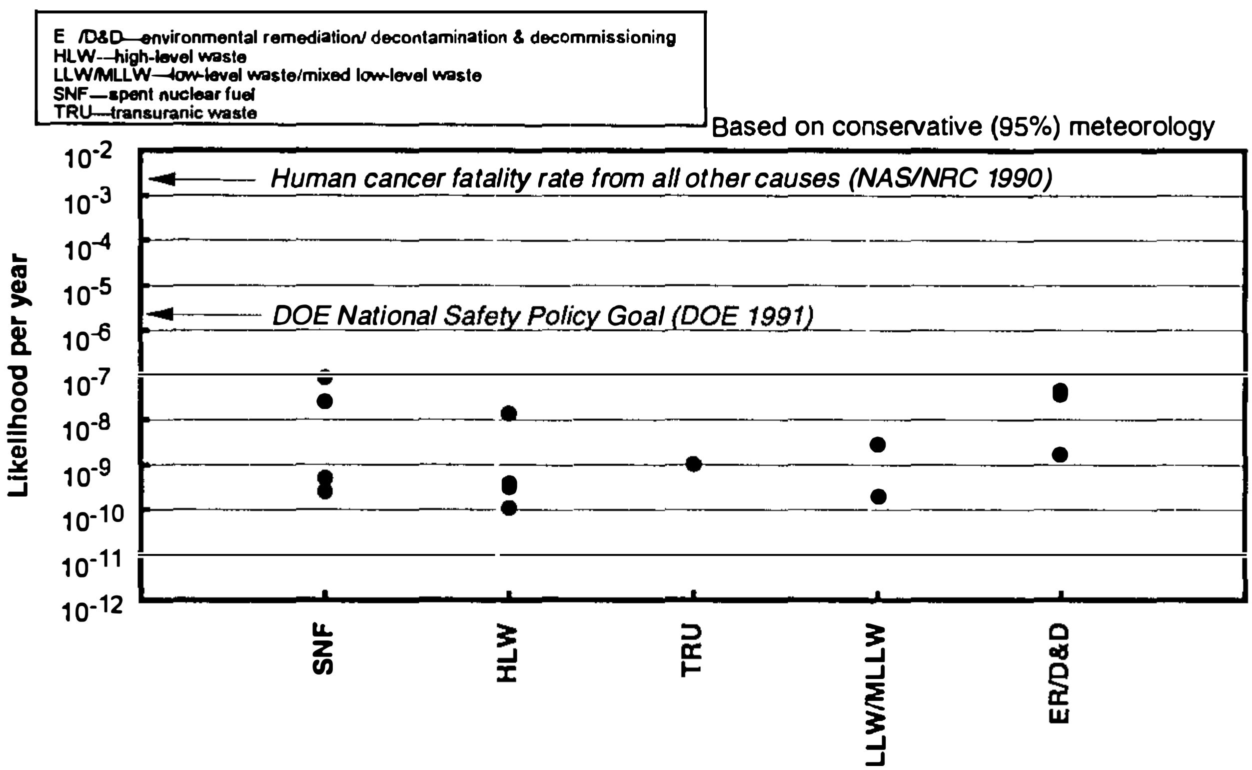


Figure 5.14-10. Risk of fatal cancer to individual at nearest Idaho National Engineering Laboratory site boundary from radiation accidents for Alternative C (Minimum Treatment, Storage, and Disposal).

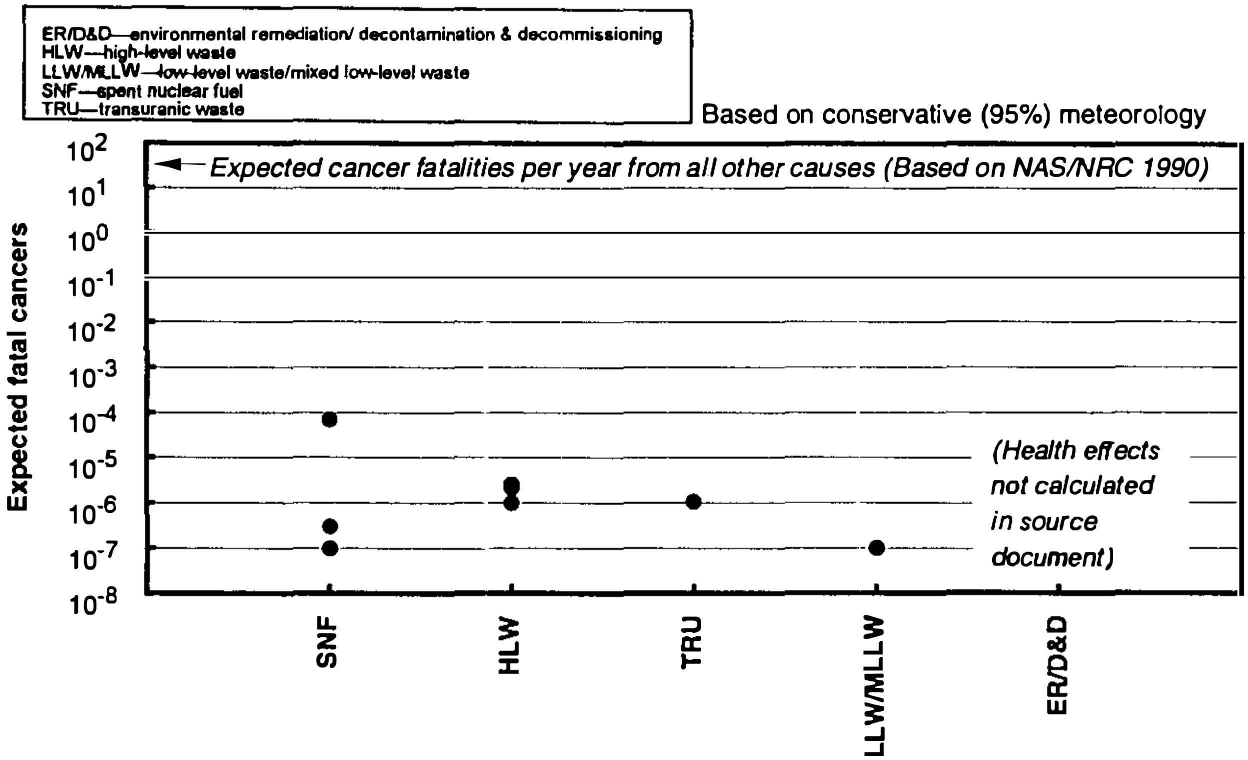


Figure 5.14-11. Excess fatal cancers in exposed population from radiation accidents at Idaho National Engineering Laboratory facilities for Alternative C (Minimum Treatment, Storage, and Disposal).

consequence accidents and construction accidents could occur as a result of proposed Alternative C actions, for example, replacement of high-level waste tanks. Replacement tanks would upgrade the safety of liquid high-level waste storage at the INEL site. Ultimately, the risk of accidents would be decreased because the tanks would be constructed in accordance with current design requirements, and would include features such as double wall confinement, leak detection, and seismic-resistant design. The construction activities would increase the likelihood of an industrial accident and worker injury or death. Another Alternative C project, selection of technologies for processing sodium-bearing liquid waste and calcined high-level waste, was discussed under Alternative B.

5.14.5.3 Transuranic Waste. Under Alternative C (Minimum Treatment, Storage, and Disposal), the majority of transuranic waste stored at the INEL site would be transported offsite to a different storage location. The increased handling necessary to retrieve, package, and transport transuranic waste from the INEL site would increase the frequency of fires approximately ten-fold. After shipment of transuranic wastes offsite, only impacts associated with INEL-generated transuranic wastes would continue.

5.14.5.4 Mixed and Low-Level Waste. Under Alternative C (Minimum Treatment, Storage, and Disposal), all stored and newly generated mixed low-level waste/low-level waste would be transported offsite for treatment, storage, and disposal. The increased handling necessary to package and transport mixed low-level waste/low-level waste from the INEL site would approximately double the frequency of a design basis fire in the Waste Experimental Reduction Facility Waste Storage Building. Following offsite shipment, only those quantities staged for offsite shipment from operating facilities would remain.

5.14.5.5 Hazardous Materials. The frequency and consequences of maximum reasonably foreseeable accidents associated with hazardous wastes and hazardous materials in inventory would be the same under Alternative C (Minimum Treatment, Storage, and Disposal) as those analyzed under Alternative A (No Action). Under Alternative C, mixed waste with hazardous constituents stored at the Radioactive Waste Management Complex would be transported offsite, eventually eliminating that source of hazardous material.

5.14.5.6 Environmental Remediation and Decontamination and Decommissioning. The frequency and consequences of accidents associated with environmental remediation and decontamination and decommissioning activities would be the same under Alternative C (Minimum Treatment, Storage, and Disposal) as those analyzed under Alternative A (No Action).

5.14.6 Impacts from Alternative D (Maximum Treatment, Storage, and Disposal)

Secondary impacts are shown in Table 5.14-4. Worker risks are similar to those characterized in Alternative A (No Action); workers near the source of releases have a potential risk of injury or death. The accident impacts from several Alternative D (Maximum Treatment, Storage, and Disposal) projects are evaluated.

5.14.6.1 Spent Nuclear Fuel. The incremental risk of accidents over those assessed in Alternative A (Section 5.14.3.1) would be related to two factors: (a) receipt of additional offsite shipments of relatively long-cooled spent nuclear fuel, and (b) processing of spent nuclear fuel for ultimate disposal. The additional handling necessary to receive and store spent nuclear fuel would be approximately 20 times that under Alternative A. The fuel received would be managed at a new dry storage/canning and characterization facility at the Idaho Chemical Processing Plant. The additional fuel-handling and dry storage activities would be expected to increase by 20 times the frequency, but not the consequences, of fuel-handling-type accidents. Stabilization of the fuel for long-term storage would be performed in a new Waste Immobilization Facility at tbe Idaho Chemical Processing Plant. Consequences of potential accidents at the Waste Immobilization Facility are bounded by spent nuclear fuel activities involving short-cooled fuel as assessed in Alternative A.

Fuel processing would take place in the Fluorinel and Storage (FAST) facility (CPP-666) and the Fuel Processing Restoration Facility (CPP-691). Processing would consist of dissolving spent nuclear fuel in an acid solution, and processing the dissolved fuel to immobilize radionuclides for final waste disposal. On the basis of accidents previously analyzed in EG&G Idaho (1993), bounding accidents associated with fuel processing are nuclear criticality, dissolver hydrogen explosion, and accidental dissolution of 30-day cooled fuel.

For analysis purposes, operations at Argonne National Laboratory-West were assumed to continue as in Alternative A (No Action), and because of the short-cooled fuel handled at this facility, Alternative A accidents would continue to bound the design-basis and beyond-design-basis accident frequency categories under Alternative D (Maximum Treatment, Storage, and Disposal). The bounding accident characteristics within each frequency category that differ from those specified in Alternative A (Section 5.14.3.1) are summarized in Table 5.14-8. The Alternative D accident consequences for spent nuclear fuel and all radioactive waste streams are illustrated in Figures 5.14-12, 5.14-13, and 5.14-14.

5.14.6.2 High-Level Waste. Because of spent fuel processing activities, additional high-level waste would be generated and processed at the Idaho Chemical Processing Plant under Alternative D (Maximum Treatment, Storage, and Disposal). However, the frequency and consequences of accidents associated with high-level waste facilities would be bounded by those analyzed under Alternative A (No Action) because existing calcine facilities would continue to be used, and because of proposed safety upgrades to liquid waste management facilities under Alternative D. Several example Alternative D projects involving high-level waste (selection of technologies for processing sodium-bearing liquid waste and calcined high-level waste and replacement of high-level waste tanks) were discussed briefly under Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal), respectively.

5.14.6.3 Transuranic Waste. The incremental risk of accidents over those assessed in Alternative A (No Action) would be related to the receipt of DOE complex-wide waste for examination, treatment, storage, and preparation for shipping for disposal at the Waste Isolation

Table 5.14-8. Characteristics of radiological accidents at the Idaho National Engineering Laboratory site under Alternative D (Maximum Treatment, Storage, and Disposal) that differ from those under Alternative A (No Action).

Accident	Frequency (events/yr)	Facility worker dose (rem)[c]	Dose at nearest public access (rem)[d]	Dose to MEI (rem)[e]	Offsite population dose (person-rem) 95% meteorology	Risk of fatal cancer per year[b] MEI	Population, 50% meteorology	Population, 95% meteorology
Spent Nuclear Fuel Accidents								
Fuel handling accident, fuel pin breach, venting of noble gases and iodine (bounded by HFEF fuel handling accident)	2.0×10^{-1}	(f)	(f)	2.0×10^{-3}	(f)	2.0×10^{-7}	(f)	(f)
Inadvertent nuclear criticality during processing	[g]1×10^{-3}	9.1	4.9×10^{-2}	2.8×10^{-2}	5.6	1.4×10^{-8}	3.1×10^{-6} (3.1×10^{-3})	2.8×10^{-6} (2.8×10^{-3})
Dissolver hydrogen explosion	1×10^{-5}	(f)	(f)	6.3×10^{-4}	[h]8.1×10^{-1}	3.2×10^{-12}	(f)	4.1×10^{-9} (4.1×10^{-4})
Inadvertent dissolution of 30-day cooled fuel	1×10^{-6}	(f)	(f)	3.0×10^{-2}	[h]2.9×10^{1}	1.5×10^{-11}	(f)	1.5×10^{-8} (1.5×10^{-2})
High-Level Waste Accidents - *No Change from Alternative A*								
Transuranic Waste Accidents								
Lava flow over RWMC	2×10^{-5}	Evacuate	Evacuate	1.1×10^{-1}	1.2×10^{2}	1.1×10^{-9}	2.9×10^{-7} (1.4×10^{-2})	1.2×10^{-6} (5.8×10^{-2})
Fire in RWMC TSA	4×10^{-5}	(f)	(f)	1.0×10^{-6}	(f)	2.0×10^{-14}	(f)	(f)
Mixed Low-Level/Low-Level Waste Accidents								
Fire in RWMC SDA	1×10^{-2}	(f)	(f)	4.0×10^{-3}	(f)	2.0×10^{-8}	(f)	(f)
Design basis fire at WERF Waste Storage Building	1×10^{-2}	(f)	(f)	2.8×10^{-3}	(f)	1.4×10^{-8}	(f)	(f)
Environmental Remediation/Decontamination and Decommissioning Accidents - *No Change from Alternative A*								

a. Accidents involving hazardous materials for Alternative A (No Action) are summarized in Table 5.14-5 (Section 5.14.3.5).

b. Fatal cancer risk = dose × accident frequency × (5.0×10^{-4} fatal cancers per rem) (ICRP-60 conversion factor) if dose is <20 rem (ICRP 1991). For doses ≥20 rem, the ICPR-60 conversion factor is doubled, or 1.0×10^{-3}. Numbers in parentheses indicate total number of fatal cancers in the population if the accident occurs.

c. A facility worker is defined as a worker located 100 m (330 ft) from the point of release.

d. Member of the public on a highway at the nearest point to the facility within the site boundary.

e. MEI = maximally exposed hypothetical individual whose residence is located at the nearest site boundary.

f. The safety analysis report utilized for this accident does not provide this information because it was developed before DOE orders specifically required this information. As demonstrated by the dose to the MEI, consequences to the public from this accident are less than or comparable to the consequences from the spent nuclear fuel and high-level waste accidents in Table 5.14-3 with calculated population doses.

g. Idaho Chemical Processing Plant has experienced three inadvertent criticalities during its operating history, the last one 14 years ago. The frequency shown is based on modern facility design and safeguards.

h. The safety analysis report utilized for this accident used a population of 100,000. Assuming worst-case atmospheric conditions and wind direction, the projected maximum sector within 50 miles of the accident is approximately 9,100.

Definition of acronyms:

HFEF - Hot Fuel Examination Facility
MEI - maximally exposed individual at nearest site boundary
RWMC - Radioactive Waste Management Complex
SDA - Subsurface Disposal Area
TSA - Transuranic Storage Area
WERF - Waste Experimental Reduction Facility

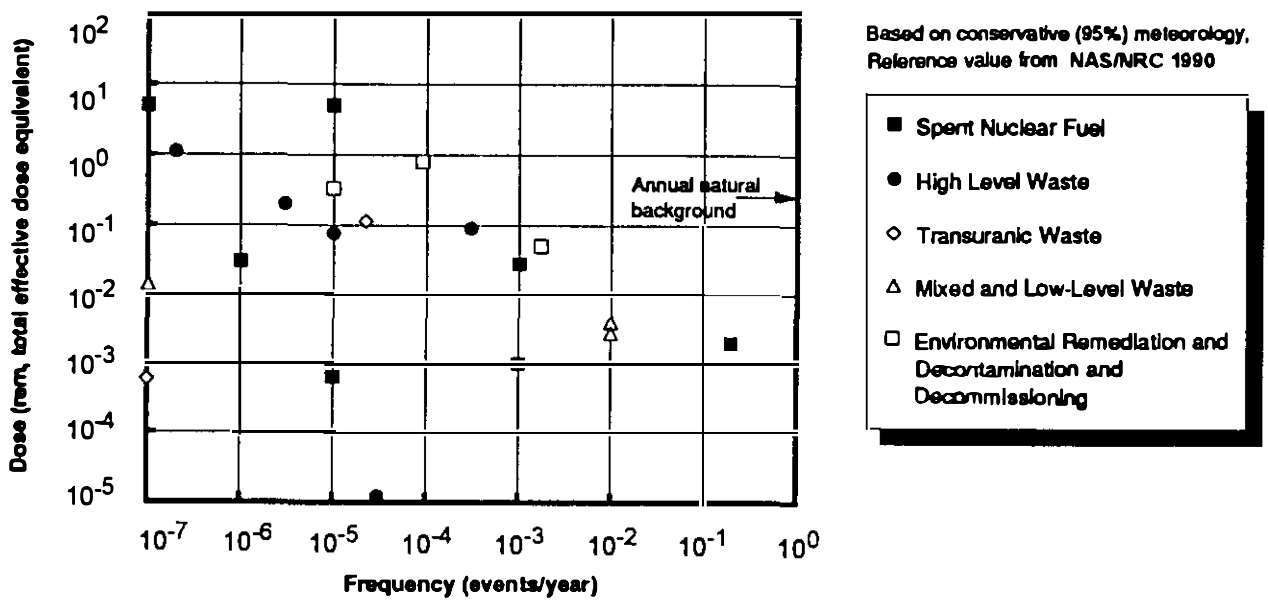


Figure 5.14-12. Potential radiation exposures from accidents to individual at nearest Idaho National Engineering Laboratory site boundary for Alternative D (Maximum Treatment, Storage, and Disposal).

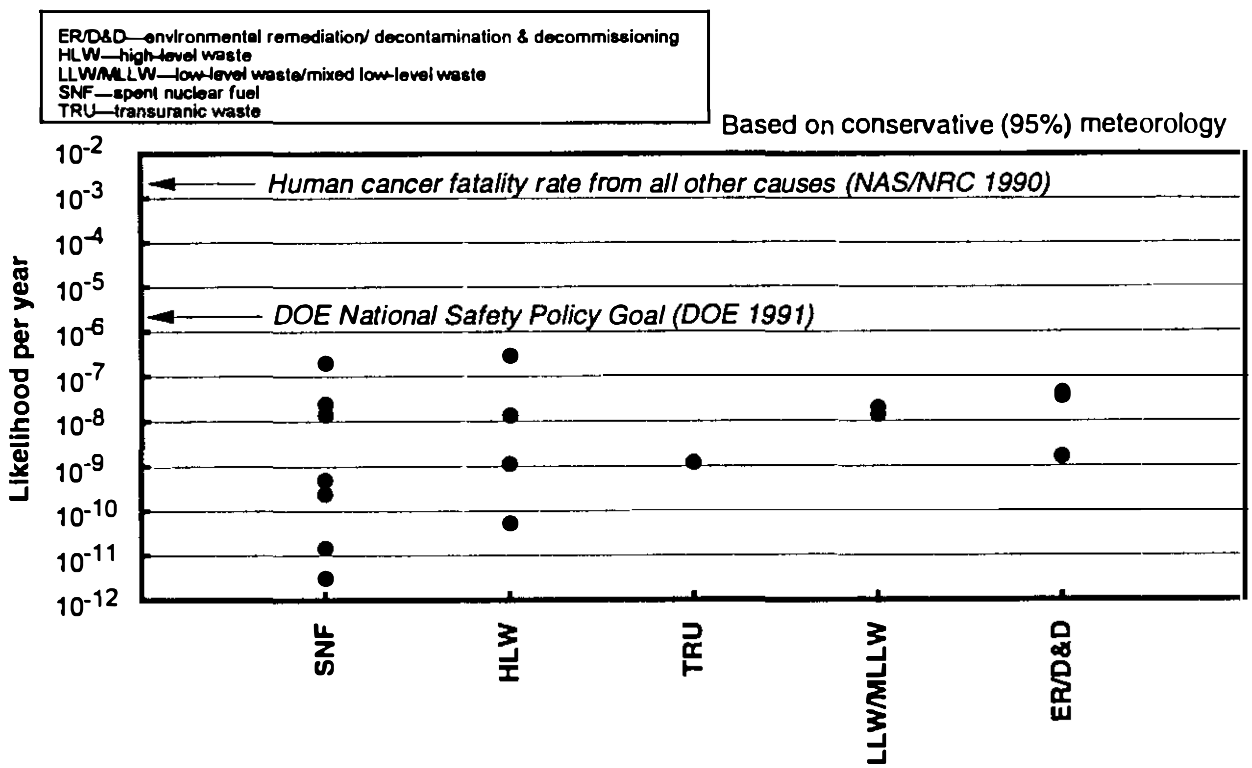


Figure 5.14-13. Risk of fatal cancer to individual at nearest Idaho National Engineering Laboratory site boundary from radiation accidents for Alternative D (Maximum Treatment, Storage, and Disposal).

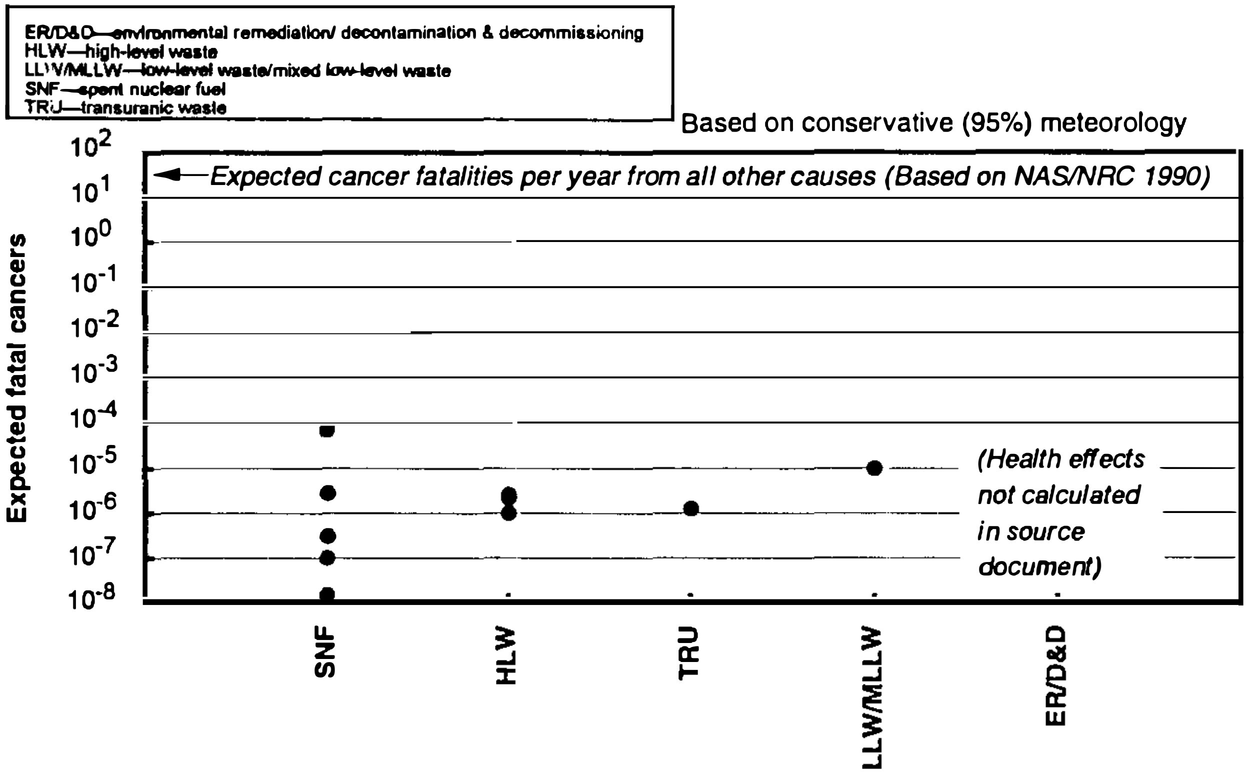


Figure 5.14-14. Excess fatal cancers in exposed population from radiation accidents at Idaho National Engineering Laboratory facilities for Alternative D (Maximum Treatment, Storage, and Disposal).

Pilot Plant transuranic waste inventory at the INEL site would be increased by approximately 20 percent. The frequency of fires is assumed to increase by no more than a factor of ten because not all fires are associated with the increased handling and storage of waste. The frequency of a lava flow event would be the same as that assessed under Alternative A, but the consequences are assumed to increase by a factor of 20 percent under Alternative D (Maximum Treatment, Storage, and Disposal) because of the increased inventory.

5.14.6.4 Mixed and Low-Level Waste. The incremental risk of accidents over those assessed in Alternative A (No Action) would be related to the receipt of DOE complex-wide waste for treatment, storage, and disposal. The annual mixed low-level waste/low-level waste volume managed at the INEL site would be increased approximately ten-fold. Waste would be managed by additional inventory turnover in existing storage facilities. The frequency of fires is assumed to increase by no more than ten-fold because not all fires are associated with the increased handling and storage of waste. No increase in consequence was assumed because facilities with the same maximum capacity as assumed under Alternative A would be used. The frequency and consequence of a fire at the Subsurface Disposal

Area at the Radioactive Waste Management Complex was assumed to increase ten-fold on the basis of the receipt of additional offsite shipments and wastes from decontamination and decommissioning activities. Accidents associated with incineration at the Waste Experimental Reduction Facility are the same for this alternative as those considered in the Alternative B (Ten-Year Plan) analyses for low-level and mixed low-level waste streams.

5.14.6.5 Hazardous Materials. The incremental risk of accidents over those assessed in Alternative A (No-Action) would be related to two factors: (a) increased inventory of chemicals at the Idaho Chemical Processing Plant in support of spent fuel processing, and (b) receipt of additional transuranic waste containing hazardous constituents. Additional chemicals at the Idaho Chemical Processing Plant in support of fuel processing would be hydrofluoric acid and anhydrous ammonia. As discussed in Section 5.14.6.3, the volume of transuranic waste containing hazardous constituents at INEL would increase by 20 percent. The frequency of a lava flow event would be the same as that assessed under Alternative A, but the toxicological consequences are assumed to increase by 20 percent under Alternative D (Maximum Treatment, Storage, and Disposal). The bounding accident characteristics that differ from those specified in Alternative A (Section 5.14.3.5) are summarized in Table 5.14-9.

Table 5.14-9. Characteristics of hazardous material accidents at the Idaho National Engineering Laboratory under Alternative D (Maximum Treatment, Storage, and Disposal) that differ from those under Alternative A (No Action).

Accident	Frequency (events/year)	MEI[a] chemical concentration (mg/m^3)	MEI chemical concentration (percentage of ERPG3)[b]
Lava flow over Radioactive Waste Management Complex	2×10^{-5}	Mercury: 3.6 Nitric acid: 24 Phosgene gas: 0.12	Mercury: 36 Nitric acid: 7 Phosgene gas: 4
Hydrofluoric acid spill at Idaho Chemical Processing Plant	1×10^{-5}	0.078	0.2
Anhydrous ammonia release at Idaho Chemical Processing Plant	1×10^{-6}	82	12

a. MEI — maximally exposed individual at the nearest site boundary.
b. ERPG3 — Emergency Response Planning Guide Level 3 (immediately dangerous to life and health).

5.14.6.6 Environmental Remediation and Decontamination and Decommissioning. The frequency and consequences of accidents associated with environmental remediation and decontamination and decommissioning activities would be the same under Alternative D (Maximum Treatment, Storage, and Disposal) as those analyzed under Alternative A (No Action).

5.15 Cumulative Impacts and Impacts from Connected or Similar Actions

Evaluation of cumulative impacts is necessary to develop an understanding of the implications for implementation of the alternatives. A cumulative impact is the result of the incremental impact of the proposed action added to all other past, present, and reasonably foreseeable future actions. These other actions may include DOE projects not associated with the Spent Nuclear Fuel or Environmental Restoration and Waste Management (ER&WM) Programs and any offsite projects conducted by government agencies, businesses, or individuals.

Table 5.15-1 lists additional onsite and offsite projects to be assessed. This table represents the largest anticipated future offsite projects identified by the appropriate county agencies, Chambers of Commerce, and local development groups and are commensurate with the level of reasonably foreseeable development within the communities surrounding the INEL. These projects also represent most of the new sources of impacts not associated with the proposed actions.

In most cases, cumulative impacts are obtained by combining impacts caused by the alternative with those caused by other past, present, and reasonably foreseeable future actions. However, in some cases, impacts are population-specific and are not appropriate to combine. For example, estimated excess fatal cancers for workers as a result of radiological exposures from all facilities at the INEL can be combined quantitatively to estimate excess fatal cancers derived from INEL operations; however, it would be inappropriate to combine estimated excess fatal cancers for workers at another location that produces radiological emissions, such as in Pocatello, Idaho, with those estimated at INEL because the worker populations are almost entirely independent of one another.

Evaluation of cumulative impacts is important because a significant impact can arise from several small actions that, by themselves, do not have significant impacts. Nonhealth-related

Table 5.15-1. Other projects to be included for assessment of cumulative impacts.

Project	Description
At the Idaho National Engineering Laboratory	
Test Area North-616 Liquid Waste Treatment Support Facility	Facility consists of a one-story cast-in-place, reinforced concrete building (11 × 14 × 4.5 meters high; 36 × 46 × 15 feet high) with a basement and mechanical penthouse on the roof. Ground floor divided into an evaporator pit, valve-operating room, caustic pump room, control room, and a vestibule. Basement contains a pump room and a cooling tower; heating/ventilating room is located on the roof. The facility operated from 1958 to 1970; rated Zone III. Decontamination and decommissioning (D&D) would begin in Fiscal Year 1999. Until then, facility is in surveillance and maintenance mode while undergoing environmental assessment.
Test Train Assembly Facility	Located in the basement of the Materials Test Reactor building, D&D of this facility would include removal and treatment of radioactively contaminated shielding water (MTR-603 Water Canal) and decontamination of canal walls, floor, and associated equipment. The canal is 2.5 meters (8.0 feet) wide, 4.7 meters (15.5 feet) below floor level, and 37 meters (121.5 feet) long [25 meters (81.5 feet) outside of the reactor building]. Water depth in the main canal is 5.3 meters (17.5 feet). The canal contains irradiated fuel elements that would be removed prior to D&D. Canal would be partially drained until radiation level reaches 0.10 rem (10 millirem) per hour; remaining water would be responsibility of D&D project. Decontamination would be completed in Fiscal Year 1999.
Power Burst Facility	D&D of facility including capping of SL-1 burial ground [1.9 hectare (4.6 acres)] and remediation of two injection wells. Facility includes a reactor (in shutdown mode), the Waste Experimental Reduction Facility for treatment of low-level waste (compaction of waste and incineration of combustible waste), and the Mixed Waste Storage Facility (interim status under the Resource Conservation and Recovery Act). Facility remains candidate for the site of Boron Neutron Capture Therapy, if program should become revitalized.
Underground Storage Tank Upgrade (Argonne National Laboratory-West)	Replacement of two emergency support generator tanks with tanks that meet current underground storage tank regulations. Replacement would involve less than 0.8 hectare (2 acres) of previously disturbed land.

Table 5.15-1. (continued).

Project	Description
Fuel Cycle Facility Water Storage and Delivery Improvements (Argonne National Laboratory-West)	Upgrade of existing water system with redundant water tank and supply, in accordance with DOE Order 6431.A. Upgrade would involve less than 2 hectares (5 acres) of previously disturbed land.
Site Utilities Upgrade (Argonne National Laboratory-West)	General repair on steam condensate system, water supply, electric utilities, and communication services. Project would involve less than 4 hectares (10 acres) of previously disturbed land.
Experimental Breeder Reactor-II/FCF External Fuel Handling Upgrade (Argonne National Laboratory-West)	Improve fuel handling capabilities outside of reactor including the Fuel Cycle Facility. Improvements would involve less than 2 hectares (5 acres) of previously disturbed land.
Fuel Handling and Plant Support (Argonne National Laboratory-West)	Improve fuel handling capabilities for the Fuel Cycle Facility. Improvements would involve less than 0.4 hectare (1 acre) of previously disturbed land.
Offsite	
Housing Development, Idaho Falls	300-unit single family housing development planned on approximately 61 hectares (150 acres) of vacant land.
Business Park, Rexburg	20 hectares (50 acres) of vacant land between two light industrial facilities are planned for an expansion into a light industrial/business park for 30-40 businesses.
Manufacturer, Pocatello	Existing manufactured home factory to expand from approximately 50 to between 140 and 150 employees. Expansion of 8.9 hectares (22 acres) in Pocatello Airport Industrial Park.
Food, Machinery, and Chemical Corp., Pocatello	FMC phosphate manufacturing plant to reduce number of furnaces from 4 to 3 within the next two years; 25-30 jobs could be lost.
Target Department Store, Idaho Falls	Opening of Target discount store and associated commercial development planned on vacant land near the Teton Mall in Idaho Falls.

cumulative impacts are summarized in Table 5.15-2 and discussed in Sections 5.15.1 through 5.15.6 and 5.15.9. Transportation-related cumulative health effects and occupational and public health cumulative effects are discussed in Sections 5.15.7 and 5.15.8.

5.15.1 Land Use

Implementation of any of the alternatives would contribute to the cumulative loss of land with open-space land use. As discussed in Section 5.2, Land Use, the maximum amount of space that would be disturbed on the INEL site would be 1,339 acres (542 hectares) under Alternative D (Maximum Treatment, Storage, and Disposal). A list of activities that are unrelated to the alternatives but that are projected to take place at the INEL and in nearby communities is presented in Table 5.15-1. While exact maximum figures are not available, over 200 acres (80 hectares) of vacant land in nearby communities are scheduled for development. It is unknown what types of land uses currently exist on this vacant land. Projects that would potentially disturb previously disturbed land are scheduled to take place on more than 20 acres (8 hectares) at the INEL site. None of these other activities would create irreversible or irretrievable effects on land use, except for a project at the Power Burst Facility that would cap a currently existing piece of ground [approximately 5 acres (2 hectares)] containing buried radioactive items.

Combining the acreage of onsite and offsite projects, less than 1,500 acres (610 hectares) of undeveloped land would be disturbed. The five-county region (Bingham, Bonneville, Butte, Jefferson, and Clark counties) in which the INEL site is situated contains approximately 795,000 acres (322,000 hectares) of land classified as barren. In addition, approximately 791,500 acres (320,000 hectares) are classified as forest or wetland, and another 2,945,700 acres (1,192,000 hectares) are classified as range (Bingham County 1986, Bonneville County 1976, Butte County 1976, Clark County 1994, Jefferson County 1988, Jefferson County 1990). Combined, these acreages make up more than 75 percent of the land use in the region. The disturbance of undeveloped land that would take place as a result of activities at the INEL and unrelated offsite activities would represent about 0.03 percent of the five-county land uses summarized above.

Table 5.15-2. Nonhealth-related cumulative impacts by resource area and alternative.

Discipline	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum TSD[a])	Alternative D (Maximum TSD[a])	Comments
Land use/ amount of land not available for other use	Small compared to regional land uses	Small compared to regional land uses	Small compared to regional land uses	Small compared to regional land uses	
Socioeconomics/ change in number of total jobs	Overall decrease of 4,808	Overall decrease of 2,250	Overall decrease of 4,350	Overall decrease of 1,449	Under all alternatives, additional ER&WM jobs created would be more than offset by decrease from other actions
Cultural resources/minimum number of potentially historic structures/archaeological sites disturbed[b]	6 structures and 0 sites	70 structures and 22 sites	11 structures and 0 sites	70 structures and 22 sites	Under all alternatives, number of cultural resources would be reduced
Air resources[c]	Below applicable standards	Below applicable standards	Below applicable standards	Below applicable standards	
Water resources/water usage	Negligible	Negligible	Negligible	Negligible	
Ecological resources/acreage loss	285	1068	600	1,584	

Table 5.15-2. (continued).

Discipline		Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum TSD[a])	Alternative D (Maximum TSD[a])	Comments
Waste management/waste volume total pending disposition[f]	High-level[d,e]	12,100 m^3	12,500 m^3	17,000 m^3	12,100 m^3	These volumes reflect existing and newly generated wastes pending disposition under each alternative
	Transuranic[g]	67,000 m^3	73,000 m^3	67,000 m^3	87,000 m^3	
	Mixed low-level	17,000 m^3	17,000 m^3	17,000 m^3	167,000 m^3	
	Low-level[g]	46,000 m^3	72,000 m^3	47,000 m^3	840,000 m^3	
	Hazardous[e]	12,000 m^3	12,000 m^3	12,000 m^3	12,000 m^3	
	INEL[g] industrial	540,000 m^3	590,000 m^3	550,000 m^3	590,000 m^3	

a. Treatment, storage, and disposal.

b. Numbers for archaeological sites potentially impacted would be expected to increase as cultural resource surveys are conducted for onsite and offsite projects on acreage previously unsurveyed.

c. See Health and Safety (Section 5.15.8 and associated table) for cumulative health risks related to radiological dose from air emissions.

d. High-level waste includes both liquid and calcine forms. Liquid high-level waste totals do not include processing which would increase these reported totals by some degree. Numbers represent all high-level waste onsite.

e. Numbers represent total volume stored onsite.

f. Derived in Freund (1994), Morton and Hendrickson (1995).

g. Numbers do not include existing dispositioned waste stored or buried onsite.

5.15.2 Socioeconomics

The cumulative impact on regional employment under implementation of any of the alternatives would be an overall decline during the ten-year timeframe of this EIS (see Table 5.15-2). Initially, implementation of any of the alternatives would generate temporary increases in employment within the region surrounding INEL, primarily due to construction activities. The magnitude of the cumulative impact on regional employment under implementation of any of the alternatives is not expected to be sufficient to notably affect the socioeconomic resources of the region.

Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would continue to generate moderate employment increases through fiscal year 2004, while Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), which include phaseout of the Expended Core Facility, would ultimately result in employment declines.

Based on currently available data, it is expected that additional employment would be generated by larger offsite projects planned to occur in the communities surrounding INEL (Table 5.15-1). Upon implementation, the offsite projects could contribute approximately 280 jobs to the regional economy. However, the expected future declines in baseline employment at the INEL would more than offset any increases associated with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) and the offsite projects. The level of the cumulative employment effect ranges from a loss of 4,526 jobs under Alternative A (No Action), representing a 4.1-percent decline in total regional employment, to a loss of 1,167 jobs under Alternative D, representing a 1.0-percent decline in total regional employment.

The magnitude of the cumulative effect on regional employment under implementation of any of the alternatives is not expected to be sufficient to adversely affect the socioeconomic resources of the region. Potential population declines associated with the cumulative effect on regional employment are estimated to represent less than 2 percent of the total regional population. It is unlikely that a change in population of this size would generate any notable long-term adverse impacts to housing, community services, or public finance in the region. Further discussion regarding potential impacts to population and community services can be found in Section 5.3, Socioeconomics.

5.15.3 Cultural Resources

The types of cumulative impacts on cultural resources are the same for all alternatives. Projects under each of the alternatives, when combined with associated offsite activities (see Table 5.15-1), would reduce the number of cultural resources in southeastern Idaho. However, surveying, recording, and stabilizing archaeological and historic sites and structures at the INEL site would increase scientific knowledge of the region's cultural resources; although stabilizing prehistoric resources may adversely affect their significance to the Native American groups because it interrupts the natural deterioration of sites, which is important to these groups. The unchecked deterioration of both structures and historical documents on nuclear facilities at the INEL site could have a long-term adverse impact on these resources. Long-term effects may also occur due to the loss of traditional resources. Cumulative impacts associated with Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal) have the greatest potential for impacts. Alternative A (No Action) would have the least impact.

5.15.4 Air Resources

The cumulative impacts of radiological and nonradiological air emissions have been assessed for each of the four alternatives (see Section 5.7, Air Resources) and for individual waste management options within each alternative. These impacts are assessed for emissions from maximum operation of existing facilities, construction and operation of new facilities, demolition activities associated with decontamination and decommissioning of existing facilities, environmental restoration activities, and mobile sources such as vehicular traffic and heavy equipment operation within the INEL.

For radiological emissions, all impacts at onsite and offsite locations are well below applicable standards and are a small fraction of the dose received from natural background sources. The highest dose to an offsite individual is associated with Alternative D (Maximum Treatment, Storage, and Disposal) and is about 0.0008 rem (0.8 millirem) per year. When added to the maximum baseline dose of 0.00005 rem (0.05 millirem) per year, this dose remains well below the dose limit of 0.01 rem (10 millirem) per year specified in the National Emissions Standards for Hazardous Air Pollutants. This dose is considered an upper bound to the cumulative emissions from existing and proposed sources at the INEL, as well as other sources of human origin (notably, the Food, Machinery and Chemical Corp. phosphorus plant in Pocatello, Idaho, which releases polonium-210 and other naturally occurring radionuclides in airborne effluents). The cumulative dose to the collective population is about 4 person-rem per year, about half of which is attributable to incineration of transuranic waste under Alternative D (Maximum Treatment, Storage, and Disposal). Health risks related to radiological doses from the airborne pathway are discussed in Section 5.15.8.

Cumulative nonradiological impacts are expressed in terms of concentrations of criteria and toxic air pollutants in ambient air (that is, locations to which the public has access, such as outside the INEL site boundary and along public roads traversing the site) and general deterioration of existing air quality. At site boundary locations, the highest predicted concentrations of criteria pollutants [from Alternative D (Maximum Treatment, Storage, and Disposal)] remain well below applicable air quality standards. Concentrations at public road locations within the INEL boundary could increase significantly from current levels, especially if a major project or combustion source is located relatively close to a public road, but remain well below applicable standards. Offsite levels of toxic air pollutants are below applicable standards for all cases.

The incremental impacts at onsite locations of toxic air pollutant emissions are well below occupational standards in all cases. However, when the cumulative effect of maximum baseline levels is considered, the highest predicted level of benzene (near gasoline storage tanks at the Central Facilities Area) is slightly above the occupational exposure limit.

Cumulative impacts related to ozone formation and stratospheric ozone depletion are well below the levels considered "significant" by State or Federal standards. The potential for impacts on atmospheric visibility at Craters of the Moon Wilderness Area has been found to exist under worst-case modeling conditions (see Section 5.7.4.3, Regulatory Compliance Evaluation). If confirmed by more realistic analysis, these impacts would be averted by more extensive use of emission control equipment to further reduce nitrogen dioxide emissions or by relocation of specific projects to onsite locations more distant from Craters of the Moon. Potential visual impacts would be further defined and resolved during the air permitting process before projects could proceed.

5.15.5 Water Resources

Cumulative impacts to water quality are the same for all alternatives. Past disposal practices have resulted in some adverse impacts to water resources, but primarily in isolated areas within INEL site boundaries. These impacts are observed in the tritium, strontium-90, and iodine-129 plumes. Only portions of the plumes have concentrations above the U.S. Environmental Protection Agency's drinking water standards. Future predictions beyond the timeframe of this EIS show that concentrations detected within the plumes would decrease with time and, by 2035, only iodine-129 would be present above maximum contaminant levels. No contaminants are predicted to migrate past the INEL site boundaries in concentrations exceeding the maximum contaminant levels. Compared to previous practices, impacts from projects under the alternatives and reasonably foreseeable future actions listed in Table 5.15-1 would not result in concentrations above the U.S. Environmental Protection Agency's maximum contaminant levels beyond the INEL site boundaries, and impacts are expected to have a minimal effect on water resources.

The INEL's contribution to the cumulative impact on regional water quality as a result of nonradiological contamination is far less than contributions from other commercial, industrial, and agricultural activities (such as pesticides and fertilizer use), which have impacted a number of municipal water supplies in the communities surrounding the INEL site (IDHW 1994). Therefore, the contribution from the INEL to the cumulative impact on regional groundwater quality is expected to be minimal.

Water usage from all INEL operations and proposed projects would have a negligible effect on the quantity of water in the aquifer. Given that 1.77 billion cubic meters (470 billion gallons) of water pass under the INEL site every year (Robertson et al. 1974), the maximum cumulative increase represents approximately 0.43 percent of the volume of water passing under the INEL site.

5.15.6 Ecological Resources

The types of cumulative impacts on ecological resources would be the same for all alternatives. However, the scale of the impacts could vary because of the differences in scale among the alternatives (see Section 5.9, Ecology). At least an additional 8 hectares (20 acres) of previously disturbed habitat would be disturbed on the INEL site from activities not associated with the proposed action, and about 81 hectares (200 acres) of habitat would be disturbed in nearby communities. Therefore, the minimum cumulative loss of habitat and vegetation for each alternative would be 105 hectares (260 acres) under Alternative A (No Action), 333 hectares (823 acres) under Alternative B (Ten-Year Plan), 233 hectares (576 acres) under Alternative C (Minimum Treatment, Storage, and Disposal), and 631 hectares (1,560 acres) under Alternative D (Maximum Treatment, Storage, and Disposal). Other potential effects, besides lost productivity and reduced biodiversity on the disturbed acres, would include additional displacement of animals from the disturbed habitat and habitats in close proximity. Some habitat fragmentation may occur; however, it should be limited because the new construction would be contiguous or within existing industrial, residential, or commercial areas. Potential impacts from traffic would be slightly increased. Increased truck transport could result in 2 to 20 more vehicles per day (assuming no transport by rail) over current numbers. Rail shipments for all alternatives could increase over current levels, thereby increasing the potential for train collisions with wildlife.

5.15.7 Transportation

5.15.7.1 Radiological Impacts. The cumulative impacts of the transportation of radioactive material consist of impacts from (a) historical shipments of waste and spent nuclear fuel to the INEL site, (b) the alternatives evaluated in this EIS, (c) reasonably foreseeable actions that include transportation of radioactive material, and (d) general radioactive materials transportation that is not related to a particular action. Table 5.15-3 lists these existing and reasonably foreseeable activities assessed to determine the cumulative impact of transportation. The assessment of cumulative transportation impacts concentrated on the cumulative impacts of offsite transportation, because offsite transportation yields larger doses to the general population than does onsite transportation. The collective dose to the general population and workers was the measure used to quantify cumulative transportation impacts. This measure of impact was chosen because it can be directly related to estimates of cancer fatalities using a cancer risk coefficient, and because of the difficulty in identifying a maximally exposed individual for shipments that occur, and would occur, all over the U.S. over an extended period of time, 1953 through 2005 (53 years).

Collective doses from historical shipments of waste and spent nuclear fuel to the INEL were summarized in Maheras (1994). The historical waste shipments consisted of shipments from offsite waste generators to the INEL Radioactive Waste Management Complex from 1957 through 1993.

Table 5.15-3. Other activities to be included for assessment of cumulative impacts for transportation.

Activity	Description
Existing activities	
Historical shipments to INEL	Historical shipments of radioactive waste, naval spent nuclear fuel, and test specimens to INEL
General transportation	Nation-wide shipment of radioactive materials for medical, industrial, fuel cycle, and disposal purposes
Reasonably foreseeable activities	
Geological repository	Shipments of commercial spent nuclear fuel and defense high-level waste to a geologic repository
Waste Isolation Pilot Plant	Shipments of transuranic waste to the Waste Isolation Pilot Plant at Carlsbad, New Mexico (including a 5-year test phase and 20-year disposal phase)
Submarine reactor compartments	Shipments of reactor compartments from Puget Sound Naval Shipyard to Hanford
Return of cesium-137 isotope capsules	Shipments of isotope capsules to the Hanford Site
Uranium billets	Shipment of low-enriched uranium billets from the Hanford Site to the United Kingdom

These data were linearly extrapolated back to 1954, the year that transuranic waste was first shipped to the Radioactive Waste Management Complex from the Rocky Flats Plant, because data for 1954 through 1956 were not available.

The historical shipments of spent nuclear fuel to the INEL site consisted of shipments of naval spent nuclear fuel and test specimens from 1957 through 1995 (see Attachment A to Appendix D of Volume 1 of this EIS). No extrapolation of naval shipments was necessary because a detailed records search accounted for all shipments. Historical spent nuclear fuel also consisted of shipments of other DOE spent nuclear fuel to the INEL besides naval shipments, such as research reactor spent nuclear fuel, commercial spent nuclear fuel, and Three Mile Island core debris. Data for these shipments were available for 1973 through 1993 and were linearly extrapolated back to 1953, the start of operations at the Idaho Chemical Processing Plant, because data for 1953 through 1972 were not available.

For workers, historical offsite shipments of waste and spent nuclear fuel to the INEL yielded a collective dose of 110 person-rem or 0.044 cancer fatalities. For the general population, historical offsite shipments of waste and spent nuclear fuel to the INEL site yielded a collective dose of 60 person-rem or 0.030 cancer fatalities.

There were considerable uncertainties in these historical estimates of collective dose. For example, the population densities and transportation routes used in the dose assessments were based on census data for 1990 and the U.S. highway and rail system as it existed in 1993. Using census data for 1990 overestimated historical collective doses because the U.S. population has continuously increased over the time covered in these assessments. Basing collective dose estimates on the U.S. highway and rail as it existed in 1993 may result in slightly underestimated doses for shipments that occurred in the 1950s and 1960s, because a larger portion of the transport routes would have been on noninterstate highways where the population may have been slightly closer to the road. Data were not available that correlated transportation routes and population densities for the 1950s, 1960s, and 1970s; so it was necessary to use more recent data in order to make dose estimates. By the 1970s, the structure of the interstate highway system was largely fixed and most truck shipments would have been made on interstates.

Shipment data were linearly extrapolated for years when data were unavailable, which also resulted in uncertainty. However, this technique was validated by linearly extrapolating the data in SAIC (1991) for 1973 through 1989 to estimate the number of shipments that took place over 1964 through 1972 (also contained in SAIC 1991). The 1973-through-1989 time period corresponded to the time period when data were available for the Idaho Chemical Processing Plant. The data in SAIC (1991) could not be used directly because only shipment counts were presented for 1964 through 1982 and no origins or destinations were listed for years prior to 1983. Based on the data in SAIC (1991), linearly extrapolating the data for 1973 through 1989 overestimated the shipments for 1964 through 1972 by 20 percent when compared to the actual shipment counts for 1964 through 1972.

Collective doses for waste shipments associated with all alternatives are summarized in Section 5.11, Traffic and Transportation, of this volume of the EIS. For truck shipments, the collective dose to workers would range from 120 person-rem (Alternative A, No Action) to 1700 person-rem (Alternative D, Maximum Treatment, Storage, and Disposal), or 0.048 to 0.68 cancer fatalities. Collective dose to the general population would range from 66 person-rem (Alternative A) to 940 person-rem (Alternative D), or 0.033 to 0.47 cancer fatalities.

For train shipments, the collective dose to workers would range from 3.2 person-rem (Alternative A) to 48 person-rem (Alternative D), or 0.0013 to 0.019 cancer fatalities. Collective dose to the general population would range from 4.1 person-rem (Alternative A) to 58 person-rem (Alternative D), or 0.0021 to 0.029 cancer fatalities.

Collective doses for spent nuclear fuel shipments associated with all alternatives are summarized in Section 5.11, Traffic and Transportation, of this volume of the EIS. For truck shipments, the collective dose to workers would range from 1.5 person-rem (Alternative A) to 1000 person-rem (Alternative 5, Centralization at Savannah River), or 0.0006 to 0.4 cancer fatalities. Collective dose to the general population would range from 0.34 person-rem (Alternative A) to 2400 person-rem (Alternative 5, Centralization at Savannah River), or 0.00017 to 1.2 cancer fatalities. (See Volume 1 for a more complete discussion of the Centralization Alternative discussed in this section.)

For train shipments, the collective dose to workers would range from 1.5 person-rem (Alternative A) to 150 person-rem (Alternative 5, Centralization at Nevada Test Site), or 0.0006 to 0.06 cancer fatalities. Collective dose to the general population would range from 0.34 person-rem (Alternative A) to 190 person-rem (Alternative 5, Centralization at Savannah River), or 0.00017 to 0.095 cancer fatalities.

Transportation impacts may also result from reasonably foreseeable projects. Two major proposed projects that would involve transportation of radioactive material are (a) shipments of spent nuclear fuel and defense high-level waste to a geologic repository and (b) proposed shipments of transuranic waste to the Waste Isolation Pilot Plant, located in Carlsbad, New Mexico. The U. S. DOE is presently studying the Yucca Mountain, Nevada, site to determine its suitability for a geologic repository for commercial spent nuclear fuel and defense high-level waste; therefore, the geologic repository was assumed to be located in Yucca Mountain, Nevada, for the transportation cumulative impacts analysis.

Based on the transportation dose assessments presented in DOE (1986), the worker collective dose for truck shipments to a repository was 8,600 person-rem or 3.4 cancer fatalities. The collective dose to the general population from truck shipments to a repository was 48,000 person-rem or 24 cancer fatalities. The worker collective dose for train shipments to a repository was 750 person-rem or 0.3 cancer fatalities. The collective dose to the general population from train shipments to a repository was 740 person-rem or 0.37 cancer fatalities.

Based on the transportation dose assessments presented in DOE (1990), the worker collective dose from truck shipments to the Waste Isolation Pilot Plant was 1,900 person-rem or 0.76 cancer fatalities. The collective dose to the general population from truck shipments to the Waste Isolation Pilot Plant was 1,500 person-rem or 0.75 cancer fatalities. The worker collective dose from train shipments to the Waste Isolation Pilot Plant was 180 person-rem or 0.072 cancer fatalities. The collective dose to the general population from train shipments to the Waste Isolation Pilot Plant was 990 person-rem or 0.5 cancer fatalities. These collective doses included the 5-year Test Phase and the 20-year Disposal Phase.

There are also other reasonably foreseeable projects that involve limited transportation of radioactive material: (a) shipments of submarine reactor compartments from the Puget Sound Naval Shipyard to the Hanford Site for burial, (b) return of cesium-137 isotope capsules to the Hanford Site, and (c) shipment of uranium billets from the Hanford Site to the United Kingdom. Doses for these proposed actions are summarized in Table 5.15-4.

There are also general transportation activities that take place that are unrelated to the alternatives evaluated in this EIS or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The U. S. Nuclear Regulatory Commission evaluated these types of shipments based on a survey of radioactive materials transportation published in 1975 (NRC 1977). Categories of radioactive material evaluated in NRC (1977) included (a) limited quantity shipments, (b) medical, (c) industrial, (d) fuel cycle, and (e) waste. The U. S. Nuclear Regulatory Commission estimated that the annual collective worker dose for these shipments was 5,600 person-rem or 2.2 cancer fatalities. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem or 2.1 cancer fatalities. Because comprehensive transportation doses were not available, these collective dose estimates were

Table 5.15-4. Cumulative transportation-related radiological collective doses and cancer fatalities (1953 to 2005).

Category[a]	Collective occupational dose (person-rem)	Collective general population dose (person-rem)
<u>Historical</u>		
Waste (1954-1995)	47	28
DOE spent nuclear fuel (1953-1995)	56	30
Naval spent nuclear fuel (1957-1995)	6.2	1.6
<u>Alternatives A-D</u>		
Waste shipments for Alternatives A-D		
Truck (100 percent)	120-1700	66-940
Train (100 percent)	3.2-48	4.1-58
Spent nuclear fuel shipments for Alternatives A-D		
Truck (100 percent)	1.5-1000	0.34-2400
Train (100 percent)	1.5-150	0.34-190
<u>Reasonably Foreseeable Actions</u>		
Geologic Repository[c]		
Truck	8,600	48,000
Train	750	740
Waste Isolation Pilot Plant[d]		
Test Phase	110	48
Disposal Phase		
Truck	1800	1500
Train	68	940
Submarine Reactor Compartments[e]	(b)	0.053
Return of Cesium-137 Isotope Capsules[f]	0.42	5.7
Uranium Billets[g]	0.5	0.014
<u>General Transportation</u>		
1953-1982	170,000	130,000
1983-2005	39,000	42,000

Table 5.15-4. (continued).

Category[a]	Collective occupational dose (person-rem)	Collective general population dose (person-rem)
<u>Summary</u>		
Historical	110	60
Waste shipments for Alternatives A-D		
Truck (100 percent)	120-1700	66-940
Train (100 percent)	3.2-48	4.1-58
Spent nuclear fuel shipments for Alternatives A-D		
Truck (100 percent)	1.5-1000	0.34-2400
Train (100 percent)	1.5-150	0.34-190
Reasonably foreseeable actions		
Truck	11,000	50,000
Train	820	1700
General transportation (1953-2005)	210,000	170,000
Total collective dose	220,000	220,000
Total cancer fatalities	88	110

a. LLW = low-level waste; MLLW = mixed low-level waste; TRU = transuranic waste.
b. Information not available.
c. Reference: DOE (1986).
d. Reference: DOE (1990).
e. Reference: USN (1984).
f. Reference: DOE (1994).
g. Reference: DOE (1992).

used to estimate transportation collective doses for 1953 through 1982 (30 years). These dose estimates included spent nuclear fuel and radioactive waste shipments.

Based on the transportation dose assessments in NRC (1977), the cumulative transportation collective doses for 1953 through 1982 were 170,000 person-rem for workers and 130,000 person-rem for the general population. These collective doses correspond to 68 cancer fatalities for workers and 65 cancer fatalities for the general population.

In 1983, another survey of radioactive materials transportation in the U.S. was conducted (Javitz et al. 1985). This survey included U.S. Nuclear Regulatory Commission and Agreement State licensees and the U.S. DOE. Both spent nuclear fuel and radioactive waste shipments were included in the survey. Weiner et al. (1991a,b) used the survey by Javitz et al. (1985) to estimate collective doses from general transportation. The transportation dose assessments in Weiner et al. (1991a,b) were used to estimate transportation doses for 1983 through 2005 (23 years). The interval 1995 through 2005 corresponds to the interval of time associated with the ER&WM activities evaluated in this EIS.

Weiner et al. (1991a) evaluated eight categories of radioactive material shipments by truck: (a) industrial, (b) radiography, (c) medical, (d) fuel cycle, (e) research and development, (f) unknown, (g) waste, and (h) other. Based on a median external exposure rate, an annual collective worker dose of 1400 person-rem and an annual collective general population dose of 1400 person-rem were estimated. These collective doses correspond to 0.56 and 0.7 cancer fatalities/year for workers and the general population, respectively. Over the 23-year time period from 1983 through 2005, the collective worker and general population doses would be 32,000 person-rem or 13 and 16 cancer fatalities for workers and the general population, respectively.

Weiner et al. (1991b) also evaluated six categories of radioactive material shipments by plane: (a) industrial, (b) radiography, (c) medical, (d) research and development, (e) unknown, and (f) waste. Based on a median external exposure rate, an annual collective worker dose of 290 person-rem and an annual collective general population dose of 450 person-rem were estimated. These collective doses correspond to 0.12 and 0.23 cancer fatalities/year for workers and the general population, respectively. Over the 23-year time period from 1983 through 2005, the collective worker dose would be 6,700 person-rem and the general population collective dose would be 10,000 person-rem or 2.7 and 5 cancer fatalities for workers and the general population, respectively.

Like the historical transportation dose assessments, the estimates of collective doses due to general transportation also exhibited considerable uncertainty. For example, data for 1975 were applied to all general transportation activities from 1953 through 1982. This approach probably overestimated doses because the amount of radioactive material that was transported in the 1950s and 1960s was less than the amount that was shipped in the 1970s. For example, in 1968, the shipping rate for radioactive material packages was estimated to be 300,000 packages/year (Patterson 1968); in 1975 this rate was estimated to be 2,000,000 packages/year (NRC 1977). However, because comprehensive data that would enable a more realistic transportation dose assessment to be made were not available, the dose estimates developed by the U.S. Nuclear Regulatory Commission were used.

The total worker and general population collective doses are summarized in Table 5.15-3. Total collective worker doses from all types of shipments (historical, the alternatives, reasonably foreseeable actions, and general transportation) were estimated to be 220,000 person-rem (88 cancer fatalities), for the period of time 1953 through 2005 (53 years). Total general population collective doses were also estimated to be 220,000 person-rem (110 cancer fatalities). The majority of the collective dose for workers and the general population was due to general transportation of radioactive material. The total number of cancer fatalities from 1953 through 2005 was estimated to be 200. Over this same period of time (53 years), approximately 16,000,000 people will die from cancer, based on 300,000 cancer deaths/year (NRC 1977). The transportation-related cancer deaths are 0.0013 percent of this total.

5.15.7.2 Vehicular Accident Impacts. Fatalities that involved the shipment of radioactive materials were surveyed for 1971 through 1993 using the Radioactive Material Incident Report data base (Cashwell and McClure 1992), which includes accident data from the U. S. Department of Transportation, U. S. Nuclear Regulatory Commission, U. S. Department of Energy, and state radiation control offices. For 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These were fatalities that resulted from vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities due to transportation accidents have ever occurred in the U. S. During the same period of time, over 1,000,000 persons were killed in vehicular accidents in the U. S.

For all alternatives, 0.35 to 4.8 vehicular accident fatalities were estimated to occur. During the ten-year time period from 1995 through 2005, approximately 400,000 people will be killed in vehicular accidents in the U.S.

5.15.8 Health and Safety

A number of potential exposure pathways exist by which radioactive materials from INEL operations could affect workers onsite or could be transported to offsite environments. The airborne pathway is the principal pathway by which radioactive materials released on the INEL site could reach an offsite member of the public.

A summary of the health effects from these individual exposure pathways is presented in Table 5.15-5. The health effects from radiation exposure are presented as the estimated number of fatal cancers in the affected population. The health effects for chemical carcinogens are presented as the estimated number of lifetime cancers in the affected population. For exposure to noncarcinogenic chemicals, the health effects are presented as estimated fatalities. It is important to note that with the exception of the occupational exposures, these data are estimations derived from modeling analysis. Occupational exposure data are calculated from actual dosimeter measurements of INEL personnel. The methodology for health effects calculations and a summary of results are provided in Appendix F, Section F-4, Health and Safety. The numerical results for these calculations are tabulated in Section 5.12, Health and Safety.

Although highly unlikely, it is possible that an individual could simultaneously receive a maximal exposure from more than one of the environmental pathways listed in Table 5.15-5. For example, the maximally exposed onsite worker could also reside at the site boundary and theoretically be exposed to the highest onsite and offsite chemical and/or radionuclide concentrations. However, assuming that the individual were exposed to both maximum modeled onsite and offsite radiation doses, total estimated cumulative dose over the ten-year period would range from approximately 0.0047 rem (4.7 millirem) for Alternative A (No Action) to 0.0133 rem (13.3 millirem) for Alternative D (Maximum Treatment, Storage, and Disposal). These potential radiation doses would be in addition to natural background radiation, which averages about 0.35 rem (350 millirem) per year [3.5 rem (3500 millirem) over 10 years].

Table 5.15-5. Health-related cumulative impacts by alternative.

	Pathway	Type of impact	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum TSD[b])	Alternative D (Maximum TSD[b])	Comments
				Radiological[a]			
Public	Atmospheric	Estimated excess fatal cancers	< 1	< 1	< 1	< 1	
	Groundwater	Estimated excess fatal cancers	< 1	< 1	< 1	< 1	
	Biotic	Estimated excess fatal cancers	< 1	< 1	< 1	< 1	
Workers[c]	Atmospheric	Estimated excess fatal cancers	Negligible	Negligible	Negligible	Negligible	Overall cancers expected to be less than base-line because fewer employ-ees under all alternatives.
	Occupational exposures	Estimated excess fatal cancers	1	1	1	1	

Table 5.15-5. (continued).

	Pathway	Type of impact	Alternative A (No Action)	Alternative B (Ten-Year Plan)	Alternative C (Minimum TSD[b])	Alternative D (Maximum TSD[b])	Comments
			Nonradiological[a]				
Public	Atmospheric (Carcinogens)	Estimated lifetime cancers	< 1	< 1	< 1	< 1	
	Atmospheric (Noncarcino-gens)	Estimated adverse health effects	0	0	0	0	
Workers	Atmospheric (Carcinogens)	Estimated lifetime cancers	< 1	< 1	< 1	< 1	
	Atmospheric (Noncarcino-gens)	Estimated adverse health effects	0	0	0	0	
	Routine workplace safety hazards	Estimated fatalities	3	3	3	3	Estimates differ only slightly between alternatives due to changes in number of workers.

a. Approximate numbers. See Section 5.12, Health and Safety, and Appendix F-4, Health and Safety, for detailed discussion and analyses.

b. Treatment, storage, and disposal.

c. Estimated excess fatal cancers calculated from dosimeter measurements.

This section provides a brief discussion of the historical radiation releases and subsequent offsite doses associated with the operation of the INEL. The cumulative impacts of occupational health and public health are discussed in Sections 5.15.8.2 and 5.15.8.3, respectively. Detailed discussions of collective offsite doses to the public through the air and water pathways are found in Section 5.12.1. Transportation-related occupational and offsite population doses are discussed in Section 5.15.7.

5.15.8.1 Historical Dose Perspective. Historical offsite airborne radiation doses associated with the operation of the INEL were evaluated and summarized in the Idaho National Engineering Laboratory Historical Dose Evaluation (DOE-ID 1991). The total amount of radioactivity released during operational activities is summarized in Figure 5.15-1. The total amounts of radioactivity shown in Figure 5.15-1 include a wide variety of radionuclides associated with normal operations. Each radionuclide behaves differently and results in a different radiation dose for each curie released. For this reason, the totals in Figure 5.15-1 are not directly proportional to radiation dose or any other measure of environmental impact. Detailed information on the individual radionuclides released and resulting radiation dose appears in DOE-ID (1991).

While not directly related to radiation dose, the total amounts of radioactivity presented in Figure 5.15-1 provide a useful illustration of the historical patterns of radioactive releases from the INEL. Evaluation of these data indicates that the total amount of radioactivity associated with annual operational releases at the INEL site was largest during the late 1950s and early 1960s and, since that time, radioactive releases have decreased dramatically. For example, the largest release of radioactivity in any given year during the 1981-to-1991 timeframe was about one-tenth of the 1,500,000 curies released during 1961, the historical peak year (DOE-ID 1991).

Estimated radiation doses from airborne releases over the operating history of the INEL site have always been within the radiation protection standards applicable at that time. Offsite doses from operational and episodic releases during the late 1950s may have been as high as 9 percent of the whole body dose standard [0.5 rem (500 millirem)] (DOE-ID 1991). Since 1985, when more restrictive standards were put in place, offsite doses to a maximally exposed individual were only about 1 percent of the whole body count dose standard [0.025 rem (25 millirem)]. Furthermore, doses from airborne releases over the operation history of the INEL site have been small compared to doses from sources of natural background radiation in the vicinity of the INEL site (DOE-ID 1991).

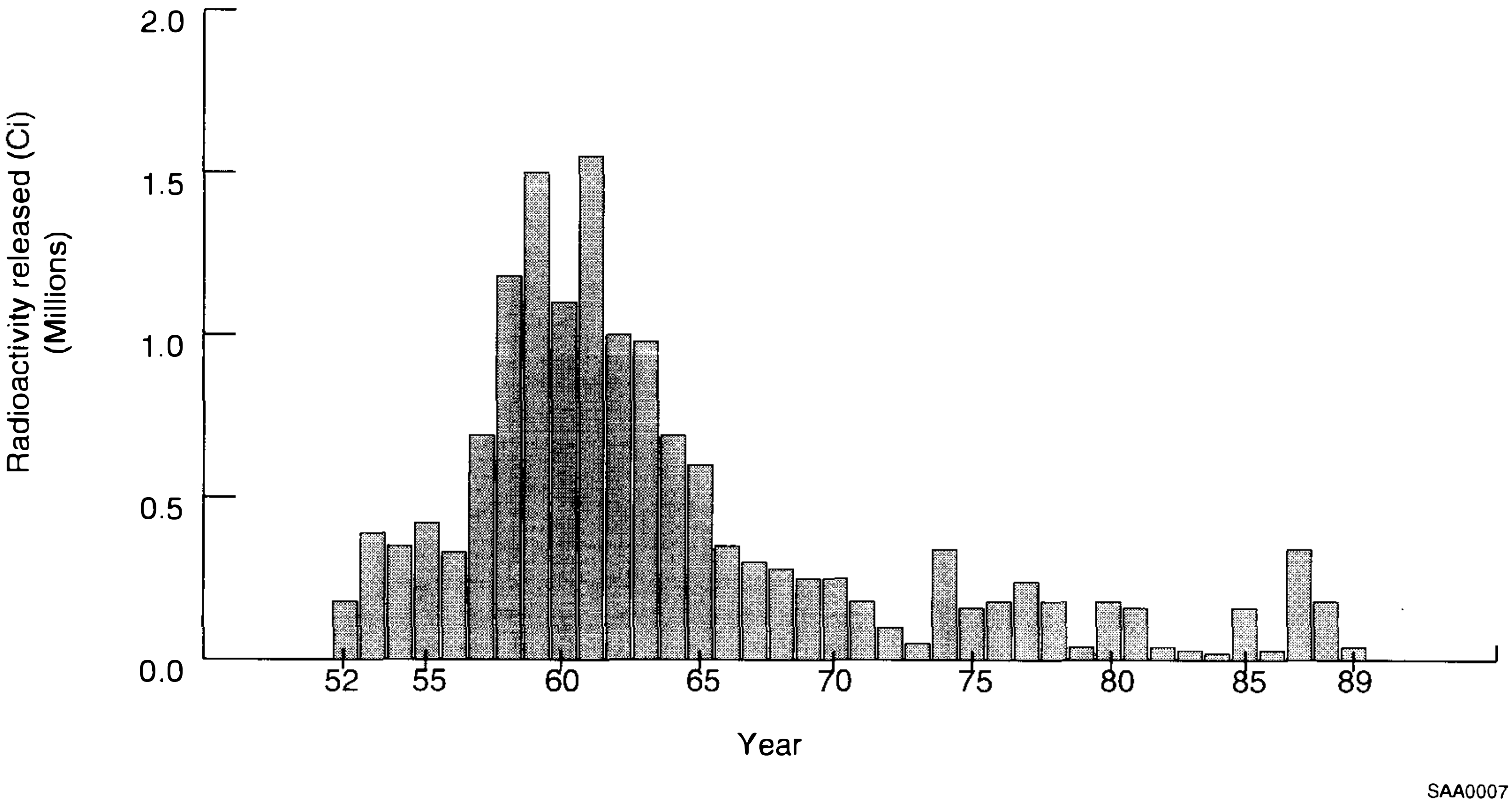


Figure 5.15-1. Annual quantity of radionuclides released at the Idaho National Engineering Laboratory for operational releases.

Occupational health data concerning historic accidents are incomplete and not readily available. Though historical records of accidents at the INEL are available, occupational doses were not always known and reported. Worker dose data are currently being collected and analyzed under a National Institute of Occupational Safety and Health program. An assessment of the cumulative impacts of accidents at the site to the health of INEL workers is not available at this time.

Liquid-borne radioactive effluents from the INEL have not, to this time, produced measurable exposure to an offsite member of the public living in the vicinity of the INEL. In the past, liquid radioactive materials have been disposed of directly to the Snake River Plain Aquifer through injection wells. The practice was discontinued in 1984. Radiological and nonradiological effluents attributable to the INEL operations have not been detected in wells beyond the INEL site boundary nor has there been a significant dose to an offsite member of the public through the Snake River Plain Aquifer pathway.

Some potential biotic pathways (animals and vegetation) also exist at the INEL. The most important biotic pathway has been game animals that can assimilate some radioactivity onsite. However, the probability of a hunter shooting one of these animals shortly after the animal migrates off the INEL is small. The potential for radiation dose to people offsite through game animals, although unlikely, could be up to 0.01 rem (10 millirem) per hunting season (DOE-ID 1991).

5.15.8.2 Occupational Health. The activities to be performed by workers under each of the alternatives are similar to those currently performed at each site. Therefore, the potential hazards encountered in the work place would be similar to those that currently exist. For these reasons, the average measured radiation dose and the number of reportable cases of injury and illness are anticipated to be proportional to the number of workers employed under each alternative (see Appendix F-4, Health and Safety). The airborne pathway, by which radioactive materials released on the INEL site could affect workers, was modeled but was found to add negligible amounts to actual measured data.

Based on occupational radiation monitoring results, the average reportable radiation dose to an INEL worker is about 0.027 rem (27 millirem) per year [0.27 rem (270 millirem) over the 10 years covered by this EIS). In addition, there is a potential for small additional radiation dose due to atmospheric releases from INEL facilities. For the maximally exposed worker, the additional dose over the period from 1995 to 2005 could range from 0.0033 rem (3.3 millirem) for Alternative A (No Action) to 0.0063 rem (6.3 millirem) for Alternative D (Maximum Treatment, Storage, and Disposal). These potential radiation doses would be in addition to natural background radiation which averages about 0.35 rem (350 millirem) per year [3.5 rem (3500 millirem) over 10 years].

For each alternative, occupational radiation dose received by the entire INEL workforce (about 10,000 workers) from 1995 to 2005 would result in about one fatal cancer. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 2,000.

For the evaluation of occupational health effects from chemical emissions, the modeled chemical concentration was compared with the applicable occupational standard. Modeled concentrations below the occupational standards were considered acceptable. As a result, no adverse health effects for onsite workers are projected as a result of normal chemical emissions.

Routine workplace safety hazards can also result in injury or fatality. Total injury and illness rates for INEL workers are comparable to those for DOE and its contractors, which average 3.2 per 200,000 hours worked. For comparison, rates in private industry across the U.S. are 8.4 per 200,000 hours worked.

For each alternative, about three fatalities would result in the entire INEL workforce (about 10,000 workers) from 1995 to 2005 due to workplace safety hazards. Estimates differ only slightly between alternatives because the total number of workers for all alternatives is similar.

These analyses indicate that the cumulative impacts of radiological health effects, nonradiological health effects, and workplace safety hazards to the INEL workforce would be similar for all alternatives. The combined occupational risks are less than those encountered by the average worker in private industry.

5.15.8.3 Public Health. The airborne pathway is the principal pathway by which radioactive materials released on the INEL site can reach an offsite member of the public. The potential for radiation dose to the public in the vicinity of the INEL site due to atmospheric releases is similar for all alternatives. For the maximally exposed member of the public, the additional radiation dose over the period from 1995 to 2005 could range from 0.0014 rem (1.4 millirem) for

Alternative A (No Action) to 0.0084 rem (8.4 millirem) for Alternative D (Maximum Treatment, Storage, and Disposal). These potential radiation doses would be in addition to natural background radiation, which averages about 0.35 rem (350 millirem) per year [3.5 rem (3500 millirem) over 10 years]. For each alternative, less than one fatal cancer would result from radiation dose received by the population within 50 miles (80 km) of the INEL site from 1995 to 2005. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 24,000 out of a population of 120,000.

Other regional sources of atmospheric radioactivity have the potential to contribute to the radiation dose of the public near the INEL. The primary source is emissions from phosphate processing operations in Pocatello, Idaho. These emissions have been evaluated by the U.S. Environmental Protection Agency (EPA 1989). The number of fatal cancers in the population within 50 miles (80 km) of Pocatello would be about one over a ten-year period comparable to that covered in this EIS. The population exposed to the cumulative impact of both facilities would be small.

In addition to radiation dose from atmospheric emissions, there is a potential for impacts to the public from exposure to carcinogenic chemicals released to the air. The highest risks calculated for any alternative are small compared to the risks from radioactive releases and imply less than one fatal cancer in the exposed population over the ten-year period covered in the EIS. There is no basis currently available for evaluating risks from chemical exposure from other regional commercial, industrial, and agricultural sources, such as combustion of diesel and gasoline fuels and agricultural uses of pesticides, herbicides, and fertilizers.

The volume of surface water that flows from the INEL site to offsite areas is negligible. There are no liquid discharges from INEL operations to the intermittent streams in the vicinity. Therefore, the cumulative impacts from the surface water pathway on public health is negligible.

Past disposal of radioactive effluents to surface infiltration ponds and deep injection wells resulted in contamination to the Snake River Plain Aquifer. Effluent from these sources percolated through the soil and bedrock or was directly injected into the Snake River Plain Aquifer. Based on analyses of these past practices, the collective dose to an offsite member of the public through the Snake River Plain Aquifer pathway over the period 1995 to 2005 would be negligible. Currently, radioactive liquid effluents are not discharged directly to the aquifer from operations. Any discharge of effluents to infiltration ponds is monitored for the presence of radioactive and chemical constituents, as required under Federal and State regulations.

5.15.9 Waste Management

Table 5.15-2 presents, by waste stream for each alternative, the total volumes of waste existing and projected to be generated at or shipped to the INEL site that would be pending disposition over the ten-year timeframe of this EIS. The conversion of liquid high-level waste to calcine is scheduled to continue over the ten-year period of this EIS, but no provision to satisfy the requirement to cease the use of existing liquid storage tanks has been incorporated under Alternative A (No Action). Existing dispositioned waste stored or buried onsite includes approximately 145,000 cubic meters (190,000 cubic yards) of low-level waste and about 62,000 cubic meters (81,000 cubic yards) of transuranic waste (Pole et al. 1993). Although the volume of INEL industrial waste deposited previously in the INEL Landfill Complex is unknown, it is estimated that the Landfill Complex would provide adequate capacity for the next 30 to 50 years (see Chapter 2, Background). Furthermore, the capacity of the Landfill Complex may be prolonged as a result of an active onsite recycling program (see Chapter 2, Background). Without available treatment or disposal under Alternative A, it is anticipated that the permitted storage capacity for mixed low-level waste would be exceeded during the first year of the 10-year timeframe of the EIS. All other alternatives include facility construction for storage or shipping of mixed low-level waste; therefore, storage capacity is accounted for.

5.16 Adverse Environmental Effects Which Cannot Be Avoided

The construction and operation of facilities under any of the four alternatives at the INEL would result in some adverse impacts to the environment. Changes in project design and other measures (for example, sound engineering practices during construction) could eliminate, avoid, or reduce many of these to minimal levels (see Section 5.19, Mitigation); this section only includes discussion of adverse effects that potential mitigation measures could not reduce or avoid. These adverse effects are identified by discipline for each of the alternatives.

5.16.1 Cultural Resources

The unchecked deterioration of both structures and historical documents on nuclear facilities at the INEL site could have a long-term adverse impact on these resources. However, some potentially adverse impacts could be avoided by preserving the historic value of the property through appropriate research or by conducting limited rehabilitation on these structures. Adverse impacts related to removal or alteration of potentially significant historic structures could occur under Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal). Under either of these alternatives, nine potentially significant historic structures could be affected. Impacts to eight structures have been addressed in a Memorandum of Agreement between DOE, the Advisory Council on Historic Preservation, and the State Historic Preservation Office (DOE 1993). Adverse impacts may also occur to archaeological sites of importance to Native Americans and areas or resources of traditional or religious importance.

Unavoidable adverse impacts under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) are the same as those described under Alternative A (No Action). However, 22 potentially important significant archaeological sites and an additional 70 potentially significant historic structures could be affected. Although most adverse effects to sites can be mitigated through scientific study, effects to sites that are important to Native American groups may remain adverse.

5.16.2 Aesthetic and Scenic Resources

Potential impacts related to visibility impairment at Craters of the Moon Wilderness Area as a result of nitrogen dioxide emissions are associated with each alternative. These impacts would be further defined and resolved during the air permitting process before projects could proceed.

5.16.3 Air Resources

Construction and remediation activities would result in short-term, elevated levels of particulate matter in localized areas. During the operational phases of specific projects, emissions of radionuclides, criteria pollutants, and toxic air pollutants may result in some degradation of air quality, but all impacts would be below applicable standards established for public health and welfare.

5.16.4 Water Resources

An unavoidable adverse impact of all alternatives would be that contaminant remediation would not include comprehensive remediation of all contaminated media and areas. Although Alternative A (No Action) would use the least amount of water and would produce the least amount of wastewater, adverse impacts for water resources would be slightly greater under Alternative A because of the smaller number of remediation projects that would be completed under this alternative.

5.16.5 Ecology

Unavoidable impacts to biota under Alternative A (No Action) would result from disturbance of approximately 16 hectares (40 acres) of terrestrial habitat: 2 hectares (5 acres) of undisturbed habitat and 14 hectares (35 acres) of previously disturbed habitat that is of low quality and limited use to wildlife. Mortality or displacement of species would include those species that are less mobile such as burrowing animals, insects, and rodents. An increase in the potential mortality from train/wildlife collisions also would be anticipated. Nesting birds could also be adversely impacted if construction activities occur during prime nesting seasons. Short-term adverse impacts could potentially include temporary elevated exposure of hazardous materials and radionuclides to biota during and immediately after soil remediation activities. Residual radionuclides and hazardous materials from past activities, not part of the proposed action, would still be potentially consumed by animals and absorbed by plants. These materials may result in injury to individual animals or plants, but have not historically resulted in measurable impacts to populations on or off the INEL site.

Unavoidable adverse impacts to biota in previously disturbed habitat under Alternative B (Ten-Year Plan) would be similar to those described for Alternative A, but on a larger scale as discussed in Section 5.9, Ecology. Utilization of additional acreage increases the amount of habitat loss and, unlike Alternative A, would have the potential to increase habitat fragmentation on the INEL site.

Unavoidable adverse impacts to biota under Alternative C (Minimum Treatment, Storage, and Disposal) would be similar to those described for Alternative A; about 94 hectares (233 acres) of previously disturbed land would be cleared for construction activities. Of the total 144 hectares (355 acres) to be disturbed, 49 hectares (122 acres) would be in previously undisturbed habitat.

Unavoidable adverse impacts under Alternative D (Maximum Treatment, Storage, and Disposal) would be similar to those described for Alternatives A and B; however, the scale would be larger (see Section 5.9, Ecology).

5.17 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Implementation of any of the alternatives would cause some adverse impacts to the environment and would permanently commit certain resources. However, under several of the alternatives these uses of the environment would be of short duration and offset by long-term enhancements to the environmental productivity of the region. The following is a brief comparison of potential short-term influences each alternative would have on the environment and the associated effects on the maintenance and enhancement of long-term productivity of the environment.

5.17.1 Alternative A (No Action)

- General: Under Alternative A (No Action), short-term uses of resources would have little or no impact on long-term environmental productivity.

- Land Use: Environmental impacts under Alternative A include only a very small amount of additional land disturbance. No effect on the long-term productivity of the environment is expected.

- Air Quality: Construction or remediation activities would result in short-term, elevated levels of particulate matter and combustion by-products in the areas of disturbance. Operational impacts have been assessed and shown to be within applicable standards and, therefore, represent an acceptable short-term commitment of resources. The potential for visual impacts exists, but would be further defined and resolved during the air permitting process. Impacts to air quality, as described in Section 5.7, would occur during project construction, operation, and remediation, but would not result in a long-term commitment of resources beyond the life of the alternative. Implementing the measures outlined in Section 5.19.4 would reduce the impacts on air quality.

- Ecology: There would be a potential short-term productivity loss in habitats adjacent to INEL facilities. There would be a long-term loss of about 15 hectares (38 acres) of habitat that is widely dispersed and that is within and adjacent to existing industrial areas. These losses would be offset at least partially by a minor reduction in contaminant exposure to ecological resources, thereby increasing environmental productivity. Under Alternative A, long-term environmental productivity would be enhanced the least compared to the other alternatives.

- Environmental Restoration and Waste Management (ER&WM): Alternative A includes only short-term interim actions and does not provide for long-term disposition and enhanced management of waste or environmental cleanup as specified in the Federal Facility Agreement and Consent Order. Therefore, these short-term interim actions would provide little enhancement of the environment in the long-term.

5.17.2 Alternative B (Ten-Year Plan)

- General: Under Alternative B (Ten-Year Plan), short-term uses of resources would be greater than for Alternative A. However, because of remediation efforts related to this alternative, impacts would result in enhanced long-term productivity compared to Alternatives A and C.

- Land Use: Environmental impacts under Alternative B include land disturbance and land-use category changes from open space to industrial uses. These land-use changes occur on acreage within or adjacent to existing industrial facilities, therefore minimizing any land-use impacts. Subsequently, no effect on long-term productivity of the surrounding environs is expected.

- Cultural Resources: Additional information gained during preactivity surveys for archaeological, historical, or paleontological resources could be compiled into a database or added to an existing database to improve the knowledge of area history. Also, coordination with affected Native Americans would provide information necessary for the protection and preservation of Native American resources. Increasing the historical knowledge and understanding of the area would provide a basis for the enhancement of future management of cultural resources in the region.

- Geology: In areas undergoing short-term uses, such as construction or remediation activities, some soil loss would be expected. However, these activities would be of short duration and soil loss would be minimized by implementing the measures outlined in Section 5.19.3. Therefore, no long-term effect on environmental productivity of the habitat surrounding these sites is expected.

- Air Quality: Construction or remediation activities would result in short-term, elevated levels of particulate matter and combustion by-products in the areas of disturbance. Operational impacts have been assessed and shown to be within applicable standards and, therefore, represent an acceptable short-term commitment of resources. The potential for visual impacts exists, but would be further defined and resolved during the air permitting process. Impacts to air quality, as described in Section 5.7, would occur during project construction, operation, and remediation, but would not result in a long-term commitment of resources beyond the life of the alternative. Implementing the measures outlined in Section 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term productivity loss in habitats adjacent to INEL facilities would be offset by a reduction in contaminant exposure to ecological resources, thereby increasing environmental productivity. There would be a long-term loss of productivity and biodiversity associated with the approximately 239 hectares (591 acres) that would be disturbed and used.

- ER&WM: All ER&WM actions started or scheduled in the next 10 years as outlined in the Federal Facility Agreement and Consent Order would be completed. These activities would enhance the long-term productivity of the area by decreasing the risk to onsite workers and surrounding biota through exposure to toxic and radioactive substances.

5.17.3 Alternative C (Minimum Treatment, Storage, and Disposal)

- General: Under Alternative C (Minimum Treatment, Storage, and Disposal), short-term uses of resources would be somewhat greater than for Alternative A but would be less than for Alternatives B and D. However, because of remediation efforts related to this alternative, impacts would result in enhanced long-term productivity that is greater than for Alternative A and less than for Alternatives B and D.

- Land Use: Environmental impacts under this alternative include only a very small amount of additional land disturbance. No effect on long-term environmental productivity is expected.

- Air Quality: Construction or remediation activities would result in short-term, elevated levels of particulate matter and combustion by-products in the areas of disturbance. Operational impacts have been assessed and shown to be within applicable standards and, therefore, represent an acceptable short-term commitment of resources. The potential for visual impacts exists, but would be further defined and resolved during the air permitting process. Impacts to air quality, as described in Section 5.7, would occur during project construction, operation, and remediation, but would not result in a long-term commitment of resources beyond the life of the alternative. Implementing the measures outlined in Section 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term productivity loss in habitats adjacent to INEL facilities would be offset by a minor reduction in contaminant exposure to ecological resources, thereby increasing environmental productivity. There would be a long-term loss of productivity and biodiversity associated with the disturbance and use of approximately 50 hectares (123 acres).

- ER&WM: To the extent that those cleanups of groundwater and soil already mandated by the Federal Facility Agreement and Consent Order would be completed to minimum requirements under this alternative, there would be, in the long term, a slight decrease in risk to onsite workers and biota through exposure to toxic and radioactive substances. However, because neither cleanups beyond those mandated nor major upgrades in waste management would occur, these long-term enhancements on the productivity of the environment would be less than those described under Alternative B (Ten-Year Plan).

5.17.4 Alternative D (Maximum Treatment, Storage, and Disposal)

- General: Under Alternative D (Maximum Treatment, Storage, and Disposal), short-term uses of resources would be greater than for Alternative A. However, because of remediation efforts related to this alternative, impacts would result in enhanced long-term productivity compared to Alternatives A, B, and C.

- Land Use: Environmental impacts under this alternative include land disturbance and land-use category changes from open space to industrial uses. No effect on long-term productivity of the environment is expected.

- Cultural Resources: Additional information gained during preactivity surveys for archaeological, historical, or paleontological resources could be compiled into a database or added to an existing database to improve the knowledge and understanding of area history. Also, coordination with affected Native Americans would provide information necessary for the preservation and protection of areas that hold cultural and religious significance for them. Creating and/or improving these databases would provide a basis for enhancement of management of cultural resources in the region.

- Geology: In areas undergoing short-term uses, such as construction or remediation activities, some soil loss would be expected. However, these activities would be of short-duration with soil loss minimized by implementing the measures outlined in Section 5.19.3. No long-term effect on productivity is expected.

- Air Quality: Construction or remediation activities would result in short-term, elevated levels of particulate matter and combustion by-products in the areas of disturbance. Operational impacts have been assessed and shown to be within applicable standards and, therefore, represent an acceptable short-term commitment of resources. The potential for visual impacts exists, but would be further defined and resolved during the air permitting process. Impacts to air quality, as described in

Section 5.7, would occur during project construction, operation, and remediation, but would not result in a long-term commitment of resources beyond the life of the alternative. Implementing the measures outlined in Section 5.19.4 would reduce the impacts on air quality.

- Ecology: The potential short-term loss in habitats adjacent to INEL facilities would be offset by a reduction in contaminant exposure to ecological resources, thereby increasing environmental productivity. Also, there would be a long-term loss of productivity and biodiversity associated with the disturbance and use of approximately 448 hectares (1108 acres).

- ER&WM: Environmental restoration at all contaminated sites identified for remediation and waste management actions would be completed under this alternative. These activities would enhance the long-term environmental productivity of the area by decreasing the risk to onsite workers and surrounding biota through exposure to toxic and radioactive substances. However, some of the reduction in risk would be potentially offset by the increase of toxic and radioactive waste and spent nuclear fuel that would be disposed, treated, or stored at INEL under this alternative.

5.18 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources for each alternative would potentially include land, groundwater (areas of contamination), aggregate, and energy resources. However, some materials (for example, structural and stainless steel) and resources (for example, water use) are considered recyclable and are not considered an irreversible and irretrievable commitment of resources. These resource commitments would be caused by past activities, construction and operation of new storage or disposal facilities, and potential remediation actions that would be identified through the comprehensive and project-specific Remedial Investigations/Feasibility Studies and the resulting Records of Decision.

Impacts on air quality are not considered irreversible and irretrievable commitments of resources. Rather, these are potential impacts that could materialize and persist for the duration of the projects in question.

Disposal of radioactive and/or hazardous wastes would cause irreversible and irretrievable commitments of land resources under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). Under Alternative D, mixed low-level waste and low-level waste disposal would irreversibly and irretrievably commit approximately 162 hectares (400 acres) of previously open-space land. Hazardous waste treatment, storage, and disposal under the same alternative would irreversibly and irretrievably affect 2 hectares (5 acres) of open-space land. Under Alternative B, mixed low-level waste and low-level waste disposal would irreversibly and irretrievably affect 81 hectares (200 acres) of previously open-space land. Services potentially lost from the commitment of these acreages would include lost vegetation productivity, lost wildlife productivity, and lost multiple-use or alternative-use opportunities (for example, disposal sites would not undergo future decommissioning or decontamination and habitat reclamation). Under Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), there would be no land resources irreversibly or irretrievably committed to waste disposal facilities.

The aggregate resources (sand, gravel, pumice, and landscaping cinders) extracted on the site would be irreversibly and irretrievably committed in support of INEL spent nuclear fuel and ER&WM activities. Aggregate would also be utilized during construction for concrete production, foundation preparation, and road construction and maintenance. Aggregate demands would be highest under Alternative D (Maximum Treatment, Storage, and Disposal) with an estimated volume of approximately 1,772,000 cubic meters (2,317,000 cubic yards). Estimated aggregate demands commensurate with the level of construction activities proposed under Alternatives B, C, and A, would be 408,000; 285,000; and 226,000 cubic meters (534,000; 373,000; and 296,000 cubic yards), respectively.

As discussed in Sections 4.8, Water Resources, and 5.8, Water Resources, activities at the INEL site have resulted in the irreversible and irretrievable commitment of groundwater in the Snake River Plain Aquifer that has been affected by chemical and radioactive contaminant plumes. However, these plumes occur in localized areas within INEL site boundaries and are not expected to migrate beyond the site's boundaries within the timeframe of this EIS (see Section 5.8). Services lost from these commitments may include limiting the locations and use of certain types of wells (for example, drinking water supply) or the volume of water pumped from the aquifer by DOE for activities at the INEL site. All potable water wells on the INEL site are monitored routinely to ensure that water withdrawn from the aquifer is utilized appropriately, as specified under Federal and State regulations.

Commitment of energy and other resources would be greatest under Alternative D (Maximum Treatment, Storage, and Disposal). Alternative D would require (above the baseline usage of these resources) about 127,700 megawatt-hours per year of electricity, 5.86 million liters (1.55 million gallons) per year of heating oil, 1.2 million liters (320,000 gallons) per year of diesel fuel, and 2.73 million liters (730,000 gallons) per year of propane. Construction associated with this alternative is estimated to require approximately 100,000 cubic meters (130,000 cubic yards) of concrete. All other alternatives would have smaller demands on these resources, commensurate with the level of construction and operation activities proposed.

5.19 Mitigation

An overview of potential mitigation measures for the proposed activities outlined in this EIS is presented in the following discussion.

5.19.1 Cultural Resources

Detailed specifications associated with proposed construction projects at INEL have not been completed for all proposed projects. This precludes identifying specific project impacts in all cases for particular structures and facilities. Section 106 of the National Historic Preservation Act, as amended (NHPA 1966), requires a Federal agency head with jurisdiction over a Federal, federally funded, federally assisted, or federally licensed undertaking to take into account the effects of the agency's undertakings on properties included in or eligible for the National Register of Historic Places and, prior to approval of an undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. Under the regulations of the National Historic Preservation Act, as amended, impacts to significant resources that would otherwise be found to be adverse may be reduced by preserving the historic value of a property through the conduct of appropriate scientific or historic research, or by rehabilitating buildings and structures when this work is supported by appropriate planning documents.

Basic compliance under cultural resource law involves steps that would be essentially the same under all alternatives. These steps are to (a) initiate consultation process with the Idaho State Historic Preservation Office and representatives of the Shoshone-Bannock tribes and conduct a preactivity survey for identification and evaluation of resources in danger of impact, (b) assess effects to these resources in consultation with the State Historic Preservation Office and the tribal representatives, (c) develop plans and documents to minimize any adverse effects, (d) consult with the Advisory Council on Historic Preservation and the tribes as to the appropriateness of mitigation measures, and (e) implement mitigation measures. Therefore, if a cultural resource survey has not been performed in an area planned for ground disturbance under one of the proposed alternatives, consultation would be initiated with the Idaho State Historic Preservation Office and the survey would be conducted prior to any disturbance. If cultural resources are discovered, they would be evaluated according to National Register of Historic Places criteria. Whenever possible, important resources would be left undisturbed. If the impacts are determined to be adverse and it is not feasible to leave the resource undisturbed, then measures would be initiated to reduce impacts. In most cases, this would involve an expanded data recovery program to collect significant information before it is lost; elements of this program might include archaeological excavation, study of archival materials, consultation with concerned Native American tribes (where appropriate), and detailed drawings and photographs. All mitigation plans would be developed in consultation with Native American tribes (where appropriate), the State Historic Preservation Office, and the Advisory Council on Historic Preservation and would conform to appropriate standards and guidelines established for historic preservation activities by the Secretary of the Interior.

In situations where historically significant facilities on the INEL site are likely to be affected, the compliance process would be essentially the same as outlined above. In this context, if it is not possible to leave these facilities intact, then historical information would be collected to evaluate the eligibility of the structure for the National Register of Historic Places. Eligibility would be determined in consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation. Mitigation may include the development of a Memorandum of Agreement or Programmatic Agreement between DOE, the State Historic Preservation Office, and the Advisory Council on Historic Preservation, which may include provisions for historic documentation, development of a historic context for the facility, and preservation of historic photographs, plans, and records.

Some actions may affect areas of religious, cultural, or historic value to Native Americans. DOE has implemented a Working Agreement (DOE-ID 1992) to ensure communication with the Shoshone-Bannock Tribe, especially relating to the treatment of archaeological sites during excavation as mandated by the Archeological Resources Protection Act (ARPA 1979) and the protection of human remains as required under the Native American Graves Protection and Repatriation Act (NAGPRA 1990) and the free exercise of religion under the American Indian Religious Freedom Act (AIRFA 1978). In keeping with DOE's Native American policy (DOE 1990), DOE (1992), and procedures to be defined in the final Cultural Resources Management Plan, DOE would conduct Native American consultations during the planning and implementation of all proposed alternatives. If human remains are discovered, DOE would notify all tribes that have expressed an interest in the repatriation of graves as required under the Native American Graves Protection and Repatriation Act, including the Shoshone-Bannock, Shoshone-Paiute, and the Northwestern Band of the Shoshoni

Nation. These tribes would then have an opportunity to claim the remains and associated artifacts in accordance with the requirements of the Native American Graves Protection and Repatriation Act. The procedures for the repatriation of "cultural items," in accordance with Native American Graves Protection and Repatriation Act, will be described in the curation agreement, which will be finalized by June 1996.

In addition to consultation, other measures would mitigate potential adverse effects to Native American resources, in particular those effects to air, water, plants, animals, and visual setting. These measures include the following:

- Avoiding sensitive areas
- Placing facilities within existing areas of construction
- Revegetating with native plants of areas with ground disturbance
- Monitoring plants and animals within hunting or gathering areas for radiological contamination
- Reducing noise and night lights outside of existing facilities
- Monitoring tanks, ponds, and runoff for contaminants
- Minimizing ground disturbance
- Using dust suppressors during construction
- Using filters and other air pollutant control equipment to reduce air contaminants.

Projects involving excavation or other ground disturbance could also adversely affect paleontological resources. Before construction or excavation begins, the area would be assessed as to the likelihood of disturbing potentially important paleontological resources. Assessment may include archival research, surface surveys, consultation with knowledgeable individuals, or limited test excavation in previously disturbed areas. If the disturbance would take place within sensitive areas (for example, basalt, fluvial deposits, playas), then ground disturbance would be monitored by a qualified professional paleontologist. A plan for recovering, stabilizing, and curating important paleontological resources found during construction would be prepared before ground disturbing activities begin.

5.19.2 Aesthetic and Scenic Resources

Conservative, screening-level analyses have indicated that potential impacts related to visibility degradation at Craters of the Moon Wilderness Area could result from facility emissions under each of the alternatives. If the application of refined modeling confirms the findings of the screening-level analyses, mitigative measures, such as the use of emissions controls, would be required to prevent these impacts. Alternatively, perceptible changes in the visual resource in this area could also be prevented by relocating the proposed sites of individual projects to areas more distant from Craters of the Moon (that is, away from the southwest portion of the INEL). As changes in visual setting, particularly in the Middle Butte area located in the southern portion of the INEL site, are seen by the Shoshone-Bannock to be an adverse effect on an important Native American resource, the Shoshone-Bannock would be consulted before any project is developed that could have impacts to resources of importance to the tribes. For a more thorough discussion of the potential effects on the visual resource, refer to Section 5.7, Air Resources.

5.19.3 Geology

Potential soil erosion in areas of ground disturbance could be mitigated through minimizing areas of surface disturbance and by utilizing engineering practices such as storm water runoff control including sediment catchment basins, slope stability (for example, rip-rap placement), and soil stockpiling with wind erosion protection (for example, covering of stockpiles). Furthermore, wind erosion (for example, fugitive dust) would be controlled by spraying disturbed areas with water and other methods mentioned in this section.

5.19.4 Air Resources

Controls to reduce radiological emissions and doses would be evaluated based on the nature of the specific process under evaluation and the types and amounts of radionuclides that may be released. For example, controls would include limiting iodine-129 emissions from spent nuclear fuel or high-level waste processing by means such as filtration based on adsorption of gaseous forms of iodine on charcoal or silver zeolite filtering media. High-efficiency particulate air filters would be used extensively to reduce emissions of radionuclides that are particulates.

State of Idaho regulations dictate that any modification of a major facility that would result in significant emissions increases is considered a major modification and would be subject to requirements for best available control technology to limit emissions. Best available control technology is defined as an "emission standard based on the maximum control of emissions achievable through application of production processes or available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combination techniques) for control of such contaminants. The best available control technology shall be determined on a case-by-case basis, taking into account energy, environmental and economic impacts...." (IDHW 1994). Best available control technology must be designed for each pollutant associated with a significant emissions increase as defined in the State regulation. As a minimum, air pollutant control equipment, administrative controls, changes in raw material feed, or design changes would be required on several proposed projects to reduce emissions of nitrogen dioxide, sulfur dioxide, and mercury for Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage and Disposal). Control of emissions of nitrogen dioxide and sulfur dioxide could be required for Alternative A (No Action). A listing of potential levels of control for specific projects is contained in Belanger et al. (1995). Fugitive dust control methods would be similar to those described in Section 5.19.3. Mitigation of potential visual impacts is discussed in Sections 5.5, 5.7.4.3.3, and 5.19.2.

5.19.5 Water Resources

The development of pollution prevention plans, such as the INEL Storm Water Pollution Prevention Plan (DOE-ID 1993a, b) and the INEL Groundwater Protection Management Plan (Case et al. 1990), and implementation of best management practices are important in preventing future sources of pollution to water resources. These practices develop standard procedures for handling waste materials and preventing accidental discharges. Waste minimization techniques, best available technologies, and engineered barriers (for example, double-liner systems) are also employed to prevent or minimize the potential for a release of pollutants to the vadose zone or water resources. Existing monitoring and surveillance programs around tanks and ponds would also reduce impacts of inadvertent liquid release by restricting their duration and volume. An extensive site-wide groundwater monitoring network, vadose zone monitoring, and drinking water monitoring program allow for early detection of contaminant migration. Contaminants (principally organics) in the vadose zone and groundwater could be removed through treatment and remediation using state-of-the-art technologies, where feasible. For example, the volatile organic compound remediation program at the Radioactive Waste Management Complex is designed to extract volatile organic compound contaminants before they affect the regional environment. Remediation efforts have already successfully removed 640 kilograms (1411 pounds) of volatile organic material at the Radioactive Waste Management Complex, and concentrations of organics and radionuclides in the Test Area North injection well dropped after sludge removal in 1990. In addition, the natural decay of radionuclides and the change in waste management practices would decrease the contaminant concentrations in the aquifer.

Best management practices and storm water monitoring have been implemented under the INEL Storm Water Pollution Prevention Program (DOE-ID 1993a, b) to reduce the potential of liquid effluent discharges from commingling with storm water runoff under normal operations and during spills. Storm water runoff from facility areas of concern would be monitored during snowmelt and rain events to ensure that any contaminants present are identified. If problem areas are identified during field inspections or monitoring, additional best management practices would be implemented to further decrease impacts to natural surface water.

5.19.6 Ecology

Unavoidable impacts to biota would include disturbance of a limited amount of habitat, mortality or displacement of some animals (primarily small mammals, reptiles, and birds), and possibly temporary elevated exposure levels to airborne radionuclides and hazardous materials.

The DOE would implement several actions to ensure that activities do not adversely affect protected, candidate, or sensitive species. If bald eagles or peregrine falcons are observed during activities, DOE would consult with the U.S. Fish and Wildlife Service to ensure that individual eagles and falcons observed are not harassed or killed. Preactivity surveys would be conducted to determine if endangered or candidate species or their habitat are present in the area. If candidate or sensitive species or important habitat (such as rattlesnake hibernacula, sage grouse mating grounds, or bat roosts) are observed during preactivity surveys, DOE would evaluate the project design to determine if modifications would minimize potential negative effects. Where practicable, modifications would be implemented.

Projects that would disturb habitat would be evaluated to determine if jurisdictional wetlands are present. Activities would be modified to avoid affecting the wetland. If avoidance is not possible, DOE would consult with the U.S. Army Corps of Engineers to obtain permits and develop any needed mitigation (for example, construction of new wetlands, enhancement of existing wetlands). Jurisdictional wetlands within or near remediation activities would be avoided and discussions with the U.S. Army Corps of Engineers would identify any required mitigation. In addition, workers would be informed of wetland locations so that inadvertent disturbance (for example, filling, dredging, or draining) would not occur to wetlands.

Other measures would include minimizing ground disturbance using temporary drainage structures during facility removal to minimize erosion, grading, and seeding bare ground with native plant species for long-term stability (see Section 5.19.3). A speed limit would be maintained to ensure that animal mortality from vehicles would be limited. During remediation, potential increased exposure and uptake of radionuclides would be minimized by (a) using dust-suppression and containment methods to minimize resuspension, (b) removing buried contaminants as soon as possible after they are exposed, and (c) using erosion-control measures to minimize water-erosion movement of radionuclides. After cleanup, the potential of exposure to radionuclides would be diminished to acceptable levels that probably would not result in acute or chronic effects to biota (IAEA 1992).

5.19.7 Transportation

The possible impacts from transportation associated with the alternatives could be mitigated in a number of different ways. For example, the routes used for truck shipments would be chosen using

U.S. Department of Transportation routing guidelines. These guidelines are designed to reduce the radiological impacts associated with transportation. According to the guidelines, primary factors include (a) the radiation exposure from incident-free transport, (b) the risk to public health from an accidental release of radioactive material, and (c) the economic risk from an accidental release of radioactive material. Secondary factors, according to the guidelines, include (a) emergency response effectiveness, (b) evacuation capabilities, (c) location of special facilities such as schools or hospitals, and (d) traffic fatalities and injuries unrelated to the radioactive nature of the cargo.

Impact mitigation would also be provided through the use of approved shipment containers. For shipments containing small amounts of radioactivity, such as low-level waste, Type A containers may be sufficient. These containers are designed to withstand the rigors of normal transport. For shipments containing large amounts of radioactivity, such as spent nuclear fuel or transuranic waste, Type B containers would be used. These containers are designed to withstand normal transport conditions and hypothetical accident conditions.

The U.S. Department of Transportation also has requirements that help to mitigate transportation impacts. For example, there are requirements for drivers, packaging, labeling, marking, and placarding. There are also requirements that specify the maximum dose rate associated with radioactive material shipments, which help to reduce incident-free transportation doses.

If an accident did occur, Federal, State, local, and tribal authorities are trained in emergency response. For example, the Shoshone-Bannock Tribes, the State of Idaho, Bingham County, Bingham Memorial Hospital, Bannock Regional Medical Center, Pocatello Regional Medical Center, Idaho Power Company, Intermountain Gas Company, and DOE participated in a comprehensive, cooperative Transportation Accident Exercise held in Idaho in 1992 (TRANSAX '92).

The U.S. Environmental Protection Agency has developed protective action guides and protective actions that are designed to limit doses in the event of a nuclear incident. Use of these guides and actions would also minimize the impacts of transportation accidents involving radioactive material.

The impacts that transportation has on hunting could potentially increase if the number of shipments result in additional game being killed due to vehicle-game collisions. The most significant event would be a train collision with a herd of antelope during adverse weather conditions such as a blizzard. Mitigation measures could include distributing the deceased animals to hunters, relocating game, or reallocation of hunting permits, if necessary.

5.19.8 Health and Safety

Hazards would be minimized by best management practices and occupational and radiological safety programs operating under the same regulatory standards and limits that currently apply at the INEL.

5.19.9 Idaho National Engineering Laboratory Services

Practices would be implemented to reduce inefficient use of utilities and energy services. Initiatives would include using effective thermal insulation, installing state-of-the-art heating furnaces, and incorporating water conservation measures. Also, recycling of materials generated during decontamination and decommissioning activities would be given appropriate consideration.

5.19.10 Accidents

Mitigation measures to minimize exposure and, therefore, dose that would affect the postulated results of the accident scenarios are discussed in this section. In general, limited credit was assumed for emergency response.

INEL facilities employ emergency response programs to mitigate impacts of accidents to workers and the public in accordance with the 5500 series of DOE orders. These programs typically involve emergency planning, emergency preparedness, and emergency response. Each plan utilizes resources specifically dedicated to assist the facility in emergency management. These resources include the following:

- INEL Warning Communications Center

- INEL Fire Department

- Facility emergency command centers

- DOE Emergency Operations Center

- County and State emergency command centers

- Medical, health physics, and industrial hygiene specialists

- Protective clothing and equipment (respirators, breathing air supplies, and so forth).

The radiation doses estimated in this document for the various radiological accident scenarios are the doses that would be received by the population if only limited protective actions were taken. INEL has detailed plans for responding to accidents of the type described here, and the response activities would be closely coordinated with State and local officials. INEL personnel are trained and drilled in the protective actions to be taken if a release of radioactive or otherwise toxic material occurs. Even though this training may result in personnel receiving lower exposures should an accident occur, limited credit is taken for this training in estimating the exposure durations for workers.

An individual at the nearest public access highway is assumed to be exposed to the airborne plume resulting from the accident for no more than two hours because site security personnel could evacuate people from the affected area within two hours. For most of the postulated accidents, the individual could be exposed to the entire plume. However, in a few accidents where the assumed release time is 24 hours, the individual would be exposed to only a portion of the plume prior to being evacuated. There is the possibility of certain roadways being inaccessible due to plume direction, accidents, or weather conditions.

For the offsite population, the need for any protective action would be based on the predicted radiation doses. The emergency response would be based on the guidance provided in the protective action guides developed by the U.S. Environmental Protection Agency. The underlying principle for the protective action guides is that under emergency conditions all *reasonable* measures would be taken to minimize the radiation exposure of the general public and emergency workers. In the absence of significant constraints, protective actions may be implemented when projected doses are lower than the ranges given in the protective action guides.

Interdiction activities by INEL accident recovery personnel are expected to take place following an accident to limit doses to offsite individuals at risk. This interdiction could limit ingestion exposure so that the maximally exposed individuals would derive much less than the assumed 10 percent of their diet from locally grown crops and livestock.

5.20 Environmental Justice

In February 1994, Executive Order 12898, titled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FR 1994), was released to Federal agencies. This order directs Federal agencies to incorporate environmental justice as part of their missions. As such, Federal agencies are specifically directed to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. In addition to describing environmental justice goals, Executive Order 12898 directs the Administrator of the U.S. Environmental Protection Agency to convene an interagency Federal Working Group on Environmental Justice (referred to below as the Working Group). The Working Group is directed to provide guidance to Federal agencies on criteria for identifying disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The Working Group is also directed to coordinate with each Federal agency to develop an environmental justice strategy if a strategy is required by the proposed activities. At the time of this analysis, the Working Group had not issued final guidance on the approach to be used in analyzing environmental justice, as directed by the Executive Order. The Working Group has issued draft definitions of terms in the Draft Guidance for Federal Agencies on Terms in Executive Order 12898, dated November 28, 1994. These definitions, with slight modifications, were used in the following analysis. Further, in coordination with the Working Group, DOE is developing internal guidance for the implementation of the Executive Order, which has not yet been adopted. Because both DOE and the Working Group are still in the process of developing guidance, the approach used in this analysis might depart somewhat from whatever guidance is eventually issued.

This section provides an assessment of the area surrounding the INEL with respect to proposed environmental restoration and waste management programs under all alternatives considered in this volume. In addition, this assessment includes consideration of the management of spent nuclear fuel under all alternatives evaluated in Volume 1 of this EIS, which are integrated into the alternatives of Volume 2 as appropriate. This assessment includes potential adverse impacts resulting from both onsite activities and associated transportation of materials. Based on this assessment, it is concluded that none of the alternatives considered under the proposed action results in disproportionately high and adverse effects on minority populations or low-income communities surrounding the INEL or associated offsite transportation routes.

5.20.1 Public Comment Received on the Draft Environmental Impact Statement

Public comment received on the Draft EIS is addressed in Volume 3, Response to Public Comment, of this final EIS. Overall comment indicated a widespread concern about past and present DOE activities on human health and the environment. A small number of comments relating to environmental justice indicated the need for an expanded analysis in the final EIS, which was previously committed to in Section 5.20 of the Draft EIS. The most specific comments were received from the U.S. Environmental Protection Agency's Office of Enforcement and Compliance Assurance and the Shoshone-Bannock Tribes on the Fort Hall Indian Reservation. Environmental justice comments pertaining to Volume 2 of this EIS were in essence:

- Although the Draft EIS includes discussions on socioeconomic impacts, it does not state whether the alternatives would affect minority communities and low-income communities (Sanderson 1994).

- The DOE must meet the requirements of Executive Order 12898 on environmental justice and fully consider the comments of the Shoshone-Bannock Tribes on the Draft EIS and consider the impacts of its proposed actions on the Tribes, the Fort Hall Indian Reservation, and on other disadvantaged populations living in proximity to the INEL. It was stated that the Indian Tribes are not just another "minority population," but are governments that have a special relationship to the Federal government and its agencies, and have certain authorities to regulate others including the United States government (Tinno 1994, Wolfley 1994).

All pertinent public comments relating to environmental justice have been considered in this assessment, which has been expanded over the discussions in the Draft EIS.

5.20.2 Community Characteristics

Demographic information obtained from the U.S. Bureau of Census was used to identify minority populations and low-income communities in the zone of potential impact surrounding the INEL. This zone is within a circle that has an 80-kilometer (50-mile) radius. This 80-kilometer (50-mile) radius was selected because it was judged to encompass all of the impacts that may occur. This radius is also based on air impact modeling and socioeconomic impact analysis used in this EIS. Transportation impacts are assessed within 800 meters (0.5 miles) of transportation routes for incident-free transportation because impacts beyond this distance are negligible. For transportation accidents, an 80-kilometer (50-mile) radius was used. Demographic maps were prepared using 1990 census data available from the U.S. Bureau of Census (USBC 1992). Figures 5.20-1 and 5.20-2 illustrate census tract distributions for both minority populations and low-income populations respectively for areas surrounding the INEL. These maps were generated from an analysis of 1990 United States Bureau of Census Tiger Line files, which contain political boundaries and geographical features, and Summary Tape Files 3A (as processed by the U.S. Environmental Protection Agency), which contain demographic information. Data were resolved to the census tract group level. Census tracts are designated areas designed to encompass roughly 4,000 people per tract, but in reality generally range from 2,500 to 8,000 people.

An 80-kilometer (50-mile) radius circle appears on each map defining a zone of potential impact. As discussed above, this zone of potential impact relates to the analysis performed in the EIS. Because of the diversity of locations of current and potential onsite environmental restoration and waste management activities, the circle has been centered on a conservative location to identify the maximum number of minority populations and low-income populations. The center is located in the southeast corner of the INEL, at the location of the Argonne National Laboratory-West.

Minority populations and low-income populations are defined as follows:

- *Minority population:* A group of people and/or community experiencing common conditions of exposure or impact that consists of persons of the United States classified by the U. S. Bureau of Census as Negro/Black/African-American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other nonwhite

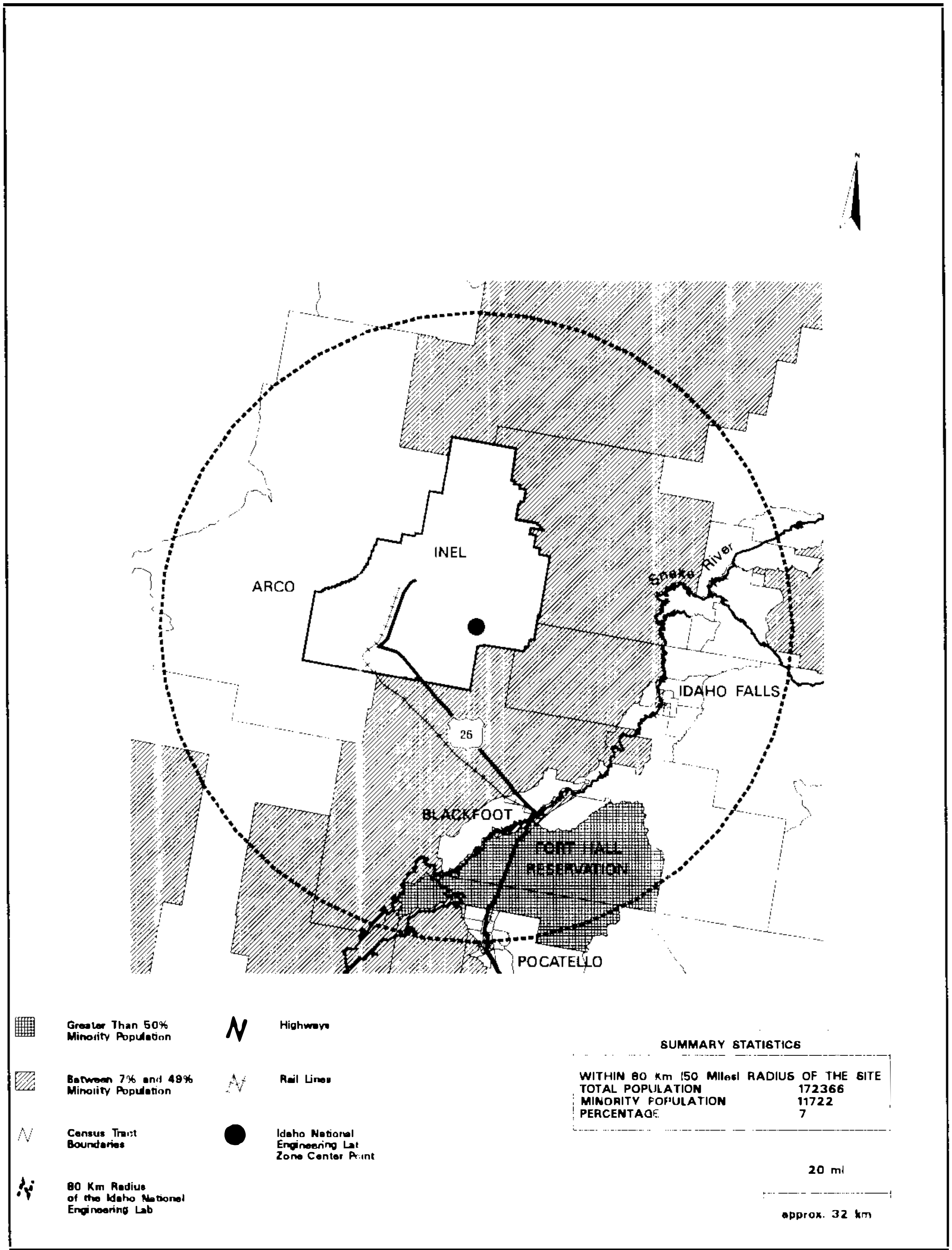


Figure 5.20-1. Minority population distribution within 80 kilometers (50 miles) of the Idaho National Engineering Laboratory.

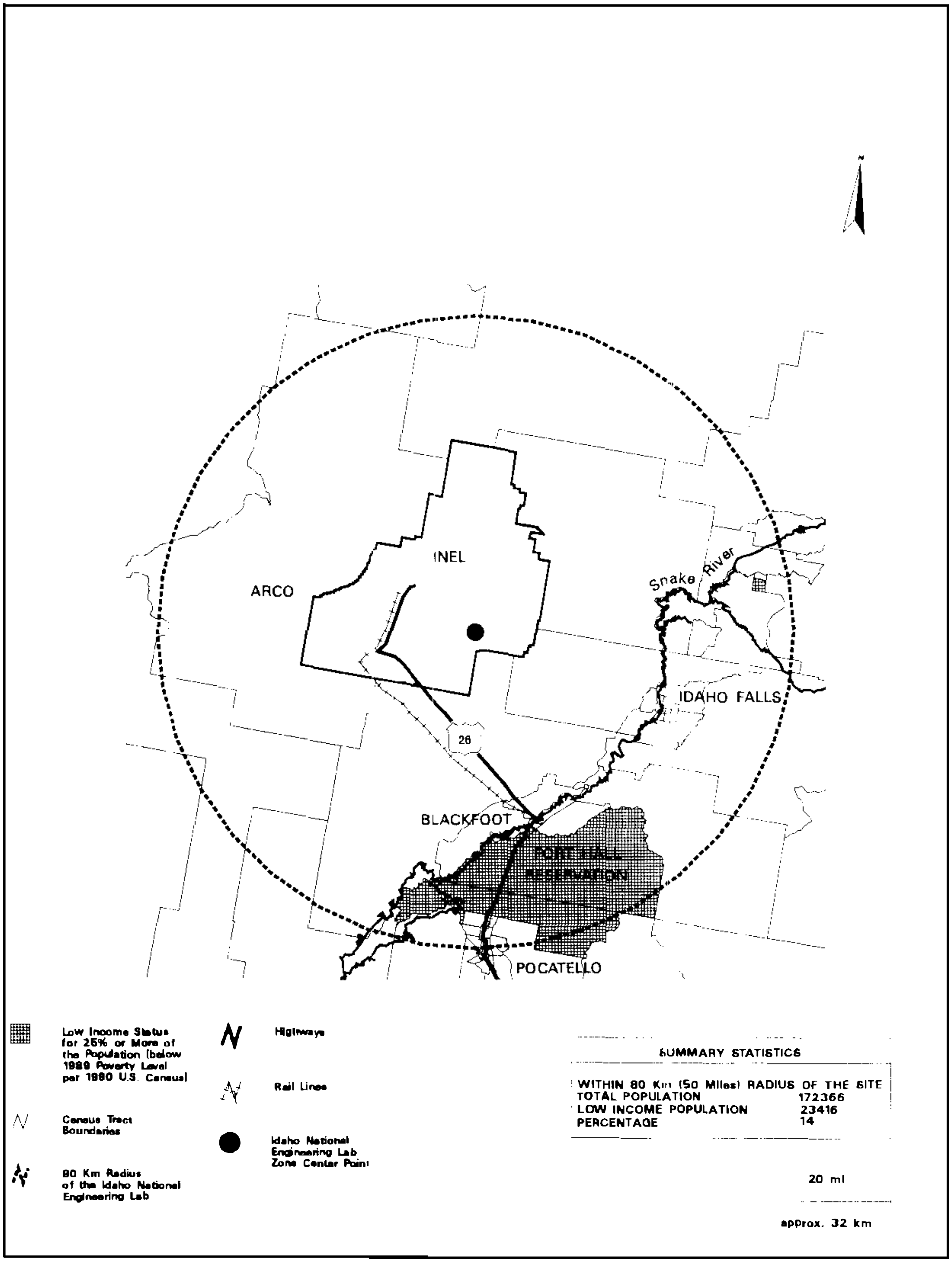


Figure 5.20-2. Low-income population distribution within 80 kilometers (50 miles) of the Idaho National Engineering Laboratory.

persons, based on self-classification by the people according to the race with which they most closely identify. For the purposes of analysis, minority populations are defined as tbose census tracts within the zone of impact for which tbe percent minority population exceeds the average of all census tracts witbin the zone of impact or where the percent minority population exceeds 50 percent for any given census tract. In tbe case of migrant or dispersed populations, a minority population consists of a group that is greater tban 50 percent minority.

- *Low-income population:* A group of people and/or community experiencing common conditions of exposure or impact, in which 25 percent or more of tbe population is characterized as living in poverty (FR 1993). The U.S. Bureau of Census characterizes persons in poverty as tbose whose income is less than a "statistical poverty threshold." The tbreshold for tbe 1990 census was a 1989 income of $12,674 for a family of four. This tbreshold is a weighted average based on family size and tbe age of tbe persons in the family. Table 5.20-1 presents tbe U.S. Census poverty tbresholds (USBC 1992) used in tbis analysis.

5.20.2.1 Distribution of Minority Populations and Low-Income Populations Near the INEL. According to the data, approximately 172,366 people reside witbin the 80-kilometer (50-mile) radius of the INEL. Of that total population, 7 percent, or approximately 11,722, are classified as minority individuals. The area surrounding tbe INEL has a relatively small percentage of minorities compared to comparable DOE sites (see Appendix L to Volume 1 of tbis EIS). The minority composition is primarily Hispanic, Native American, and Asian. The Fort Hall Indian Reservation of the Shoshone-Bannock Tribes lies largely within 80 kilometers (50 miles) of tbe INEL. The spatial distribution of the minority population residing in 37 census tracts witbin 80 kilometers (50 miles) of tbe INEL is shown in Figure 5.20-1. Census tracts that were bisected by tbe 80-kilometer (50-mile) radius circumference line were included in the analysis if 50 percent of tbe tract fell witbin the 80-kilometer (50-mile) radius. As indicated in the legend, census tracts have been shaded according to the percentage of minority individuals within the area. Because of tbe variations in tbe populations of census tracts, the geographical size of any particular census tract area is not necessarily proportional to tbe numerical population within that tract. Because of the sparse

Table 5.20-1. Poverty thresholds in 1989 by size of family and number of related children under 18 years.

Size of family unit	Weighted average threshold ($)	Related children under 18 years: None ($)	One ($)	Two ($)	Three ($)	Four ($)	Five ($)	Six ($)	Seven ($)	Eight or more ($)
One person (unrelated individual)	6,310									
Under 65 years	6,451	6,451								
65 years and over	5,947	5,947								
Two persons	8,076									
Household under 65 years	8,343	8,303	8,547							
Household 65 years and over	7,501	7,495	8,515							
Three persons	9,885	9,699	9,981	9,990						
Four persons	12,674	12,790	12,999	12,575	12,619					
Five persons	14,990	15,424	15,648	15,169	14,796	14,572				
Six persons	16,921	17,740	17,811	17,444	17,092	16,569	16,259			
Seven persons	19,162	20,412	20,540	20,101	19,794	19,224	18,558	17,828		
Eight persons	21,328	22,830	23,031	22,617	22,253	21,738	21,084	20,403	20,230	
Nine or more persons	25,480	27,463	27,596	27,229	26,921	26,415	25,719	25,089	24,933	23,973

population surrounding the site, census tracts are relatively large in geographical area. The minority population surrounding the INEL resides largely to the southeast of the site.

Of the total population, 14 percent, or approximately 23,416 individuals, fall within the definition of low-income for purposes of this analysis. Figure 5.20-2 shows the spatial distribution of low-income individuals within 80 kilometers (50 miles) of the INEL. Census tracts containing low-income populations lie largely southeast of the site.

5.20.3 Environmental Justice Assessment

This assessment of potential environmental justice impacts addresses waste management and environmental restoration programs at the INEL for the near term (1995 to 2005). In addition, this assessment includes the management of spent nuclear fuel at the INEL under all alternatives considered in Volume 1 of this EIS which are integrated into the alternatives of Volume 2 as appropriate. This environmental justice analysis was based on a qualitative assessment of proposed projects and impacts reported in Section 5 of Volume 2 of the EIS to determine if there were identifiable disproportionately high and adverse human health or environmental impacts on minority populations or low-income populations surrounding the INEL.

The following definitions were used for this assessment:

- *Disproportionately high and adverse human health effects:* Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts to human health. Disproportionately high and adverse human health effects occur when the risk or rate for a minority population 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 impacts:* An adverse environmental impact is a deleterious environmental impact determined to be unacceptable or above generally accepted norms. A disproportionately high impact refers to an impact (or risk of an impact) in a low-income or minority community that significantly exceeds that on the larger community. In assessing cultural and aesthetic environmental impacts, account shall be taken of impacts that uniquely affect geographically dislocated or dispersed low-income or minority populations.

In this assessment, DOE reviewed the proposed projects, facilities, and transportation associated with the proposed alternatives in Volume 2 of this EIS. This review included potential impacts arising under each of the major disciplines evaluated for the alternatives, including land use, socioeconomics, water resources, air resources, ecology, health and safety, facility operations, cultural resources, and transportation, which are the sciences pertinent to the identification of environmental impacts in the EIS. Regarding health effects, both normal facility operations and accident conditions were examined, with accident scenarios evaluated in terms of the risk to the public. Likewise, the examination of transportation included both normal and potential accident conditions for both truck and rail transportation of materials. Special exposure pathways were evaluated with respect to subsistence consumption of fish, game, or native plants.

As discussed in the following subsections, the potential radiological impacts due to both facility operations and reasonably foreseeable accident conditions are small. In addition, potential impacts as well as the potential number of fatalities due to both radiological and nonradiological exposures to truck or rail transportation is also small. Likewise, the probability of adverse impacts due to subsistence consumption of fish, game, or native plants is low.

5.20.3.1 Facility Operations. As indicated in Section 5.7 of Volume 2, for the maximally exposed member of the public living offsite, the likelihood of contracting a fatal cancer from normal operations ranges between about 1 occurrence in 240,000 to 1 occurrence in 1,000,000. This equates to less than one latent cancer fatality to the general public under any of the alternatives being considered over the 10-year period from 1995 to 2005.

Impacts from high consequence, low probability accident scenarios (Section 5.14 of Volume 2) would be adverse should they occur; however, the impacts to specific population locations would be subject to meteorological conditions on the day of the accident. Whether or not such impacts would have disproportionately high and adverse effects with respect to any particular segment of the population, minority and low-income populations included, would be subject to natural motive forces including random meteorological factors. Prevailing winds for the INEL are primarily from the southwest, although winds at the Test Area North are frequently from the north and west-northeast. Local rivers and streams drain the mountain watersheds north and west of the INEL, but most surface water is diverted for irrigation before it reaches the site boundaries. Groundwater in the underlying Snake River Plain Aquifer generally flows to the south and southwest. As explained in the EIS, the risk to the public is defined as the potential consequence multiplied by the probability of occurrence. This risk represents the expected impact to members of the public. Based on this risk, no latent cancer fatalities are expected from reasonably foreseeable facility accidents.

Because the impacts due to facility operations and reasonably foreseeable accidents present no significant risk and do not constitute a reasonably foreseeable adverse impact to the surrounding population, no disproportionately high and adverse impacts would be expected for any particular segment of the surrounding population, minority and low-income populations included.

5.20.3.2 Transportation. Transportation corridors associated with Volume 2 of the EIS can be classified as roughly 80 percent rural, 17 percent suburban, and 3 percent urban. More specific details are available in Table 5.11-1 in Volume 2 to the EIS. As evaluated in Section 5.11 of Volume 2, for incident-free transportation, the total number of potential fatalities would be the sum of the health effects because of exposure to radiation and vehicular emissions. Over the 10-year period between 1995 and 2005, the estimated number of total potential fatalities because of waste shipments would range from 0.10 to 1.4 if shipments were made by truck, to from 0.02 to 0.3 if made by rail. Over the 40-year period between 1995 and 2035, estimated potential fatalities because of spent nuclear fuel shipments made by truck would range between 0.1 to 1.7 and between 0.1 to 0.26 if made by rail.

When and where an accident occurred, if one in fact occurred, would be completely random with respect to the immediate and surrounding population, as well as the motive forces that could propagate the impacts during the timeframe of occurrence. Although adverse impacts could occur in the unlikely event of a high consequence accident, any potential disproportionality with respect to any population, minority and low-income populations included, is subject to the randomness of the combination of factors that can produce such impacts.

Over the 10-year period, the estimated cumulative risk of latent cancer fatalities from radiological accidents would range from 1 in 1,300 to 1 in 340 if waste shipments were made by truck. During this period of time, from 0.3 to 3.4 fatalities would occur from traffic accidents. By contrast, if waste shipments were made by rail, the cumulative risk of latent cancer fatalities would range from 1 in 17,000 to 1 in 2,900, while traffic accidents unrelated to waste shipment cargo would range between 0.003 to 0.04 fatalities. The risk from the maximum nonradiological chemical release accident involving a nitric acid shipment (discussed in Section 5.11.2.5) is also small. The cumulative risk of latent cancer fatalities between the years 1995 and 2035 because of shipments of spent nuclear fuel by truck would range from 1 in 240,000 to 1 in 200, with an associated risk of traffic accident fatalities from 0.05 to 1.4. The corresponding risk if all spent nuclear fuel shipments were made by rail would range from 1 in 240,000 to 1 in 700 for latent cancer fatalities, with a risk for traffic fatalities ranging from 0.05 to 1.2.

Because the impacts due to transportation of waste materials or spent nuclear fuel by either truck or rail under either incident-free or reasonably foreseeable adverse accidents present no significant risk and do not constitute a reasonably foreseeable impact to the surrounding population, no disproportionately high and adverse impact would be expected for any particular segment of the surrounding population, minority and low-income populations included.

5.20.3.3 Perspective. To place the impacts in perspective with respect to risks encountered in everyday life, in 1990 there were approximately 510,000 cancer deaths in the United States population, of which about 64,000 were among the nonwhite population. This equates to roughly 1,132 cancer fatalities (of which 142 would affect minority populations) in an area comparable to that included in the 80-kilometer (50-mile) radius around the INEL. Additionally, in 1992 there were about 40,000 traffic fatalities in the United States, of which about 7,400 were among the nonwhite population. This equates to roughly 89 traffic fatalities (of which 16 would affect minority populations) in an area comparable to that included in the 80-kilometer (50-mile) radius around the INEL. The risk of latent cancer fatalities and the expectation of vehicular fatalities because of the activities proposed in this EIS would not appreciably increase this total, even if all impacts were associated with minority and low-income populations.

5.20.3.4 Subsistence Consumption of Fish, Wildlife, or Native Plants. The calculations in this EIS estimate dose and risk from ingestion of radionuclides based on site-specific agricultural data, and they assume a typical dietary pattern. Subsistence consumption of fish, wildlife, and native plant species is not explicitly addressed in this analysis. However, the calculations in this EIS include several conservative assumptions (see Appendix F of Volume 2) that bound the potential for ingestion of radionuclides through these special exposure pathways. In particular, these calculations assume that a very high proportion of the diet is based on locally grown produce and locally grazed livestock, both of which are produced at locations representing the highest calculated concentrations of radioactivity. Nevertheless, there may be some differences between the uptakes of grazed livestock and free-ranging game. No human populations in the immediate vicinity of the INEL are known to subsist entirely on locally harvested fish or wildlife.

Fishing and hunting are usually not allowed on the INEL. One exception is depredation hunts, which were negotiated between the Idaho Department of Fish and Game and DOE (Hoff et al. 1993) and allow hunter access to one-half mile inside the northern INEL boundaries. In addition to limited onsite hunting, several game species, including elk and pronghorn antelope, that contribute to the diets of local populations live on and migrate through the INEL. This potential exposure pathway is small, as few animals that migrate from the INEL contain elevated levels of contaminants. Data from game species, sheep that have grazed on the INEL, and locally grown foodstuffs and native plants around the INEL are routinely sampled for radionuclides. Concentrations of radioactivity generally have been small, and they are seldom elevated above those observed at locations distant from the INEL where the principal likely source of nonnatural radionuclides is very small amounts of residual global fallout from past nuclear weapons tests. Data from monitoring programs are reported annually in INEL Site Environmental Reports (Hoff et al. 1993).

If transportation associated with environmental restoration and waste management activities at the INEL (including spent nuclear fuel management) were to increase wildlife losses because of vehicle collisions with game, there might be a disproportionate impact to minority or low-income communities that rely primarily on hunted game. However, the maximum potential increases in shipments of spent nuclear fuel would be small additions to current rail and highway traffic, so the overall impact to wildlife would be small. Potential mitigation measures for any resulting adverse impact to low-income or minority populations include distributing the deceased animals to hunters in the vicinity known to partially subsist on game, controlling subsequent hunts, or relocating game if necessary.

5.20.3.5 Other Considerations. In addition to the above, reviews of other technical disciplines pursuant to the methodology in Section 5.20.3 did not indicate any significant adverse impacts because of land use, socioeconomics, water and air resources, ecology, cultural resources, or cumulative impacts. Therefore, no disproportionately high and adverse impacts were identified for any segment of the population. Of particular interest are the following:

5.20.3.5.1 Socioeconomics—Depending upon the various alternatives evaluated, the total labor force involved in INEL environmental activities, including spent nuclear fuel management, could decrease by up to 500 jobs or increase by more than 900 jobs over the 10-year period between 1995 and 2005. Affirmative action programs would distribute such effects proportionately among workers, whereas coordination of planning activities with local communities would be intended to avoid placing undue burdens on local community resources. DOE may also provide support to local agencies if necessary to mitigate localized impacts.

5.20.3.5.2 Land Use, Ecology, and Cultural Resources—None of the alternatives would have a significant adverse impact on land use, ecology, and cultural resources because of the limited amount of previously undisturbed land that would be needed for use onsite (no offsite lands are involved) and mitigative programs already in place. These programs include working closely under agreements with the State of Idaho Historical Preservation Officer and the Shoshone-Bannock Tribal government regarding preservation of historic and cultural resources. Similarly, DOE is aware of sensitive ecological resources and avoids wetlands and endangered plant or animal specie habitats. Disturbance of certain ecological resources (which are not federally listed as threatened or endangered) is possible but not likely. The reasonably foreseen environmental impacts, if any, to land use, ecological resources, or cultural resources are expected to be small under any of the alternatives.

5.20.3.5.3 Cumulative Impacts—Based on the analysis of the impacts for each of the disciplines analyzed in this EIS, along with the impact of other past, present, and reasonably foreseeable future activities at the INEL, no reasonably foreseeable cumulative adverse impacts are expected to the surrounding populations, minority populations and low-income populations included.

5.20.3.6 Impacts Because of Perception. Potential adverse impacts may result from the public's perception of risk associated with nuclear industry activities in general and DOE's activities in particular. For example, a waste management or spent nuclear fuel management facility has the potential to increase awareness of the nuclear industry, leading to concerns of potential adverse effects to the conduct of local commerce, such as tourism and agriculture. From both a National Environmental Policy Act and an environmental justice perspective, both the character and the substance of these potential impacts are not discernable. Therefore, it is not possible to identify any quantifiably adverse or disproportionately high distribution of any impacts of such perceived risk.

To better understand and help mitigate unfounded perceptions, DOE is working to enhance the general population's understanding of the potential impacts of INEL programs in general and the various alternatives considered in this EIS in particular, with emphasis on minority populations, low-income groups. and Tribal governments.

5.20.4 Discussion of Related Issues Raised by the Shoshone-Bannock Tribes on the Fort Hall Indian Reservation in Public Comment and Consultations

The EIS Project Office has reviewed the comments on the EIS received from the Shoshone-Bannock Tribes on the Fort Hall Indian Reservation, which lies largely within 80 kilometers (50 miles) of the INEL. To fully understand, evaluate, and consider these comments, consultations have taken place among tribal officials and appropriate INEL officials. In addition to addressing specific comments on the EIS, these ongoing consultations are designed to promote a mutual understanding of INEL-related issues important to the tribes, both within and beyond the scope of INEL environmental restoration and waste management programs and spent nuclear fuel management activities addressed in this EIS. As discussed earlier, no disproportionately high and adverse impacts have been identified to the Shoshone-Bannock Tribes or any other segment of the population as a whole.

To date, these consultations have resulted in an increased awareness of tribal values as they relate to nature, ties to the land, and religious beliefs. For the tribes, traditional resources include not only Native American archaeological sites, which are important in the context of religious and cultural heritage, but also features of the natural landscape, air, plant, water or animal resources that have special significance. Potential impacts to such resources on the INEL, once inhabited by the Shoshone-Bannock Tribes, are of concern to the tribes. These potential impacts may result from disturbing the land or changing the environmental setting of sacred or traditional use areas. They may also result from pollution, noise, and contamination. Actions that have a deleterious effect on the land, air, water, or view are considered by the Shoshone-Bannock Tribes to be adverse to their traditional way of life. Potential mitigation measures include involving tribal representatives in discussions during the project planning stages to avoid sensitive areas, locating new facilities in areas with similar visual settings, avoiding Native American archaeological sites and traditional use and sacred areas, monitoring gathering areas and game animals for operational effects, and restoring native vegetation to areas of ground disturbance per revegetation guidelines (Anderson and Shumer 1989). If avoidance is not feasible, data recovery at archaeological sites (such as archiving artifacts) and restoration of alternative hunting or gathering areas may be substituted after consultation with the tribes.

Based on these consultations, a number of changes have been made to the EIS to better characterize the Fort Hall Indian Reservation and its socioeconomic activities and setting. In addition, the DOE and Navy are working with the tribes to enhance their understanding of the potential impacts of the various alternatives considered in this EIS as they specifically relate to the Fort Hall Indian Reservation. These include potential exposures and impacts to the reservation from postulated facility and transportation accidents, as well as the impact from normal operations. One of the results of consultations between the DOE Idaho Operations Office and the Shoshone-Bannock Tribes is the preparation of a management agreement between the DOE Idaho Operations Office, the Federal Advisory Council on Historic Preservation, the State of Idaho, and the Tribes with respect to cultural resources at the INEL.

5.20.5 Conclusion

The overall review indicated that the potential impacts calculated for each discipline under each of the proposed INEL environmental restoration and waste management alternatives, including spent nuclear fuel management, are small and do not constitute a reasonably foreseeable adverse impact to the surrounding population. Therefore, the impacts also do not constitute a disproportionately high and adverse impact on any particular segment of the population, minorities or low-income communities included; thus, they do not present an environmental justice concern.

In addition, the DOE is confident that continued consultation between the tribes and the Federal government will enhance the knowledge and expertise of both and promote both informed decisionmaking and effective mitigation of potential impacts from INEL operations.

6. LIST OF PREPARERS AND REVIEWERS

This Environmental Impact Statement (EIS) was prepared under the supervision of the U.S. Department of Energy (DOE) Idaho Operations Office. The organizations and individuals who contributed to the preparation of this document are listed below, accompanied by each person's project role and level of experience and training. Table 6.1-1 lists contributors and the chapters or appendices for which they provided input or analysis.

6.1 Preparers

U.S. Department of Energy Idaho Operations Office

Thomas L. Wichmann, Manager EIS Project Office, U.S. DOE
U.S. Naval Nuclear Propulsion Program Graduate
Light Water Breeder Reactor/Expended Core Facility Project Officer
S1W Naval Nuclear Reactor Prototype Project Officer
Years of Experience: 25
EIS Project Manager

Kathleen B. Whitaker, Public Affairs Specialist
BA, 1973, English, University of Utah
Years of Experience: 17
EIS Stakeholder Involvement Manager

John E. Medema, Health Physicist
BS, Biology, Central Michigan University
MS, Biology, Central Michigan University
Years of Experience: 15
Volume 2 Manager
Analytical Lead - Spent Nuclear Fuel and Materials & Waste Management

Mary V. Willcox, Physical Scientist
BS, 1990, Chemistry, University of New Mexico
Years of Experience: 5
EIS Technical Sections Manager

Peter J. Dirkmaat, Senior Engineering Adviser
BS, Electrical Engineering, California State College, Long Beach
MS, Nuclear Engineering, Stanford University
Years of Experience: 30
Review, Approval, and Decision Process

Robert Brown, PE, General Engineer
BS, Electrical Engineering
MA, Business Administration
Years of Experience: 24
Analytical Lead - Utilities and Energy

Robert Creed, Jr., PG, Physical Scientist/Geologist
AS, 1980, Geology, Santa Barbara City College
AS, 1980, Geoscience Technology, Santa Barbara City College
BA, 1983, Earth Sciences, University of California, Santa Cruz
Years of Experience: 7
Analytical Lead - Geology and Water Resources

Denise M. Glore, Attorney
BA, 1978, Geography and Anthropology, University of New Mexico
MS, 1980, Biology, University of New Mexico
JD, 1985, University of New Mexico
Years of Experience: 15
FEIS Analytical Lead - Consultations, Laws, and Requirements

Jan Hagers, General Engineer
BS, 1968, Mechanical Engineering, North Carolina State University
MBA, 1974, College of William and Mary
Years of Experience: 27
Analytical Lead - Environmental Justice

John A. Herritt, Health Physicist
BS, 1968, Physics, Pennsylvania State University
MS, 1976, Nuclear Physics, Pennsylvania State University
Years of Experience: 13
Analytical Lead - Occupational Health and Safety

Mark W. Howard, Packaging and Transportation Program Manager
BS, 1989, Mechanical Engineering, University of Idaho
Years of Experience: 6
Analytical Lead - Traffic and Transportation, Transportation Accidents

Paul Martin, Environmental Protection Specialist
BA, English
BS, Wildlife
Years of Experience: 21
Analytical Lead - Land Use

Mary McKnight, Attorney
BA, 1982, Communications, University of Nebraska
JD, 1989, Creighton University
Years of Experience: 6
DEIS Analytical Lead - Consultations and Environmental Requirements

Mark S. Pellechi, PE, Nuclear Engineer
BS, 1979, Nuclear Engineering, Polytechnic Institute of New York
Years of Experience: 16
Analytical Lead - Accident Analysis

Ralph W. Russell, Environmental Engineer
BS, 1970, Chemical Engineering, Texas A&M University
Years of Experience: 18
Analytical Lead - Air Resources, Air Quality

Roger Twitchell, Physical Scientist
BS, 1977, Botany, Weber State College
Years of Experience: 18
Analytical Lead - Cultural Resources, Ecological Resources

C. Brooks Weingartner, Environmental Engineer
BS, 1988, Geological Engineering, Montana Tech.
MS, 1991, Environmental Engineering, Montana Tech.
Years of Experience: 4
Analytical Lead - Socioeconomics

Science Applications International Corporation

Dee H. Walker, Vice President/Technical Staff Consultant
BS, Chemical Engineering
MS, Chemical Engineering
PhD, Chemical Engineering
Years of Experience: 40
SAIC Project Manager

Ted B. Doerr, Senior Environmental Specialist
BS, Wildlife and Fisheries Sciences
MS, Range Management
PhD, Wildlife and Fisheries Sciences
Years of Experience: 16
Volume 2 Manager
Analyst - Summary, Purpose and Need, Background, Ecology, Consultation Letters

R. Kingsley House, PE, Technical Staff Consultant
BS, Mechanical Engineering
MS, Engineering Science/Nuclear Option
Years of Experience: 35
Technical Support Coordinator
Analyst - Purpose and Need, Background, Noise, INEL Services

Barbara Brown, Principal Communication Specialist
BS, Mathematics
Years of Experience: 16
Analyst - Index

Christopher Clayton, Principal Analyst
BA, Geography
MA, Geography
PhD, Geography
Years of Experience: 22
Analyst - Socioeconomics, Technical Methodologies and Key Data

Mark A. Dagel, Senior Hydrogeologist
BS, Geology
MS, Geological Sciences
Years of Experience: 11
Analyst - Cumulative Impacts, Unavoidable Adverse Effects, Short-Term Use vs. Long-Term Productivity, Irreversible and Irretrievable Resource Commitments, Mitigation

Sandy Enyeart, Senior Engineering Specialist
BCE, Civil Engineering
BA, Fine Arts
Years of Experience: 15
Analyst - Ecology

Thomas D. Enyeart, CHP, Senior Staff Scientist
BS, Physics
MS, Nuclear Engineering
MS, Environmental Engineering
Years of Experience: 19
Analyst - Background, Transportation Accident Analysis, Technical Methodologies and Key Data

Mason Estes, Scientist
BS, Engineering Geology
Years of Experience: 3
Analyst - Water Resources, Technical Methodologies and Key Data

Michele A. Fikel, Environmental Specialist
BA, Geography
Years of Experience: 9
Analyst - Aesthetic and Scenic Resources

George A. Freund, PE, Chemical/Nuclear Engineer
BS, Chemical Engineering
MS, Chemical Engineering
Years of Experience: 45
Analyst - Background, Alternatives, Summary, Facility Accidents, Information Supporting the Alternatives, Technical Methodologies and Key Data

Paul D. Freund, Records Administrator
BS, Human Resource Management
Years of Experience: 5
Analyst - References

Gayla Gross, Environmental Specialist
BS, Geology
MS, Environmental Geology
Years of Experience: 10
Analyst - Summary, Purpose and Need, Alternatives

Lorraine S. Gross, Archaeologist
BA, Archaeology
MA, Archaeology
Years of Experience: 15
Analyst - Cultural Resources

Morris Hall, Senior Scientist
AS, Nuclear Industrial Operations
BS, Mathematics & Science
MS, Health Physics
Years of Experience: 9
Analyst - Health and Safety, Technical Methodologies and Key Data

Joel B. Hebdon, Principal Engineer
BS, Engineering Geology
MBA, Management
Years of Experience: 12
Analyst - Background, Alternatives

Keith Hendrickson
BS, Mechanical Engineering
Years of Experience: 11
Analyst - Alternatives, Systems Engineering, Transportation Accident Analysis

William E. House, Staff Scientist
BS, Geological Engineering
Years of Experience: 9
Analyst - Alternatives, Geology, Facility Accidents, Information Supporting the Alternatives, Technical Methodologies and Key Data

Michael Ingram, Senior Communications Specialist
BA, Journalism
Years of Experience: 17
Analyst - Primer on Radioactivity and Toxicology

Irene Johnson, Environmental/Socioeconomic Analyst
BS, Economics
MA, Economics
Years of Experience: 6
Analyst - Socioeconomics, Technical Methodologies and Key Data

Dan Kevin, Environmental Specialist
BA, Political Science
MA, Political Science
ABD, Political Science
Years of Experience: 15
Analyst - Land Use

Pamela L. Lassahn, Deputy Division Manager
BS, Technical Journalism
MS, Technical Journalism
Years of Experience: 30
Document Production Manager

Barbara Larsen, Economist
BA, Economics
Years of Experience: 6
Analyst - Socioeconomics, Technical Methodologies and Key Data

Anne Lundahl, Scientist
BS, Geology
Years of Experience: 8
Analyst - Geology, Water Resources, Technical Methodologies and Key Data

Steven J. Maheras, CHP, Environmental Health Physicist
BA, Zoology
MS, Health Physics
PhD, Health Physics
Years of Experience: 11
Analyst - Traffic and Transportation, Incident-Free Transportation Dose Assessments

Mark Mortenson, Staff Engineer
BS, Mechanical Engineering
Years of Experience: 1
Analyst - Land Use, Systems Engineering

Diane Morton, Senior Engineer
BS, Chemical Engineering
Years of Experience: 15
Analyst - Background, Alternatives, Glossary

Lee Morton, Senior Engineer
BS, Nuclear Engineering
Years of Experience: 15
EIS Project Management Team

Mark Otis, CHP, Division Manager
BS, Physics
MS, Radiation Health
PhD, Radioecology
Years of Experience: 23
Analyst - Health and Safety, Technical Methodologies and Key Data

John Raudsep, Senior Engineer
BS, Chemical Engineering
Years of Experience: 24
Analyst - Air Resources, Technical Methodologies and Key Data

James L. Rudolph, Archaeologist
BA, Anthropology
MA, Anthropology
Years of Experience: 21
Analyst - Purpose and Need, Background

Teresa Rudolph, Senior Archaeologist
MA, Anthropology
Years of Experience: 18
Analyst - Cultural Resources

Angela Sewall, Environmental Geoscientist (former employee)
BA, Earth Science
MS, Geoscience
Years of Experience: 7
Analyst - Cumulative Impacts, Unavoidable Adverse Effects, Short-Term Use vs. Long-Term Productivity, Irreversible and Irretrievable Resource Commitments, Mitigation

Samuel E. Shepley (former employee)
JD, Doctor of Law
Years of Experience: 16
Analyst - Alternatives, Information Supporting the Alternatives

Brenda Shim, Economist
BA, Economics/International Area Studies
Years of Experience: 3
Analyst - Socioeconomics, Technical Methodologies and Key Data

Donald C. Slaughterbeck, Senior Engineer
BS, Mechanical Engineering
MS, Mechanical Engineering
Years of Experience: 28
Analyst - Facility Accidents, FEIS Volume 2 Manager, Technical Methodologies and Key Data

Donald Stadelman, Project Manager/Senior Economist
BS, Forest Resources
MA, Public Finance
PhD, Economics
Years of Experience: 21
Analyst - Impact Analysis

Jane Tallman, Junior Engineer
BS, Mechanical Engineering
Years of Experience: 2
Analyst - Traffic and Transportation, Air Resources

Todd B. Thompson, Senior Communication Specialist
BS, Journalism
Years of Experience: 11
Analyst - Primer on Radioactivity and Toxicology

John von Reis, Program Manager
BA, English and Prelegal Studies
JD, Doctor of Law
Years of Experience: 25
Analyst - Comparison of Impacts

Price L. Worrell, Technical Support Specialist
Years of Experience: 6
Graphics Coordinator
Analyst - Acronyms and Abbreviations, Preparers

Jon Young, Senior Program Manager
BA, Mathematics
Years of Experience: 26
Analyst - Cumulative Impacts, Unavoidable Adverse Effects, Short-Term Use vs. Long-Term Productivity, Irreversible and Irretrievable Resource Commitments, Mitigation

<u>Science Applications International Corporation (Consultants)</u>

Richard Belanger, CHP, Air Quality Consultant
BA, Biology
MS, Radiological Physics
Years of Experience: 18
Analyst - Air Resources, Technical Methodologies and Key Data

Kenneth D. Bulmahn, Consulting Engineer
BS, Mechanical Engineering
Years of Experience: 21
Analyst - Spent Nuclear Fuel, High-Level Waste

Robert N. Ferguson, PE, Senior Engineer
BS, Mechanical Engineering
MA, Business Administration
Years of Experience: 35
Analyst - Background, Alternatives, Information Supporting the Alternatives

Deborah A. Ryan, Air Quality Meteorologist
BS, Meteorology
Years of Experience: 17
Analyst - Air Resources, Technical Methodologies and Key Data

Ecology and Environment, Inc.

Wendy Green, Environmental Planner
MPA, Public Affairs
Years of Experience: 10
Public Information Coordinator
Analyst - Consultations and Environmental Requirements, Consultation Letters

David J. Lechel, Environmental Consultant
BS, Fisheries Biology
MS, Fisheries Biology
Years of Experience: 22
Analyst - Summary

Jason Associates Corporation

Harry Fugate, Environmental Engineer
BS, Civil/Environmental Engineering
MS, Environmental Engineering
Years of Experience: 9
Analyst - Background

Daniel A. Reny, Senior Consultant
BS, Applied Physics
Years of Experience: 15
Analyst - Facility Accidents

Naval Nuclear Propulsion Program

Donald P. Doherty, Deputy Director, Reactor Materials Division
BS, General Engineering
MS, Nuclear Engineering
Years of Experience: 34
Analyst - Expended Core Facility

Richard A. Guida, PE, Associate Director for Regulatory Affairs
BS, Electrical Engineering
MS, Nuclear Engineering
MBA, Business
Years of Experience: 22
Analyst - Coordinator Naval Nuclear Fuel Management Program

Craig S. Hansen, Manager Finance and Administration, Naval Reactors-ID
BA, Operations Management
Years of Experience: 8
EIS Project Office Liaison

Michael A. Kuprenas, Deputy Manager, Non-prototype Operations, Naval Reactors-ID
BS, Chemical Engineering
Years of Experience: 13
Analyst - Spent Nuclear Fuel

Lisa S. Megargle, Special Assistant to the Associate Director for Regulatory Affairs
BS, Operations Research and Industrial Engineering
MEng, Civil Engineering
Years of Experience: 5
Analyst - Assistant Coordinator, Nuclear Fuel Management Program

Andrew N. Richardson, Environmental Analyst, Naval Reactors-ID
Naval Reactors Power School, Naval Reactors Technical Assistant Qualification
Years of Experience: 20
Analyst - Idaho National Engineering Laboratory Naval Reactors

Table 6.1-1. Contributors to the Environmental Impact Statement.

	Section										Appendix					
Contributor	S	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Department of Energy																
Tom Wichmann	x	x	x	x		x										
Kathleen Whitaker	x	x					x	x	x	x						
John Medema	x	x	x	x	x	x		x					x			
Mary Willcox	x	x	x	x	x	x										
Robert Brown					x	x										
Robert Creed, Jr.					x	x										
Jan Hagers						x										
John Herritt					x	x										
Mark Howard					x	x										
Paul Martin					x	x										
Mary McKnight						x		x								
Mark Pellechi						x										
Ralph W. Russell					x	x										
Roger Twitchell					x	x										
C. Brooks Weingartner					x	x										
Science Applications International Corporation																
Dee H. Walker	x	x	x	x												
Ted B. Doerr	x	x	x		x	x						x				
R. Kingsley House		x	x		x	x										
Barbara Brown									x							x
Christopher Clayton					x	x										x
Mark A. Dagel						x										
Sandy Enyeart						x						x				
Thomas D. Enyeart			x		x	x										x
Mason Estes					x	x										x
Michele A. Fikel					x	x										
George A. Freund	x		x	x		x							x			x
Paul D. Freund										x						
Gayla Gross	x	x		x												

Table 6.1-1. (continued).

Contributor	S	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Section										Appendix					
Ecology and Environment, Inc.																
Wendy Green								x				x				
David J. Lechel	x															
Jason Associates Corporation																
Harry Fugate			x													
Daniel A. Reny						x										
Naval Nuclear Propulsion Program																
Donald P. Doherty	x			x		x		x					x			x
Richard A. Guida	x			x		x		x					x			x
Craig S. Hansen	x			x		x		x					x			x
Michael A. Kuprenas	x			x		x		x					x			x
Lisa S. Megargle	x			x		x		x					x			x
Andrew N. Richardson	x			x		x		x					x			x

7. CONSULTATIONS AND ENVIRONMENTAL REQUIREMENTS

7.1 Consultations

The National Environmental Policy Act (NEPA) requires that Federal, State, and local agencies with jurisdiction or special expertise regarding any environmental impact be consulted and involved in the NEPA process. Agencies involved include those with authority to issue applicable permits, licenses, and other regulatory approvals, as well as those responsible for protecting significant resources (for example, endangered species, critical habitats, or historic resources). These agencies will be sent copies of the Final Environmental Impact Statement (EIS).

Consultations with Federal and state agencies have been initiated by the U.S. Department of Energy (DOE) pursuant to the preparation of this Environmental Impact Statement (EIS). Letters regarding consultation under the Endangered Species Act and National Historic Preservation Act have been received (see Appendix B, Consultation Letters).

7.2 Environmental Requirements

This section identifies and summarizes the major laws, regulations, executive orders, and U.S. Department of Energy (DOE) orders that may apply to the proposed action and alternatives at the INEL. This section also provides information concerning the status of permits and regulatory compliance at the INEL.

The discussion includes the major Federal statutes that impose environmental protection and compliance requirements upon DOE (Section 7.2.1), as well as those State and local measures applicable to the proposed action because Federal law delegates enforcement or implementation authority to State or local agencies (Section 7.2.4). Section 7.2.2 addresses environmentally related presidential executive orders that clarify issues of national policy and set guidelines under which Federal agencies, including DOE, must act. The DOE implements its responsibilities for protection of public health, safety, and the environment through a series of departmental orders that are mandatory for operating contractors of DOE facilities. Section 7.2.3 discusses those DOE orders related to environmental, health, and safety protection.

Section 7.2.5 discusses the status of regulatory compliance at the INEL and includes a table identifying all permits currently held by DOE governing various INEL activities. Section 7.2.5 also briefly describes DOE's internal compliance program that includes self-assessments and the recent Tiger Team reviews.

7.2.1 Federal Environmental Statutes and Regulations

7.2.1.1 National Environmental Policy Act of 1969, as amended (42 USC §4321 et seq.). The National Environmental Policy Act establishes a national policy promoting awareness of the environmental consequences of major Federal activities on the environment and promoting consideration of the environmental impacts during the planning and decisionmaking stages of a project. The National Environmental Policy Act requires all agencies of the Federal government to prepare a detailed statement on the environmental effects of proposed major Federal actions that may significantly affect the quality of the human environment.

The Council on Environmental Quality and DOE have promulgated regulations for implementing the National Environmental Policy Act (40 CFR Parts 1500-1508 and 10 CFR Part 1021).

7.2.1.2 Atomic Energy Act of 1954, as amended (42 USC §2011 et seq.). The Atomic Energy Act of 1954 authorizes the DOE to establish standards to protect health or minimize dangers to life or property (42 USC §2011 et seq.) with respect to activities under its jurisdiction. Through a series of DOE orders, the DOE has established an extensive system of standards and requirements to ensure safe operation of its facilities.

7.2.1.3 Clean Air Act, as amended (42 USC §7401 et seq.). The Clean Air Act, as amended, is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the Clean Air Act, as amended, requires that each Federal agency, such as DOE, with jurisdiction over any property or facility that might result in the discharge of air pollutants, comply with "all Federal, State, interstate, and local requirements" with regard to the control and abatement of air pollution.

The law requires the U.S. Environmental Protection Agency (EPA) to establish national primary and secondary ambient air quality standards as necessary to protect public health, with an adequate margin of safety, from any known or anticipated adverse effects of a regulated pollutant (42 USC §7409). The Clean Air Act also requires establishment of (a) national standards of performance for new stationary sources of atmospheric pollutants; (b) emissions limitations for any new or modified building, structure, facility, or installation that emits or may emit an air pollutant (42 USC §7411); and (c) standards for emission of hazardous air pollutants (42 USC §7412). In addition, the Clean Air Act requires specific emission increases to be evaluated so as to prevent a significant deterioration in air quality (42 USC §7470).

To comply with these requirements, the EPA issued: (a) Primary and Secondary National Ambient Air Quality Standards, including standards for emissions of sulfur dioxide, oxides of nitrogen, carbon monoxide, particulate matter with a diameter of less than or equal to 10 micrometers (PM-10), ozone, and lead (40 CFR Part 50); (b) the Standards of Performance for New Stationary Sources within specific source categories enumerated in 40 CFR Part 60.16, including electric steam-generating units, industrial-commercial-institutional steam-generating units, and stationary gas turbines (40 CFR Part 60); (c) the National Emission Standard for Hazardous Air Pollutants, including radionuclides (40 CFR Part 61 and 40 CFR Part 63); and (d) the Prevention of Significant Deterioration of Air Quality review regulations (40 CFR Part 52.21).

The Clean Air Act requires each state to develop and submit for approval to the EPA implementation plans to control air pollution and air quality in that state. Under EPA regulations, Idaho has been delegated authority under the Clean Air Act to maintain the Primary and Secondary National Ambient Air Quality Standards (40 CFR Part 52, Subpart N), to issue permits under the Prevention of Significant Deterioration (40 CFR Part 52.683), and to enforce performance standards for new stationary sources. The entire INEL facility is treated as a single pollutant source and, therefore, is a major stationary source for Prevention of Significant Deterioration review. To date, the State of Idaho does not have authority to administer the National Emission Standards for Hazardous Air Pollutants program regulating emissions of radionuclides at DOE facilities. Therefore, National Emission Standards for Hazardous Air Pollutants approvals authorizing release of radionuclides are obtained from the EPA Region 10. However, the State does regulate radionuclides under its Prevention of Significant Deterioration program and, therefore, DOE coordinates any National Emission Standards for Hazardous Air Pollutants approvals obtained from the EPA with the State of Idaho to fulfill applicable requirements of the State's Prevention of Significant Deterioration program.

On November 15, 1990, the Clean Air Act Amendments were signed into law. Under these amendments, new standards will be imposed on major sources emitting air pollutants in nonattainment areas, and states will have to submit new State Implementation Plans to address these new requirements. Mobile sources of air pollutants, such as cars, trucks, buses, and certain off-the-road engines, also will have to meet new standards.

7.2.1.4 The Clean Water Act, as amended (33 USC §1251 et seq.). The Clean Water Act, which amended the Federal Water Pollution Control Act, was enacted to "restore and maintain the chemical, physical and biological integrity of the Nation's water." The Clean Water Act prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 313 of the Clean Water Act, as amended, requires all branches of the Federal government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, State, interstate, and local requirements.

In addition to setting water quality standards for the nation's waterways, the Clean Water Act supplies guidelines and limitations for effluent discharges from point-source discharges, and provides authority for the U.S. Environmental Protection Agency (EPA) to implement the National Pollutant Discharge Elimination System permitting program. The National Pollutant Discharge Elimination System program is administered by the Water Management Division of the EPA pursuant to regulations in 40 CFR Part 122 et seq. Idaho has not applied for National Pollutant Discharge Elimination System authority from the EPA. Thus, all National Pollutant Discharge Elimination System permits required for the INEL would be obtained by DOE through the EPA Region 10 (40 CFR Part 122 et seq.).

Sections 401 and 405 of the Water Quality Act of 1987 added Section 402(p) to the Clean Water Act. Section 402(p) requires that the Environmental Protection Act establish regulations for issuing permits for storm water discharges associated with industrial activity. Stormwater discharges associated with industrial activity are permitted through the National Pollutant Discharge Elimination System. General Permit requirements are published at 40 CFR Part 122.

7.2.1.5 Safe Drinking Water Act, as amended (42 USC §300f et seq.). The primary objective of the Safe Drinking Water Act, as amended, is to protect the quality of the public water supplies and all sources of drinking water. The implementing regulations are found in 40 CFR Part 141, National Interim Primary Drinking Water Regulations. These regulations, administered by the U.S. Environmental Protection Agency (EPA) unless delegated to the states, establish standards applicable to public water systems. They promulgate maximum contaminant levels, including those for radioactivity, in community water systems, which are defined as public water systems that serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. For radionuclides, the regulations specify that the average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 0.004 rem (4 millirem)/year. The maximum contaminant level for gross alpha particle activity is 15 picocuries per liter. The U. S. Environmental Protection Agency proposed revisions to regulating radionuclides in drinking water on July 18, 1991. The proposed rule has not been finalized. For purposes of analysis, however, the more conservative standards were used. Other programs established by the Safe Drinking Water Act include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control Program. The Snake River Plain Aquifer, a portion of which flows beneath the INEL, has been designated by the EPA as a sole source aquifer pursuant to the Sole Source Aquifer Program. The State of Idaho has received authorization from the EPA to implement the public drinking water system program and the underground injection control program under the Safe Drinking Water Act.

7.2.1.6 Resource Conservation and Recovery Act, as amended (42 USC §6901, et seq.). The treatment, storage, or disposal of hazardous and nonhazardous waste is regulated under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments of 1984. Pursuant to Section 3006 of the Act, any state that seeks to administer and enforce a hazardous waste program pursuant to the Resource Conservation and Recovery Act may apply for U.S. Environmental Protection Agency (EPA) authorization of its program. The EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260-280. These regulations define hazardous wastes and specify hazardous waste transportation, handling, treatment, storage, and disposal requirements.

The regulations imposed on a generator or a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.

7.2.1.7 Current Status of Spent Nuclear Fuel. Historically, the U.S. Department of Energy chemically reprocessed spent nuclear fuel to recover valuable products and fissionable materials, and, as such, the spent nuclear fuel was not a solid waste under the Resource Conservation and Recovery Act (RCRA).

World events have resulted in significant changes in DOE's direction and operations. In particular, in April 1992, DOE announced the phase out of reprocessing for the recovery of special nuclear materials. With these changes, DOE's focus on most of its spent nuclear fuel has changed from reprocessing and recovery of materials to storage and ultimate disposition. This, in turn, has created uncertainty in regard to the regulatory status of some of DOE's spent nuclear fuel relative to RCRA.

DOE has initiated discussion with the U.S. Environmental Protection Agency (EPA) on the potential applicability of RCRA to spent nuclear fuel. Further discussions with EPA Headquarters, EPA Regional Offices, and state regulators are ongoing to develop a path forward toward meeting any RCRA requirements that might apply.

7.2.1.8 Federal Facility Compliance Act. The Federal Facility Compliance Act, enacted on October 6, 1992, waives sovereign immunity for fines and penalties for Resource Conservation and Recovery Act violations at Federal facilities. However, the effective date of the waiver has been delayed for three years for mixed waste storage prohibition violations, as long as the Federal facility is in compliance with all other applicable requirements of RCRA. During this three-year period, DOE is required to prepare plans for developing the required treatment capacity for mixed wastes stored or generated at each facility. Each plan must be approved by the host state or the U.S. Environmental Protection Agency, after consultation with other affected states, and a consent order must be issued by the regulator requiring compliance with the plan. The Federal Facility Compliance Act further provides that the DOE will not be subject to fines and penalties for land disposal restriction storage prohibition violations for mixed waste as long as it is in compliance with such an approved plan and consent order and meets all other applicable regulations.

7.2.1.9 Comprehensive Environmental Response, Compensation, and Liability Act, as amended (42 USC §9601 et seq.). The Comprehensive Environmental Response, Compensation, and Liability Act, as amended, provides a statutory framework for the cleanup of waste sites containing hazardous substances and—as amended by the Superfund Amendments and Reauthorization Act—provides an emergency response program in the event of a release (or threat of a release) of a hazardous substance to the environment. Using the Hazard Ranking System, Federal and private sites are ranked and may be included on the National Priorities List. The Comprehensive Environmental Response, Compensation, and Liability Act, as amended, requires such Federal facilities having such sites to undertake investigations and remediation as necessary. The Act also includes requirements for reporting releases of certain hazardous substances in excess of specified amounts to State and Federal agencies.

7.2.1.10 Emergency Planning and Community Right-to-Know Act of 1986 (42 USC §11001 et seq.) (also known as "SARA Title III"). Under Subtitle A of this Act, Federal facilities, including those owned by the DOE, provide various information such as inventories of specific chemicals used or stored and releases that occur from these sites, to the State Emergency Response Commission and to the Local Emergency Planning Committee to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. Implementation of the provisions of this Act began voluntarily in 1987, and inventory and annual emissions reporting began in 1988, based on 1987 activities and information. The DOE also requires compliance with Title III as matter of agency policy.

In addition, under Subtitle B of the Act, Material Safety Data Sheets Reports (SARA §311), Emergency and Hazardous Chemical Inventory Reports, (Superfund Amendments and Reauthorization Act, §312), and Toxic Chemical Release Inventory Reports (Superfund Amendments and Reauthorization Act §313), must be provided to appropriate State, local, national, and Federal authorities. Executive Order 12856 requires Federal facilities to adhere to the same planning and reporting provisions of Federal right-to-know and pollution prevention laws that cover private industry.

7.2.1.11 Hazardous and Radioactive Materials Transportation Regulations.

Transport of hazardous and radioactive materials, substances, and wastes are governed by U.S. Department of Transportation (DOT), U.S. Nuclear Regulatory Commission (NRC), and U.S. Environmental Protection Agency (EPA) regulations. These regulations may be found in 49 CFR Parts 100-178, 10 CFR Part 71, and 40 CFR Part 262, respectively.

DOT regulations contain requirements for identification of a material as hazardous or radioactive. These regulations may hand off to NRC or EPA regulations for identification of material. However, DOT hazardous material regulations govern the hazard communication (for example, marking, hazard labeling, vehicle placarding, and emergency response telephone number) and transport requirements, such as required entries on shipping papers or EPA waste manifest.

NRC regulations applicable to radioactive materials transportation are found in 10 CFR Part 71 and detail packaging design requirements, including the testing required for package certification. Complete documentation of design and safety analysis as well as results of the required testing is submitted to the NRC for certification of the package for use. This certification testing involves the following components: heat, physical drop onto an unyielding surface, water submersion, puncture by dropping a package onto a rigid spike, and gas tightness. Some of the testing is designed to simulate maximum credible accident conditions.

EPA regulations pertaining to hazardous waste transportation are found in 40 CFR Part 262. These regulations deal with the use of the EPA waste manifest, which is the shipping paper used when transporting Resource Conservation and Recovery Act hazardous waste.

7.2.1.12 National Historic Preservation Act, as amended (16 USC §470 et seq.).

The National Historic Preservation Act, as amended, provides that sites with significant national historic value be placed on the *National Register of Historic Places.* There are no permits or certifications required under the Act. However, if a particular Federal activity may impact a historic property resource, consultation with the Advisory Council on Historic Preservation will usually generate a Memorandum of Agreement, including stipulations that must be followed to minimize adverse impacts. Coordinations with the State Historic Preservation Officer are also undertaken to ensure that potentially significant sites are properly identified and appropriate mitigative actions implemented.

7.2.1.13 Archaeological Resource Protection Act, as amended (16 USC §470 et seq.). This Act provides for the preservation of historical and archaeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of (a) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam, by any agency of the United States, or by any private person or corporation holding a license issued by any such agency or (b) any alteration of the terrain caused as a result of any Federal construction project or federally licensed activity or program. The law also requires that, whenever any Federal agency finds that its activities may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archaeological data, the agency must notify the U.S. Department of Interior (DOI) and may request DOI to undertake the recovery, protection, and preservation of such data. Excavations must be undertaken for the purpose of furthering archaeological knowledge in the public interest, and resources removed are to remain the property of the United States. Consent must be obtained from the Indian tribe owning lands on which a resource is located before issuance of a permit, and the permit must contain terms or conditions requested by the tribe.

7.2.1.14 Endangered Species Act, as amended (16 USC §1531 et seq.). The Endangered Species Act, as amended, is intended to prevent the further decline of endangered and threatened species and to restore these species and their habitats. The Act is jointly administered by the U.S. Departments of Commerce and the Interior. Section 7 of the Act requires consultation to determine whether endangered and threatened species are known to have critical habitats on or in the vicinity of the proposed action.

7.2.1.15 Migratory Bird Treaty Act, as amended (16 USC §703 et seq.). The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. It regulates the harvest of migratory birds by specifying the mode of harvest, hunting seasons, bag limits, and so forth. The Act stipulates that it is unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States (Section 668, 668c). A permit must be obtained from the U.S. Department of the Interior to relocate a nest that interferes with resource development or recovery operations.

7.2.1.16 Noise Control Act of 1972, as amended (42 USC §4901 et seq.). Section 4 of the Noise Control Act of 1972, as amended, directs all Federal agencies to carry out "to the fullest extent within their authority" programs within their jurisdictions in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.

7.2.1.17 Toxic Substance Control Act (15 U.S.C. §2601 et seq.). This Act provides the U.S. Environmental Protection Agency with the authority to require testing of both new and old chemical substances entering the environment and to regulate them where necessary. The Toxic Substances Control Act (TSCA) came about as a result of concerns that there were no general Federal regulations for the thousands of new chemicals developed each year for their potential environmental or health effects prior to their introduction to the public or into commerce. TSCA also regulates the treatment, storage, and disposal of certain toxic substances not regulated by Resource Conservation Recovery Act or other statutes, specifically polychlorinated biphenyls (PCBs), choloroflurocarbons (CFCs), asbestos, dioxins, certain metal-working fluids, and hexavalent chromium. The asbestos regulations under the Toxic Substances Control Act were ultimately overturned. However, regulations pertaining to asbestos removal, storage, and disposal are promulgated through the National Emission Standard for Hazardous Air Pollutants Program (40 CFR Part 61, Subpart M). For chlorofluorocarbons, Title VI of the Clean Air Act Amendments of 1990 requires a reduction of chlorofluorocarbons beginning in 1991, and prohibits production beginning in 2000.

7.2.1.18 American Indian Religious Freedom Act of 1978 (42 USC §1996). This Act reaffirms Native American religious freedom under the First Amendment and sets U.S. policy to protect and preserve the inherent and constitutional right of American Indians to believe, express, and exercise their traditional religions. The Act requires that Federal actions avoid interfering with access to sacred locations and traditional resources that are integral to the practice of religions.

7.2.1.19 Native American Graves Protection and Repatriation Act of 1990 (25 USC §3001). This law directs the Secretary of Interior to guide responsibilities in repatriation of Federal archaeological collections and collections held by museums receiving Federal funding that are culturally affiliated to Native American tribes. Major actions to be taken under this law include: (a) establishing a review committee with monitoring and policy-making responsibilities; (b) developing regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims; (c) overseeing museum programs designed to meet the inventory requirements and deadlines of this law; and (d) developing procedures to handle unexpected discoveries of graves and/or grave goods during activities on Federal or tribal land.

7.2.1.20 Nuclear Waste Policy Act (42 USC §10101 et seq.). The Act authorizes the Federal agencies to develop a geologic repository for the disposal of high-level radioactive waste and spent nuclear fuel from commercial reactors. The Act specifies the process for selecting a repository site and constructing, operating, closing, and decommissioning the repository. The law also establishes programmatic guidance for these activities.

7.2.1.21 Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240). This law establishes two major national policies: (a) each state is responsible for assuring adequate disposal capacity for the low-level commercially generated waste generated within its own borders, with the exception of waste generated by Federal defense or research and development activities; and (b) the required disposal facilities can best be provided through regional groupings of states allied through interstate agreements called compacts. A compact ratified by a group of states must be approved by Congress before it takes full effect.

7.2.1.22 Occupational Safety and Health Act of 1970, as amended (29 USC § 651 et seq.). The Occupational Safety and Healthy Act establishes standards to enhance safe and healthful working conditions in places of employment throughout the United States. The Act is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. While OSHA and the U.S. Environmental Protection Agency both have a mandate to reduce exposures to toxic substances, OSHA's jurisdiction is limited to safety and health conditions that exist in the workplace environment. In general, under the Act, it is the duty of each employer to furnish all employees a place of employment free of recognized hazards likely to cause death or serious physical harm. Employees have a duty to comply with the occupational safety and health standards and all rules, regulations, and orders issued under the Act. OSHA regulations (published in Title 29 of the Code of Federal Regulations) establish specific standards telling employers what must be done to achieve a safe and healthful working environment. DOE places emphasis on compliance with these regulations at DOE facilities and prescribes through DOE orders the OSHA standards that contractors shall meet, as applicable to their work at government-owned, contractor-operated facilities (DOE Orders 5480.1B, 5483.1A). DOE keeps and makes available the various records of minor illnesses, injuries, and work-related deaths as required by OSHA regulations.

7.2.1.23 Religious Freedom Restoration Act of 1993 (42 USC §2000bb et seq.).
This Act prohibits the government, including Federal departments, from substantially burdening the exercise of religion unless the government demonstrates a compelling governmental interest and the action furthers a compelling government interest and is the least restrictive means of furthering that interest.

7.2.1.24 Bald and Golden Eagle Protection Act, as amended (16 USC §668-668d).
This Act makes it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States (Section 668, 668c). A permit must be obtained from the U.S. Department of the Interior to relocate a nest that interferes with resource development or recovery operations.

7.2.1.25 Pollution Prevention Act of 1990 (42 USC §13101 et seq.). The Pollution Prevention Act of 1990 establishes a national policy for waste management and pollution control that focuses first on source reduction, followed sequentially by environmentally safe recycling, treatment, and, lastly, disposal. Disposal or releases to the environment should only occur as a last resort. In response, DOE has committed to participation in the Superfund Amendments and Reauthorization Act Section 313, U.S. Environmental Protection Agency 33/50 Pollution Prevention Program. The goal, for facilities already involved in Section 313 compliance, is to achieve a 33 percent reduction in the release of 17 priority chemicals by 1997 from a 1993 baseline. On August 3, 1993, Executive Order 12856 was issued, expanding the 33/50 program such that DOE must reduce its total releases of all toxic chemicals by 50 percent by December 31, 1999. DOE is also requiring each DOE site to establish site-specific goals to reduce generation of all waste types. At the Idaho National Engineering Laboratory, reduction/recycling programs and goals have been established for all wastes. In addition to the 33/50 goals, a zero generation goal for hazardous waste has tentatively been set for 2010.

7.2.2 Executive Orders

7.2.2.1 Executive Order 12088 [Federal Compliance with Pollution Control Standards (October 13, 1978), as amended by Executive Order 12580 (January 23, 1987)]. Federal Compliance with Pollution Control Standards requires Federal agencies, including the DOE, to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the Clean Air Act, Noise Control Act, Clean Water Act, Safe Drinking Water Act, Toxic Substances Control Act (15 USC §2061 et seq.), and Resource Conservation and Recovery Act.

7.2.2.2 Executive Order 11593 (May 13, 1971) (National Historic Preservation). This Order requires Federal agencies, including DOE, to locate, inventory, and nominate properties under their jurisdiction or control to the *National Register of Historic Places* if those properties qualify. This process requires the DOE to provide the Advisory Council on Historic Preservation the opportunity to comment on the possible impacts of the proposed activity on any potential eligible or listed resources.

7.2.2.3 Executive Order 11514 (NEPA). This Order requires Federal agencies to continually monitor and control their activities to protect and enhance the quality of the environment and to develop procedures to ensure that fullest practicable provision of timely public information and understanding of the Federal plans and programs with environmental impact to obtain the views of interested parties. The DOE has issued regulations (10 CFR Part 1021) and DOE Order 5440.1E for compliance with this Executive Order.

7.2.2.4 Executive Order 12580 (Superfund Implementation). This Order delegates to the heads of executive departments and agencies the responsibility for undertaking remedial actions for releases, or threatened releases that are not on the National Priority List and removal actions other than emergencies where the release is from any facility under the jurisdiction or control of executive departments and agencies.

7.2.2.5 Executive Order 11988 (Floodplain Management). This Order requires Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken in a floodplain and that floodplain impacts be avoided to the extent practicable.

7.2.2.6 Executive Order 11990 (Protection of Wetlands). This Order requires governmental agencies to avoid, to the extent practicable, any short- and long-term adverse impacts on wetlands wherever there is a practicable alternative.

7.2.2.7 Executive Order 12898 (Environmental Justice). This Order directs Federal agencies to achieve environmental justice by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. The Order creates an Interagency Working Group on Environmental Justice and directs each Federal agency to develop strategies within prescribed time limits to identify and address environmental justice concerns. The Order further directs each Federal agency to collect, maintain, and analyze information on the race, national origin, income level, and other readily accessible and appropriate information for areas surrounding facilities or sites expected to have a substantial environmental, human health, or economic effect on the surrounding populations, when such facilities or sites become the subject of a substantial Federal environmental administrative or judicial action, and to make such information publicly available.

7.2.2.8 Executive Order 12344 (Naval Nuclear Propulsion Program). [enacted as permanent law by Public Law 98-525 (42 USC 7158)]. This Order prescribes the authority and responsibility of the Naval Nuclear Propulsion Program, a joint Navy/DOE organization, for all matters pertaining to naval nuclear propulsion. These responsibilities include all environmental and occupational safety and health aspects of the program.

7.2.2.9 Executive Order 12856 (Right-to-Know Laws and Pollution Prevention Requirements). This Order requires all Federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response and accident notification; and encourage clean technologies and testing of innovative prevention technologies. The Order also provides that Federal agencies are persons for purposes of the Emergency Planning and Community Right-to-Know Act (SARA Title III), which obliges agencies to meet the requirements of the Act.

7.2.2.10 Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions). This Order declares that Federal agencies are required to prepare environmental analyses for "major Federal actions significantly affecting the environment of the global commons outside the jurisdiction of any nation (e.g., the ocean or Antarctica)." According to the Executive Order, major Federal actions significantly affecting the environment of foreign countries may also require environmental analyses under certain circumstances. The procedural requirements imposed by the Executive Order are analogous to those under the National Environmental Policy Act.

7.2.3 Department of Energy Regulations and Orders

Through the authority of the Atomic Energy Act, the DOE is responsible for establishing a comprehensive health, safety, and environmental program for its facilities. The regulatory mechanisms through which DOE manages its facilities are the promulgation of regulations and the issuance of DOE orders.

DOE regulations generally are found in Volume 10 of the Code of Federal Regulations. These regulations address such areas as energy conservation, administrative requirements and procedures, and classified information. For purposes of this EIS, relevant subchapters include Part 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High Level Radioactive Waste; Part 1021, Compliance with the National Environmental Policy Act; and Part 1022, Compliance with Floodplains/Wetlands Environmental Review Requirements.

DOE orders generally set forth policy and the programs and procedures for implementing that policy. The following sections provide a brief discussion of selected orders.

7.2.3.1 DOE Order 5440.1E, National Environmental Policy Act. This Order establishes responsibilities and sets forth procedures necessary for implementing the National Environmental Policy Act of 1969, as amended, to operate each of its facilities in full compliance with the letter and spirit of the Act. This Order was revised and reissued by DOE on November 10, 1992.

7.2.3.2 DOE Order 5000.3B, Occurrence Reporting and Utilization of Operations Information. This Order establishes the requirements for reporting and processing occurrences relating to safety, health, security, property, operations, and environment up to and including emergencies.

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

7.2.3.4 DOE Order 5480.3, Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes. This Order provides DOE policy, sets forth requirements, and assigns responsibilities for the safe transport of hazardous materials, hazardous substances, hazardous wastes, and radioactive materials.

7.2.3.5 DOE Order 5480.9A, Construction Project Safety and Health Management. This Order establishes procedures and provides guidelines for the protection of the DOE and DOE contractor employees engaged in construction activities; protection of the general public from hazards in connection with DOE construction activities; protection of adjacent property from damage; and prevention of delay or interruption of DOE programs caused by accident or fires.

7.2.3.6 DOE Order 5483.1A, Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities. This Order establishes requirements and procedures to assure that occupational safety and health standards prescribed pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, and the DOE Organization Act of 1977, provide occupational safety and health protection for DOE contractor employees in Government-owned contractor-operated facilities that is consistent with the protection afforded private industry employees by the occupational safety and health standards promulgated under the Occupational Safety and Health Act of 1970.

7.2.3.7 DOE Order 5700.6C, Quality Assurance. This Order provides DOE policy, sets forth requirements, and assigns responsibilities for establishing, implementing, and maintaining plans and actions to assure quality achievement in DOE programs. Requirements from this order for nuclear facilities were also issued April 5, 1994, under 10 CFR Part 830.120, Quality Assurance.

7.2.3.8 DOE Order 5820.2A, Radioactive Waste Management. This Order establishes policies and guidelines by which the DOE manages its radioactive waste, waste by-products, and radioactively contaminated surplus facilities.

7.2.3.9 DOE Order 5400.1, General Environmental Protection Program. This Order establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for assuring compliance with applicable Federal, State, and local environmental protection laws and regulations as well as internal DOE policies.

7.2.3.10 DOE Order 5400.5, Radiation Protection of the Public and the Environment. This Order establishes standards and requirements for operation of the DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation. The requirements of this order are being codified in the proposed 10 CFR Part 834, Radiation Protection of the Public and the Environment.

7.2.3.11 DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards. This Order specifies and provides requirements for the application of the mandatory environmental, safety, and health standards applicable to all DOE and DOE contractor operations.

7.2.3.12 DOE Order 5480.10, Contractor Industrial Hygiene Program. This Order establishes the requirements and guidelines applicable to DOE contractor operations for maintaining an effective industrial hygiene program to preserve employee health and well-being.

7.2.3.13 DOE Order 5480.11, Radiation Protection for Occupational Workers. This Order establishes radiation protection standards and program requirements for the DOE and DOE contractor operations with respect to the protection of the worker from ionizing radiation.

7.2.3.14 DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements. This Order establishes the requirements and procedures for the reporting of information having environmental protection, safety, or health protection significance for DOE operations.

7.2.4 Idaho Laws and Regulations

The Idaho Environmental Protection and Health Act (Idaho Code, Title 39, Chapter 101 et seq.) establishes general provisions for the protection of the environment and public health. The Act created the Idaho Department of Health and Welfare and its subordinate Division of Environmental Quality, thus consolidating all State public health and environmental protection activities under one department. The Idaho Department of Health and Welfare is authorized to implement these environmental, health, and social services requirements. The Act authorizes the Department to promulgate standards, rules, and regulations relating to water and air quality, noise reduction, and solid waste disposal and grants authority to issue required permits, collect fees, establish compliance schedules, and review plans for the construction of sewage and public water treatment and disposal facilities.

Authorization is also granted to the Idaho Department of Health and Welfare by the Idaho Water Pollution Control Act (Idaho Code, Title 39, Chapter 36) for the protection of the waters of Idaho. General language concerning the prevention of water pollution and the provision of financial assistance to municipalities is contained in the law.

The Idaho Department of Health and Welfare is also responsible for enforcement and implementation of the Hazardous Waste Management Act of 1983, as amended (Idaho code, Title 39, Chapter 44), which provides for the protection of health and the environment from the effects of improper or unsafe management of hazardous wastes and for the establishment of a tracking or manifesting system for these wastes. This program is intended to be consistent with and not more stringent than Federal regulations as established under the Resource Conservation and Recovery Act. At this time, Idaho has primacy over hazardous and mixed waste promulgated by the U.S. Environmental Protection Agency. The Hazardous Waste Management Act sets forth requirements for the development of plans that address identification of hazardous wastes, unauthorized treatment, storage, release, use, or disposal of these wastes, and permit requirements for hazardous waste facilities. Rules and regulations concerning the transportation, monitoring, reporting, and record keeping of hazardous wastes have also been promulgated by the Idaho Department of Health and Welfare under authority of this Act.

The following sections discuss the major requirements and regulations pursuant to these State laws.

7.2.4.1 Idaho Air Pollution Control Regulations. Pursuant to the Rules and Regulations for the Control of Air Pollution in Idaho (Idaho Administrative Procedures Act Title 1, Chapter 1), the Department of Health and Welfare established ambient air quality standards for particulate matter, sulfur dioxide, ozone, oxides of nitrogen, carbon monoxide, and fluorides.

Title 1, Chapter 1, of the Rules and Regulations for the Control of Air Pollution in Idaho is intended to provide authority and standards in compliance with the Clean Air Act. The Department of Health and Welfare has been granted authority to implement the requirements of the Clean Air Act and to adopt rules to implement the requirements of the Clean Air Act for that purpose. These rules and regulations include provisions for establishing compliance schedules and emission limits, reporting and correction of emissions that exceed established limits, and permitting requirements for construction and operation of facilities or activities that may generate emissions in excess of the prescribed standards. The Prevention of Significant Deterioration, control of open burning, and fugitive dust are addressed by these rules, as are specified types of facilities that may exceed emission limits. Also required by the Idaho Air Pollution Control Regulations is the formulation of a plan for the prevention and alleviation of air pollution emergencies. The plan includes definitions of the severity of the emergency, requirements for public notification, and recommended actions to be taken in abating an air pollution emergency.

7.2.4.2 Idaho Water Quality Standards and Wastewater Treatment Requirements and Wastewater Land Application Permit Regulations. Provisions are set forth by these regulations (Idaho Department of Health and Welfare, Rules and Regulations, Title 1, Chapter 2) for protection of designated water uses and the establishment of water quality standards that will protect those uses. The Department of Health and Welfare has been authorized to develop and enforce these regulations by Section 39-105 of the Idaho Code. Restrictions are outlined by these regulations for control of point-source and nonpoint-source discharges and other activities that may adversely affect waters of the State of Idaho, including surface water and groundwater. These regulations identify water-use classifications, specifically prohibited discharges, water quality criteria, and requirements for treatment of wastewater before discharge in the waters of Idaho. In addition, State regulations require that a permit be obtained for the application of wastewater to the land surface.

7.2.4.3 Idaho Regulations for Public Drinking Water Systems. Maximum contaminant levels for public drinking water systems are provided by these regulations. The Water Quality Bureau, as a subdivision of the Department of Health and Welfare, sets forth monitoring and reporting requirements for inorganic and organic chemicals and radiochemicals. Other water quality and locational standards are also included in these regulations. The Department reserves the authority to determine whether the contamination is caused by nuclear facilities and to require further monitoring.

7.2.4.4 Idaho Hazardous Waste Management Regulations. Pursuant to the Hazardous Waste Management Act, the Department of Health and Welfare (Title 1, Chapter 5) has adopted by reference the Federal regulations regarding hazardous waste rulemaking, hazardous waste delisting, and identification of wastes. Included in these regulations are requirements for hazardous waste generators, transporter, and management facilities as well as detailed procedures for permitting these activities. The general requirements for generators, transporters, and management facilities have been incorporated by reference; however, some sections have been revised to reflect Idaho's permitting program. Section 39-4404 (14) of the Act identifies "restricted hazardous waste" that includes liquid hazardous wastes containing specified concentrations of constituents as well as hazardous wastes containing concentrations of halogenated compounds.

7.2.4.5 Idaho Solid Waste Management Regulations. These regulations, as developed by the Idaho Department of Health and Welfare in Title 1, Chapter 6, of the *Solid Waste Management Regulations and Standards Manual*, provide standards for the management of solid wastes to minimize the detrimental effects of disposal. These standards include requirements for the review of plans and approval of procedures and operational and postoperational standards for landfills, incinerators, and processing facilities and for transportation and storage of solid waste.

7.2.4.6 Idaho Rules and Regulations for Construction and Use of Injection Wells. Requirements for the construction, location, and use of injection wells within the State of Idaho are set forth in these regulations. The Department of Water Resources has been granted administrative authority over injection wells. Injection of radioactive or hazardous materials through an existing well or above a drinking water source is prohibited. Parameters for quality of fluids discharged and allowable uses of injection wells are included in these regulations as are classifications of well types and permitting requirements for injection wells.

7.2.5 Compliance Status at the Idaho National Engineering Laboratory

The INEL is committed to operating in compliance with all environmental laws, regulations, executive orders, DOE orders, and permits and compliance agreements with regulatory agencies. Regulatory agencies conduct inspections at the INEL to assure compliance with permits and other applicable legal requirements are being met.

In addition to oversight through external regulatory agencies, the DOE has a comprehensive program for conducting internal audits or inspections and self-assessments, including periodic reviews conducted by interdisciplinary teams of experts. DOE-ID has also prepared and issued an *Environmental Compliance Planning Manual* (DOE-ID-10166) that identifies the various requirements of Federal and State agencies that DOE-ID considers to be pertinent to activities at the INEL. This Manual provides guidance and step-by-step methods needed to maintain compliance with applicable environmental requirements. A summary of the INEL's current compliance with major environmental statutes and regulations is presented in the discussion that follows.

7.2.5.1 Comprehensive Environmental Response, Compensation, and Liability Act. In November 9, 1989, the INEL was placed on the Environmental Protection Agency's (EPA's) National Priority List, which is the nationwide list of private- and Federal-owned sites identified by the EPA as requiring response actions under the Comprehensive Environmental Response, Compensation, and Liability Act. Following this listing, the DOE entered into negotiations with the State of Idaho and EPA Region 10, leading to execution of a Federal Facility Agreement and Consent Order on December 9, 1991. The purpose of the Federal Facility Agreement and Consent Order is to establish a procedural framework and schedule for developing, prioritizing, implementing, and monitoring appropriate response actions at the INEL in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, which will also be deemed to meet any corrective action requirements of the Resource Conservation and Recovery Act Section 3008(h) Consent Order and Compliance Agreement (see discussion below). The Action Plan portion of the Federal Facility Agreement and Consent Order sets forth a schedule for accomplishing the required activities. In conjunction with the EPA Region 10 and State of Idaho Project Managers, DOE-ID is engaged in various characterization, sampling, investigation, and interim action activities that are intended to provide the basis for selection of remedies at the operable units located on the INEL. The activities accomplished to date are summarized in Table 7.2-1.

7.2.5.2 Emergency Planning and Community Right-to-Know Act of 1986 (SARA Title III). Authority for the programs under the Superfund Amendments and Reauthorization Act Title III reporting has been delegated by the U.S. Environmental Protection Agency to each individual state. In accordance with Subtitle A (Emergency Response Planning and Release Notification), the State of Idaho has established an Emergency Response Commission to handle the statewide work and the counties have established emergency planning committees to manage local activities. The INEL is subject to and complies with the reporting requirements established in Title III. DOE-ID also prepares and submits reports required by Sections 311, 312, and 313 of the Superfund Amendments and Reauthorization Act.

7.2.5.3 National Environmental Policy Act. A comprehensive program to assure compliance with the National Environmental Policy Act requirements is in place at the INEL and is described in the *DOE-ID Environmental Compliance Planning Manual* (DOE/ID-10166). This program has evolved over the last several years, culminating recently in promulgation of DOE National Environmental Policy Act regulations (10 CFR Part 1021) and the issuance of numerous guidance memoranda by the DOE Office of NEPA Policy and Assistance (EH-42). Table 7.2-2 is a list of the Environmental Assessments and EISs that are related to this EIS and that have either been approved or are under preparation.

7.2.5.4 Safe Drinking Water Act. The Safe Drinking Water Act Underground Injection Control regulations require that deep injection wells be permitted or that permits be submitted to the State, and shallow wells be inventoried. The injection wells are used to dispose of storm water

Table 7.2-1. Federal Facility Agreement/Consent Order status.[a]

Operable Unit No.	Site Description	Interim Action	RI/FS[b]	Status
1-07A	Test Support Facility	X		ROD[c] signed 9/92- remedial action commenced 5/93
1-07B	Test Area North		X	RI/FS and PP[d] complete
2-10	Test Reactor Area	X		ROD signed 12/91; remedial action complete 5/94
2-12	Test Reactor Area		X	ROD signed 12/92 - No Action
4-11	Central Facilities Area		X	ROD signed 1/93 - No Action
4-12	Central Facilities Area		X	RI/FS under preparation
5-05	SL-1 Burial Ground		X	RI/FS under preparation
5-10	Auxiliary Reactor Area		X	ROD signed 12/92 - No Action
5-13	Power Burst Facility Reactor Area Corrosive Waste Disposal Sump Brine Tank Power Burst Facility Reactor Area Evaporation Pond	X		ROD signed 9/92; RA[f] report under preparation
7-08	Organic Contamination in Vadose Zone		X	ROD signed 12/94; RD/RA in process
7-10	Pit 9 Process Demonstration	X		ROD signed 10/93; RD/RA in process
7-12	Pad A		X	ROD signed 1/94; RA report under preparation
8-07	Naval Reactors Facility Industrial Waste Ditch		X	ROD signed 9/94; RD/RA in process
10-5	Unexploded Ordnance	X		ROD signed 6/92; RA complete 4/94
10-6	Radioactively Contaminated Soils		X	RI/FS under preparation

a. This table reflects only those actions under the Federal Facility Agreement/Consent Order that have been designated as interim actions or RI/FSs. Other Track 1 and Track 2 actions are not reflected in the table, although considerable action has been performed at these various operable units.
b. Remedial Investigation/Feasibility Study.
c. Record of Decision.
d. Proposed Plan.
e. Scope of Work.
f. Remedial Design/Remedial Action.

Table 7.2-2. National Environmental Policy Act documents.

Description of Action	Status[a]	EIS	EA
Waste management operations at the INEL	ROD issued 1977	X	
Special Isotope Separation Project	ROD issued January 1989	X	
Siting, construction, and operation of New Production Reactor capacity	Draft EIS issued April 1991	X	
Transportation, receipt, and storage of spent nuclear fuel from the Fort St. Vrain Reactor to the INEL	FONSI issued February 1991[b]		X
INEL Federal Aviation Administration Explosive Detection System Independent Validation and Verification Program	FONSI issued May 1991		X
Test Reactor Area evaporation pond	FONSI issued December 1991		X
Expansion of the INEL Research Center	FONSI issued March 1994		X
High-Level Waste Tank Farm Replacement Project	FONSI issued June 1993[c]		X
Decontamination and selective demolition of Auxiliary Reactor Areas II and III	FONSI issued September 1993		X
Low-level and mixed waste processing at the Waste Experimental Reduction Facility	FONSI issued June 1994		X
Retrieval and re-storage of Transuranic Storage Area waste at the INEL	FONSI issued May 1992		X
INEL Sewer System Upgrade Project	FONSI issued April 1994		X
INEL Consolidated Transportation Facility	FONSI issued April 1993		X
Waste Characterization Facility	FONSI issued March 1995		X
Test Area North Pool Stabilization Project	EA in progress		X
Replacement of the Radiological and Environmental Sciences Laboratory	Planned		X
Interim action for the cleanup of Pit 9 at Radioactive Waste Management Complex	FONSI issued July 1993		X
Interim action to reduce contamination near the injection well and in the surrounding groundwater at Test Area North at the INEL	FONSI issued October 1992		X

Table 7.2-2. (continued).

Description of Action	Status[a]	EIS	EA
Replacement of the Health Physics Instrumentation Laboratory	EA in progress		X
Continuing operation of the Specific Manufacturing Capability	FONSI issued August 1991		X
Process Equipment Waste and Process Waste Liquid Collection Systems at Idaho Chemical Processing Plant	FONSI issued June 1990		X
Waste Handling Facility at Argonne National Laboratory-West	Planned		X
Fuel Cycle Facility at Argonne National Laboratory-West	FONSI issued May 1990		X
INEL new borrow source site	EA in progress		X
Plasma Hearth Process Project	EA in progress		X

a. EIS = environmental impact statement; EA = environmental assessment; ROD = record of decision; FONSI = finding of no significant impact.

b. The EA was ruled inadequate by the United States District Court for the District of Idaho in June 1993 (PSC 1993).

c. FONSI issued for line upgrades, but not tank replacement.

runoff. The DOE also inventoried shallow injection wells at the INEL and submitted the information to the State as required. The Idaho Department of Environmental Quality conducts periodic sanitation surveys. A sanitation survey was conducted by the Idaho Department of Environmental Quality in December 1990. Additionally, both the State of Idaho and the City of Idaho Falls regularly monitor the INEL's drinking water supply system. The most recent State audit was conducted in December 1990.

7.2.5.5 Clean Air Act. The INEL has several facilities with air quality permits from the State of Idaho. These facilities are operated in compliance with permit conditions. Permit applications currently are pending with the State of Idaho for proposed new or modified emission sources. Table 7.2-3 lists current air permits, under the Clean Air Act, in effect and pending at the INEL.

An inventory of all potential radioactive and criteria pollutant emission sources was completed and sent to the State of Idaho in April 1991. The inventory contains information necessary to issue the INEL a Permit to Operate.

The Idaho Department of Health and Welfare, Division of Environmental Quality, and Air Quality Bureau conduct annual inspections of the INEL facility to determine whether the operating portions of the facility are in compliance with the *Rules and Regulations for the Control of Air Pollution in Idaho*. The most recent inspections were conducted in February and March 1992.

Additionally, pursuant to 40 CFR Part 61.94 (H), the DOE submits on an annual basis a report documenting compliance with National Emission Standards for Hazardous Air Pollutants at the INEL.

On September 12-14, 1990, and again on March 18-21, 1991, the Idaho Department of Health and Welfare inspected the status of INEL's compliance with air quality regulations. As a result of these inspections, the DOE was issued an Air Quality Notice of Violation on June 5, 1991. This Air

Table 7.2-3. Permits held or applied for by the Idaho National Engineering Laboratory.

Permit No.	Regulatory agency	Permit type	Facility permitted	Application date	Date issued
PSD-X81-11	EPA	PTC/PSD	Coal Fired Steam Generating Facility, ICPP		2/86
0340-0001-300	IAQB	PTC/PSD	Fuel Processing Restoration Project, ICPP. Includes all boilers from ICPP, CFA, ARA, ANL-W, PBF, RWMC, TRA, NRF, WERF Incinerator	4/88	8/89
0140-0022	IAQB	PTC/PSD	Hot Fuel Examination Facility/South Modifications, ANL-W	1/88	Pending
900809	IAQB	PTC/PSD	SMC TAN 607 R&D Facility	8/90	12/90
0140-0022	IAQB	PTC/PSD	Paint Spray Booth at ANL-W	10/89	2./92
0340-0001	IAQB	PTC	Classified Incinerator, SMC	1/86	3/86
0260-0030	IAQB	PTC	2B Paint Process. SMC	11/89	3/90
0340-0001	IAQB	PTC	CFA 609 Boiler	3/87	5/87
0340-0001	IAQB	PTC	ICPP Hazardous Waste Chemical Handling Facility (637)	12/91	Pending
0340-0001-11	IAQB	PTC	Waste Experimental Reduction Facility and Waste Engineering Development Facility	Revision Submitted 5/93	10/87
0340-0001	IAQB	PTC	Transuranic Storage Area Retrieval Enclosure and Transuranic Waste Storage Facility	3/90	12/90
0340-0001	IAQB	PTC/PSD	Test Reactor Area Evaporation Pond	11/88	10/90
0340-0001-300	IAQB	PTC	Process Experimental Pilot Plant	10/86	12/86
0340-0001	IAQB	PTC	ICPP Hazardous Chemical Handling Facility (660)	2/88	8/88
0340-0001	IAQB	PTC	Fluoric Acid Supply System ICPP	6/88	3/90
	IAQB	PTC/BRC	Diesel Pump for Fire Water at ICPP	4/90	4/90
0340-0001	IAQB	PTC	HF Acid Storage Tank, ICPP		
0340-0001	IAQB	PTC	ARVFS NaK D&D Project, TAN	12/88	10/89
	IAQB	PTC/PSD	SMC Facility Permit	12/91	Pending
	IAQB	PTC/PTO	IRC Chemistry Wing Addition	4/91	Pending

Table 7.2-3. (continued).

Permit No.	Regulatory agency	Permit type	Facility permitted	Application date	Date issued
	IAQB	PTC/BRC	Perchloric Acid Hood, IRC	7/91	9/91
		PTC	Expended Core Facility Dry Cell Project[a]		
	IAQB	PTC	FDP Development and Support Facility, ICPP	1/90	Pending
	IAQB	PTC/BRC	Anti-C Safety Equipment Building, ICPP	3/91	11/91
	IAQB	PTC/BRC	Ongoing R&D Project (MOD. 2), SMC TAN-679	8/91	Pending
	IAQB	PTC/PTO	ICPP Pilot Plants	12/90	3/92
	IAQB	PTC/PSD	SIS Production Plant, ICPP and Stand Alone Storage Vault	12/87 Resubmitted 2/88	Withdrawn 2/90
	IAQB	PTC/BRC	Acid Fractionator Pilot Plant, ICPP		
	IAQB	PTC/BRC	NO_x Abatement Pilot Plant ICPP	12/91	2/92
	IAQB	PTC/BRC	PEW Evaporator, ICPP		
	IAQB	PTC/BRC	Diesel Pump at ICPP Injection Well	1/89	Pending
	IAQB	PTC/BRC	TAN Fire Station Emergency Generator and Vehicle Trunks, TAN 688	11/88	Pending
	IAQB	PTC	CFA 665 Boiler Replacement		
	IAQB	PTC/BRC	TREAT Facility at ANL-W		
	IAQB	PTC/BRC	Emergency Diesel Generator at ANL-W	3/90	4/90
	IAQB	PTC/BRC	Electrolytic Dissolver Pilot Plant, ICPP		
	IAQB	PTC/BRC	Cold-Feed Make-up Pilot Plant, ICPP		
	IAQB	PTC/BRC	In-Situ Vitrification Intermediate Scale Demo at WRRTF		7/89
Phase 2d	IDHW	RCRA Part B	RWMC	5/91	Pending
Phase 2h	IDHW	RCRA Part B	HWSF	11/91	Pending
Phase 2j	IDHW	RCRA Part B	HCWHF	6/92	Pending

Table 7.2-3. (continued).

Permit No.	Regulatory agency	Permit type	Facility permitted	Application date	Date issued
Phase 2k	IDHW	RCRA Part B	NWCF	11/91	Pending

NWCF = New Waste Calcining Facility

RWMC = Radioactive Waste Management Complex

HWSF = Hazardous Waste Storage Facility

ICPP = Idaho Chemical Processing Plant

SMC = Special Manufacturing Capability

IRC = INEL Research Center

IAQB = Idaho Air Quality Bureau

EPA = U.S. Environmental Protection Agency

BRC = Below Regulatory Concern

PTC = Permit to Construct

PTO = Permit to Operate

PSD = Prevention of Significant Deterioration

a. Permit issued but suspended after June 1993 following Court Ruling; DOE/Naval Reactors will apply for reinstatement if Dry Cell Project is determined to proceed after the Record of Decision.

Quality Notice of Violation was recently resolved by the DOE and the State by execution of a consent order.

7.2.5.6 Clean Water Act. The INEL does not discharge liquid effluents to surface waters of the United States. Sewage treatment plants are operated in compliance with applicable State regulations. The DOE has obtained a general permit for storm water discharges under the National Pollution Discharge Elimination System regulations, and has prepared storm water pollution prevention plans for industrial facilities at the INEL and for construction activities.

7.2.5.7 Toxic Substances Control Act. Efforts to comply with the Toxic Substances Control Act included the implementation of a plan at INEL to remove or retrofill polychlorinated biphenyl and polychlorinated biphenyl-contaminated transformers and capacitors. Following a September 1988 inspection, the U.S. Environmental Protection Agency (EPA) issued a Complaint and Notice for Opportunity for Negotiation concerning alleged Toxic Substances Control Act violations. The Complaint alleged that the INEL violated the record keeping and use provisions of the polychlorinated biphenyl regulations. After attending a settlement conference with the EPA, the DOE implemented a plan to remove or retrofill polychlorinated biphenyl and polychlorinated biphenyl-contaminated transformers and capacitors. During 1990, 69 polychlorinated biphenyl capacitors and 16 polychlorinated biphenyl-contaminated transformers were removed from service or retrofilled and reclassified as non-polychlorinated biphenyl. There are currently no polychlorinated biphenyl capacitors and only two polychlorinated biphenyl-contaminated transformers in service at the INEL.

In conjunction with efforts at DOE Headquarters, DOE-ID is in the process of preparing a strategy to address management of radioactively contaminated polychlorinated biphenyls and "mixed" polychlorinated biphenyls (polychlorinated biphenyls mixed with Resource Conservation and Recovery Act hazardous wastes) currently in storage at the INEL.

7.2.5.8 Resource Conservation and Recovery Act and State of Idaho Hazardous Waste Management Act. The State of Idaho was granted final authorization by the U.S. Environmental Protection Agency (EPA) to operate its hazardous waste program in lieu of the Federal

Resource Conservation and Recovery Act program (with the exception of the Hazardous and Solid Waste Amendments corrective action provisions) on April 9, 1990. Before this point, the EPA administered the entire Resource Conservation and Recovery Act program in Idaho. On June 5, 1992, the State of Idaho received final authorization for the Hazardous and Solid Waste Amendments corrective action provisions.

In October 1985, Resource Conservation and Recovery Act Part A and B permit applications were submitted by DOE-ID to EPA Region 10 for a number of hazardous waste units at the INEL. In November 1985, the EPA requested additional information on hazardous waste land disposal units at the INEL. It was determined that corrective action for these units would be the subject of a Consent Order and Compliance Agreement that was signed by the EPA, DOE-ID, and the U. S. Geological Survey in July 1987. In December 1991, the Federal Facility Agreement and Consent Order was signed. The Federal Facility Agreement and Consent Order superseded the Consent Order and Compliance Agreement that resulted in corrective action requirements at the INEL being investigated under 40 CFR Part 120 (Comprehensive Environmental Response, Compensation, and Liability Act).

After DOE-ID's submittal of an initial Part A and B permit application in October 1985, the State of Idaho and EPA Region 10 concluded the application was incomplete. On September 23, 1988, the EPA announced that hazardous waste management units involving radioactive waste mixed with hazardous waste in existence on or before July 3, 1986, were eligible for interim status if Resource Conservation and Recovery Act Part A permit applications identifying these units were submitted by March 23, 1989. On November 8, 1988, DOE-ID submitted a revised Part A and B permit application for Resource Conservation and Recovery Act units at the INEL. The permit application addressed all hazardous and mixed waste management units potentially subject to the Resource Conservation and Recovery Act, thus qualifying these units for interim status. Because of the large number of units involved, adequate time was not available for submittal of all of the Part B permit application by November 8, 1988. Thus, a schedule was negotiated for submitting the Part B permit applications on a phased basis (see Table 7.2-4). The State of Idaho issued a determination in March 1990 that the units listed in the DOE-ID November 1988 Part A permit application were

Table 7.2-4. Resource Conservation and Recovery Act permit status.

RCRA unit	Part A status	Part B status: Submitted/planned submittal date	Part B status: Permit issued
ANL-W Radioactive Scrap and Waste Facility	Interim status	7/30/90	12/93
ANL-W Waste Characterization Facility	Interim status	7/30/90	
ANL-W Radioactive Sodium Storage Facility	Interim status	7/30/90	12/93
RWMC Waste Storage Facility	Interim status	5/30/91	
ILTSF (Pad 1)	Interim status	To be closed	
ILTSF (Pad 2)	Interim status	5/30/91	
New Waste Calcining Facility	Interim status	10/01/91	
CPP-633 WCF Evaporator	Interim status	To be closed	
CPP-633 WCF Storage Tanks (4)	Interim status	To be closed	
CPP-633 WCF HEPA Filter Storage	Interim status	To be closed	
CPP-640 Headend Holdup Storage Tanks (3)	Interim status	To be closed	
CPP-633 Hot Shop Storage Tank	Interim status	To be closed	
ICPP Percolation Ponds	Interim status	To be closed	
ICPP Tank Farm (15 of 19 Tanks)	Interim status	To be closed	
CPP-666 FAST Storage and Treatment Tanks (2)	Interim status	To be closed	
CPP-1619 HCRWSF Hazardous Waste Compactor	Interim status	To be closed	
NO_x Abatement Storage Tanks	Interim status	To be closed	
FPR Storage Tanks	Interim status	To be closed	
CPP-659 Organic Solvent Storage Tanks	Interim status	To be closed	
Hazardous Waste Storage Facility	Interim status	11/29/91	
HCWHNF	Interim status	6/30/92	
Waste Experimental Reduction Facility	Interim status	10/30/92	

Table 7.2-4. (continued).

RCRA unit	Part A status	Part B status: Submitted/planned submittal date	Part B status: Permit issued
FAST HEPA Filter Storage	Interim status	6/30/93	
NWCF HEPA Filter Leaching System	Interim status	6/30/93	
LET&D Facility	Interim status	6/30/93	
NWCF	Interim status	6/30/93	
Mixed Waste Storage Facility	Interim status	7/31/93	
Portable Storage Units	Interim status	7/31/93	
WERF Waste Storage Building	Interim status	7/31/93	
SMC Hazardous Waste Storage Area	Interim status	7/31/93	
Evaporators at TAN-607A and TAN-681	Interim status	To be closed	
TSA-RE Retrieval Modification Facility	Interim status	2/28/94	
Waste Characterization Facility	Interim status request	2/28/94	
TSA-3 (SWEPP)	Interim status	2/28/94	
PREPP Incinerator	Interim status	To be closed	
PREPP Waste Stabilization	Interim status	To be closed	
Reactives Storage and Treatment Area	Interim status	To be closed	
TAN-726 Chromate Waste Storage	Interim status	To be closed	
TAN-647 Sodium Storage	Interim status	To be closed	
IET Mercury Storage	Interim status	To be closed	
HTRE-3 Assembly	Interim status	To be closed	
ARVFS Storage (NaK)	Interim status	To be closed	
ARVFS Chemical Treatment (NaK) at WRRTF	Interim status	To be closed	
TAN-726A Chromate Treatment	Interim status	To be closed	

Table 7.2-4. (continued).

RCRA unit	Part A status	Part B status: Submitted/planned submittal date	Part B status: Permit issued
TSA-1TSA-R	Interim status	To be closed	
TSA-2	Interim status	To be closed	
TSA-3 (C&S Building)	Interim status	To be closed	
TSA-610 Lead Storage Building	Interim status	To be closed	
NODA Treatment	Interim status	To be closed	
ICPP Tank Farm	Interim status	7/30/94	
PEW System	Interim status	7/30/94	
Calcine Bin Sets	Interim status	7/30/94	
RMWSF	Interim status	6/30/95	
HCRWSF	Interim status	6/30/95	
Westside Holdup Storage Tanks	Interim status	6/30/95	
WG/WH Cells Storage and Treatment Tanks	Interim status	6/30/95	
CPP-601 Container Storage	Interim status requested	6/30/95	
WEDF Waste Stabilization	Interim status	11/30/95	
WEDF Storage	Interim status	11/30/95	
Evaporation	New facility	11/30/95	
Ion Exchange	Interim status	11/30/95	
Neutralization	Interim status	11/30/95	
Amalgamation	Interim status	11/30/95	
Macroencapsulation	New facility	11/30/95	
TAN-647 Waste Storage Facility	Interim status	11/30/95	
TAN-666 Storage Tanks	Interim status	11/30/95	

Table 7.2-4. (continued).

RCRA unit	Part A status	Part B status	
		Submitted/planned submittal date	Permit issued
TAN-666 Treatment	Interim status	11/30/95	
TAN Potable Water Treatment Unit	Interim Status	11/30/95	
MLLWTF	New facility	10/30/96	
MLLW Disposal Facility	New facility	10/30/97	
ICPP New Tank Farm	Interim status	2/26/98	
Idaho Waste Processing Facility	New facility	7/31/99	

eligible for interim status. On March 19, 1991, the State of Idaho approved interim status for all INEL units listed in the September 1990 submittal of the INEL Permit Application.

One Notice of Noncompliance and three Notices of Violation have been received from the EPA and the State of Idaho, respectively, for INEL Resource Conservation and Recovery Act hazardous waste management activities. The Notice of Noncompliance was received by DOE-ID on January 29, 1990, and the resulting consent order was signed on April 3, 1992. The Notice of Noncompliance was based primarily on secondary containment issues for the Idaho Chemical Processing Plant Tank Farm and hazardous waste storage issues including those at the Radioactive Waste Management Complex. The consent order provides schedules for either bringing the Tank Farm into compliance with secondary containment requirements or closing the tanks. Additionally, a schedule for developing more storage capacity at the Radioactive Waste Management Complex was provided, as well as requirements for correcting the remaining violation cited in the Notice of Noncompliance. The Notice of Noncompliance Consent Order was modified on March 17, 1994, to incorporate terms of the settlement agreement among DOE, the State of Idaho, and the Navy. The first Notice of Violation was received by DOE-ID on June 5, 1991, and the resulting consent order was signed on October 23, 1992. This Notice of Violation required DOE to cease use of the Idaho Chemical Processing Plant Percolation Ponds for disposal of hazardous waste and begin Resource Conservation and Recovery Act closure. This Notice of Violation also addressed minor storage-related violations. The consent order provides a schedule for ceasing use of the Idaho Chemical Processing Plant Percolation Ponds and beginning Resource Conservation and Recovery Act closure. The consent order also sets requirements for coming into compliance on the storage-related violations. The second Notice of Violation was received by DOE-ID in February 1993, and the resulting consent order was signed on May 16, 1994. This Notice of Violation alleged minor labeling, recordkeeping, and waste characterization violations. Except for a disagreement about proper procedures for handling Comprehensive Environmental Response, Compensation, and Liability Act investigation derived waste, the minor violations were either addressed by on-the-spot corrective action or dismissed by the State of Idaho. The third Notice of Violation was received by DOE-ID in October 1994, and the resulting consent order is currently under negotiation. This Notice of Violation alleged minor labeling, recordkeeping, inspection, and waste characterization violations. The Notice of Violation also alleged violations of Resource Conservation and Recovery Act groundwater monitoring requirements and improper disposal of hazardous wastes. Most of the concerns were corrected at the time of inspection or shortly thereafter.

The INEL currently is in compliance with all applicable underground storage tank requirements (40 CFR Parts 280-281). On September 25, 1992, the EPA conducted an overview and audit of the underground storage tank program at the INEL site. The EPA physically inspected various tanks and reviewed the status of DOE's recordkeeping system. In the course of this review, potential deficiencies in contractor monthly reconciliations of tank inventory records were identified by the EPA. DOE-ID has provided the reconciliation records and the EPA has concurred that the potential deficiencies no longer exist. The State of Idaho routinely observes underground storage tank closure and remediation.

7.2.5.9 INEL Federal Facility Compliance Act Status. The DOE is developing an inventory of the mixed waste subject to the Federal Facility Compliance Act. The Interim Mixed Waste Inventory Report was completed and published by the DOE in April 1993. The Final Mixed Waste Inventory Report is scheduled to be completed during the Spring of 1994. In coordination with the development of the Interim Mixed Waste Inventory Report and the Final Mixed Waste Inventory Report, the DOE is developing a Site Treatment Plan that will identify the selected treatment for DOE's mixed waste streams. The Conceptual Site Treatment Plan was completed during October 1993. In accordance with DOE's Federal Register Notice of April 6, 1993, 58 FR 17875, the Draft Site Treatment Plan will be completed before August 1994. The Final Site Treatment Plan is scheduled to be completed before February 1995. The Consent Order based on the Site Treatment Plan will be completed before October 1995.

7.2.5.10 Transportation Requirements. All transport of hazardous and radioactive materials that takes place offsite (that is, on public roads) is in compliance with U.S. Department of Transportation and U.S. Nuclear Regulatory Commission requirements.

7.2.5.11 Water Quality and Wastewater Land Application. Separate from the Clean Water Act, the State of Idaho has a program that provides for the protection of all "waters of the

State." Specifically, water quality standards established by the State of Idaho are met for current operations at the INEL. In addition, DOE-ID is in the process of obtaining wastewater land application permits for appropriate facilities at the INEL. Table 7.2-5 indicates those permits that have been issued in draft and those that have been applied for.

Tahle 7.2-5. Wastewater Land Application Permit (WLAP) status.

Permit no.	Regulatory	Permit type	Facility permitted	Application date	Date issued
LA-000130	DEQ[a]	WLAP	Idabo Chemical Processing Plant Percolation Ponds	August 1992	January 1995
LA-000115	DEQ	WLAP	Idabo Chemical Processing Plant Sewage Treatment Plant Infiltration Trenches	September 1992	January 1995
	DEQ	WLAP	Central Facilities Area Sewage Treatment Plant Sprinkler System	August 1993	
	DEQ	WLAP	Test Area North Sewage Treatment Plant Infiltration Pond	In preparation	

a. Division of Environmental Quality (State of Idaho).

7.3 Environmental Permits and Licenses

This section lists, by project in Table 7.3-1, the Federal permits, licenses, and other entitlements that may be required to implement the proposed actions. Because some of the proposed actions are not yet clearly defined, it is not certain whether permits will be required for some of the proposed facilities. As such, this list is not complete or absolute, and the requirements listed may be deleted, modified, or supplemented as further information becomes available. Appendix C, Information Supporting the Alternatives, gives more details on the individual projects listed in the table.

The permitting requirements are described in a general manner. For example, the designation of "solid and hazardous waste" would encompass any permitting requirements under the Resource Conservation and Recovery Act, or any state solid or hazardous waste permitting requirements. "Air" would include any permitting requirements under the Clean Air Act or state equivalent, and would also include any approvals needed to be obtained, such as the approvals required under the National Emissions Standards for Hazardous Air Pollutants program. Finally, "water" would encompass any permitting requirements under the Clean Water Act, and related programs, including the National Pollutant Discharge Elimination System (NPDES in general and storm water discharge permits), wastewater land application permits (specific to the State of Idaho), and any approvals required under the Safe Drinking Water Act.

Table 7.3-1. Project-specific list of permits, licenses, and so forth, that may be required.

Project	Solid & hazardous waste	Air	Water
Expended Core Facility Dry Cell Project		X	
Increased Rack Capacity for Building CPP-666		X	
Additional Increased Rack Capacity (CPP-666)		X	
Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization & Shipping		X	
Fort St. Vrain Spent Nuclear Fuel Receipt & Storage		X	
Spent Fuel Processing	X	X	
Experimental Breeder Reactor-II Blanket Treatment		X	
Electrometallurgical Process Demonstration		X	
Central Liquid Waste Processing Facility Decontamination & Decommissioning (D&D)		X	
Engineering Test Reactor D&D			
Materials Test Reactor D&D			
Fuel Processing Complex (CPP-601) D&D	X		
Fuel Receipt/Storage Facility (CPP-603) D&D	X		
Headend Processing Plant (CPP-640) D&D	X		
Waste Calcine Facility (CPP-633) D&D	X	X	
Tank Farm Heel Removal Project	X	X	
Waste Immobilization Facility	X	X	
High-Level Tank Farm New Tanks	X	X	
New Calcine Storage	X	X	
Radioactive Scrap/Waste Facility			
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	X	X	X
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	X	X	X
Idaho Waste Processing Facility	X	X	X
Shipping/Transfer Station		X	
Waste Experimental Reduction Facility Incineration	X	X	
Mixed/Low-Level Waste Treatment Facility	X	X	X
Mixed/Low-Level Waste Disposal Facility	X	X	X
Nonincinerable Mixed Waste Treatment	X	X	
Remote Mixed Waste Treatment Facility	X	X	X

Table 7.3-1. (continued).

Project	Solid & hazardous waste	Air	Water
Sodium Processing Project	X	X	
Greater-Than-Class-C Dedicated Storage	X	X	
Hazardous Waste Treatment, Storage, and Disposal Facilities	X	X	X
Industrial/Commercial Landfill Expansion	X		
Gravel Pit Expansions		X	X
Central Facilities Area Clean Laundry and Respirator Facility		X	
Calcine Transfer Project (Bin Set #1)		X	
Plasma Hearth Process Project	X	X	X

8. INDEX

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APPENDIX A
PRIMER ON RADIOACTIVITY AND TOXICOLOGY

This appendix gives a brief introduction to radioactivity and toxicology. In the radioactivity section, topics covered include radioactive decay, fission, radioactive wastes, and units and categories of exposure [taken from WINCO (1988)]. In the toxicology section, topics covered include definitions of toxic and toxicology, how substances or materials can be toxic, major types of toxic substances and wastes, and major factors in determining toxicity. In addition to the sections covering these topics, a third section discusses exposure pathways, which have the same attributes whether the source of the exposure is radioactive or toxic.

A-1 Radioactivity

Through natural or man-made processes, atoms of elements can be put in an unstable state. When an atom is in an unstable state, its nucleus (which is made up of protons and neutrons) will undergo a process of change by releasing energy in order to achieve stability. This change can come about through either radioactive decay or fission.

Radioactive decay is the process whereby the nuclei (plural of nucleus) of unstable atoms emit energy in the form of subatomic-sized particles or light-like waves in order to become stable. As this emitted energy, termed ionizing radiation, passes through a material, it can change the chemical structure and behavior of the material's atoms. It is through this process of chemical structure change that radiation can lead to biological damage in humans. The level of damage depends on several factors, including the amount of energy absorbed.

Radioactive decay produces three main types of ionizing radiation—alpha particles, beta particles, and gamma rays. None can be detected by our senses. These types can each have different levels of energy and thus have varying abilities to penetrate and harm the human body. Because each type has different characteristics, different amounts of material must be used to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped, or shielded, by thin layers of material such as a single sheet of paper. Shielding for beta particles requires thicker material, such as several reams of paper or several inches of wood or water. For gamma rays, which are highly penetrating, very thick material is required, such as several feet of paper or several inches of concrete or lead.

Fission is the process whereby a large nucleus (for example, uranium-235) absorbs a neutron and splits into two fragments, resulting in the release of energy. In each fission, two or three neutrons are released, on the average, which may go on to produce fissions of nearby nuclei. If in fact one or more of the released neutrons go on to cause additional fissions, and the process is repeated again and again, the effect is a self-sustained chain reaction, and a condition called criticality. When the tremendous energy released in fission is controlled (as in a nuclear reactor), it can be used for various benefits, such as to propel submarines or to provide electricity that can light and heat homes.

Radiation occurs on earth in many forms, both natural and man-made. Natural forms include light, heat from the sun, and the decay of radioactive elements in the earth's crust. Radioactivity even exists naturally within the human body, mostly from potassium, which is an essential element for health. Man has also deliberately created sources of ionizing radiation for various uses, such as nuclear-power generation, diagnostic and therapeutic medicine, nondestructive testing of pipes and welds, and nuclear materials related to the production of atomic weapons.

Radioactive waste is another possible product of activities dealing with radioactivity. The Department of Energy (DOE) manages various types of radioactive wastes, mostly generated by weapons production and nuclear-power research programs. Such wastes are classified as low-level, transuranic, or high-level. Also managed by DOE is spent nuclear fuel, which has been used as the fuel in a nuclear reactor and is highly radioactive (though not officially regarded currently as "waste"). Low-level waste is the least dangerous of these and can in some cases be handled with no shielding other than that provided by the waste's container. Transuranic waste, high-level waste, and spent nuclear fuel are more dangerous and require special handling procedures, shielding, and other measures to isolate them from people and the environment.

Special units are used to measure radiation and its effects. The most common units are roentgen, radiation absorbed dose (rad), roentgen equivalent man (rem), and person-rem.

The roentgen measures the amount of electrical charge (or ionization) produced by x-rays or gamma radiation in air. Rad is the amount of energy absorbed by a material. Neither the roentgen nor the rad gives an indication of biological damage. The rem equates the biological damage done to organisms regardless of the type of ionizing radiation absorbed. For external radiation exposure from gamma rays, roentgen, rad, rem, and effective dose equivalent are approximately equal. (See below for a definition of effective dose equivalent.) Person-rem is a unit of collective radiological dose, that is, the collective total dose to a population. Person-rem is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem (100 millirem), then the collective dose would be 10 person-rem (100 persons x 0.1 rem). Current regulatory limits, as well as limits described in Volume 2 of this EIS, are expressed in effective dose equivalent.

The biological effects of ionizing radiation vary according to the type of radiation, the dose received, and the type of cell affected. Any dose of radiation can damage body cells. However, at low radiation levels, such as those administered to patients receiving x-rays or those received by workers handling radioactive wastes, damage to cells is so slight that they can usually either repair themselves or be replaced by the regeneration of healthy cells.

Effective dose equivalent is another key term used in the radiological protection field to describe the damage that radiation exposure can do to the body. The effective dose equivalent measures the damage to the exposed individual's total body due to radiation exposure. The effective dose equivalent can be used to estimate the exposed individual's risk of health effects. Effective dose equivalent takes account of variables such as different susceptibilities of body tissues to different forms of radiation. The effective dose equivalent is often referred to simply as dose.

Exposures are often classified into two categories—acute exposure, which is a large dose received over a few hours or less; and chronic exposure, which involves repeated small doses over a long time (months to years). Chronic doses are usually less harmful than acute doses because the time between exposures at low dose rates allows the body time to repair damaged cells.

A-2 Toxicology

When certain natural or man-made materials or substances have harmful effects that are not random or not solely at the site of contact, the materials or substances can be described as toxic (Ottoboni 1991). Toxicology is a branch of science dealing with the toxic effects that chemicals or other substances may have on living organisms.

Chemicals can be toxic for many reasons, including their ability to cause cancer; to harm or destroy tissue or organs; or to harm body systems such as reproductive, immune, blood-forming, or nervous systems (Ottoboni 1991). The following list gives a brief definition and examples of three types of substances that can be toxic:

- *Carcinogens* are substances known to cause cancer in humans or to cause cancer in animals and therefore may be capable of causing cancer in humans. Examples of generally accepted human carcinogens include asbestos, benzene, and vinyl chloride (Kamrin 1988).

- Some *chemicals* in controlled studies have been shown to cause a harmful or fatal effect. Examples include metals such as cadmium, lead, and mercury; strong acids such as nitric acid and sulfuric acid; some welding fumes; coal dust; sulfur dioxide; and some solvents (Ottoboni 1991).

- Some *biological materials* that may be toxic include various body fluids and tissues and infectious agents (Ottoboni 1991).

Some waste materials contain substances that may be toxic if not handled properly. Wastes are substances that are no longer useful or that may be discarded from manufacturing, maintenance, construction, or research operations. Some wastes contain toxic materials to which the public may be exposed if the waste is not treated, stored, or disposed of properly, so their handling and care is especially important.

There are two major types of nonradioactive wastes—industrial/commercial solid waste (at the INEL, this is called INEL industrial waste) and hazardous waste. Industrial/commercial solid waste is waste generated by manufacturing or industrial processes that do not contain hazardous ingredients. Hazardous waste is any waste that is either characteristically hazardous or is listed as hazardous by the Resource Conservation and Recovery Act. Examples of hazardous waste include metals, such as selenium, arsenic, lead, and mercury, and organic compounds, such as carbon tetrachloride and trichloroethylene.

Even though chemicals can be toxic, many factors influence whether inhalation or ingestion of a particular substance has a toxic effect on humans (Ottoboni 1991). These factors include (a) how much of the substance the person comes into contact with, (b) whether the person inhales or ingests a relatively large amount of the substance in a short time (called acute exposure) or a relatively small amount repeatedly (called chronic exposure), and (c) the period of time over which the exposure occurs.

Scientists determine a substance's toxic effect (or toxicity) by performing controlled tests on animals. In addition to environmental and physical factors, these tests help establish three other important factors that are considered when measuring toxicity—dose-response relationship, threshold concept, and margin of safety (Ottoboni 1991). The dose-response relationship is established as a result of controlled tests on animals. It relates percentage of animals with observable toxic effects to dose administered. Once an initial dose is administered, it is increased or decreased until, at the upper end, all animals are affected and, at the lower end, no animals are affected. The threshold concept means that most toxic chemicals will produce no effect if present in small enough amounts. Thus, there is a threshold of effect or a "no-effect level." Margin of safety is an arbitrary separation between the highest exposure level producing no adverse effect in any test animal species and the exposure level that has been estimated to be safe for humans. No margin of safety has been universally established. For some chemicals, a small margin of safety is sufficiently protective but for others a larger margin is required. The importance of margin of safety is that all factors related to the use of the chemical are taken into account so that a permissible exposure level is set well into the no-effect range.

To ensure protection of the health and safety of workers and the public, companies develop programs that help keep toxic exposures to a minimum. In some cases, specific levels are set by government or professional organizations. In others, the protection guideline is more strict than a set exposure level. In any case, the greater the health hazard, the greater the level of protection required. For many toxic substances, the level of protection allows no exposure under normal conditions and much effort is made to ensure no exposure will result from accidents.

A-3 Exposure Pathways

Normal and emergency operations at some DOE facilities have the potential to expose workers or members of the public to radioactive or toxic materials. To maintain high levels of safety, specialists analyze exposure scenarios possible for normal operations and accidents. The materials involved and appropriate protective measures are also considered. The term used to describe these scenarios is "environmental exposure pathways." The following describes the four conditions that must exist to form a pathway by which radioactive or toxic materials can be transported through the environment to workers or the public (Maheras and Thorne 1993):

1. Source term - This is the material released to the environment, including the amount of radioactivity (if any) or mass of material, the physical form (solid, liquid, gas), particle size distribution, and chemical form.

2. Environmental transport medium - This can be air, surface water, groundwater, or the food chain.

3. Exposure route - This is the method by which a person can come into contact with the material, for example, external exposure from contaminated ground or immersion in contaminated air or internal exposure from inhalation or ingestion of radioactive or toxic material.

4. Human receptor - This is the person or persons potentially exposed. The level of exposure depends on such factors as location, duration of exposure, time spent outdoors, and dietary intake.

These four elements define an exposure pathway. For example, one scenario might involve gases released from a stack as the source term, air as the transport medium, external gamma exposure from the passing cloud as the exposure route, and an onsite worker as the human receptor. Another scenario might involve a volatile organic compound as the source term, groundwater as the transport medium, ingestion of contaminated drinking water as the exposure route, and an offsite member of the public as the human receptor. No matter which pathway the scenario involves, local factors, such as water sources, agriculture, and weather patterns, also play a big role in determining the pathway's importance to potential exposures.

A-4 References

Kamrin, M. A., 1988, *Toxicology--A Primer on Toxicology Principles and Applications*, Chelsea, Michigan: Lewis Publishers, Inc.

Maheras, S. J. and D. J. Thorne, 1993, *New Production Reactor Exposure Pathways at the Idaho National Engineering Laboratory*, EGG-NPR-8957, EG&G Idaho, Inc., January.

Ottoboni, M. A., 1991, *The Dose Makes the Poison: A Plain-Language Guide to Toxicology*, second edition, New York: Van Nostrand Reinhold.

WINCO (Westinghouse Idaho Nuclear Co., Inc.), 1988, *Introduction to Radiological Safety: Study Guide*, Rev. 2, Idaho Falls, Idaho.

APPENDIX B
CONSULTATION LETTERS

This appendix includes consultation/approval letters between the U.S. Department of Energy (DOE) and the U.S. Department of the Interior, Fish and Wildlife Service, regarding threatened and endangered species, and between other State and Federal agencies as needed. Letters currently supplied are from the U.S. Department of the Interior, Fish and Wildlife Service, to DOE.

Also included in Appendix B is a description of the public involvement process and correspondence documenting consultation meetings held between DOE and various concerned agencies.

B-1 Consultation/Approval Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Idaho State Office, Ecological Services
4696 Overland Road, Room 576
Boise, Idaho 83705

RECEIVED
JAN 30 1995

January 24, 1995

Tim Reynolds
Environmental Science Research Foundation
101 South Park Suite #2
P.O. Box 51838
Idaho Falls, Idaho 83405-1838

Subject: INEL-DOE Species List Update
(SP# 1-4-95-SP-80/Updates SP# 1-4-94-46/506.0000)

Dear Mr. Reynolds:

As requested by your telephone call on January 11, 1995, we have attached a list (Enclosure 1) of endangered and threatened, proposed and/or candidate species that may be present in the proposed project area. The list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973 (Act), as amended. The requirements for Federal agency compliance under the Act are outlined in Enclosure 2. Please reference the species list number on Enclosure 1 in all subsequent correspondence, reports, environmental assessments, environmental impact statements, biological assessments (evaluations), Coordination Act reports, etc. If a construction project is not commenced within 180 days of this response, a subsequent species list request is required by regulations. This letter updates the Service's species list response of January 26, 1994, SP# 1-4-94-46.

If a listed species appears on Enclosure 1, a biological assessment (evaluation) would be prudent. Should your biological assessment (evaluation) determine that a listed species is likely to be affected adversely by the project, the Environmental Science Research Foundation should request formal Section 7 consultation through this office. If a proposed species is likely to be jeopardized by a Federal action, regulations require a conference between the Federal agency and the Service.

Candidate species that may appear on Enclosure 1 have no protection under the Act, but are included for early planning consideration. Proposed species could be formally listed and candidate species could be formally proposed and listed during project planning, thereby falling within the scope of Section 7 of the Act. Therefore, if they appear on Enclosure 1, we recommend that additional surveys be made for proposed and/or candidate species that are likely to be in your project area. If the project is likely to adversely impact candidate species, informal consultation with this office is recommended.

If you have any questions regarding Federal consultation responsibilities under the Act, please contact Alison Beck Haas of this office at (208) 334-1931.

Thank you for your continued interest in the Endangered Species Program.

Sincerely,

for Susan B. Martin

Charles H. Lobdell
State Supervisor-Ecological Services

Enclosures

cc: IDFG, Hdqtrs., Boise
IDFG, Region 6, Idaho Falls

ENCLOSURE 1

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR WITHIN THE AREA OF THE INEL-DOE PROJECT AREAS
FWS-1-4-95-SP-80

LISTED SPECIES	COMMENTS
Bald Eagle (LE) (Haliaeetus leucocephalus)	Occasionally winter on part of INEL
PROPOSED SPECIES	
None	
CANDIDATE SPECIES	
Burrowing Owl (C2) (Athene cunicularia)	
Ferruginous Hawk (C2) (Buteo regalis)	
Long-eared Myotis (C2) (Myotis evotis)	
Small-footed Myotis (C2) (Myotis subulatus)	
Idaho pointheaded grasshopper (C2) (Acrolophitus punchellus)	Occur just north of INEL
Townsend's big-eared Bat (C2) (Plecotus townsendii)	Also State species of special concern status
Pygmy Rabbit (C2) (Brachylagus idahoensis)	Also State species of special concern status

Painted milkvetch (3c) (*Astragalus ceramicus* var. *apus*)	Also State species INPS monitor status

OTHER SPECIES OF CONCERN

Merriam's Shrew (*Sorex merriami*)	State protected species
Long-billed curlew (*Numenius americanus*)	State protected species
King's bladderpod (*Lesquerella kingii* var. *cobrensis*)	State INPS monitor species
Nipple cactus (*Coryphantha missouriensis*)	State INPS monitor species
Sepal-tooth dodder (*Cuscuta denticulata*)	State INPS 1 species
Lemhi milkvetch (*Astragalus aquilonius*)	State INPS sensitive species
Winged-seed evening primrose (*Camissonia pterosperma*)	State INPS sensitive species
Spreading gila (*Ipomopsis polycladon*) (Gilia polycladon)	State INPS 2 species
Tree-like oxyytheca (*Oxytheca dendroidea*)	State INPS sensitive species

GENERAL COMMENTS

C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

INPS M = Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats.

INPS S = Sensitive Taxa with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats.

INPS 1 - State Priority 1 Taxa in danger of becoming extinct or extirpated from Idaho in the foreseeable future if identifiable factors contributing to their decline continue t operate; these are taxa whose populations are present only at critically low levels or whose habitats have been degraded or depleted to a significant degree.

INPS 2 = State Priority 2 Taxa likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to their population decline or habitat degradation or loss continue.

ENCLOSURE 2

FEDERAL AGENCIES' RESPONSIBILITY UNDER SECTIONS 7(a) AND (c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species; or result in destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Major Construction Activities [1/]

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action[2/] on listed and proposed species. The process begins with a Federal agency in requesting from FWS a list of proposed and listed threatened and endangered species (list attached). If the BA is not initiated within 90 days of receipt of the species list, the accuracy of the species list should be informally verified with our Service. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

We recommend the following for inclusion in the BA; an onsite inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

---

[1] A major construction activity is a construction project (or other undertaking having similar physical impacts) which is a major action significantly affecting the quality of human environment as referred to in the NEPA (42 U.S.C. 4332 (2)(c).

[2] "Effects of the action" refers to the direct and indirect effects on an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Idaho State Office, Ecological Services
4696 Overland Road, Room 576
Boise, Idaho 83705

January 26, 1994

Dr. Tim Reynolds
Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

Subject: INEL Species List Update
SP# 1-4-94-SP-46/updates 1-4-93-SP-362 File # 506.0000

Dear Dr. Reynolds:

The U.S. Fish and Wildlife Service (Service) is writing to update the species list SP-1-4-93-362 for the Department of Energy. That list is enclosed for your information. There are no additions or changes to the list; the previous list continues to fulfill the requirements of the Service under Section 7(c) of the Endangered Species Act of 1973 (Act), as amended. This officially updates the list as of the date of this letter, and provides you with a new reference number SP-1-4-94-46. You should refer to the new species list number in all subsequent correspondence and documentation.

Information regarding Federal agency obligations under the Act, biological assessments, and candidate species has been provided to you in previous correspondence from this office. If you have further questions, or would like the information sent to you again, please contact RIchard Howard of this office at 208-334-1931.

Thank you for your continued interest in the Endangered Species Program.

Sincerely,

Charles H. Lobdell
State Supervisor

Enclosure

cc: FWS-ES, Portland
IDFG-HQ, Boise
IDFG-Reg. 6, Idaho Falls

ENCLOSURE 1

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR WITHIN THE AREA OF THE INEL PROJECTS
FWS-1-4-94-SP-46/UPDATES 1-4-93-SP-362

LISTED SPECIES	COMMENTS
Bald Eagle (*Haliaeetus leucocephalus*)	Wintering area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbitt (C2)
(*Brachylagus idahoensis*)

Loggerhead Shrike (C2)
(*Lanius ludovicianus*)

Townsend's Big-eared Bat (C2)
(*Plecotus townsendii*)

Ferruginous Hawk (C2)
(*Buteo regalis*)

Long-billed Curlew (3c)
(*Numenius americanus*)

Painted milkvetch (3c)
(*Astragalus ceramicus* var. *apus*)

GENERAL COMMENTS

C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

3c = Category 3 Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

ENCLOSURE 2

FEDERAL AGENCIES' RESPONSIBILITY UNDER SECTIONS 7(a) AND (c)
OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangerec threatened species to insure that any action authorized, funded or carried out by a Fede: agency is not likely to jeopardize the continued existence of listed species; or result i destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modificatic of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Major Construction Activities [1/]

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for m construction activities. The BA analyzes the effects of the action[2/] on listed and propo species. The process begins with a Federal agency in requesting from FWS a list of prop and listed threatened and endangered species (list attached). If the BA is not initiate within 90 days of receipt of the species list, the accuracy of the species list should b informally verified with our Service. The BA should be completed within 180 days after initiation (or within such a time period as is mutually agreeable). No irreversible commitment of resources is to be made during the BA process which would foreclose reason. and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

We recommend the following for inclusion in the BA; an onsite inspection of the area to affected by the proposal which may include a detailed survey of the area to determine if species are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities and others who have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration cumulative effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discuss of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

[1/] A major construction activity is a construction project (or other undertaking havinc similar physical impacts) which is a major action significantly affecting the quality of human environment as referred to in the NEPA (42 U.S.C. 4332 (2)(c).

[2/] "Effects of the action" refers to the direct and indirect effects on an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Boise Field Station
4696 Overland Road, Room 576
Boise, Idaho 83705

DEC 21 199

December 15, 1992

R. S. Rothman
EIS Project Manager
Department of Energy
785 DOE Place
Idaho Falls, Idaho 83401

Subject: EIS - Environmental Restoration
and Waste Management (506.0110/1019.2036/ER 92/0911)

Dear Mr. Rothman:

The U. S. Fish and Wildlife Service is writing in response to your letter of November 10, 1992 concerning the preparation of an Environmental Impact Statement (EIS) for the Environmental Restoration and Waste Management (ER&WM) activities at the Idaho National Engineering Laboratory. On November 4, 1992 we responded with scoping statements to the Notice of Intent to Prepare an EIS and sent it to your office. This letter amends those scoping statements by providing a list of threatened, endangered and candidate species that are found in the area. For further information please contact Bill Mullins or Rich Howard of my staff at 208/334-1931.

Sincerely,

Charles H. Lobdell
Field Supervisor

cc: 8FA (ERT), Washington, D.C.
FWS-FWE, Portland

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR WITHIN THE AREA OF THE DEPARTMENT OF ENERGY'S IDAHO NATIONAL ENGINEERING LABORATORY SITE
FWS-1-4-93-SP-84

LISTED SPECIES	COMMENTS
Bald Eagle (*Haliaeetus leucocephalus*)	Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbit (C2)
(*Brachylagus idahoensis*)

Loggerhead Shrike (C2)
(*Lanius ludovicianus*)

Townsend's Big-eared Bat (C2)
(*Plecotus townsendii*)

Long-billed Curlew (3c)
(*Numenius americanus*)

Ferruginous Hawk (C2)
(*Bueto regalis*)

Painted milkvetch (3c)
(*Astragalus ceramicus* var. *apus*)

OTHER SPECIES

Lemhi milkvetch (*Astragalus aquilonius*)	USFS/BLM Sensitive
Plains milkvetch (*Astragalus gilviflorus*)	USFS/BLM Sensitive
Thistle milkvetch (*Astragalus kentrophyta* var. *jessiae*)	BLM Sensitive
Winged-seed evening primrose (*Camissonia pterosperma*)	BLM Sensitive
Nipple cactus (*Coryphantha missouriensis*)	INPS Monitor Species
Large-flowered gymnosteris (*Gymnosteris nudicaulis*)	BLM Sensitive
Spreading gilia (*Ipomopsis polycladon*)	BLM Sensitive
King's bladderpod (*Lesquerella kingii* var. *cobrensis*)	INPS Monitor Species
Tree-like oxytheca (*Oxytheca dendroidea*)	BLM Sensitive

GENERAL COMMENTS:

C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

C3 = Category 3 Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

Sensitive Species - USFS Those animal species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward-trends in population numbers or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Sensitive Species - BLM Sensitive species are those designated by the state director, usually in cooperation with the state agencies responsible for managing the species as sensitive. They are those species that are 1) under status review by USFWS/NMFS; or 2) whose numb
federal listing may become necessary; or 3) with typically small and widely dispersed populations; or 4) those inhabiting ecological refugia or other specialized or unique habitats.

INPS M = Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

April 26, 1994

Charles H. Lobdell
Field Supervisor
US Fish and Wildlife Service
4696 Overland Road, Room 576
Boise ID 83705

SUBJECT: Species List Update Request for the Spent Nuclear Fuel (SNF) and Environmental Restoration and Waste Management (ER & WM) Environmental Impact Statement (EIS) (OPE-EIS-94.235)

Dear Mr. Lobdell:

We are in receipt of your letter dated December 15, 1992, which provides a list of threatened, endangered, and candidate species for the above referenced project at the Idaho National Engineering Laboratory (INEL). Due to the length of time since the last request for information, we are formally requesting an update for any changes in species' status or additional available information regarding critical habitats. Thank-you for your consideration.

Sincerely,

Roger Twitchell
Acting NEPA Compliance Officer
EIS Project Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Idaho State Office, Ecological Services
4696 Overland Road, Room 576
Boise, Idaho 83705

May 18, 1994

Roger Twitchell
Acting NEPA Compliance Officer
Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

Subject: Species List Update for Environmental Restoration and Waste Management
(SP# 1-4-94-SP-142/File# 506.0110)

Dear Mr. Twitchell:

The U.S. Fish and Wildlife Service (Service) is writing to provide you with an updated list of threatened, endangered, candidate, and proposed species which may occur on the project site at the Idaho National Engineering Laboratory. You requested the update in a letter to our office on April 26, 1994. There are no additions or changes to the previous list. This letter officially updates species list number 1-4-93-SP-84 and provides you with a new number 1-4-94-SP-142. You should refer to the new number in subsequent correspondence and documents.

Information concerning Federal agency obligations under the Endangered Species Act have been provided to you in the past. If you would like us to send you any of this information again or if you have questions, please contact Alison Beck Haas of my staff at (208)334-1931.

Thank you for your continued interest in the endangered species program.

Sincerely,

Susan B. Martin
for Charles H. Lobdell
State Supervisor, Ecological Services

Enclosure

cc: FWS-ES, Portland

ENCLOSURE

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE DEPARTMENT OF ENERGY'S IDAHO NATIONAL ENGINEERING LABORATORY SITE
SP# 1-4-94-SP-142

LISTED SPECIES	COMMENTS
Bald Eagle (*Haliaeetus leucocephalus*)	Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbit (C2)
(*Brachylagus idahoensis*)

Loggerhead Shrike (C2)
(*Lanius ludovicianus*)

Townsend's Big-eared Bat (C2)
(*Plecotus townsendii*)

Long-billed Curlew (3c)
(*Numenius americanus*)

Ferruginous Hawk (C2)
(*Buteo Regalis*)

Painted Milkvetch (3c)
(*Astragalus ceramicus* var. *apus*)

OTHER SPECIES	
Lemhi Milkvetch (*Astragalus aquilonius*)	USFS/BLM Sensitive
Plains Milkvetch (*Astragalus gilviflorus*)	USFS/BLM Sensitive
Thistle Milkvetch (*Astragalus kentrophyta* var. *jessiae*)	BLM Sensitive

Winged-seed Evening Primrose (<u>Camissonia pterosperma</u>)	BLM Sensitive
Nipple Cactus (<u>Coryphantha missouriensis</u>)	INPS Monitor Species
Large-flowered Gymnosteris (<u>Gymnosteris nudicaulis</u>)	BLM Sensitive
Spreading Gilia (<u>Ipomopsis polycladon</u>)	BLM Sensitive
King's Bladderpod (<u>Lesquerella kingii</u> var. <u>cobrensis</u>)	INPS Monitor Species
Tree-like Oxytheca (<u>Oxytheca dendroidea</u>)	BLM Sensitive

GENERAL COMMENTS:

C2 = <u>Category 2</u> Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

3c = <u>Category 3</u> Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

Sensitive Species - <u>USFS</u> Those animal species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Sensitive Species - <u>BLM</u> Sensitive species are those designated by the state director, usually in cooperation with the state agencies responsible for managing the species as sensitive. They are those species that are: 1) under status review by the Service/National Marine Fisheries Service; or 2) whose numbers are declining so rapidly that federal listing may become necessary; or 3) with typically small and widely dispersed populations; or 4) those inhabiting ecological refugia or other specialized or unique habitats.

INPS M = Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

May 26, 1994

Ms. Mollie Beattie, Director
U. S. Fish and Wildlife Service
1849 C Street NW, MIB 3012
Washington, D. C. 20240

Subject: Department of Energy (DOE) Consultation Strategy in Conjunction with the Preparation of a Draft Programmatic Environmental Impact Statement (EIS). (OPE-EIS-94.302)

Dear Ms. Beattie:

The DOE Idaho Operations Office is preparing a draft EIS for DOE Programmatic Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory (INEL) Environmental Restoration and Waste Management (ER&WM) Programs.

The EIS is organized into two separate volumes. Volume I addresses programmatic spent nuclear fuel management for the entire DOE complex. Volume II covers spent nuclear fuel management and ER&WM management actions within the boundaries of the INEL. In order to fulfill our responsibilities to consult under the National Environmental Policy Act (NEPA) and the Endangered Species Act, we requested an updated species list for INEL and the surrounding area from the USFWS Idaho State Supervisor for Ecological Services. Our request was mailed on April 26, 1994 and the updated species list was received in our office May 23, 1994.

Volume I of the EIS deals with Programmatic Spent Nuclear Fuel issues that involve five DOE sites and five Navy sites. We have not specifically requested species lists in conjunction with the preparation of Volume I, although recent USFWS species lists were among the resources used in characterizing the sites and analyzing potential impacts to threatened and endangered species. Site specific NEPA documents will be prepared for actions based on decisions derived from the final programmatic EIS. It is our strategy to request species lists for these more detailed site specific environmental reviews.

We fully recognize our responsibility under NEPA and the Endangered Species Act to consult with your agency. This letter is to inform you of our strategy with regard to the programmatic aspects of this EIS.

The draft EIS will be available for your review in early July 1994 through Lillian Stone's office of the Department of Interior (DOI) and we look forward to your review and comments through DOI's consolidated response. If you have any questions concerning this or related matters please contact me at (208) 526-0776.

Sincerely,

Roger Twitchell

Roger Twitchell
Acting NEPA Compliance Officer

B-2 Public Involvement

In scoping this Environmental Impact Statement (EIS), DOE actively solicited comments from a wide group of interested parties. A Notice of Intent, announcing the scoping period for a programmatic EIS addressing environmental restoration and waste management activities (including spent nuclear fuel management) across the entire DOE complex, was published by DOE in the *Federal Register* (see 55 FR 204; October 22, 1990; p. 42633), as required under the National Environmental Policy Act. Written comments, as well as oral comments received at 23 public scoping meetings, were received in response to this announcement. Comments were received on the Draft Implementation Plan for the DOE Programmatic EIS during six regional workshops held across the country in early 1992. In October 1992, a Notice of Intent was published in the *Federal Register* (see 57 FR 193; October 5, 1992; p. 45773), addressing the Idaho National Engineering Laboratory (INEL) environmental restoration and waste management and spent nuclear fuel activities. Five scoping meetings were subsequently held throughout Idaho at which additional comments were received.

A Notice of Opportunity to Comment, announcing DOE's intention to expand the scope of the ongoing Spent Nuclear Fuel (SNF) and INEL EIS to include a review of spent nuclear fuel management alternatives across the entire DOE complex, was published in the *Federal Register* (see 58 FR 170; September 3, 1993; p. 46951). Government agencies and the public were invited to comment on the expanded scope. The Notice of Opportunity included a toll-free telephone number to which comments could be sent by facsimile, oral comments could be recorded for later transcription, or information could be requested. To facilitate the scoping and public involvement process, DOE has compiled a mailing list that contains the addresses of interested agencies, organizations, and individuals. As a result of this effort, numerous comments have been received that have contributed to EIS planning.

As a result of the scoping process and related activities, DOE developed its mailing list of potentially interested parties for the initial distribution of the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement (SNF and INEL EIS). This list for the draft EIS includes more than 1000 Federal, State, and local agencies; public organizations; and private citizens to whom the EIS (or a Summary only, if so requested) was made available for review and comment during tbe comment period. The list was updated based on responses to tbe Notice of Availability for tbe draft EIS.

B-3 Agency Meetings

The EIS Project Office has reviewed all comments received on tbe draft SNF and INEL EIS. To more fully understand, evaluate, and consider certain agency comments, consultations have taken place among agency, INEL, and Navy officials. In addition to addressing specific comments on tbe draft SNF and INEL EIS, tbese consultations helped promote a mutual understanding of DOE issues important to tbe agencies. Continued consultation between tbese agencies and tbe Federal government enhances tbe knowledge and expertise of botb and promotes botb informed decisionmaking and effective mitigation of potential impacts from tbe proposed actions. Table B-1 shows tbe dates and locations of tbe meetings held witb tbe various agencies. Meeting correspondence follows on subsequent pages.

Table B-1. Meetings held in response to agency comments on tbe Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement.

Agency	Location	Date
Defense Nuclear Facilities Safety Board	Washington, D.C.	November 9, 1994
Environmental Protection Agency	Washington, D.C.	December 15, 1994
Center for Disease Control	Conference call	November 22, 1994
Council on Environmental Quality	Washington, D.C.	December 21, 1994
Seneca Nation of New York	New York	January 10, 1995
Shoshone-Bannock Tribes of Idaho	Fort Hall, Idaho	December 2, 21, and 29, 1994 January 10, 1995

Department of Energy
Washington, DC 20585

JAN 20 1995

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, DC 20004

Dear Mr. Chairman:

Thank you very much for the Defense Nuclear Facilities Safety Board (DNFSB) staff participation in the meeting held November 9, 1994. The Department of Energy (DOE) requested that meeting with the goal of resolving, where possible, your September 30, 1994, comments on the Spent Nuclear Fuel and Idaho National Engineering Laboratory Draft Environmental Impact Statement (EIS). The Department desired, by bringing our respective staffs together, to glean further insight into the bases of DNFSB's comments and to exchange technical information regarding the DOE's analytical approach in the Draft EIS. The results of our meeting should enhance the quality of the information presented to the DOE decisionmakers and the public in the Final EIS.

The purpose of this follow-up letter is to summarize our discussions and agreements during the meeting. The enclosed Comment Resolution Summary constitutes DOE's understanding of what was discussed and agreed to during our meeting, as well as the Department's proposed action to resolve the DNFSB technical comments. We would appreciate confirmation of the acceptability of the proposed resolution of your comments. Thank you again for the Board's participation in this process.

Sincerely,

Jill E. Lytle
Deputy Assistant Secretary
for Waste Management
Environmental Management

Enclosure

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

February 17, 1995

Mr. Andrew Stadnik
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W., Suite 700
Washington, D. C. 20004

SUBJECT: Resolution of Defense Nuclear Facilities Safety Board (DNFSB) Comment on the Multifacility Accident Assessment in the Department of Energy (DOE) Spent Nuclear Fuel Management (SNF) and Idaho National Engineering Laboratory (INEL) Draft Environmental Impact Statement (EIS) (OPE-EIS-95.051)

Dear Mr. Stadnik:

Enclosed are the more detailed information the Department of Energy committed to providing during the November 9, 1994, meeting between the DOE and the DNFSB on DNFSB comment number B.1 (multifacility accident assessment).

Three enclosures are included. The first is a copy of the comment B.1 resolution summary that was transmitted to Mr. J. Conway, DNFSB Chairman, under separate cover. The second enclosure contains the assessments of multifacility accident caused by a seismic event. The sites addressed in the material include the Idaho National Engineering Laboratory, the Hanford site, the Savannah River site, and the Navy sites. The discussion is based on the review the Department completed following the November 9 meeting. Finally, the third enclosure is the reference material which supports the EIS accident analysis for the Idaho National Engineering Laboratory, Report #DOE/ID-10471 Draft. The draft report is cited as a reference in Enclosure 2. It is important to note that this report will be slightly modified to support the final EIS and as a result of addressing the DNFSB's comments.

If you would like to discuss the details of the analysis, or have any questions, please call Mr. Mark Pellechi, (208) 526-1545, of my staff.

Sincerely,

Tom Wichmann, Manager
EIS Project Office

Enclosure (3)

cc w/enc: D. Brown, DOE-OR
S. Clark, DOE-RL
D. Connors, Bettis
C. Gertz, DOE-NV
R. Guida, NR
C. Hansen, NR-IBO
P. Phillips, DOE-OR
D. Ryan, DOE-SR
K. Waltzer, DOE-SR

cc w/o enc: J. Conway, DNFSB
D. Hoel, EM-37

Department of Energy
Washington, DC 20585

JAN 19 1995

Ms. Katie Biggs
United States Environmental Protection Agency
Office of Federal Activities
Mail Stop: 2252
401 M Street, SW
Washington, D.C. 20460

Dear Ms. Biggs:

This letter transmits the final meeting minutes for the conference calls held on December 15, 1994, to clarify and resolve the Environmental Protection Agency's (EPA) comments on the Department of Energy's Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement (EIS). We have incorporated your comments on the draft minutes and are pleased to provide this final version for your records and for distribution as you deem appropriate.

Once again, I would like to express our appreciation for the excellent cooperation we have received from EPA in reviewing the EIS and in discussing the comments.

Sincerely yours,

David F. Hoel
Office of Spent Fuel Management
Office of Waste Management
Environmental Management

Enclosure

Department of Energy

Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

January 6, 1995

Mr. Kenneth W. Holt., M.S.E.H.
Special Programs Group (F29)
National Center for Environmental Health
Centers for Disease Control
Atlanta, GA 30341-3724

SUBJECT: Transmittal of Telephone Conference Call Meeting Minutes (OPE-EIS-95.010)

Dear Mr. Holt:

Thank you very much for your participation in the conference call held November 22, 1994. The Department of Energy requested this meeting with the National Center for Environmental Health (NCEH) with the goal of resolving, where possible, your September 30, 1994 comments on the Spent Nuclear Fuel and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Draft Environmental Impact Statement. The Department desired, by bringing our respective staffs together, to glean further insight into the bases of NCEH's comments and to exchange technical information regarding DOE's analytical approach in the DEIS.

As agreed to during the conference call, DOE prepared draft meeting minutes documenting the results of the conference call. NCEH reviewed and commented on the draft minutes on January 5, 1995.

Enclosed please find for your review the final meeting minutes, which reflect NCEH's January 5, 1995 comments. Please sign and return the minutes to the EIS Project Office. Thank you again for your valuable participation in this effort.

Sincerely,

Tom Wichmann

Tom Wichmann, Manager
EIS Project Office

Enclosure

DECEMBER 21, 1994, MEETING WITH COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) STAFF REGARDING THE DRAFT SNF/INEL EIS

Participants:

CEQ STAFF	DOE
Ray Clark	David Hoel, EM-37
Elizabeth Blag	Matt Urie, GC-51
Joe Fuller	Stan Lichtman, EH-25

David Hoel opened the meeting by thanking the CEQ staff for agreeing to meet with us and then proposed to brief them on the DOE Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement (SNF/INEL EIS) per the attached handout. (A copy of the Draft EIS Summary had been previously provided to Ray Clark.)

Before beginning the briefing, Stan Lichtman briefly described history of spent fuel management and the 1992 phaseout of DOE spent fuel reprocessing, which led to the need for interim storage decisions. David Hoel described the evolution of the SNF/INEL EIS as a result of the INEL court order, including the rationale for combining programmatic spent fuel management NEPA analyses (Volume 1) with that of the INEL cleanup and waste management programs (Volume 2).

The following summarizes the discussions that occurred during the course of the handout briefing:

- DOE (Hoel and Lichtman) clarified for Elizabeth Blag the relationship of the SNF/INEL EIS to the DOE Waste Management Programmatic EIS, the EIS on the Proposed Policy for Acceptance of Foreign Research Reactor Spent Nuclear Fuel, and the Office of Civilian Radioactive Waste Management EIS regarding development of a Multi-Purpose Canister.

- When discussing the public comments regarding confusion on how all DOE's EISs tie together (see chart #5), Stan Lichtman offered to provide a separate briefing on this to CEQ staff at a later date.

- Elizabeth Blag noted the Defense Nuclear Facilities Safety Board (DNFSB) comment that the EIS lacks a proposed action (see chart #5) and stated that she previously had conversations with John MacEvoy, of the DNFSB staff, on this subject. She told Mr. MacEvoy that she believes that the DOE approach to framing the proposed action and alternatives analyzed is appropriate and in accordance with CEQ regulations. DOE agreed with her opinion and Matt Urie briefly described DOE/DNFSB staff interactions regarding this DNFSB comment.

- Ray Clark asked whether there was any research going on to explore different technologies for treatment of SNF. DOE (Hoel and Lichtman) explained that, while the EIS does analyze the reasonably foreseeable impacts of the use of technologies for wet storage, dry storage and SNF processing, the EIS is not intended to support decisions on use of these technologies. Such decisions would be based on project- or site-specific NEPA reviews.. DOE further explained that except for some ideas on using surplus plutonium as fuel in nuclear reactors, we are unaware of any research to reduce the radioactivity or accelerate the radioactive decay of SNF or other highly radioactive materials.

- During discussion of EIS analyses being performed on environmental justice (see chart #13), Matt Urie reminded Elizabeth Blag of the EIS technical guideline on environmental justice that had been provided for her review. Blag stated that she had reviewed the technical guideline and passed it to another CEQ staff member for review. Generally, she feels that the technical guideline is a reasonable approach and would forward any comments after consulting with the other staff member.

- David Hoel emphasized that the briefing information on cost comparisons (charts #14-16) was preliminary and the selection of preferred alternatives (charts #17 and 20-24) was pending Secretarial approval.

The CEQ staff thanked the DOE representatives for the briefing, as it greatly enhances their understanding of DOE spent nuclear fuel management proposals and respective NEPA reviews.

Attachment:
SNF and INEL ER&WM EIS Briefing for Council on Environmental Quality (27 charts on 11 pages)

Meeting with Seneca Nation Representatives

Date: January 10, 1995

Location: SNI Offices, Irving NY

Attendees: Ahmad Al-Daouk, DOE-WVAO
Russ Gill, WVNS
John Chamberlain, WVNS

Lisa Maybee, SNI
Adrian Stevens, SNI
Doug Wiggins, SNI

WVDP activities and potential cooperative actions with SNI were discussed. DOE spent fuel stored at WVDP was discussed and the DOE Programmatic EIS for Fuel.

D. Wiggins was primarily interested in any potential WVDP waste shipments, including the DOE spent fuel stored at the WVDP, that may cross or pass near the SNI reservations. He requested that SNI be included in planning for any future waste shipments.

SNI representatives did not inquire about possible waste shipments other than from the WVDP. DOE contacts for information on the Programmatic Fuel EIS were offered in addition to those available in the documentation SNI had previously received. SNI representatives declined.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

December 14, 1994

Mr. Marvin Osborne
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, Idaho 83203-0306

SUBJECT: Resolution of Shoshone-Bannock Comments on the Department of Energy (DOE) Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement (PSNF and INEL ER&WM DEIS) (OPE-EIS-94.774)

Dear Mr. Osborne:

Thank you very much for the Tribes' participation in the meeting held December 2, 1994, at Fort Hall. The DOE arranged this meeting with the Shoshone-Bannock Tribes with the goal of resolving, where possible, your September 29, 1994, comments on the PSNF and INEL ER&WM DEIS. The Department desired, by bringing our respective staffs together, to glean further insight into the bases of the Tribes' comments and to exchange technical information regarding DOE's analytical approach in the DEIS. The results of our meeting should enhance the quality of the information presented to the DOE decisionmakers in the Final EIS.

The purpose of this followup letter is to summarize what was discussed and agreed to during our meeting. The enclosed minutes constitute DOE's understanding of what was discussed and agreed to, as well as the Department's action to resolve the comments. If your understanding differs from what is described in the enclosed, please notify us as soon as possible.

I look forward to continued sessions between our technical specialists, as well as a wrap-up meeting with Tribal Council members and our management officials to conclude our consultation on this document. Thank you again for your participation in this process.

Sincerely,

Tom Wichmann

Tom Wichmann, Manager
EIS Project Office

Enclosure

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

January 9, 1995

Ms. Diane Yupe, Tribal Anthropologist
Shoshone-Bannock Tribes
Bureau of Indian Affairs
P. O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: Ethnobotany Concerns of the Shoshone-Bannock Tribes (OPE-EIS-95.012)

Dear Ms. Yupe:

Per a commitment at our December 22, 1994 meeting, we have obtained a preliminary ethnobotany table from the forthcoming Environmental and Research Science Foundation publication: Anderson, J. E., K. Rupple, J. M. Glennon, K. E. Holte, and R. C. Rope. 1995. Vegetation, Flora, and Ethnoecology of the Idaho National Engineering Laboratory, ESRF-005.

Please review and supplement the information in the table for its accuracy, particularly as it relates to the Shoshone-Bannock Tribes. We are currently considering the appropriate level of detail, and format of the information for the Final Environmental Impact Statement.

To meet production schedules, we need your comments by January 17, 1995. If you have questions or need additional information, please call Roger Twitchell, our ecological specialist, at (208) 526-0776.

Sincerely,

Tom Wichmann, Manager
EIS Project Office

Enclosure

The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
PHONE (208) 238-3706
FAX (208) 237-0797

CULTURAL RESOURCE COORDINATOR/
ANTHROPOLOGIST
P. O. BOX 306
FORT HALL, IDAHO 83203

January 18, 1995

Mr. Roger L. Twitchell
NEPA Compliance Officer
U.S. Department of Energy
850 Energy Drive, MS-1216
Idaho Falls, Idaho 83401-1563

RE: Vegetation, Flora, and Ethnoecology of the INEL, ESRF-005 (Anderson, J.E., et.al., 1995)

Dear Roger,

The Tribes' received the several pages of tables of the botanical study done by Idaho State University on the INEL. Please thank Mr. Wichmann for his immediate attention to gathering this information we requested.

I have reviewed the enclosed documents and I also spoke with one of the researchers about the content of the tables. I believe the information provided is accurate in the sense of scientific analysis and referencing previous anthropological work. I noted that the authors didn't complete the category of Shoshone Bannock terms and uses. I further believe that additional work between the researchers and the Tribes' can compliment a completed document and be a major benefit to both our interests.

In summary, the document as written is acceptable for EIS purposes. Additionally, the Tribes' and DOE may want to make plans in completing the omitted portions of the study document. If there are any questions or concerns, feel free to contact me (238-3706) at your convenience.

Sincerely,

Diana K. Yupe

Diana K. Yupe
Cultural Resource Coordinator

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

January 25, 1995

Ms. Jeanette Wolfley, Esquire
Counsel, The Shoshone-Bannock Tribes
P. O. Box 306
Fort Hall, ID 83202

SUBJECT: Comments on the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Draft Environmental Impact Statement (OPE-EIS-95.029)

Dear Ms. Wolfley:

Thank you very much for your participation in the meeting held on December 29, 1994 at your office in Fort Hall. The Department of Energy requested this consultation with Tribal Counsel with the goal of resolving, if possible, the Tribes' comments on the legal aspects of the SNF and INEL ER&WM Draft EIS. I appreciate your discussions with me on these matters, as well as the Tribes' legal system, and the Tribes' viewpoint on its relationship with the INEL. The results of our meeting should enhance the quality of the information presented to the DOE decision-makers in the Final EIS.

The purpose of this follow-up letter is to summarize what we discussed during our meeting. Please review the enclosed draft meeting notes for accuracy. If these notes are acceptable to you, please sign them indicating your agreement, and return the original to me. If I have misstated our discussion, or otherwise left out pertinent points, or made any other errors, please let me know as soon as possible, and I will make corrections.

Thank you again for your participation in this process.

Sincerely,

Denise M. Glore
Counsel

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

February 2, 1995

Mr. Curtis Williams
Transportation Manager, The Shoshone-Bannock Tribes
P. O. Box 306
Fort Hall, Idaho 83202

SUBJECT: Documents from Union Pacific (OPE-EIS-95-049)

Dear Mr. Williams:

Enclosed is a copy of the subject reply for your information and use. The Project Office provides these documents as an element of after-actions from our recent consultation with the Shoshone-Bannock Tribes. Thank you very much for your participation in the meeting held on December 2, 1994, at the Business Council Chambers at Fort Hall. The Department of Energy requested this consultation with the goal of resolving, if possible, the Tribes' comments on the Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Draft EIS.

Thank you again for your participation in this process. Questions regarding the documents should be directed to Mark Howard, (208) 523-4164.

Sincerely,

for

Tom Wichmann, Manager
EIS Project Office

Enclosures

cc w/enc: J. Wolfley, Shoshone-Bannock Tribes
B. Hayball, Shoshone-Bannock Tribes

APPENDIX C
INFORMATION SUPPORTING THE ALTERNATIVES

CONTENTS

FIGURES

TABLES

APPENDIX C

INFORMATION SUPPORTING THE ALTERNATIVES

C-1 INTRODUCTION

This appendix provides data and environmental information about the Idaho National Engineering Laboratory (INEL) site and surrounding area, related to projects that are being completed, or are being considered, to implement the four spent nuclear fuel management, environmental restoration, and waste management alternatives shown in the box to the right. Chapter 3 of Volume 2 of this Environmental Impact Statement (EIS) describes these alternatives in detail.

SNF and INEL EIS 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 functions at the INEL 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.

The appendix presents two types of projects:

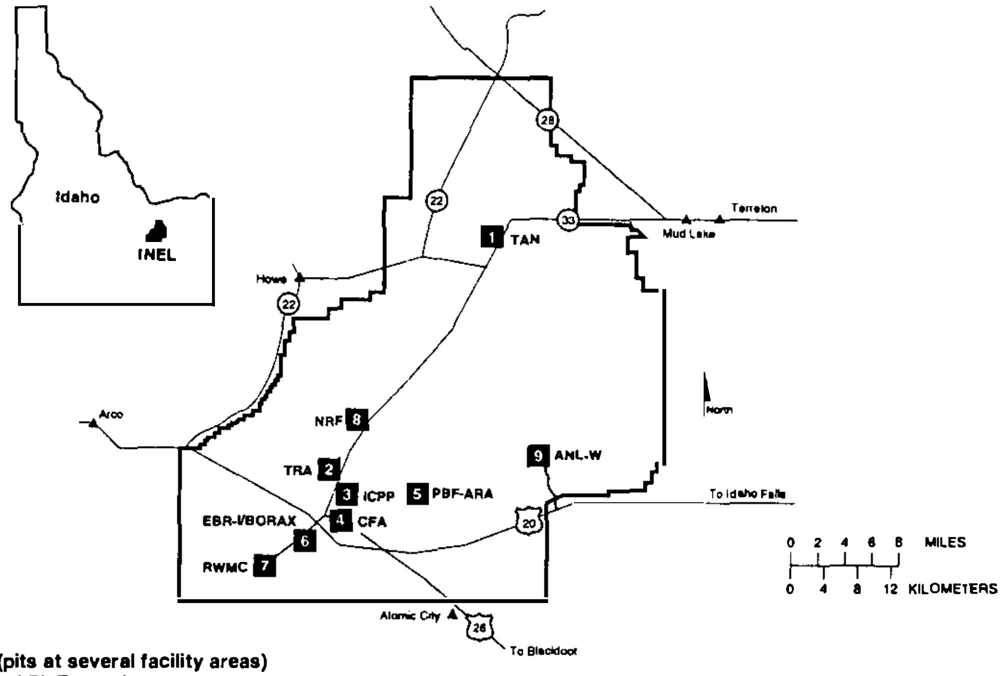
1. Planned or ongoing projects whose National Environmental Policy Act (NEPA) documentation was proposed to be completed before the Record of Decision for this EIS is issued.

2. Foreseeable proposed projects whose detailed design or planning will not begin until the Department of Energy (DOE) has determined that the requirements of the NEPA process for the project have been completed.

An objective of this appendix is to provide sufficient analysis for twelve foreseeable projects to allow timely deployment if needed for the project. DOE would evaluate the remaining 25 foreseeable projects on a case-by-case basis to determine if any additional NEPA or further evaluation is needed before implementing the project. The twelve projects are as follows:

Project	Alternative
Expended Core Facility Dry Cell Project	B, D
Increased Rack Capacity for CPP-666	B, D
Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	B, C, D
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	B, D
Tank Farm Heel Removal Project	B, C, D
High-Level Tank Farm New Tanks	C, D
Shipping/Transfer Station	C
Waste Experimental Reduction Facility Incineration	B, D
Nonincinerable Mixed Waste Treatment	B, D
Sodium Processing Project	B, D
Gravel Pit Expansions	B, D
Calcine Transfer Project	B, D

Figure C-1-1 shows the locations of all 49 projects. Most of these projects are within established industrial areas on the INEL site corresponding to the numbered areas shown on the figure. These numbers correspond to the numbered Waste Area Groups used to facilitate environmental remediation efforts on the INEL site. Throughout this appendix these areas are called major facility areas.



INEL (pits at several facility areas)
- Gravel Pit Expansions

1 Test Area North (TAN)
- TAN Pool Fuel Transfer
- Remediation of Groundwater Contamination [Environmental Remediation (ER)]

2 Test Reactor Area (TRA)
- Engineering Test Reactor Decontamination and Decomissioning (D&D)
- Materials Test Reactor D&D

Test Area North or Test Reactor Area
- Greater-Than-Class-C Dedicated Storage

3 Idaho Chemical Processing Plant (ICPP)
- New Calcine Storage
- Tank Farm Heel Removal Project
- High-Level Tank Farm New Tanks
- High Level Tank Farm Replacement (upgrade phase)
- Calcine Transfer Project (Bin Set #1)
- Waste Immobilization Facility
- Additional Increased Rack Capacity (CPP-666)
- Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping
- Fort St. Vrain Spent Nuclear Fuel Receipt and Storage
- Increased Rack Capacity for CPP-666
- Spent Fuel Processing
- Fuel Processing Complex (CPP-601) D&D
- Fuel Receipt and Storage Facility (CPP-603) D&D
- Headend Processing Plant (CPP-640) D&D
- Waste Calcine Facility (CPP-633) D&D

4 Central Facilities Area (CFA)
- Industrial/Commercial Landfill Expansion
- Health Physics Instrument Laboratory
- Radiological Environmental Sciences Laboratory Replacement
- CFA Clean Laundry and Respirator Facility

5 Power Burst Facility (PBF)/Auxiliary Reactor Area (ARA)
- Nonincinerable Mixed Waste Treatment
- Waste Experimental Reduction Facility Incineration
- ARA-II D&D

6 Experimental Breeder Reactor (EBR)-I/ Boiling Water Reactor Experiment (BORAX)
- BORAX-V D&D

7 Radioactive Waste Management Complex (RWMC)
- Shipping/Transfer Station
- RWMC Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste
- Waste Characterization Facility
- Transuranic Storage Area Enclosure and Storage Project
- Pit 9 Retrieval (ER)
- Vadose Zone Remediation (ER)

2.5 miles east of RWMC (for analysis purposes)
- Idaho Waste Processing Facility
- Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment
- Hazardous Waste Treatment, Storage, and Disposal Facilities
- Mixed/Low-Level Waste Treatment Facility
- Mixed/Low-Level Waste Disposal Facility

8 Naval Reactors Facility (NRF)
- Expended Core Facility Dry Cell Project

9 Argonne National Laboratory-West (ANL-W)
- Remote Mixed Waste Treatment Facility
- Radioactive Scrap/Waste Facility
- Central Liquid Waste Processing Facility D&D
- EBR-II Blanket Treatment
- Plasma Hearth Process Project
- Electrometallurgical Process Demonstration
- Sodium Processing Project
- Waste Handling Facility

RED 0626

Figure C-1-1. The Idaho National Engineering Laboratory location of projects associated with proposed alternatives.

Table C-1-1 lists the twelve projects called "ongoing projects." Because their NEPA documentation was proposed to be completed before the Record of Decision for this EIS, they are included in Alternative A (No Action) and other applicable alternatives. Their descriptions are presented in Section C-2 of this appendix in the order listed in the table. The list of twelve includes three remediation-related projects whose NEPA review was well advanced before the decision of June 1994 for DOE to institute a policy to avoid duplication by using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for review of actions to be taken under CERCLA (DOE 1994a).

Foreseeable projects[a] are listed in Table C-3-1 at the beginning of Section C-3, which provides generic environmental information applicable to these projects. Summary descriptions of these projects are presented in Section C-4 in the order listed in the table.

The remaining introductory sections discuss the organization and content of the project summaries (C-1.1) and generic assumptions (C-1.2).

C-1.1 Organization of Project Summaries

Each project summary contains a narrative and a data sheet. The narrative includes a general project objective and a project description. Foreseeable projects summaries include project-specific options (alternatives) where these differ from the EIS alternatives or are options within an EIS alternative. The project data sheets provide project-specific data for both ongoing and foreseeable projects for INEL spent nuclear fuel, environmental restoration, and waste management activities. These data sheets differ depending upon the applicable phases(s) of a project: (a) projects with a construction and operations phase, (b) projects with an operations phase only, and (c) decontamination and decommissioning projects.

a. In response to public comments, the portion of this appendix dealing with these projects has been revised and expanded to consolidate environmental information found in other parts of this EIS and supporting documentation.

Table C-1-1. Ongoing projects associated with programs and waste streams.

Projects	Facility location[a]	Material/ waste stream[a]	Alternative[b]
SPENT NUCLEAR FUEL PROJECTS			
Test Area North Pool Fuel Transfer	TAN	SNF	A, B, D
ENVIRONMENTAL RESTORATION—REMEDIATION PROJECTS			
Remediation of Groundwater Contamination[c]	TAN	NA	All
Pit 9 Retrieval[c]	RWMC	NA	All
Vadose Zone Remediation	RWMC	NA	All
ENVIRONMENTAL RESTORATION—DECONTAMINATION AND DECOMMISSIONING PROJECTS (D&D)			
Auxiliary Reactor Area (ARA)-II D&D	PBF/ARA	NA	All
Boiling Water Reactor Experiment V D&D[d]	EBR-I/BORAX	NA	All
WASTE MANAGEMENT PROJECTS			
High-Level Tank Farm Replacement (upgrade phase)	ICPP	HLW	All
Transuranic Storage Area Enclosure and Storage Project	RWMC	TRU	All
Waste Characterization Facility	RWMC	TRU	All
Waste Handling Facility[d]	ANL-W	LLW, MLLW, hazardous	All
INFRASTRUCTURE PROJECTS			
Health Physics Instrument Lab	CFA	NA	All
Radiological and Environmental Sciences Laboratory Replacement[d]	CFA	NA	All

a. Acronym definition:

BORAX	Boiling Water Reactor Experiment
CFA	Central Facilities Area
EBR-I	Experimental Breeder Reactor I
ICPP	Idaho Chemical Processing Plant
LLW	low-level waste
HLW	high-level waste
MLLW	mixed low-level waste
NA	not applicable
PBF/ARA	Power Burst Facility/Auxiliary Reactor Area
RWMC	Radioactive Waste Management Complex
SNF	spent nuclear fuel
TAN	Test Area North
TRU	transuranic waste

b. Alternatives (See also box on page C-1-1 and discussion in Chapter 3, EIS Volume 2)
A — No Action
B — Ten-Year Plan
C — Minimum Treatment, Storage, and Disposal
D — Maximum Treatment, Storage, and Disposal

c. When DOE decided in June 1994 to institute a policy to avoid duplication by using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for review of CERCLA actions (DOE 1994a), this project, as described in this appendix, was an Interim Action being implemented under the INEL Federal Facility Agreement and Consent Order. A separate CERCLA Record of Decision would be signed for the Final Action.

d. National Environmental Policy Act documentation for these projects is essentially complete. Due to program constraints, the decision may not be approved before June 1, 1995.

A generic data sheet is shown in Figure C-1-2, and a guide to the types of data on the sheet is given in Table C-1-2. The data sheets provide the basis for the analyses of the impacts for the following environmental attributes:

- Geology and soil (acres disturbed)
- Water resources
- Wildlife and habitat
- Historic, archaeological, or cultural resources
- Air resources
- Human health
- Transportation
- Waste management
- Socioeconomic conditions.

The project summaries for foreseeable projects include a table that summarizes the project-specific impacts of the proposed action on selected conditions within these environmental attributes.

C-1.2 Generic Assumptions

The general assumptions used for analysis purposes that are applicable to several or all projects are listed in the section. Project-specific assumptions are given in individual project descriptions. Assumptions that form the basis for all the project analyses are as follows:

1. INEL construction projects scheduled for completion by June 1, 1995, are included in the baseline against which the impacts of the proposed alternatives are analyzed.[a] Ongoing projects were assumed to have their NEPA documentation completed by that time.

2. The time frame for the SNF and INEL EIS is the 10 years from June 1, 1995, to June 1, 2005. Ultimate shutdown and decontamination and decommissioning (life cycle) impacts for these projects are qualitatively assessed if they occur beyond the time frame analyzed in this EIS.

a. These projects are not described in this appendix (see EIS Section 2.2.4).

Project Data Sheet		
General info.	Description/function:	(1)
	WAG	(2)
	EIS Alter. (A, B, C or D):	(3)
	SNF or Waste stream:	(4)
	Action type:	(5)
	Structure Type: Size: (m2) Other features: (Pits, ponds, power /water/sewer lines)	(6)
	Location: Inside/outside of fence Inside/outside of bldg.	(7)
Construction Info.	Cost($): PreConst. Cost($): Const. Schedule Start /End: PreConst. Schedule Start /End: Const.	(8)
	No. of workers: (new/exist)	(9)
	Heavy Equip. Equip. used: Trips:	(10)
	Acres Disturbed: New Previous Revegetated	(11)
	Air Emissions: (None / Ref.)	(12)
	Effluents: Type: Quantity: (liters)	(13)
	Solid wastes: Type: Quantity: (m3)	(14)
	Haz./Toxic Chemicals: Storage/inventory	(15)

	Rev.	Date
Const.	Cultural resource effects:	(16)
	Pits/ponding created: (m2)	(17)
	Water usage: (liters)	(18)
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	(19)
	Nightlights used: Y/N	(20)
	Generators: Night Y/N Day Y/N	(21)
Operational Information	Cost($): Operation: Schedule Start /End:	(22)
	No. of workers: (new/exist)	(23)
	Heavy Equip. Equip. used: Trips:	(24)
	Air Emissions: (None / Ref.)	(25)
	Effluents: Type: Quantity: (liters/yr)	(26)
	Solid wastes: Type: Quantity: (m3/yr)	(27)
	Haz./Toxic Chemicals: Storage/inventory	(28)
	Pits/ponds used: Y/N (m2)	(29)
	Water usage: (liters/yr)	(30)
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	(31)
	Nightlights used: Y/N	(32)
	Generators: Night Y/N Day Y/N	(33)

Figure C-1-2. Generic project data sheet (refer to Table C-2 for guide to information).

Table C-1-2. Guide to project data sheet.

Data box identification (Refer to Figure C-1-2)	Parameter name	Explanation
		GENERIC INFORMATION
(1)	Description/Function	Project title
(2)	Waste Area Group (WAG)	Indicates which INEL grouping is used to facilitate the project's environmental remediation efforts. Within each WAG are regulatory "units" (facilities or areas) designated as waste management units. The WAGs are identified on Figure C-1-1 by WAG number and are as follows: WAG 1 Test Area North (TAN) WAG 2 Test Reactor Area (TRA) WAG 3 Idaho Chemical Processing Plant (ICPP) WAG 4 Central Facilities Area (CFA) WAG 5 Power Burst Facility (PBF)/Auxiliary Reactor Area (ARA) WAG 6 Experimental Breeder Reactor I (EBR-I) WAG 7 Radioactive Waste Management Complex (RWMC) WAG 8 Naval Reactors Facility (NRF) WAG 9 Argonne National Laboratory-West (ANL-W) WAG 10 Miscellaneous surface sites and liquid disposal areas throughout the INEL that are not included within other WAGs
(3)	EIS alternative	Indicates which SNF and INEL EIS alternative would include the project: Alternative A No Action Alternative B Ten-Year Plan Alternative C Minimum Treatment, Storage, and Disposal Alternative D Maximum Treatment, Storage, and Disposal
(4)	Spent nuclear fuel or waste stream	Indicates the type of project: spent nuclear fuel, waste management program (waste streams), environmental restoration, or infrastructure. Acronyms used are as follows: SNF spent nuclear fuel HLW high-level waste TRU transuranic waste [includes alpha-low-level waste (α-LLW)] LLW low-level waste MLLW mixed low-level waste GTCC greater-than-Class-C waste HW hazardous waste ER environmental restoration Infra. infrastructure
(5)	Action type	Provides the major objective of the project: New - construction of a new facility D&D - D&D of an existing facility Expand - expand a facility or process Modify - modify a facility or process Operation - operation of an existing capability

Table C-1-2 (continued).

Data box identification (Refer to Figure C-1-2)	Parameter name	Explanation
(6)	Structure type	Indicates the type of structure to be constructed by the project. For D&D projects, lists the facilities that would be affected, provides the structure size (square meters), and identifies significant features
(7)	Location	Indentifies the physical location of the project in reference to existing INEL facilities
CONSTRUCTION OR DECONTAMINATION AND DECOMMISSIONING (D&D) INFORMATION: The D&D sheet is basically the same as the construction data sheet but does not include an operations section.		
(8)	Preconstruction (Pre-D&D) costs	Indicates project costs prior to construction or D&D
	Construction (D&D) costs	Indicates project costs associated with construction or D&D
	Schedule dates	Provides schedule dates in calendar year format (for example, 1995)
(9)	Number of workers	Projects the number of workers that would be required for construction or D&D
(10)	Heavy equipment	Defines equipment that would be used during construction or D&D and estimates heavy equipment traffic volumes (trips) to and from the construction or D&D site
(11)	Acres disturbed	Provides description of land use, by identifying new or previously disturbed and revegetated areas (acres)
(12)	Air emissions	References Technical Support Document for Air Resources (Belanger et al 1995) for project-specific air emissions during construction or D&D
(13)	Effluents	Identifies the type and lists amounts (liters) of liquid wastes that would be generated during construction or D&D
(14)	Solid wastes	Identifies the type and lists amounts (cubic meters) of solid wastes that would be generated during the construction or D&D
(15)	Hazardous/toxic chemicals	Lists the types and lists amounts (inventory/storage) of hazardous and toxic chemicals that could be present at the construction or D&D site
(16)	Cultural resource effects	Identifies issues that would relate to cultural resources and historical preservation of the construction or D&D site
(17)	Pits and ponding created	Indicates if a new pit or pond would be used during construction or D&D and lists area(s) (square meters)
(18)	Water usage	Projects the total amount of water (liters) that would be used during construction or D&D
(19)	Energy requirements	Projects the amount of electricity (megawatt hours per year) and fossil fuels (liters) that would be needed during construction or D&D
(20)	Night lights	Indicates if night lights would be used during construction or D&D

Table C-1-2 (continued).

Data box identification (Refer to Figure C-1-2)	Parameter name	Explanation
(21)	Generators	Indicates if a generator would be required during construction or D&D, and whether day or night use would be indicated
	OPERATIONAL INFORMATION	
(22)	Operation costs	Projects the operating cost of a project for a given period of time
	Schedule	Provides start and end operation dates
(23)	Number of workers	Projects the number of workers (new and existing) that would be required for operations
(24)	Heavy equipment	Defines equipment that would be used during operations and estimates heavy equipment traffic volumes (trips) to and from the operations site
(25)	Air emissions	References operations air emission analyses, or lists the type and amount of air emissions to the environment during operations
(26)	Effluents	Identifies the types and lists amounts (liters per year) of liquid waste that would be generated during operations
(27)	Solid wastes	Identifies the types and lists amounts (cubic meters per year) of solid waste that would be generated during operations
(28)	Hazardous/toxic chemicals	Identifies the types and lists amounts (inventory/storage) of hazardous and toxic chemicals that would be present at the operations site
(29)	Pits and ponding used:	Indicates if a pit or pond would be used during operations, and lists area(s) (square meters)
(30)	Water usage	Projects the amount of water (liters per year) that would be used during operations
(31)	Energy requirements	Projects the amount of electricity (megawatt hours per year) and fossil fuels (liters per year) that would be needed for operations
(32)	Night lights	Indicates if new night lights would be used during operations
(33)	Generators	Indicates if a new generator would be required during operations, and whether it would be used day or night

3. INEL industrial wastes are not analyzed as a separate waste stream. The volume of this waste is small considering the size of the INEL, and recycling and waste reduction are reducing the current quantities. Incremental changes to this waste stream are addressed in the infrastructure project summary section (Section 4.9) and in the evaluation of the Industrial/Commercial Landfill Expansion project (Section 4.9.2), which would be sized to accommodate all of this waste.

4. The following references were used for waste stream values:

Spent nuclear fuel or waste stream	Reference
Spent nuclear fuel	Heiselmann (1995)
Transuranic, low level, and mixed low level	Morton and Hendrickson (1995)
High level	Freund (1995)

5. Project schedules in the data sheets for each project are for analysis purposes only.

6. The following general assumptions relate to the transportation of spent nuclear fuel and wastes on and off the INEL site:

- The number of shipments associated with each project is based on the volume of waste that will be transported to and/or from each facility and the capacity of the transport vehicles. The method of determining the number of shipments is consistent with that used in the environmental impacts section on transportation (Section 5.11) of the EIS.

- Shipments within major facility areas (for example, from CPP-603 to CPP-666 at the Idaho Chemical Processing Plant) are not analyzed.

- High-level wastes are stored at the INEL, but shipments of high-level wastes are not planned within the timeframe of this EIS.

- Offsite shipments are allocated to those foreseeable projects (summarized in Section C-4) that are required to manage the spent nuclear fuel or waste in those shipments. (For example, naval spent nuclear fuel shipments are allocated to the Increased Rack Capacity for CPP-666 project, described in Section C-4.1.2.) Specific assumptions are identified in the footnotes of the impact table for the applicable foreseeable project.

- All onsite shipments would be made by truck. All offsite shipments were assumed to occur by truck; some offsite shipments may be by rail, which would result in a lower number of shipments.

C-2 ONGOING PROJECTS—DESCRIPTIONS

Ongoing projects as identified in Table C-1-1 in Section C-1 are described in this section.

C-2.1 TEST AREA NORTH POOL FUEL TRANSFER

PROJECT NAME: Test Area North Pool Fuel Transfer

This project is proposed to be evaluated, approved, and in process as of June 1, 1995 (DOE 1995a). It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of tbe Test Area North Pool Fuel Transfer Project are (a) to provide a low-cost, environmentally sound alternative to submerged storage of the Three Mile Island, Loss-of-Fluid-Test, and commercial spent fuels in the Test Area North Hot Shop storage pool and (b) to ensure compliance with applicable codes and regulations regarding interim storage of spent nuclear fuel.

PROJECT DESCRIPTION: The Test Area North Hot Shop storage pool contains greater than 7.5 million curies of spent fuel and fuel debris consisting primarily of 343 canisters of core debris from the Three Mile Island reactor accident. The storage pool also contains fuel and fuel remnants from the Loss-of-Fluid-Test facility tests and U.S. Government-owned commercial fuel rods and assemblies.

DOE proposes to remove all of tbese materials from the storage pool and place them in suitable interim dry storage.

The Three Mile Island fuel canisters must be dewatered or dewatered and dried before placing tbem in dry storage casks to prevent canister corrosion. The dryer system is located inside the TAN-607 Hot Shop. The canisters would be individually transferred to tbe dryer system using the existing Three Mile Island canister grapple and overhead crane. The water would then be removed from the canisters by purging the interior with hot (300°F) nitrogen and heating the exterior with heating blankets. This nitrogen would be supplied from an existing liquid nitrogen storage system and filtered and vented tbrough the existing Hot Shop filter system after passing through the canister. Four canisters would be dried at a time.

When seven canisters are ready, they would be loaded into the NRC-certified 125B shipping cask and moved to Test Area North or Idaho Chemical Processing Plant for storage.

At the Idaho Chemical Processing Plant, the shipping cask would be upended and the canisters unloaded into a new storage facility via a shielded transfer cask for safe interim storage. The Alternate Fuel Storage Facility would be an aboveground concrete monolith with individual storage vault positions for each canister. The concrete monolith would provide for seismic stability, shielding, and monitoring of monolith and vault conditions. The individual vaults would be cylindrical in section and would be sealed to the environment. Provisions for monitoring the interior of the individual vaults would be provided. The canisters would be retrievable for future transfer or maintenance activities.

The Loss-of-Fluid-Test and commercial fuel would be removed from the water, washed to remove surface contamination, and suspended in the Hot Shop to dry. These fuels would be stored dry at the Idaho Chemical Processing Plant or at Test Area North in unvented storage containers.

Approximately 3 million liters (780,000 gallons) of water would remain in the storage pool following removal of the spent fuel and fuel debris. Spectroanalysis of the pool water conducted in 1991 and 1992 identified a total radionuclide concentration of approximately 3 curies in the pool. The nonfuel solid low-level waste, approximately 485 cubic meters (635 cubic yards) consisting of Three Mile Island canister storage hardware and metals, would be removed from the pool and transferred to the Radioactive Waste Management Complex after the fuel and fuel debris have been removed. The pool water would be treated via demineralization, filtration, and ion-exchange until it meets the criteria for discharge to a surface impoundment. The water would then be discharged to a surface impoundment area. The pool would remain empty of material and water and would be dispositioned in a separate project.

Project Data Sheet

Rev. 11 January 11, '95

Section	Item	Value
General Info.	Description/function:	TAN Pool Fuel Transfer
	WAG	1 & 3
	EIS Alter. (A, B, C or D):	A, B, D
	SNF or Waste stream:	SNF
	Action type:	New
	Structure Type:	Storage Facility
	Size: (m2)	380 (30x12)
	Other features: (Pits, ponds, power /water/sewer lines)	Storage Pad 18 m x 91 m x 30 cm Existing Pool (7x21x7 m deep) Road/Power Lines
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Outside CPP-749 South or East
Construction Info.	Cost($): PreConst.	$4.12 Mil.
	Cost($): Const.	$16.48 Mil
	Schedule Start /End: PreConst.	1993 - 1994
	Schedule Start /End: Const.	1995 - 1996
	No. of workers: (new/exist)	8 (Existing)
	Heavy Equip. Equip. used:	Trucks
	Trips:	1 to CFA, 13 to RWMC
	Acres Disturbed: New	0
	Previous	0.8
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	None
	Quantity: (liters)	
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3)	485 8.5
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	None
	Water usage: (liters)	Minimal
	Energy requirements:	
	Electrical: (MWH/yr)	0
	Fossil fuel: (liters)	12,800 l diesel
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$1.7 Mil/yr for first four years
	Schedule Start /End:	1997 - 2000
	No. of workers: (new/exist)	No new
	Heavy Equip. Equip. used:	Trucks
	Trips:	66 TAN to ICPP & back
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	None
	Quantity: (liters/yr)	
	Solid wastes: Type:	None
	Quantity: (m3/yr)	
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	Minimal
	Energy requirements:	
	Electrical: (MWH/yr)	<0.1
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.2 REMEDIATION OF GROUNDWATER CONTAMINATION

PROJECT NAME: Remediation of Groundwater Contamination

This project is proposed to be evaluated and approved as of June 1, 1995 and in process in 1996. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general project objective of the Remediation of Groundwater Contamination Project is to reduce contamination in the vicinity of an injection well that is located in the Test Area North Technical Support Facility.

PROJECT DESCRIPTION: The first phase of the Remediation of Groundwater Contamination Project is an Interim Action being implemented under the INEL Federal Facility Agreement and Consent Order. The Interim Action is already in process in accordance with a Comprehensive Environmental Restoration and Compensation Liability Act Record of Decision signed by the Department of Energy Idaho Operations Office (DOE-ID), the Idaho Department of Health and Welfare, and the U.S. Environmental Protection Agency (Region 10). A second Record of Decision for the Final Action will implement the second phase or remainder of the project.

This project would reduce the concentrations of trichloroethylene, tetrachloroethylene, dichloroethylene, lead, strontium-90, and other contaminants in the groundwater surrounding the TSF-05 injection well at the Technical Support Facility. This well was used from 1955 until 1972 to dispose of Test Area North liquid wastes into the Snake River Plain Aquifer. On at least one occasion, concentrated evaporator sludges from the processing of low-level radioactive and process wastes were disposed of through injection down the well. The liquid wastes injected through the well included organic, inorganic, and low-level radioactive wastewaters that were added to industrial and sanitary wastewater.

Contaminants have been found in the aquifer down to 122 meters (400 feet) below the ground surface. The contaminant plume is estimated to have spread up to 2.5 kilometers (1.5 miles) in the direction of groundwater flow and continues to grow. The injection well (TSF-05) has been identified as a main source of these contaminants, and the highest concentration of groundwater contaminants is found near this injection well. These levels drop rapidly as the distance from the well increases.

The first-phase or Interim Action plan calls for extraction of groundwater with a pump placed in the existing TSF-05 well casing, removal of contaminants from the groundwater in a treatment facility, and discharge of the cleaned water to a surface impoundment. The Interim Action treatment facility includes an air stripper, a multimedia sand filter, carbon off-gas treatment, and an ion-exchange system. Groundwater may be extracted from two new monitoring wells, TAN-25 and TAN-26, if it is determined that their use would improve the efficiency of the remediation effort or if more water is needed to operate the treatment facility. Additional groundwater could be obtained by pumping existing Test Area North and United States Geological Survey (USGS) wells, including USGS-24 and TAN-18.

If additional water needs to be added to meet treatment system requirements, extracted groundwater would be stored awaiting treatment in a 75,700-liter (20,000-gallon) surge tank. The first step of actual treatment is by processing through an air stripper unit. Air discharge from the air stripper unit is filtered through granular activated carbon to capture volatile organic compounds removed from the groundwater. The groundwater is then filtered through a multimedia sand filter to remove any solids or sediments. As a polishing step, the groundwater is processed through an ion-exchange column to remove radionuclides. Finally, processed groundwater is discharged to the Test Area North disposal pond (TSF-07).

Wastes generated during the treatment of contaminated groundwater include spent carbon, ion-exchange resins, and filter sediment. Each of these solid wastes is disposed of in approved disposal facilities. The treatment site includes a contaminated waste storage area for the storage of processing wastes that are classified as hazardous, low-level radioactive, or mixed low-level radioactive wastes.

The Final Action or second phase to further remediate the contaminant plume will follow the Interim Action. Information and analytical data gathered during the Interim Action on contaminant concentration response to pumping will be used in designing the Final Action. The Final Action could modify/expand the Interim Action, resulting in significant changes to scope, cost, and schedule.

Project Data Sheet

Rev. 13 January 18, '95

General Info.	Description/function:	Remediation of Groundwater Contamination
	WAG	1
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	ER
	Action type:	New
	Structure Type:	Building
	Size: (m2)	925
	Other features: (Pits, ponds, power /water/sewer lines)	Pond
	Location: Inside/outside of fence	Inside TAN
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$5 Mil / yr
	Schedule Start /End: PreConst.	Complete
	Schedule Start /End: Const.	1993 - 1994
	No. of workers: (new/exist)	34 Subs.
	Heavy Equip. Equip. used:	
	Trips:	None
	Acres Disturbed: New	3
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	No information
	Haz./Toxic Chemicals: Storage/inventory	None
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	Yes
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	56,775 diesel, 5,678 propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$5 Mil /yr
	Schedule Start /End:	1994 - TBD
	No. of workers: (new/exist)	10 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	5 per year, on site
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Water
	Quantity: liters/yr)	99,000,000
	Solid wastes: Type:	LLW MLLW Haz. Ind.
	Quantity: (m3/yr)	66 100 (No info.) 21
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	Yes
	Water usage: (liters/yr)	9.90E+07
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.3 PIT 9 RETRIEVAL (Interim Action)

PROJECT NAME: Pit 9 Retrieval (Interim Action)

This project has been previously evaluated (DOE 1993a) and approved with a finding of No Significant Impact (issued September 29, 1993). It is expected to be operable as of August 1996.

GENERAL PROJECT OBJECTIVE: The proposed general objectives of this Pit 9 Interim Action are to reduce the potential for exposure of workers, the public, and the environment to contaminants disposed in Pit 9; to expedite the overall cleanup of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory; and to reduce the potential for migration of Pit 9 wastes to the Snake River Plain Aquifer.

PROJECT DESCRIPTION: The Pit 9 Retrieval Project is an Interim Action initiated under the INEL's Federal Facility Agreement and Consent Order. This Pit 9 Interim Action would excavate and treat wastes contaminated with radioactive and hazardous substances disposed of at Pit 9 of the Subsurface Disposal Area of the Radioactive Waste Management Complex. Included in the project would be the design, construction, and operation of a double-containment retrieval enclosure, treatment facilities, waste storage facilities, and an office facility for project personnel.

Pit 9 is approximately 5 meters (17 feet) deep, 39 meters (127 feet) wide, and 116 meters (379 feet) long. Materials disposed in Pit 9 include sludges, graphite, combustibles, plastics, wood, metals, and drums. Radioactive contaminants include plutonium and americium. Organic hazardous contaminants include trichloroethylene and carbon tetrachloride.

Proof-of-process testing for the proposed remediation technologies was completed in December 1993 before construction of the facilities began. A limited production test will be performed with the completed facilities before full-scale remediation would begin. Key elements of the proof-of-process testing and the limited production test would include showing that the primary steps of the remedial process would work as an integrated system, proving that material cleaned during processing meets the treatment standards for material returned to the pit, and demonstrating that the final waste material could be safely stabilized and meet all disposal and/or storage criteria.

The approach approved in the Comprehensive Environmental Response, Compensation, and Liability Act Interim Action Record of Decision would require that waste and contaminated materials requiring treatment be removed from Pit 9 using remotely operated excavators. After sorting and characterizing, wastes would be placed into a treatment unit. Treatment could include physical separation, chemical extraction, and/or stabilization processes. Physical separation technologies would be used to separate mixtures of solids and to concentrate the contaminants before further treatment. The physical separation treatment could include mechanical methods, such as wet or dry screening, flotation, gravity concentration, sedimentation, and filtration. Chemical extraction is the treatment technology selected to remove contaminants from soils and sludges. A final stabilization process would add solidifying agents or use thermal technologies to reduce the concentrated waste contaminants to an unleachable form.

After treatment, concentrated waste contaminants would be placed in drums. These drummed wastes would then be placed into storage at the Radioactive Waste Management Complex Transuranic Storage Area. All such drummed wastes would remain in storage until they were sent offsite for disposal at an acceptable facility.

Cleaned soils and waste materials meeting standards would be returned to the Pit 9 excavation for permanent disposal. Any waste being returned to the pit would be required to meet an average concentration of transuranic isotopes of less than 10 nanocuries per gram and to meet all other applicable regulatory requirements, including land disposal restrictions under the Resource Conservation and Recovery Act. The land disposal restrictions would be met for these wastes through delisting (that is, they would be demonstrated to be nonhazardous). Nonhazardous wastes are not subject to Subtitle C hazardous waste disposal and site closure requirements of the Resource Conservation and Recovery Act. After treatment operations were completed, Pit 9 would be closed in accordance with applicable requirements, including Subpart D of the Resource Conservation and Recovery Act and State of Idaho solid waste disposal requirements.

The treatment facility would be designed to treat 1,800 cubic meters (2,400 cubic yards) per year of which 200 cubic meters (260 cubic yards) per year would be concentrated waste contaminants that would be retained for disposal. The remaining cleaned soils, 1,600 cubic meters (2,100 cubic yards) per year, would be returned to Pit 9 for disposal. All waste generated by the operation of the facility would be put into the waste stream and treated with the recovered wastes.

Project Data Sheet

Rev. 11 January 9, '95

Section	Item	Value
Generic Info.	Description/function:	PIT 9 Retrieval
	WAG	7
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	ER
	Action type:	New -- Remediation
	Structure Type:	Buildings (4)
	Size: (m2)	4,830
	Other features: (Pits, ponds, power /water/sewer lines)	Utilities
	Location:	
	Inside/outside of fence	Inside RWMC
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$16 Mil.
	Cost($): Const.	$49 Mil.
	Schedule Start /End: PreConst.	1993 - 1994
	Schedule Start /End: Const.	1995 - 1999
	No. of workers: (new/exist)	150 Peak Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	11 to CFA
	Acres Disturbed: New	0
	Previous	5.2
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial HW
	Quantity: (m3)	416 0.1
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Minimal
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	136 k Diesel, 27 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$29 Mil.
	Schedule Start /End:	1999 - 2000
	No. of workers: (new/exist)	100 Existing, 100 New
	Heavy Equip. Equip. used:	
	Trips:	None
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	None
	Quantity: (liters/yr)	
	Solid wastes:	
	Type:	LLW Ind.
	Quantity: (m3/yr)	Minimal
	Haz./Toxic Chemicals:	Nitric Acid
	Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.4 VADOSE ZONE REMEDIATION

PROJECT NAME: Vadose Zone Remediation

This project is proposed to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of the Remediation of Organic Contamination of the Vadose Zone Project is to prevent organic contaminant migration to the Snake River Plain Aquifer that underlies the Idaho National Engineering Laboratory (INEL) in groundwater contaminant concentrations exceeding acceptable risk levels and/or Federal and State maximum contaminant levels.

PROJECT DESCRIPTION: The Remediation of Organic Contamination of the Vadose Zone project would remove volatile organic contamination found in the unsaturated hydrogeologic zone (vadose zone) beneath the Subsurface Disposal Area of the Radioactive Waste Management Complex at the INEL by removing and treating vapors of volatile organic contaminants from soils and underlying rock. Cleanup goals would be established as vadose zone contaminant concentrations that would not result in groundwater contaminant concentrations exceeding maximum contaminant levels or resulting in unacceptable risks to future groundwater users.

Organic contaminant concentrations have been detected in soil vapor, surficial soils, and groundwater beneath the Subsurface Disposal Area in concentrations ranging from 1 part per million to 2800 parts per million. The primary contaminants of concern are carbon tetrachloride, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane. Most of these contaminants were transported to the INEL for disposal in the form of solidified lubricants, solvents, used oils, and degreasing agents. A small quantity of contaminants have reached the Snake River Plain Aquifer in concentrations that are lower than Federal and State safe drinking water standards. The Snake River Plain Aquifer has been designated as a sole-source aquifer by the U. S. Environmental Protection Agency.

Vapor vacuum extraction has been chosen as the remediation technology to be used to remove organic vapors from the vadose zone. In implementing this technology, extracted vapors would be treated at the ground surface with catalytic oxidation. This program would use the existing vapor vacuum extraction well and several additional extraction wells that would be located in areas of the Subsurface Disposal Area known to have significant levels of organic vapors in the vadose zone.

The complexities of the subsurface environment and uncertainty associated with modeling contaminant response to extraction make it difficult to predict how many wells would eventually be required, and for what period of time they would need to operate to achieve cleanup goals. Up to three phases of cleanup activity could be implemented over six years. The first phase of the project would include the installation of five additional extraction wells, vapor treatment units, and vapor monitoring wells. If determined necessary, subsequent phases may include more vapor extraction wells, monitoring wells and vapor treatment units. The maximum number of vapor extraction wells and accompanying vapor treatment units would be 14.

Each vapor extraction well would be linked to a catalytic oxidation unit or equivalent vapor treatment system capable of maintaining an airflow that would range between 125 and 150 cubic feet per minute. No residual treatment wastes would result from use of this treatment system.

Long-term groundwater and soil vapor monitoring would be performed to confirm the ability of the vapor vacuum extraction system to prevent contaminants from migrating to the Snake River Plain Aquifer at levels that would result in unacceptable groundwater contaminant concentrations. Monitoring of soil vapor and groundwater would continue after remediation is complete to verify that organic contaminant concentrations in the vadose zone remain below acceptable levels.

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Section	Item	Value
General Info.	Description/function:	Vadose Zone Remediation
	WAG	7
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	ER
	Action type:	Remediation
	Structure Type:	No information
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Remediation Equipment
	Location: Inside/outside of fence	Inside RWMC
	Inside/outside of bldg.	TBD
Construction Info.	Cost($): PreConst.	$4 Mil.
	Cost($): Const.	$7 Mil.
	Schedule Start /End: PreConst.	1993 - 1994
	Schedule Start /End: Const.	No information
	No. of workers: (new/exist)	10 Subs.
	Heavy Equip. Equip. used:	
	Trips:	None
	Acres Disturbed: New	0
	Previous	2.1
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	Minimal
	Solid wastes: Type:	Industrial
	Quantity: (m3)	Minimal
	Haz./Toxic Chemicals: Storage/inventory	No information

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No information
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$6 Mil./yr
	Schedule Start /End:	No information
	No. of workers: (new/exist)	10 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	0.3 per year, to CFA
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	No information
	Quantity: (liters/yr)	
	Solid wastes: Type:	Ind. HW
	Quantity: (m3/yr)	10 2
	Haz./Toxic Chemicals: Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No information
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.5 AUXILIARY REACTOR AREA (ARA)-II DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning

This project has been previously evaluated (DOE 1993b) and approved with a finding of No Significant Impact (issued September 29, 1993). It is expected to be in process as of June 1, 1995.

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning Project are to ensure that the identified facilities are in a safe configuration, to determine and execute appropriate decontamination activities, and to decommission the facilities that are surplus to DOE's future programmatic needs. This project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at these sites.

PROJECT DESCRIPTION: This project would decontaminate and decommission the radiologically contaminated buildings, structures, utilities, and other miscellaneous items at ARA-II at the INEL.

The Auxiliary Reactor Area is composed of ARA-I, -II, -III, and -IV. ARA-II was the site of the Stationary Low-Power Reactor No. I (SL-1). An accident occurred at SL-1 in 1961 that resulted in three deaths. Following the accident, the SL-I building was disassembled and buried 0.8 kilometer (0.5 mile) east of the ARA-II facility boundary, and the reactor was buried at the Radioactive Waste Management Complex. Remaining support buildings at ARA-II were decontaminated and converted to laboratories and welding shops. During the 1980s, the use of these buildings was discontinued. All buildings, structures, and utilities at ARA-II would be demolished and removed and the site recontoured and reseeded.

Contaminated building materials would be cut up to reduce bulk and packaged and transported to the Radioactive Waste Management Complex for disposal. Conventional radiological decontamination methods, such as surface wiping and scabbling (which is the mechanical or hydraulic removal of surfaces), would be used to decontaminate buildings, structures, and utilities. During scabbling, effluent air would be passed through high-efficiency particulate air filters to minimize releases of particulate materials to the atmosphere.

At Auxiliary Reactor Area (ARA)-II, about 114 liters (30 gallons) of fuel oil remain in the 3,800-liter (1,000-gallon) ARA-705 underground storage tank. This oil may be contaminated and, therefore, classified as mixed waste. If contaminated, it would be disposed of at the Waste Experimental Reduction Facility or taken to the INEL Radioactive Mixed Waste Storage Facility for storage. Fifty-five cubic meters (70 cubic yards) of contaminated asbestos has been removed from ARA-II and would be transported to the Radioactive Waste Management Complex.

Project Data Sheet		
General Info.	Description/function:	ARA-II D&D
	WAG	5
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	ER
	Action type:	D & D
	Structure Type: Size: (m2)	Building (5) ARA-602, 606, 613, 614, 615
	Other features: (Pits, ponds, power /water/sewer lines)	Tanks, Utilities
	Location: Inside/outside of fence Inside/outside of bldg.	 Inside ARA-II Inside Blds.
D&D Information	Cost($): Pre D&D	$817 k
	Cost($): D&D	$4.06 Mil.
	Schedule Start/End: Pre D&D	1985 - 1993
	Schedule Start /End: D&D	1993 - 1997
	No. of workers: (new/exist)	50 Existing & Subs.
	Heavy Equip. Equip. used: Trips:	Trucks 35 to RWMC / WERF / CFA
	Acres Disturbed: New Previous Revegetated	0 6.5 all ARA-II
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	 LLW MLLW 1,900 114 cont. oil

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D&D Info.	Solid wastes: Type: Quantity: (m3)	 LLW 1004	 Asbestos 11	 IND 276
	Haz./Toxic Chemicals: Storage/inventory	None		
	Cultural resource effects:	None identified		
	Pits/ponding created: (m2)	No		
	Water usage: (liters)	Minimal		
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	 0 0		
	Nightlights used: Y/N	No		
	Generators: Night Y/N Day Y/N	No Yes		

C-2.6 BOILING WATER REACTOR EXPERIMENT (BORAX)-V DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Boiling Water Reactor Experiment (BORAX)-V Decontamination and Decommissioning

This project is proposed to be evaluated, approved, and in process as of June 1, 1995. This project is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Boiling Water Reactor Experiment (BORAX)-V Decontamination and Decommissioning Project are to remove the BORAX-V facility from the list of surplus facilities, remove or stabilize potential sources of contamination, and either eliminate or significantly reduce the requirement of future surveillance and maintenance of the facility.

PROJECT DESCRIPTION: This project would decontaminate and decommission the remaining BORAX-V facility by one of two alternatives:

1. *Dismantlement* would restore the BORAX-V site at the Idaho National Engineering Laboratory to its natural condition. Dismantling would involve the removal of the BORAX-V and BORAX-II/III/IV reactor vessels and removal of remaining facility systems (including a sump and associated structural material) from the basements. After removal of the reactor vessels, piping, and equipment, the walls of the reactor building and adjacent areas would be decontaminated to acceptable release limits. The reactor building foundation would be demolished to a minimum of six feet below grade. The site would then be backfilled, graded to resemble existing contours in the area, and revegetated.

2. *Entombment* would involve limited removal of wastes followed by backfilling the reactor vessels and building and installing a concrete cap. Because this action would not involve excavation, cultural resources would not be impacted, airborne pollutant emissions would

be minimal, industrial hazards to workers would be reduced, and residual contamination and radiation fields would remain in place under concrete containment.

Entombment would generate significantly less airborne pollutant emissions because minimal excavation would be conducted. Also, significantly less solid waste would be generated. This waste would consist of lead shielding, instruments containing mercury, and a small amount of combustible material that would not be contaminated.

Project Data Sheet

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General Info.	Description/function:	BORAX-V D & D
	WAG	10
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	ER
	Action type:	D & D (May use entombment)
	Structure Type:	Borax-717
	Size: (m2)	(12 x 26 m)
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside EBR-I
	Inside/outside of bldg.	Inside Borax-V
D&D Information	Cost($): Pre D&D	$1.3 Mil.
	Cost($): D&D	$1.6 Mil.
	Schedule Start /End: Pre D&D	1993 - 1994
	Schedule Start /End: D&D	1995 - 1996
	No. of workers: (new/exist)	6 - 8 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	13 to RWMC/WERF
	Acres Disturbed: New	0
	Previous	0.2
	Revegetated	all
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	LLW; MLLW
	Quantity: (liters)	3,000; 100 - 500

D&D Info.	Solid wastes: Type:	LLW	MLLW	HW	Ind.
	Quantity: (m3)	460	3.0	4.5	72
	Haz./Toxic Chemicals: Storage/inventory	None			
	Cultural resource effects:	No			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	Minimal			
	Energy requirements: Electrical: (MWH/yr)	0			
	Fossil fuel: (liters)	0			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	Yes			

C-2.7 HIGH-LEVEL TANK FARM REPLACEMENT (UPGRADE PHASE)

PROJECT NAME: High-Level Tank Farm Replacement (Upgrade Phase)

This project has been previously evaluated (DOE 1993c) and approved with a finding of No Significant Impact (issued June 1993). It is expected to be in process as of June 1, 1995.

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to design, construct, and start up modifications to the existing Idaho Chemical Processing Plant high-level waste tank farm ancillary systems. These modifications would (a) provide compliance with the Notice of Noncompliance Consent Order, (b) provide compliance with the Notice of Violation Consent Order, and (c) resolve other maintenance and as-low-as-reasonably-achievable issues. The Notice of Noncompliance Consent Order compliance date is December 31, 1995; the Notice of Violation Consent Order compliance date is December 31, 1996.

PROJECT DESCRIPTION: Design for this project has been completed. The construction contract was awarded June 1993; construction is in progress.

All valve boxes, transfer piping, and pressure/vacuum relief piping being upgraded by this project are for Idaho Chemical Processing Plant tank farm systems that must remain in service through at least the "cease use" dates (March 2009 for five tanks; June 2015 for six tanks) established in the Consent Order for the eleven existing high-level waste storage tanks. Some transfer lines and valves would remain permanently in service if new replacement tanks are constructed.

Detailed upgrade requirements and actions are the following:

1. Two valve boxes (B2 and B3) require secondary containment improvement. Secondary containment piping is being installed.

2. Five valve boxes (C28, C29, C30, C31, C38) require a second form of leak detection. Conductivity probes are being installed.

3. Twenty-five valve boxes require replacement valves because of as-low-as-reasonably-achievable and other maintenance considerations. The existing valves have exceeded their useful life, have become highly failure prone, and are no longer supported by the manufacturer. New top loading ball valves, with remote maintenance capability, are being installed.

4. Six valve boxes (A6, B2, B3, B4, B5, B9) must have their tops raised to grade to accommodate the new valve systems and to allow the secondary containment improvements in boxes B2 and B3.

5. The tile-encased pipe from Building CPP-641 to valve box C-29 must be replaced because of incompatibility of the secondary containment. A new double-encased, stainless steel transfer pipe is being installed.

6. Tile-encased pipes at Building CPP-604 must be replaced because of incompatibility of the secondary containment. This action would be accomplished by providing a new valve box C-40 and the associated double encased stainless steel replacement piping. Five existing valve boxes are being demolished.

7. The pressure/vacuum relief pipe from all eleven tanks must be replaced to resolve radiation safety and as-low-as-reasonably-achievable considerations. The existing pipe is carbon steel and physically deteriorated. New stainless steel pipe is being installed.

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Section	Item	Value
General Info.	Description/function:	High-Level Tank Farm Replacement (upgrade phase)
	WAG	3
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	HLW
	Action type:	Upgrade
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Piping & Valves
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Outside Tanks

Section	Item	Value		
Construction Info.	Cost($): PreConst.	$7 Mil.		
	Cost($): Const.	$45 Mil.		
	Schedule Start /End: PreConst.	1991 - 1993		
	Schedule Start /End: Const.	1993 - 1996		
	No. of workers: (new/exist)	67 - 100 Subs.		
	Heavy Equip. Equip. used:	Trucks		
	Trips:	9 to RWMC		
	Acres Disturbed: New	0		
	Previous	2.8		
	Revegetated	0		
	Air Emissions: (None / Ref.)	See Belanger et al. 1995		
	Effluents:			
	Type:	MLLW		
	Quantity: (liters)	200		
	Solid wastes:			
	Type:	LLW	MLLW	HW
	Quantity: (m3)	300	10	10
	Haz./Toxic Chemicals: Storage/inventory	None		

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	None
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	170 k Diesel, 3.8 k Propane
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

Section	Item	Value
Operational Information	Cost($): Operation:	No increase
	Schedule Start /End:	No increase
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used:	
	Trips:	None
	Air Emissions: (None / Ref.)	No increase
	Effluents:	
	Type:	No increase
	Quantity: (liters/yr)	
	Solid wastes:	
	Type:	No increase
	Quantity: (m3/yr)	
	Haz./Toxic Chemicals: Storage/inventory	No increase
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No increase
	Energy requirements:	
	Electrical: (MWH/yr)	No increase
	Fossil fuel: (liters/yr)	No increase
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-2.8 TRANSURANIC STORAGE AREA ENCLOSURE AND STORAGE PROJECT

PROJECT NAME: Transuranic Storage Area Enclosure and Storage Project

This project has been previously evaluated (DOE 1992) and approved with a finding of No Significant Impact (issued May 18, 1992). It is expected to be in process as of June 1, 1995.

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to construct a facility to retrieve and re-store transuranic waste to allow compliance with Resource Conservation and Recovery Act storage requirements and the Idaho National Engineering Laboratory's Part B Resource Conservation and Recovery Act Permit.

PROJECT DESCRIPTION: This project would provide for the retrieval and re-storage of Transuranic Storage Area waste by constructing and operating the Retrieval Enclosure, Waste Storage Facility, support facilities, and associated upgrades to utilities. Transuranic Storage Area waste is located in the Radioactive Waste Management Complex.

This project summary describes both the Transuranic Storage Area Enclosure Facility Project and the Storage Facility Project. The projects are described together because the Environmental Assessment included both activities and to facilitate documentation and review activities.

Since 1970, Department of Energy defense-generated and other contact-handled transuranic waste has been placed in 20-year retrievable storage at the Transuranic Storage Area. Presently, approximately 65,000 cubic meters (85,000 cubic yards) of contact-handled transuranic waste is stored in drums and boxes that are stacked on three asphalt pads (Transuranic Storage Area Pads 1, 2, and R) and in two nearby air support weather shield buildings at the Transuranic Storage Area. Approximately 80 percent of the waste is on these pads and is covered with 1 to 1.5 meters (3 to 4 feet) of soil and/or with a fabric tarpaulin. The remaining 20 percent of the waste is stored in two air support weather shield buildings.

Approximately 95 percent of the waste stored at the Transuranic Storage Area is estimated to be contaminated with chemically hazardous substances regulated under the Resource Conservation and Recovery Act, Toxic Substances Control Act, and the Idaho Hazardous Waste Management Act. The existing storage methods and configurations do not comply with these and other Federal and State requirements and regulations.

Because retrievable storage of Transuranic Storage Area waste began in 1970 at the Radioactive Waste Management Complex, some of the waste containers have been stored for over 20 years. It has been conservatively estimated, based on limited container integrity inspections and deterioration studies, that up to 10 percent of the Transuranic Storage Area waste containers may be breached. This possibility of breached waste containers presents the problem of potential radiological and hazardous chemical contamination of the environment unless retrieval and re-storage occur and increases the need for an enclosure during retrieval.

This project would provide capabilities to retrieve and re-store wastes in new permitted storage buildings designed to meet requirements of the Resource Recovery Conservation Act/Toxic Substances Control Act/Idaho Hazardous Waste Management Act. The design would incorporate the flexibility required to accommodate future modifications and adaptations for various waste forms and compositions present at the Radioactive Waste Management Complex. The facility and support equipment would have a minimum design life of 25 years. Wastes characterized and repackaged at the Waste Characterization Facility would be transferred to the Waste Storage Facility for permitted storage until the waste can be disposed of at either a geologic repository such as the Waste Isolation Pilot Plant, as low-level waste at another disposal facility, or until appropriate treatment can be performed.

The Retrieval Enclosure would be a metal building that would enclose Transuranic Storage Area Pads 1, 2, and R. The Waste Storage Facility would consist of a series of individual pre-engineered metal buildings. The Waste Storage Facility would replace the current air support weather shield buildings and would be a Resource Conservation and Recovery Act-permitted storage facility providing a larger storage capacity. The support facilities would include an operations control building. Utility upgrades to support the project would include fire water, potable water, electric power, communications, alarms, and sewage.

The retrieval process would consist of four steps:

1. Removing and disposing of the soil covering the waste (not applicable for waste retrieved from the Air Support Weather Shield buildings).

2. Removing the waste containers from the Air Support Weather Shield buildings (which would be done as part of Radioactive Waste Management Complex operations) and from Transuranic Storage Area Pads 1, 2, and R (which would take place within the Retrieval Enclosure).

3. Surveying the containers during retrieval for contamination and integrity and decontaminating or overpacking the containers, if necessary.

4. Re-storing the waste in the weather-protected, Resource Conservation and Recovery Act-permitted Waste Storage Facility.

Transuranic Storage Area enclosure waste, 52,000 cubic meters (68,000 cubic yards), would be retrieved at a rate of approximately 5,200 cubic meters, (2,750 cubic yards) or 25,000 drum equivalents per year [1 drum equivalent = 0.21 cubic meters (0.275 cubic yards)]. This activity would continue for approximately 10 years. This throughput may be expanded if breached or contaminated containers are encountered at a lower rate than the 10 percent assumed for design analyses.

Of the storage modules in the Waste Storage Facility, three are completed; all would be complete by 1996. The Retrieval Enclosure would be complete by 1996, and the Operations Control Building would be complete by June 1995.

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Section	Item	Value
General Info.	Description/function:	TSA Enclosure and Storage Project
	WAG	7
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	TRU
	Action type:	New
	Structure Type: Size: (m2)	Ops. Building 2,200 Enclosure 29,430 Storage 24,080
	Other features: (Pits, ponds, power /water/sewer lines)	Utilities
	Location: Inside/outside of fence	Inside RWMC except 2 acres
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	Completed
	Cost($): Const.	$139.2 Mil.
	Schedule Start /End: PreConst.	Completed
	Schedule Start /End: Const.	1993 - 1996
	No. of workers: (new/exist)	150 Peak Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	22 to CFA
	Acres Disturbed: New	2
	Previous	10.4
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	800
	Haz./Toxic Chemicals: Storage/inventory	No information
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	1,420 k
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	920 k Diesel, 184 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$5 Mil./yr
	Schedule Start /End:	1994 - 2025
	No. of workers: (new/exist)	47 New
	Heavy Equip. Equip. used:	Trucks
	Trips:	1000 to & from IWPF
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: Quantity: (liters/yr)	None
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	1 85
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	1,325 k
	Energy requirements: Electrical: (MWH/yr)	5,000
	Fossil fuel: (liters/yr)	415 k
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.9 WASTE CHARACTERIZATION FACILITY

PROJECT NAME: Waste Characterization Facility

This project (DOE 1995c, 1995d) is proposed to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to provide the Idaho National Engineering Laboratory (INEL) with a waste characterization facility for transuranic waste and reclassified low-level waste as required by the Resource Conservation and Recovery Act.

PROJECT DESCRIPTION: This project would provide the design, construction, and operation of a Waste Characterization Facility at the Radioactive Waste Management Complex on the INEL. The Waste Characterization Facility would provide facilities to open containers of contact-handled transuranic waste, reclassified low-level waste, and mixed low-level waste; obtain and examine samples; and repackage the characterized waste in an environment designed to contain alpha-type radiation.

The facility would perform the following specific functions:

- Verify waste forms contained in representative samples of waste stored in containers that have been certified using nondestructive examination techniques at the Stored Waste Examination Pilot Plant

- Sample waste in containers for characterization and analysis required by the Waste Isolation Pilot Plant Waste Acceptance Criteria, including their "no migration determination" conditions and other conditions that Environmental Protection Agency may promulgate for performance assessment. Data would be used to assign and verify waste codes, complete labels and manifests, and to prepare waste profile data forms required for shipment and disposal. The actual analysis would be performed by an approved analytical laboratory.

- Identify waste forms and composition to aid in planning future treatment and disposal facilities for wastes that do not meet certification criteria for the Waste Isolation Pilot Plant

- Demonstrate container opening, waste handling, and packaging equipment required for future treatment facilities

- Provide experimental and pilot-scale treatment process mockup and testing to support future treatment facilities

- Provide facilities for visual characterization of unknown waste contents

- Provide facilities for removal of items from containers that otherwise could be certified for disposal.

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General Info.	Description/function:	Waste Characterization Facility
	WAG	7
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	TRU
	Action type:	New
	Structure Type:	Building
	Size: (m2)	4,200
	Other features: (Pits, ponds, power /water/sewer lines)	Utilities
	Location:	
	Inside/outside of fence	Inside RWMC
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$8.6 Mil.
	Cost($): Const.	$29.4 Mil.
	Schedule Start /End: PreConst.	1990 - 1995
	Schedule Start /End: Const.	1995 - 1997
	No. of workers: (new/exist)	80 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	33 to CFA
	Acres Disturbed: New	0
	Previous	2.1
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	1,200
	Haz./Toxic Chemicals: Storage/inventory	None

Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	2 lagoons (3,200 m2 each)
	Water usage: (liters)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	128 k Diesel, 25.5 k Propane
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$5 Mil./yr
	Schedule Start /End:	1998 - 2023
	No. of workers: (new/exist)	36 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	60 per year
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	LLW
	Quantity: (liters/yr)	1,000
	Solid wastes:	
	Type:	LLW MLLW TRU HW Ind.
	Quantity: (m3/yr)	66 1 0.5 1 20
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	Yes (lagoons)
	Water usage: (liters/yr)	360 k
	Energy requirements:	
	Electrical: (MWH/yr)	10,000
	Fossil fuel: (liters/yr)	5.5 k Diesel, 900 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-2.10 WASTE HANDLING FACILITY

PROJECT NAME: Waste Handling Facility

The National Environmental Policy Act documentation for this project is ongoing and was proposed to be complete by June 1, 1995. This project is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to construct and operate a Waste Handling Facility at Argonne National Laboratory-West that has the following seven proposed objectives:

1. Provide an indoor storage area for low-level waste and mixed low-level waste that is already packaged and awaiting transport for final disposal.

2. Provide an indoor 90-day storage and repackaging area [as defined in 40 CFR 262.34(a)] for hazardous waste and for polychlorinated biphenyl wastes regulated by the Toxic Substances Control Act per 40 CFR 761.65(b).

3. Provide an indoor storage area for recyclable excess items awaiting transport to the INEL excess area, including Resource Conservation and Recovery Act-regulated recyclable materials, such as batteries and lead scrap.

4. Provide an area and equipment for the sorting, segregation, and dumpster loading of solid wastes.

5. Provide monitoring equipment for performing bulk radiological surveys of all nonradioactive wastes to ensure that no radiological wastes are released to the environment or transported to a nonpermitted facility.

6. Provide controlled aboveground outdoor tank systems for storage of waste oil and ethylene glycol awaiting recycling.

7. Provide a controlled outdoor storage area for nonradioactive metal and wood scrap.

PROJECT DESCRIPTION: The Waste Handling Facility at Argonne National Laboratory-West would provide a central point for waste receipt, sorting, storage, and transportation from Argonne National Laboratory-West. The wastes would include low-level radioactive waste, mixed low-level waste, hazardous waste, polychlorinated biphenyl-contaminated waste, and solid (nonradioactive, nonhazardous) waste. The facility would contain the following:

- Hazardous waste storage area
- Municipal sanitary waste (cold waste) sorting area
- Contact-handled radioactive waste storage area
- Excess items (nonradioactive, nonhazardous) storage area
- Offices.

The 650-square-meter (780-square-yard) Waste Handling Facility would provide room for the monitoring of all solid waste generated at Argonne National Laboratory-West for radioactive contamination and presence of hazardous materials.

- Hazardous wastes are accumulated at over 40 hazardous waste satellite accumulation areas located throughout the Argonne National Laboratory-West site. In the hazardous waste storage area, the new facility would accept hazardous wastes from the satellite accumulation areas following the filling of the waste container or termination of the waste process. The Waste Handling Facility would store the wastes in a dedicated hazardous waste storage room until transport from Argonne National Laboratory-West. A smaller room (the Drum Fill Room) would be dedicated to the combining of like wastes into a single container, reducing the number of shipments offsite. Hazardous wastes with recycle potential would be combined and identified.

- The municipal sanitary waste sorting area would provide for (a) monitoring all solid waste generated at Argonne National Laboratory-West for radioactive contamination and presence of hazardous materials and (b) sorting waste to recover recyclable materials. In anticipation of Resource Conservation and Recovery Act proposed Subtitle D requirements and to assist in meeting DOE waste minimization requirements, this facility would provide a means of establishing a maximum recycling effort. Tank storage for waste oil and ethylene glycol would also be provided.

- The Waste Handling Facility would include a storage area for contact-handled low- level radioactive wastes generated at Argonne National Laboratory-West. Radioactive materials would be packaged at the Argonne National Laboratory-West generating facility and sent to the Waste Handling Facility for storage pending transport to the Radioactive Waste Management Complex, the Waste Experimental Reduction Facility, or the Radioactive Mixed Waste Storage Facility, all located on the INEL. Covered storage of radioactive materials would satisfy requirements of DOE Orders 5400.5 (DOE 1993d) and 5820.2A (DOE 1988) to protect personnel and the environment from releases of radioactive materials.

- The Waste Handling Facility would include controlled (fenced) outdoor storage areas for scrap wood and metal that have been verified to be nonradioactive/nonhazardous. Scrap wood/metal segregation would allow for recycling.

Project Data Sheet

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Section	Item	Value
General Info.	Description/function:	Waste Handling Facility
	WAG	9
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	LLW MLLW HW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	650
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$130 K
	Cost($): Const.	$2.7 Mil.
	Schedule Start /End: PreConst.	1995 - 1996
	Schedule Start /End: Const.	1996 - 1997
	No. of workers: (new/exist)	16 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	2 to CFA
	Acres Disturbed: New	0
	Previous	0.3
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	75
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value		
Const.	Cultural resource effects:	None identified		
	Pits/ponding created: (m2)	No		
	Water usage: (liters)	No information		
	Energy requirements: Electrical: (MWH/yr)	No information		
	Fossil fuel: (liters)	18 k Diesel, 3.6 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	Yes		
Operational Information	Cost($): Operation:	$550 k/yr		
	Schedule Start /End:	1997 - 2017		
	No. of workers: (new/exist)	5 Existing		
	Heavy Equip. Equip. used:	Trucks		
	Trips:	22/yr to RWMC WERF CFA PBF		
	Air Emissions: (None / Ref.)	See Appendix F, Section 3		
	Effluents: Type:	HW		
	Quantity: (liters/yr)	8,000		
	Solid wastes: Type:	LLW	Ind.	HW
	Quantity: (m3/yr)	20	170	2
	Haz./Toxic Chemicals: Storage/inventory	None		
	Pits/ponds used: Y/N (m2)	No		
	Water usage: (liters/yr)	No information		
	Energy requirements: Electrical: (MWH/yr)	160		
	Fossil fuel: (liters/yr)	24,500		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	Yes		

C-2.11 HEALTH PHYSICS INSTRUMENT LAB

PROJECT NAME: Health Physics Instrument Lab

This project is proposed to be evaluated, approved, and in process as of June 1, 1995 (DOE 1995b). It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal, and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of the Health Physics Instrument Lab Project is to provide a technologically up-to-date facility that safely accommodates the programmatic and operational needs of the health physics program at the Idaho National Engineering Laboratory (INEL).

PROJECT DESCRIPTION: The existing Health Physics Instrument Lab is located in Central Facilities Area Building 633, which was originally designed for the World War II naval gun testing program. The facility is 40 years old, has significant structural and mechanical deficiencies, and was constructed with asbestos wallboard. The final disposition of Building 633 would not be part of this project.

This project would provide the design, construction, and operation of a replacement facility to accommodate the Health Physics Instrument Lab at the INEL. The new facility would provide approximately 2,400 square meters (2,900 square yards) of space divided among four major areas: (a) transporting, receiving, and storage; (b) instrument control and repair; (c) laboratory operations; and (d) office and support areas.

The Health Physics Instrument Lab would provide portable health physics monitoring instrumentation and direct reading dosimetry procurement, calibration, and maintenance, along with research and development support services to the INEL and others. The existing Health Physics Instrument Lab maintains National Institute of Standards and Technology quality calibration services and provides support in specification and acceptance evaluation of new radiological instrumentation. These instruments are calibrated and maintained in compliance with standards of the American National Standards Institute and are used to accurately measure exposure of personnel from radiological sources and to ensure a safe and healthy workplace for INEL workers.

All instrumentation returned to the Health Physics Instrument Lab would be brought to the transporting and receiving area, surveyed for contamination, and decontaminated. Once the instrument is checked in, it would have an "as found" determination performed to check the condition of the instrument. Defective instruments would then be repaired per recommended repair procedures.

After repair, each instrument would have a reproducibility check performed before actual calibration adjustments are made. The actual calibration control adjustment procedure would depend on the type of readout for the instrument. Calibrations would be performed in the gamma well lab, gamma lab, beta lab, x-ray lab, low-level lab, or low-scatter lab as required. After calibration, the instrument would have a calibration sticker attached and placed in storage.

In addition to calibrations, the Health Physics Instrument Lab would provide technical support and standard irradiations for the Operational Dosimetry Unit. These irradiations would be performed in the panoramic lab, alpha/beta irradiation lab, low-level lab, or low-scatter lab as required. The dosimeter assembly room would be used for disassembly before irradiation and assembly after irradiation of the dosimeters.

Project Data Sheet

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Section	Item	Value
Generic Info.	Description/function:	Health Physics Instrument Lab
	WAG	4
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	Infrastructure
	Action type:	New
	Structure Type:	Building
	Size: (m2)	2,140
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside CFA
	Inside/outside of bldg.	Outside CFA-625
Construction Info.	Cost($): PreConst.	$1 Mil.
	Cost($): Const.	$13.3 Mil.
	Schedule Start /End: PreConst.	1991 - 1998
	Schedule Start /End: Const.	1999 - 2000
	No. of workers: (new/exist)	20 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	17 to CFA
	Acres Disturbed: New	0
	Previous	1.3
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	600
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value		
Const.	Cultural resource effects:	None identified		
	Pits/ponding created: (m2)	No		
	Water usage: (liters)	No information		
	Energy requirements:			
	Electrical: (MWH/yr)	No information		
	Fossil fuel: (liters)	54 k Diesel, 11 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	Yes		
Operational Information	Cost($): Operation:	$1.3 Mil./yr		
	Schedule Start /End:	2001 to 2030 - 2050		
	No. of workers: (new/exist)	2 Existing		
	Heavy Equip. Equip. used:	Trucks		
	Trips:	1 per yer to CFA		
	Air Emissions: (None / Ref.)	See Appendix F, Section 3		
	Effluents:			
	Type:	LLW	HW	
	Quantity: (liters/yr)	< 600	No increase	
	Solid wastes:			
	Type:	LLW	Ind.	HW
	Quantity: (m3/yr)	< 0.5	25	16.4
	Haz./Toxic Chemicals: Storage/inventory	<SARA/CERCLA reportable amounts		
	Pits/ponds used: Y/N (m2)	No		
	Water usage: (liters/yr)	4.4 M liters/yr		
	Energy requirements:	(Electrical Heat)		
	Electrical: (MWH/yr)	210		
	Fossil fuel: (liters/yr)	0		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		

C-2.12 RADIOLOGICAL AND ENVIRONMENTAL SCIENCES LABORATORY REPLACEMENT

PROJECT NAME: Radiological and Environmental Sciences Laboratory Replacement

The National Engineering Policy Act (NEPA) documentation for tbis project is essentially complete. Due to budget contraints, tbe finding of No Significant Impact may not be approved prior to June 1, 1995. This project is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of tbe Radiological and Environmental Sciences Laboratory Replacement Project is to provide updated analytical and support capabilities for tbe environmental, oversight, and standardization programs of DOE, tbe United States Geological Survey, and tbe INEL.

PROJECT DESCRIPTION: The Radiological and Environmental Sciences Laboratory includes buildings CFA-690, CFA-676, and CFA-638 located at tbe Central Facilities Area witbin the Idaho National Engineering Laboratory (INEL) site boundaries. CFA-690 includes the Director's Office, tbe Analytical Chemistry Branch, Environmental Sciences Branch, Laboratory Quality Branch, and Radiological Sciences Branch; and offices for tbe Lockheed Idaho Technologies Company Operational Dosimetry Unit and tbe United States Geological Survey. CFA-638 is used for irradiation (beta, gamma, x-ray, and neutron) of dosimeters. CFA-690 was constructed in 1963, CFA-676 is a 1963 Butler storage building, and CFA-638 is a 1950 munitions bunker, all of which are inadequate for current operational requirements and have various code deficiencies. The potential decontamination and decommissioning of existing facilities would not be part of tbis action.

This project would provide for tbe design, construction, and operation of replacement test, office, and storage facilities witb tbe capability to support environmental surveillance programs, oversee certain DOE contractor activities nationwide, and provide services as a DOE standardization laboratory.

This project would provide approximately 5,300 square meters (6,300 square yards) of laboratory and office space to consolidate Radiological and Environmental Sciences Laboratory operations, correct existing facility deficiencies, and provide additional space to meet tbe demand of expanding

Radiological and Environmental Sciences Laboratory activities. The replacement facility would include the enhanced ability to conduct beta, gamma, x-ray, and neutron dosimetry irradiations and would streamline sample receipt and flow through the testing process. The facility would include controlled environment labs, chemical and biological labs, a central library, a secure sample and record storage area, a loading dock, a receiving room, a computer room and waiting room for whole body count clients, and sufficient office space to support the facility personnel.

Project Data Sheet

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Section	Item	Value
Generic Info.	Description/function:	RESL Replacement
	WAG	4
	EIS Alter. (A, B, C or D):	A, B, C, D
	SNF or Waste stream:	Infrastructure
	Action type:	New -- Replace
	Structure Type:	Building
	Size: (m2)	5,300
	Other features: (Pits, ponds, power /water/sewer lines)	Parking lot, road, power, water sewer lines
	Location:	
	Inside/outside of fence	Inside CFA
	Inside/outside of bldg.	Outside CFA-690
Construction Info.	Cost($): PreConst.	$1.1 Mil.
	Cost($): Const.	$25 Mil.
	Schedule Start /End: PreConst.	1995 - 1998
	Schedule Start /End: Const.	1999 - 2000
	No. of workers: (new/exist)	60 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	41 to CFA
	Acres Disturbed: New	0
	Previous	2.8
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	1,500
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	85 k Diesel, 17 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Info.	Cost($): Operation:	$200 k/yr
	Schedule Start /End:	2001 - 2031
	No. of workers: (new/exist)	40 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	16 per year to CFA
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	LLW
	Quantity: (liters/yr)	100
	Solid wastes:	
	Type:	TRU LLW MLLW HW Ind.
	Quantity: (m3/yr)	0.1 1 0.1 0.1 600
	Haz./Toxic Chemicals: Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	174,000
	Energy requirements:	
	Electrical: (MWH/yr)	2000
	Fossil fuel: (liters/yr)	290 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-3 ENVIRONMENTAL INFORMATION

This section provides environmental information applicable to the foreseeable projects described in Section C-4. Much of the information is given by reference to places in the EIS chapters and in EIS Appendix F, Technical Methodologies and Key Data, that describe the affected environment and environmental impacts. Topics covered are affected environment (C-3.1), generic environmental impacts (C-3.2), mitigation of impacts (C-3.3), and other generic issues (C-3.4).

Foreseeable projects are shown in Table C-3-1. This table correlates the projects to the alternatives they implement. As shown by the table some projects support management of more than one waste stream. Summary descriptions of these projects are presented in Section C-4 in the order listed in the table. Where a project is applicable to more than one category, the project is cross referenced to where the summary is located (for example, the Idaho Waste Processing Facility would manage transuranic, low-level, and mixed low-level waste, but is described only in the transuranic waste section).

Consistent with the Secretary of Energy's June 1994 (DOE 1994a) statement regarding the National Environmental Policy Act, DOE will rely on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for review of actions to be taken under CERCLA. Accordingly, DOE does not plan to make project-specific decisions on potential remedial actions at the INEL based on the analysis in this EIS, and thus summaries of such remedial action projects are not listed here. The documentation prepared for remedial actions pursuant to CERCLA and the Federal Facility Agreement and Consent Order will consider National Environmental Protection Act values such as analyses of cumulative, offsite, ecological, and socioeconomic impacts, consistent with the Secretarial Policy to the extent practicable. The cumulative impacts of reasonably foreseeable remedial actions at the INEL are included in the analyses in this EIS. In addition, in line with DOE (1994a), the list does include for NEPA review the siting, construction and operation of treatment, storage, and disposal facilities, whose functions include the management of waste from remediation-related projects.

C-3.1 Affected Environment

The baseline environmental conditions against which the potential environmental effects of the foreseeable projects (alternatives) can be measured are described primarily in Chapter 4 of this volume of the EIS. Table C-3-2 lists the major environmental attributes, the conditions that are characterized, and the SNF and INEL EIS sections or support documents where they are described in more detail. These major environmental attributes correspond to the summary impact tables included in individual project summaries.

For easier reference, applicable information from EIS Chapter 4 figures has been summarized on Figures C-3-1 through C-3-3. These figures are referenced in Table C-3-2 to show the location of selected characterized conditions relative to foreseeable projects and the INEL site. Figure C-3-1 is a map of the INEL site, Figure C-3-2 is a map of the INEL site and its vicinity showing the seven-county region of influence, and Figure C-3-3 includes the INEL in relation to southern Idaho and portions of adjacent states.

Table C-3-1. Foreseeable projects associated with programs and waste streams.

Project	Appendix C section	Facility location	Other supported waste streams[a,b]	Alternative[c]
SPENT NUCLEAR FUEL PROJECTS	C-4.1			
Expended Core Facility Dry Cell Project	C-4.1.1	NRF	NA	B,D
Increased Rack Capacity for CPP-666	C-4.1.2	ICPP	NA	B,D
Additional Increased Rack Capacity (CPP-666)	C-4.1.3	ICPP	NA	B,D
Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	C-4.1.4	ICPP	NA	B,C,D
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	C-4.1.5	ICPP	NA	B,D
Spent Fuel Processing	C-4.1.6	ICPP	NA	D
Experimental Breeder Reactor-II Blanket Treatment	C-4.1.7	ANL-W	NA	B,D
Electrometallurgical Process Demonstration	C-4.1.8	ANL-W	NA	B,C,D
ENVIRONMENTAL RESTORATION PROJECTS Decontamination and Decommissioning (D&D)	C-4.2			
Central Liquid Waste Processing Facility	C-4.2.1	ANL-W	NA	B,D
Engineering Teat Reactor	C-4.2.2	TRA	NA	B,D
Materials Test Reactor	C-4.2.3	TRA	NA	B,D
Fuel Processing Complex (CPP-601)	C-4.2.4	ICPP	NA	B,D
Fuel Receipt and Storage Facility (CPP-603)	C-4.2.5	ICPP	NA	B,D
Headend Processing Plant (CPP-640)	C-4.2.6	ICPP	NA	B,D
Waste Calcine Facility (CPP-633)	C-4.2.7	ICPP	NA	B,D

Table C-3-1 (continued).

Project	Appendix C section	Facility location	Other supported waste streams[a,b]	Alternative[c]
WASTE MANAGEMENT PROJECTS				
High-level waste	C-4.3			
Tank Farm Heel Removal	C-4.3.1	ICPP	NA	B,C,D
Waste Immobilization Facility	C-4.3.2	ICPP	NA	B,C,D
High-Level Tank Farm New Tanks	C-4.3.3	ICPP	NA	C,D
New Calcine Storage	C-4.3.4	ICPP	NA	D
Radioactive Scrap/Waste Facility	C-4.3.5	ANL-W	NA	B,C,D
Transuranic waste	C-4.4			
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	C-4.4.1	INEL[d,e]	NA	B,D
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	C-4.4.2	RWMC	NA	B,D
Idaho Waste Processing Facility	C-4.4.3	INEL[d]	LLW, MLLW	B,D
Shipping/Transfer Station	C-4.4.4	RWMC	LLW, MLLW	C
Low-level waste	C-4.5			
Waste Experimental Reduction Facility Incineration	C-4.5.1	PBF/ARA	MLLW	B,D
Mixed Low-Level Waste Treatment Facility	C-4.5.3	INEL[d]	MLLW	D
Mixed Low-Level Waste Disposal Facility	C-4.5.4	INEL[d]	MLLW	B,D
Mixed low-level waste	C-4.6			
Nonincinerable Mixed Waste Treatment	C-4.6.4	TRA/PBF	NA	B,D
Remote Mixed Waste Treatment Facility	C-4.6.6	ANL-W	NA	B,D
Sodium Processing Project	C-4.6.7	ANL-W	NA	B,D
Greater-than-Class-C waste	C-4.7			
Greater-Than-Class-C Dedicated Storage	C-4.7.1	TRA or TAN	NA	B,D
Hazardous waste	C-4.8			
Hazardous Waste Treatment, Storage, and Disposal Facilities	C-4.8.1	INEL[d]	NA	D

Table C-3-1 (continued).

Project	Appendix C section	Facility location	Other supported waste streams[a,b]	Alternative[c]
INFRASTRUCTURE PROJECTS	C-4.9			
Industrial/Commercial Landfill Expansion	C-4.9.1	CFA	NA	B,C,D
Gravel Pit Expansions	C-4.9.2	INEL	NA	B,D
Central Facilities Area Clean Laundry and Respirator Facility	C-4.9.3	CFA	NA	B,D
TECHNOLOGY DEVELOPMENT PROJECTS	C-4.10			
Calcine Transfer Project (Bin Set #1)	C-4.10.1	ICPP	(f)	B,D
Plasma Hearth Process Project	C-4.10.2	ANL	(g)	B,D

a. Acronym definition:

ANL-W	Argonne National Laboratory-West
CFA	Central Facilities Area
GTCC	greater-than-Class-C
ICPP	Idaho Chemical Processing Plant
LLW	low-level waste
MLLW	mixed low-level waste
NA	not applicable
NRF	Naval Reactor Facility
PBF/ARA	Power Burst Facility/Auxiliary Reactors Area
RWMC	Radioactive Waste Management Complex
TAN	Test Area North
TRA	Test Reactor Area
TRU	transuranic

b. As shown by this column some projects support management of more than one waste stream.

c. Alternatives (See also box on page C-1-1 and discussion in Chapter 3, EIS Volume 2):
A — No Action
B — Ten-Year Plan
C — Minimum Treatment, Storage, and Disposal
D — Maximum Treatment, Storage, and Disposal

d. For the impact analysis, these projects are assumed to be at a new location, 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex.

e. For air emission and transportation analysis, this project is also assumed to be located at the site boundary near U.S. Highway 26.

f. This project is applicable to high-level waste.

g. This project is applicable to mixed low-level and transuranic wastes.

Table C-3-2. Affected environmental attributes and conditions characterized in the Environmental Impact Statement.

Environmental attribute	Characterized existing conditions	Environmental Impact Statement and support document cross references
Geology and soil, acres disturbed	General geology, seismicity, and volcanism:	Section 4.6, Geology Appendix F-2, Geology and Water
	•Geology	4.6.1, Figure 4.6-1
	•Natural resources (soil, minerals)	4.6.2
	•Seismicity	4.6.3, Figures 4.6-3, -4 Figure C-3-3
	•Volcanism	4.6.4
	•Acres disturbed	4.9.1
Water resources	General hydrologic conditions:	Section 4.8, Water Resources Appendix F-2, Geology and Water Figures C-3-2, C-3-3
	•Snake River Plain Aquifer	4 8.2.1, Figure 4.8-2 Figure C-3-3
	•Surface drainage	4.8.1.1, 4.8.1.2 Figures C-3-1, C-3-3
	•Groundwater flow	Figure 4.8-2
	•Floodplains	4.8.1.3, Figure 4.8-1 Figure C-3-1
	•Vadose zone	4.8.2.3
	•Wetlands	See wildlife and habitat (below)
	•Water quality	4.8.2.5, Table 4.8-1
	•Water use and rights	4.8.3
Wildlife and habitat	General biotic resources:	Section 4.9, Ecology Figures C-3-1, C-3-2, C-3-3
	•Vegetation	4.9.1, Figure 4.9-1
	• Animal communities	4.9.2
	•Threatened, endangered, and sensitive species	4.9.3, Table 4.9-1
	•Wetlands	4.9.4, Figure 4.9-1 Figure C-3-1
	•Human-caused radionuclides in flora and fauna	4.9.5
Historic, archaeological, or cultural resources	General cultural resources:	Section 4.4, Cultural Resources; Section 4.2, Land Use
	•Archaeological sites and historic structures	4.4.1
	•Native American cultural resources	4.4.2, Figure C-3-2
	•Paleontological resources	4.4.3

Table C-3-2 (continued).

Environmental attribute	Characterized existing conditions	Environmental Impact Statement and support document cross references
Air resources	General air quality:	4.5, Aesthetic and Scenic Resources 4.7, Air Resources Appendix F-3, Air Resources Belanger et al (1995)
	•Climate and meteorology	4.7.1
	•Standards and regulations	4.7.2, Figure 4.7-2
	•Radiological air quality, including existing emissions, onsite and offsite doses	4.7.3
	•Nonradiological conditions including sources and concentrations of air pollutants onsite and offsite	4.7.4
	•Designated wilderness air quality standards	4.5.2, Figure C-3-3
Human health	Potential health effects from current INEL operations:	4.12, Health and Safety Appendix F-4, Health and Safety
	•Radiological and nonradiological health risks to public from atmospheric releases	4.12.1, Public Health and Safety
	•Radiological and nonradiological health risks to public from groundwater releases	4.12.1.2
	•Radiological and nonradiological exposures and health effects to workers	4.12.2
Transportation	General transportation:	4.11, Traffic and Transportation
	•Roadways and railroads	4.11.1, 4.11.2, Figure 4.11-1 Figure C-3-2
	•Baseline road and rail traffic	Tables 4.11-2, -3
	•Airports	4.11.3, 4.11.4
	•Waste and material transportation, including baseline radiological doses	4.11.5
Waste management	General activities (minimization, characterization, treatment, storage, and disposal of waste generated from ongoing activities):	Section 2.2.7, Waste Management Table 2.2-1
	•Radioactive waste	2.2.7.1
	•Hazardous waste	2.2.7.2
	•INEL industrial waste	2.2.7.3
Socioeconomic conditions	General socioeconomic conditions:	4.3, Socioeconomics Appendix F-1, Socioeconomics Figure C-3-2
	•Employment and income	4.3.1, Table 4.3-1, Figure 4.3-1
	•Population and housing	4.3.2, Figure 4.3-2, Table 4.3-3
	•Community services and public finance	4.3.3, Table 4.3-4

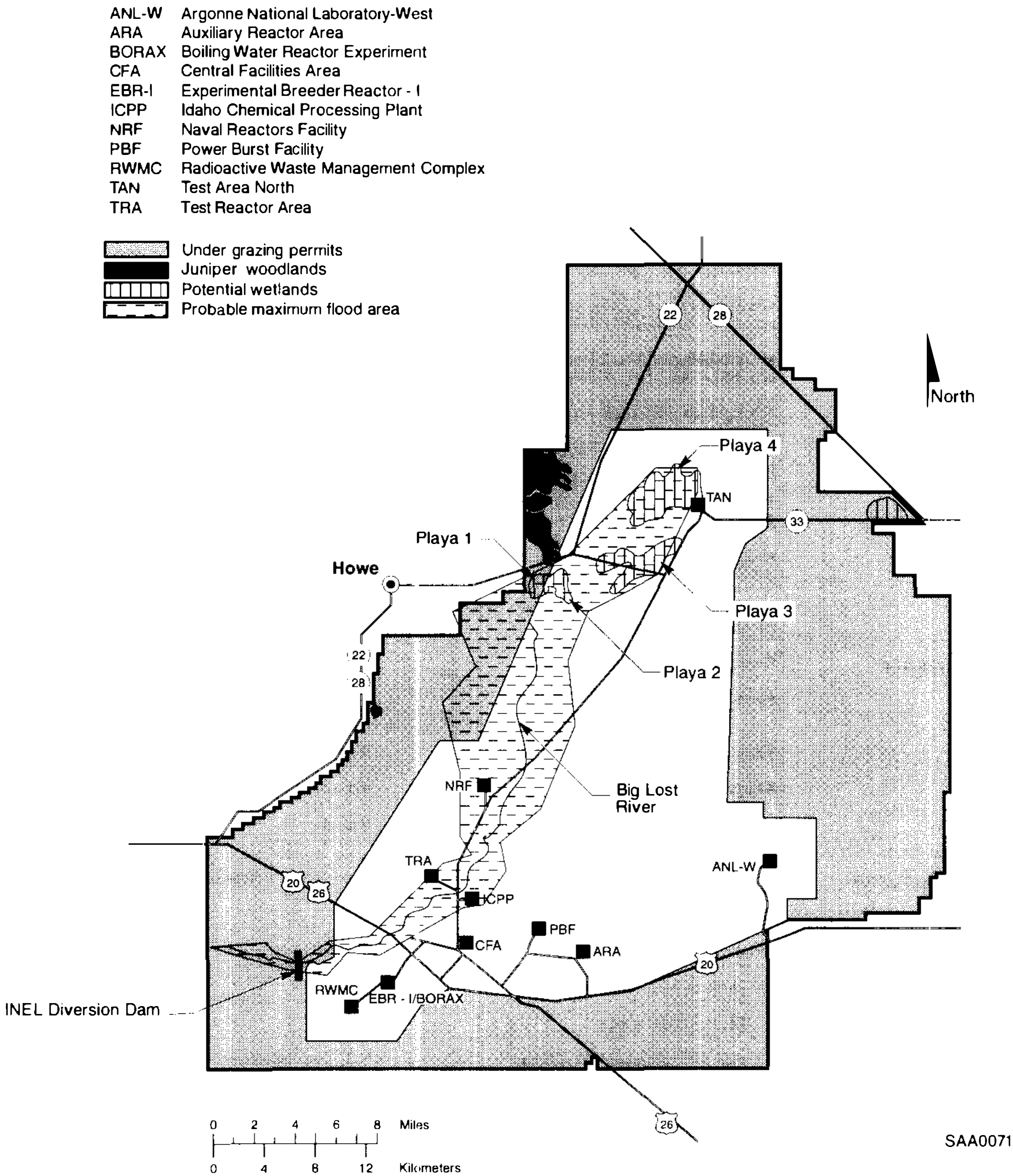

Figure C-3-1. Selected environmental attributes at the Idaho National Engineering Laboratory site.

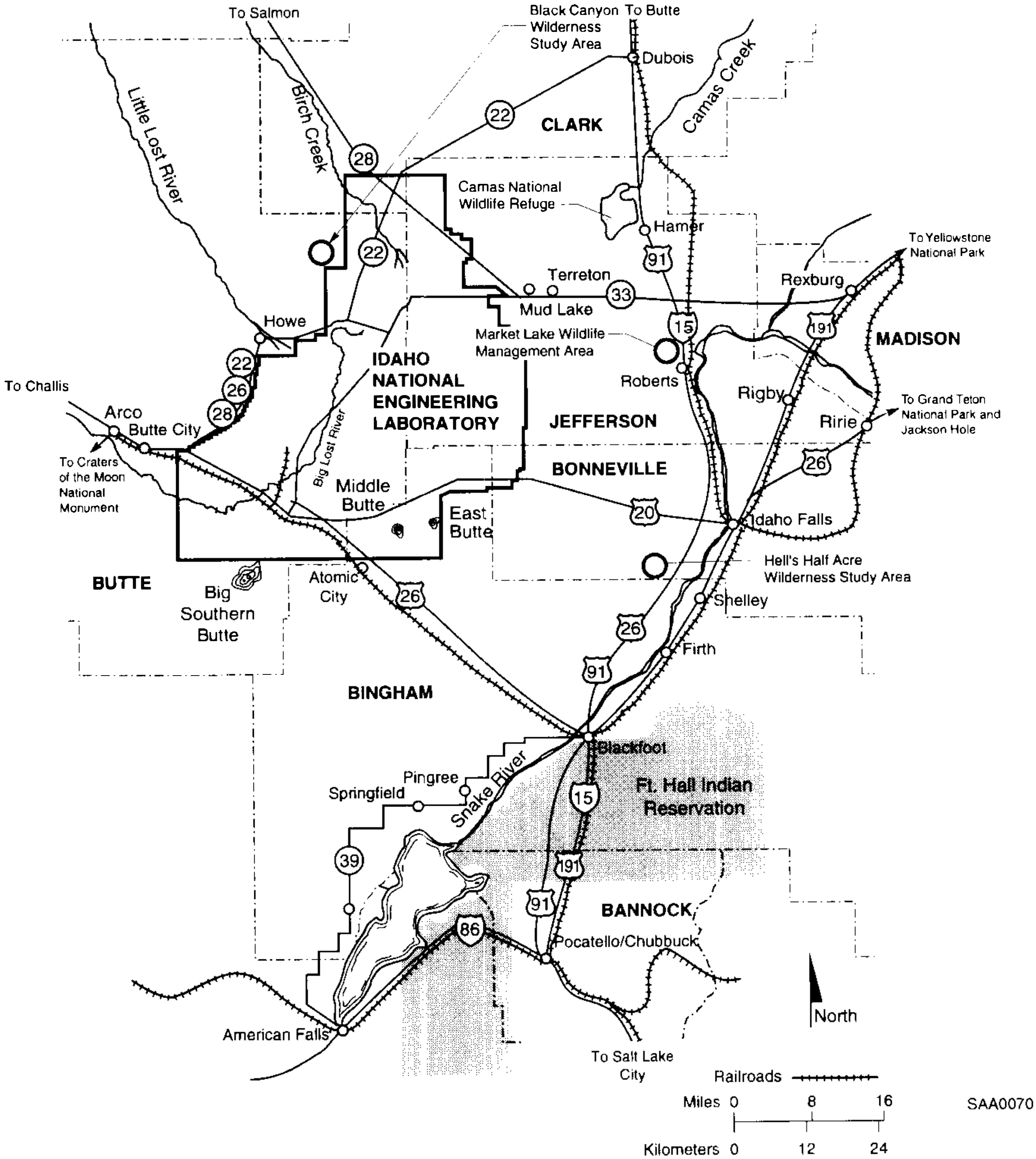

Figure C-3-2. Selected environmental attributes in the Idaho National Engineering Laboratory site vicinity (showing the seven-county region of influence).

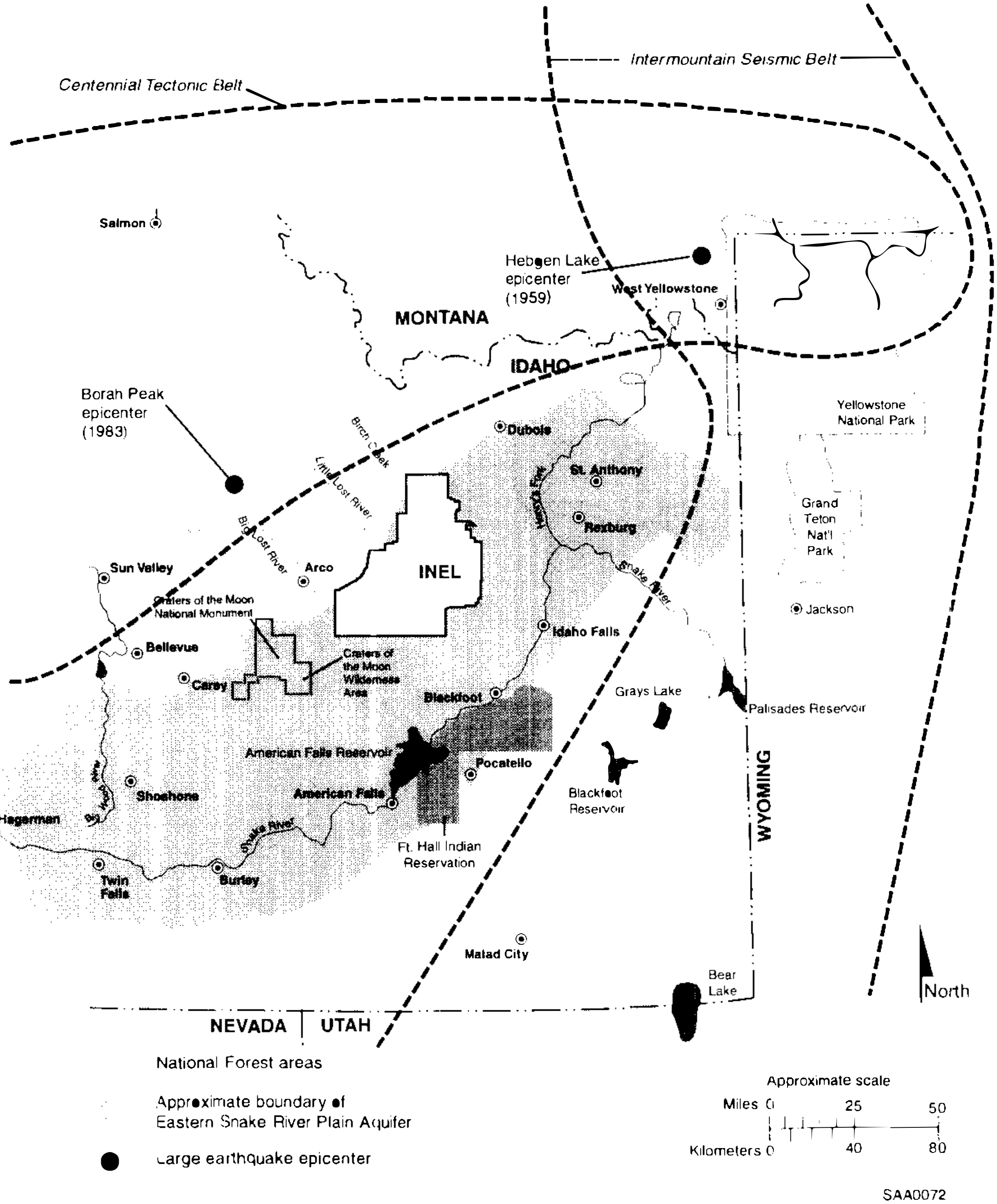

Figure C-3-3. Selected environmental attributes in southern Idaho and portions of adjacent states.

C-3.2 Generic Environmental Impacts

This section provides generic information on environmental impacts of foreseeable INEL projects, to supplement the summary impact tables in the individual project summaries and to aid in the interpretation of these tables.

The foreseeable INEL projects[a] fall into several categories with differing generic environmental impacts as follows:

- Decontamination and decommissioning of existing facilities

- New projects within existing facilities

- New construction within developed industrial areas (identified by numbers on Figure C-1-I). These areas are described as major facility areas in Section 2.2.4. This term is used in the following discussion and throughout this appendix

- New construction conservatively assumed to be outside any established major facility area (shown on Figure C-1-I as being 2.5 miles east of the Radioactive Waste Management Complex)

- Expansion of existing supporting infrastructure.

The differing generic impacts and mitigation measures for these categories are discussed in the following paragraphs.

Decontamination and Decommissioning of Existing Facilities. The process for identifying (a) foreseeable decontamination and decommissioning (D&D) projects and (b) the preferred D&D option for each such project is described in Section 2.2.6.2. The short-term impacts of any D&D

a. No foreseeable projects are located at the INEL Idaho Falls facilities. Consistent with the recent DOE secretarial policy on NEPA (DOE 1994a), no remediation-related projects are included, as discussed in the introduction to this Section C-3.

project versus the long-term productivity depend upon the end use generally specified by the EIS alternative. Alternative B (Ten-Year Plan) specifies industrial use and Alternative D (Maximum Treatment, Storage, and Disposal) specifies complete dismantlement consistent with unrestricted residential use. Alternative C (Minimum Treatment, Storage, and Disposal) relies on surveillance by institutional controls providing for no immediate restoration to long-term productivity. Because the preferred D&D option has not yet been identified, individual projects are assumed to produce waste consistent with Alternative B.

New Projects Within Existing Facilities. In foreseeable projects located in existing facilities, construction impacts would be minimized by the building confinement or containment. Examples are the following projects:

- Increased Rack Capacity for CPP-666 (spent nuclear fuel storage)

- Modification within an existing Argonne National Laboratory-West building for processing of sodium coolant (Sodium Processing Project).

For activities involving outdoor facilities, such as demonstrating calcine transfer from Bin Set 1 [Calcine Transfer Project (Bin Set #1)], other precautions would be taken to confine construction impacts.

For some of these projects, operational impacts (such as water use, emissions, and effluents) would be within the existing operational envelope for the various INEL major facility areas. Examples are new storage projects (such as the additional spent nuclear fuel racks project mentioned above) and technology development projects (such as the calcine transfer demonstration mentioned above). For other projects, such as the sodium coolant processing project (also mentioned above) and the Waste Experimental Reduction Facility incineration project, the change in impacts due to the project would be outside the existing operational envelope.

New Construction Within Major Facility Areas. Other foreseeable projects involve the construction of new facilities within the perimeter of major facility areas at the INEL, specifically at the Test Reactor Area, Idaho Chemical Processing Plant, Radioactive Waste Management Complex, Naval Reactor Facility, and Argonne National Laboratory-West. The construction impacts would depend in part on whether or not newly disturbed land is involved. In either case, location within one of these existing areas would minimize certain impacts (such as on wildlife and habitat) and make it easier to mitigate others (such as on water resources, and historic, archaeological, and cultural resources) compared with INEL locations outside these major facility areas.

Some projects in this category represent continuing functions, so operational impacts (such as water use, emissions, and effluents) would be within the existing operational envelope for the various INEL major facility areas. Examples are the Expended Core Facility Dry Cell Project at the Naval Reactor Facility and the High-Level Tank Farm New Tanks Project at the Idaho Chemical Processing Plant. For some new functions, most operational impacts would be sufficiently small to be considered within the existing operational envelope. Examples are the Dry Fuel Storage Facility (Fuel Receiving, Canning/Characterization, and Shipping) Project and the Greater-Than-Class-C Dedicated Storage Project. For production-scale treatment facilities, such as the Waste Immobilization Facility Project, the changes in impacts due to the project would be outside the existing operational envelope.

New Construction Assumed to be Outside Major Facility Areas. New treatment and disposal facilities for transuranic waste, mixed low level (both alpha-contaminated and beta-gamma-contaminated) waste, low-level waste, and hazardous waste may be located outside existing major facility areas. The five specific foreseeable projects are as follows: Idaho Waste Processing Facility; Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment; Mixed/Low-Level Waste Treatment Facility; Mixed/Low-Level Waste Disposal Facility; and Hazardous Waste Treatment, Storage, and Disposal Facilities. For analysis of impacts, these projects are assumed to be at a new location, 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex as indicated on Figure C-1-1 and noted on Table C-3-1. The impacts based on the assumed location are reasonably conservative because the location is (a) on previously undisturbed ground, (b) near an INEL site boundary, which increases the analyzed impact of air emissions on the public, and (c) in the INEL quadrant closest to the Craters of the Moon Wilderness Area, the nearest Class I visibility area as defined by the Clean Air Act (42 U.S.C §7401 et seq.).

For the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment, a location is also assumed at the INEL boundary near U.S. Highway 26 for air and transportation impacts analyses.

Expansion of Existing Supporting Infrastructure. Expansion of existing infrastructure, such as landfill and gravel pits, involves disturbing new land or extracting surface deposits at various locations outside fenced major facility locations.

Table C-3-3 lists environmental attributes and the analyzed conditions used to characterize the environmental impacts of each foreseeable project. The EIS section where the analyses are documented are also referenced. The following subsections discuss the generic impacts of the projects.

C-3.2.1 Geology and Soil, Acres Disturbed

Proposed reasonably foreseeable projects would only have minor, localized impacts on the geology of the INEL site for all alternatives evaluated. Direct impacts to geologic resources at the INEL site would be associated with disturbing land or extracting surface deposits to construct new facilities and for use as fill for remediation activities, as needed. Acreage disturbed and quantities of surface deposits are identified on summary impact tables and data sheets for the individual projects. None of the foreseeable projects would conflict with existing land use policies for the INEL site, existing uses of lands bordering the INEL site, or local land use plans.

C-3.2.2 Water Resources

The current practice of no direct radioactive discharges exceeding DOE Order 5400.5 (DOE 1993d) limits to the Snake River Plain Aquifer would continue. No foreseeable project would intentionally discharge radioactive liquids to the vadose zone. Impacts from all foreseeable projects under any of the alternatives (considered cumulatively with existing conditions) would not result in concentrations above the U.S. Environmental Protection Agency's maximum contaminant levels (or DOE-derived concentration guides) beyond the INEL site boundary. The projects collectively would have minimal impact on regional ground water quality and their water usage would have a negligible effect on the quantity of water in the aquifer. Effluents and water usage quantities are identified on summary impact tables and data sheets for the individual projects.

Table C-3-3. Environmental attributes, analyzed impacts, and cross references.

Environmental attribute	Impacts analyzed	Environmental Impact Statement and support document cross references
Geology and soil, acres disturbed	Surface deposit excavation; use of aggregate resources; new or previously disturbed acres	Section 5.6, Geology Section 5.2, Land Use Appendix F-2, Geology and Water Section C-3.2.1
Water resources	Water use, effluent type and quantity	Section 5.8, Water Resources Section 5.13, INEL Services Appendix F-2, Geology and Water Section C-3.2.2
Wildlife and habitat	Disturbed acreage (effects on flora and fauna productivity, individual displacement, and habitat fragmentation)	Section 5.9, Ecology Section 5.2, Land Use Section C-3.2.3
Historic, archaeological, or cultural resources	Cultural resource sites	Section 5.4, Cultural Resources Section C-3.2.4
Air resources	Radiological and nonradiological emissions, visibility	Section 5.7, Air Resources Appendix F-3, Air Resources Section C-3.2.5
Human health	Health impacts to workers and public from releases of radioactive and nonradioactive contaminants to the atmosphere and groundwater; radiological impacts in terms of exposure and cancer risk	Section 5.12, Health and Safety Appendix F-4, Health and Safety Section C-3.2.6
Transportation	Heavy equipment types and trips (onsite and offsite)	Section 5.11, Traffic and Transportation Section C-3.2.7
Waste management	Waste volumes generated during project construction and operation	Section 3.1, Description of Alternatives Section C-3.2.8
Socioeconomic conditions	New and existing number of workers for construction and operation phases	Section 5.3, Socioeconomics Appendix F-1, Socioeconomics Section C-3.2.9
Other impacts	Visual impacts on aesthetic and scenic resources	Section 5.5, Aesthetic and Scenic Resources Section C-3.2.10.1
	Facility accident health impacts on workers and public; secondary (environmental) impacts	Section 5.14, Facility Accidents Appendix F-5, Facility Accidents Section C-3.2.10.2

C-3.2.3 Wildlife and Habitat

Reasonably foreseeable projects outside existing buildings and some D&D projects disturb land, as identified in C-3.2.1. For such projects both within and outside the fence lines of major facility areas, previously undisturbed habitat would be impacted by loss of plant productivity and local biodiversity resulting from loss of species common to INEL shrub-steppe vegetation. Nonnative annual plant species may replace more desirable, less vigorous native species. Mortality or displacement of animal species would include those species that are less mobile such as burrowing animals, insects, and rodents. Nesting birds could also be adversely impacted if construction activities occur during prime nesting seasons. Outside fence lines, some potential for habitat fragmentation exists. For previously disturbed habitat, biodiversity loss, productivity loss, and resulting animal displacement and animal mortality would be less.

Short-term adverse impacts could potentially include temporary elevated exposure of biota to hazardous materials and radionuclides during and immediately after construction activities in environmentally controlled areas[a] inside major facility areas. Residual radionuclides and hazardous materials from past activities, not part of the proposed project, would still be potentially consumed by animals and absorbed by plants. These materials may result in injury to individual animals or plants, but have not historically resulted in measurable impacts to populations on or off the INEL site.

Federal protected and candidate species and State-sensitive species would not be affected by implementing any foreseeable project within major facility areas because no critical habitat for protected species has been designated on the INEL site. Because of their location, potential wetlands (Figure C-3-1) and aquatic resources (Figure C-3-3) would also not be affected for any foreseeable project within a major facility area. For foreseeable projects in a new location outside the major facility areas, a location would most likely be selected to avoid such habitats, wetlands, and aquatic resources and applicable mitigative measures would be implemented as described in Section C-3.3.3.

a. An environmentally controlled area (ECA) is a defined region within the boundaries of a major facility area where a hazardous and/or radioactive waste spill/release has been documented. Even when the spill/release has been cleaned up, the area retains its ECA designation.

C-3.2.4 Historic, Archaeological, or Cultural Resources

Established Federal laws and regulations would be followed for identifying, evaluating, and mitigating impacts to cultural resources. Impacts to resources of value to Native Americans (such as sacred or hunting and gathering areas, archaeological sites, and human remains) would be determined through consultation with the affected Native American groups.

In previously unsurveyed areas, undiscovered archaeological, Native American, and paleontological resources may exist and could potentially be adversely impacted. For foreseeable projects involving such areas, a cultural resource or paleontological survey would be performed.

Direct impacts to archeological resources from individual projects would be those associated with ground disturbance from construction activities. Direct impacts to existing structures would usually result from demolition or modification of the structures. Direct impacts to traditional resources may occur through land disturbance, or by changing the environmental setting of traditional use and sacred areas. When sites and structures have not been formally evaluated, they would be considered potentially eligible for the National Register of Historic Places.

For decontamination and decommissioning projects and projects inside existing structures, no land is disturbed, or previously disturbed land has already been surveyed. Any structures already placed on the National Register of Historic Places are identified in project summaries as are other potentially eligible structures. For other projects inside major facility areas and for projects outside facility areas, the evaluation requirements of the appropriate laws and regulations would be followed, as detailed in Section 5.19.1.

C-3.2.5 Air Resources

Impacts of radiological and nonradiological air emissions have been assessed for construction and operation of new facilities and for demolition activities associated with decontamination and decommissioning of existing facilities, both including heavy equipment operation within the INEL. This assessment is in conjunction with maximum operation of existing facilities, environmental restoration activities, and other mobile sources such as vehicular traffic.

For radiological emissions, impacts at onsite and offsite locations from individual projects are given, in percent of the applicable dose limit, in the summary impact table of the project summary. None of these values is more than a few percent of the dose limit of 10 millirem per year specified in the National Emissions Standards for Hazardous Air Pollutants (NESHAP).

Nonradiological impacts are expressed in terms of concentrations of criteria and toxic air pollutants in ambient air (that is, locations to which the public has access, such as outside the INEL site boundary and along public roads traversing the site) and potential impact on other air quality values. At site boundary locations, the highest predicted concentrations of criteria pollutants from the 36 foreseeable projects in Alternative D (Maximum Treatment, Storage, and Disposal) (plus the other activities described above) would remain well below applicable air quality standards. Concentrations at public road locations within the INEL boundary could increase significantly from current levels, but would remain well below applicable standards even with proposed the locations of some major construction projects or combustion sources relatively close to a public road. Offsite levels of all toxic air pollutants would be below applicable standards for all cases.

For foreseeable projects collectively, the incremental impacts at onsite locations of toxic air pollutant emissions are well below occupational standards in all cases. Health effects due to air emissions are discussed in Section C-3.2.6.

Collective impacts related to ozone formation and stratospheric ozone depletion from emissions of volatile organic compounds are well below the levels considered "significant" by State or Federal standards. The potential for impacts on atmospheric visibility at Craters of the Moon National Monument and its associated Wilderness Area has been found to exist under conservative screening analysis. The criterion for acceptable color shift is exceeded, due mainly to nitrogen dioxide emissions. Some foreseeable projects (specifically the Waste Immobilization Facility and Waste Experimental Reduction Facility Incineration projects) exceed the criterion alone or, in the case of the Idaho Waste Processing Facility, contribute significantly to the total. The potential for visibility degradation would be lessened by use of combustion control equipment to reduce nitrogen dioxide emissions. More refined visibility models (in place of the more conservative screening methods) could result in lower predicted impacts. Emission controls would be required if more refined modeling still predicts visibility impacts. Controls may, in fact, be required by other regulations, even if visibility degradation criteria are not exceeded.

C-3.2.6 Human Health

Section 5.12 provides estimates of health impacts to workers and the public from releases of radioactive and nonradioactive contaminants to the atmosphere and groundwater. A detailed explanation of the health effects methodology is contained in Appendix F-4.

C-3.2.6.1 Radiological Atmospheric Releases. Under the conservative assumptions described in Section 5.12.1.1.1, some foreseeable projects are calculated to produce some small increase in radiation exposure (mrem per year) and in lifetime fatal cancer risk, due to air emissions of radioactive materials, to an INEL worker and to the maximally exposed individual at the site boundary. In turn, the calculated risk of a fatal cancer effect expected over the next 70 years among the entire surrounding population would increase. These values for individual projects are given in the summary impact tables in the project summaries.

C-3.2.6.2 Nonradiological Atmospheric Releases. As described in Appendix F-4.2.1.2, a hazard coefficient of one establishes the level of exposure to nonradioactive emissions (both carcinogenic and noncarcinogenic) below which it is unlikely for even sensitive populations to experience adverse health effects. As described in Section 5.12.1.1.2, calculated hazard coefficients are cumulative in that they include risks associated not only with foreseeable projects but also with the maximum baseline and ongoing projects. Because of the conservative methods and assumptions used in the assessment, health effects are unlikely even for hazard coefficients somewhat above one. As discussed in Section C-3.2.5 and summarized in the project-specific impact tables, pollution levels would be within air quality standards, and negligible impact on health effects is expected for the foreseeable projects.

Minor construction-related impacts would include localized levels of fugitive dust and tailpipe emissions of combustion products from construction equipment.

C-3.2.6.3 Groundwater Releases. No health effects specific to groundwater releases from foreseeable projects are identified in Section 5.12.1. This absence is due to changes in current and future discharge practices (as described in Section C-3.2.2) compared to past practices.

C-3.2.7 Transportation

Activities included in the scope of this EIS involve the transportation of industrial, hazardous, and radioactive materials within the boundaries of the INEL site (onsite) and on highways and rail systems outside the boundaries of the INEL site (offsite). The total number of shipments for each alternative is shown in Tables 5.11-4 and 5.11-5 of Section 5.11, Transportation. General assumptions used in allocating transportation impacts (number of truck trips) to specific projects are included in Section C-1.2, Generic Assumptions, and specific assumptions are identified in footnotes to the summary impact tables for the applicable foreseeable projects.

The impact on the regional traffic system from foreseeable projects under all alternatives would be minimal. U.S. Highway 20, the regional highway with highest use around the INEL, would continue to provide free flowing (Level A) service.

C-3.2.7.1 Incident-Free Transportation. The impacts of incident-free transport of waste (transuranic, low-level, and mixed low-level) and spent nuclear fuel have been evaluated in Section 5.11.2.2. For truck shipments of waste, approximately one cancer fatality was estimated among workers and members of the public under Alternative D due to radiation and toxic exposure. These impacts are approximately double the consequences of Alternative B. The increase in Alternative D would be associated with shipments to and from existing INEL waste management facilities and the proposed Transuranic Storage Area Enclosure and Storage Project, Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, and the Greater-Than-Class-C Dedicated Storage Facility. Train shipments yielded consequences that were much lower than truck shipments.

For spent nuclear fuel, Alternative C yielded the highest consequences (approximately 1.2 cancer fatalities among workers and the general public). These impacts are approximately three times the consequences under Alternative B, and would be associated primarily with the proposed Fuel Receiving, Canning/Characterization, and Shipping Facility.

C-3.2.7.2 Transportation Accidents. The potential impacts from offsite transportation accidents involving spent nuclear fuel or radioactive waste have been evaluated in Section 5.11.2.4. For spent nuclear fuel, the radiological risk from transportation accidents would be highest for Alternative C (but still well below one cancer fatality). For radioactive waste, radiological risk from transportation accidents would be highest for alternatives A and B (also well below one cancer fatality). In addition to radiological risks associated with the accidental release of radioactivity, transportation accidents also pose nonradiological risks, such as risk of fatality from the physical impact sustained during an accident. The risk of fatalities from vehicle impacts would be approximately 10 to 10,000 times higher than the risk of fatal cancers from accidental release of radioactivity. From this perspective, the nonradiological risk from transportation accidents would be approximately 2.5 fatalities under Alternative B; this risk would be approximately 1.6 times higher under Alternative D. The increased risks under Alternative D would be associated with increased spent fuel and waste volumes shipped to existing facilities, and the five foreseeable projects in Alternative D but not in Alternative B in Table C-3-1.

The maximum reasonably foreseeable onsite spent nuclear fuel transportation accident involves baseline activity and not any foreseeable project. Because the estimated number of spent nuclear fuel shipments is expected to be the same for all EIS alternatives, the annual frequency and consequences of the maximum reasonably foreseeable accident are not affected by foreseeable projects.

Onsite transuranic waste shipments are expected to be dominated by a baseline activity (shipments between the INEL Radioactive Waste Management Complex and Argonne National Laboratory-West as part of the characterization and certification program required for shipments of INEL transuranic waste to the Waste Isolation Pilot Plant). Because the estimated number of onsite transuranic waste shipments is expected to be approximately the same for all EIS alternatives, the annual frequency and consequence of the maximum reasonably foreseeable accident are not affected by foreseeable projects.

Onsite low-level and mixed low-level waste shipments are expected to be dominated by shipments of routine operational waste from INEL facilities to INEL treatment, storage, and disposal facilities. Some variability in the number of shipments, and consequently the probability of accidents, is seen as a result of foreseeable decontamination and decommissioning projects. Total waste transportation mileage is increased about 40 percent by tbese decontamination and decommissioning activities. While tbe maximum reasonably foreseeable accident doses are tbe same, tbe annual frequencies are increased by 40 percent. The accident-related fatal cancer risk for tbe population within 50 miles (80 kilometers) from all low-level and mixed low-level waste onsite shipment is about one in 18,000 years for a generic suburban population zone. This estimate conservatively bounds tbe impact of all foreseeable decontamination and decommissioning projects (and hence any one project) (a) because tbese projects only contribute about 30 percent (4 parts in 14) to tbe estimate, and (b) because tbe population density around tbe INEL site is less than 10 percent of a generic suburban population zone.

C-3.2.8 Waste Management

Waste management would involve not only the throughput of various waste treatment facilities but also the incidental waste generated during construction and operation of tbese and other foreseeable projects. Estimated quantities of waste materials characterized by type are included on project data sheets. Where Resource Conservation and Recovery Act (RCRA) issues are not yet identified, they would be reviewed during the permitting process. Individual foreseeable projects would be designed, constructed, and operated in compliance with Federal and State laws and DOE orders and otber guidelines affecting the generation, transportation, treatment, storage, or disposal of hazardous and/or radioactive waste. Impacts of these activities are discussed under otber subheadings in this section (C-3.2).

C-3.2.9 Socioeconomic Conditions

As stated in Section 5.15.2, tbe cumulative impact on regional employment under implementation of all foreseeable projects under any of tbe EIS alternatives would be an overall decline during the ten-year time frame of tbis EIS. Initially, implementation of any of the EIS alternatives would generate temporary increases in employment within the region surrounding tbe INEL, primarily due to construction activities. However, individual construction projects could be manned by tbe regional work force. The magnitude of tbe cumulative impact on regional employment under implementation of all foreseeable projects under any of the EIS alternatives is not expected to be sufficient to notably affect the socioeconomic resources of the region.

No environmental impact due to noise is expected from the foreseeable projects because buses are the primary source of road noise. Construction workers would be driving private vehicles and no project's operating staff would change the total number of buses significantly.

Individual project requirements for electricity, water usage, waste water discharge, heating oil, diesel fuel, and propane are given on the individual project data sheets. Existing systems within major facility areas are expected to handle collective requirements, except as indicated in individual project descriptions.

C-3.2.10 Other Impacts

C-3.2.10.1 Aesthetic and Scenic Resources. Except for the potential for impacts on atmospheric visibility at Craters of the Moon Wilderness Area (see Figure C-3-2) under worst-case modeling conditions (see C-3.2.5 above), no adverse visual impact on aesthetic and scenic resources has been identified for any of the foreseeable projects. In all instances, new facilities would resemble existing facilities and would not change the visual character of the INEL site.

C-3.2.10.2 Facility Accidents. Section 5.14 addresses the consequences of possible facility accidents for a member of the public at the nearest site boundary, for the collective population within 80 kilometers (50 miles), for workers, and for the environment. Under the conservative analysis used, foreseeable projects are calculated to produce some potential for increase in human health effects. These increases are summarized below.

- For the individual at the nearest site boundary: The foreseeable projects collectively do not change either the potential radiation exposure or the frequency of the highest consequence accidents (those producing a potential exposure greater than about 0.1 rem). (See Figures 5.14-2, -6, -9, and -12.) However, the very low risk of fatal cancer from lower-exposure, higher-frequency accidents causes this annual cancer risk to increase from one in about 20 million per year to about one in 5 million per year. This increase is mostly due to the additional spent fuel and waste management activities at the INEL and the associated five projects in Alternative D but not in Alternative B (see Table C-3-1).

Even for Alternative D, this risk is about a factor of ten below the DOE National Safety Policy Goal (DOE 1991a).[a]

The potential health effects for hazardous materials are more qualitative than for radioactive materials. They are reported as a percentage of the concentration at the site boundary that could cause life-threatening health effects. Without the foreseeable projects, concentrations are well below the threshold values for life-threatening health effects. The concentrations from maximum reasonably foreseeable accidents remain unchanged as a result of the 31 foreseeable projects in Alternative B. Lower-consequence accidents could occur as a result of these projects. Concentrations as a result of the increased inventories and management activities in Alternative D, and of the five foreseeable projects in Alternative D but not in Alternative B, are 20 percent higher for a few accidents, but still well below life-threatening values.

- For the collective population: Without foreseeable projects, the estimated excess fatal cancers from any maximum foreseeable radiation accident range from 10^{-7} to 10^{-4} per year. These estimates remain essentially unchanged for the 31 foreseeable projects in Alternative B. They also remain essentially unchanged for the 36 foreseeable projects in Alternative D with one exception: The estimate for low-level/mixed low-level waste increases from 10^{-7} to 10^{-5} per year excess fatal cancers due primarily to increased inventories and management activities.

- For the worker: The estimated radiation dose to the facility worker [defined as a worker located 100 meters (300 feet) from the point of release] from various maximum foreseeable accidents is essentially unaffected for the 36 foreseeable projects in Alternative D. Regardless of the alternative, workers closer to the point of release have the potential for injury or death.

Generic potential impacts on the environment from maximum foreseeable accidents at foreseeable projects, termed secondary impacts in Section 5.14, are characterized there according to

a. The policy states that the cancer fatality risk to the population within one mile of the site boundary of a DOE nuclear facility should not exceed 0.1 percent of the sum of all cancer fatality risks resulting from all other sources.

the material handled: spent nuclear fuel, high-level waste, or transuranic waste, low-level waste, mixed low-level waste, or hazardous waste. A summary of these impacts follows.

- No environmental impacts would result from hazardous waste, low-level waste, or mixed low-level waste accidents.

- No change in land use is expected from transuranic waste accidents. A one-year agricultural land withdrawal of land on or off the INEL site may be necessary--up to 10,000 acres for a maximum foreseeable spent nuclear fuel accident and up to 4,000 acres for a maximum foreseeable high-level waste accident.

- A spent nuclear fuel, high-level waste, or transuranic waste accident could cause limited adverse effects to surface water, ground water, vegetation, or wildlife. No impacts would be expected to endangered or threatened species.

- Land may have temporary restrictions (up to one year) for agricultural and public/tribal access.

C-3.3 Mitigation of Impacts

An overview of all mitigation measures applicable to foreseeable projects is presented in Section 5.19. These measures are summarized below (with subheadings in the same order as impacts in Section C-3.2).

C-3.3.1 Geology and Soil, Acres Disturbed

Potential soil erosion in areas of ground disturbance would be mitigated through minimizing areas of surface disturbance and by using engineering practices (as described in Section 5.19.3), such as storm water runoff control, slope stabilization, and wind erosion (fugitive dust) protection. Such protection could include covering soil stockpiles and water spraying. No other mitigation measures related to land use are required.

C-3.3.2 Water Resources

The development of pollution prevention plans, such as the INEL Storm Water Pollution Prevention Plans (DOE-ID 1993a, 1993b) and the INEL Groundwater Protection Management Plan (Case et al. 1990), and implementation of best management practices are also important to preventing future sources of pollution to water resources (see Section 5.19.5). These practices develop standard procedures for handling waste materials and preventing accidental discharges. Existing monitoring and surveillance programs around tanks and ponds would also reduce impacts of inadvertent liquid release by restricting their duration and volume.

C-3.3.3 Wildlife and Habitat

Unavoidable impacts to biota from foreseeable projects within major facilities could include disturbance of a limited amount of habitat, mortality or displacement of some animals (primarily small mammals, reptiles, and birds), and possibly temporary elevated exposure levels to airborne radionuclides and hazardous materials. Mitigation measures (see Section 5.19.6) for ground disturbance would include drainage structures to minimize soil erosion and reseeding bare ground. Uptake of radionuclides would be minimized by dust suppression, containment, and erosion control, and by rapid removal of any newly exposed soil contaminants.

For any new location not within the perimeter of a major facility area, preactivity surveys for sensitive and protected species and habitats, identification of jurisdictional wetlands, and consultation with appropriate agencies would be conducted. Needed mitigations would be explicitly identified, based on the results of the surveys and consultations. DOE would evaluate the project design to determine if relocation or modifications would minimize potential negative effects. Where practicable, modifications would be implemented.

C-3.3.4 Historic, Archaeological, or Cultural Resources

For cultural resources (Section 5.19.1), all mitigation plans would be developed in consultation with Native American Tribes (where appropriate), the State Historic Preservation Office, and the Advisory Council on Historic Preservation. These plans would conform to appropriate standards and guidelines established for historic preservation activities by the Secretary of the Interior under current terms of the National Historic Preservation Act. If a foreseeable project affects areas of religious, cultural, or historic value to Native Americans, DOE would follow the mandates of the Archaeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act.

C-3.3.5 Air Resources

For air resources (Section 5.19.4), controls to reduce radiological emissions and doses would depend on the nature of the specific process and the types and amounts of radionuclides that may be released. For example, controls would include limiting iodine-129 emissions from spent nuclear fuel or high-level waste processing by means such as charcoal or silver zeolite filtering media. High-efficiency particulate air filters would be used extensively to reduce emissions of radionuclides that are particulates. Waste acceptance criteria for waste treatment processes would put a limit on the radioactive source term.

Best available control technology would be designed for each pollutant associated with a significant emissions increase as defined in the State of Idaho regulations. These impacts would be further defined and resolved during the air permitting process before a project could proceed. Emission control equipment would be used as required or appropriate to reduce such impacts.

C-3.3.6 Human Health

Health and safety hazards would be mitigated by best management practices and by occupational and radiological safety programs that operate under the same regulatory standards and limits as currently apply to the INEL. Elements of these programs include access control, personnel dosimetry, safety analysis, inspection and surveillance, annual reporting. The intent of these programs is to keep risks as low as reasonably achievable. For this reason, administrative limits on radiation exposure and other hazards are set well below the allowed regulatory limits.

C-3.3.7 Transportation

Mitigation measures related to transportation of radioactive and hazardous materials include use of approved transport vehicles and containers. There are U.S. Department of Transportation requirements for drivers, packaging, labeling, marking, and placarding. There are also requirements that specify the maximum dose rate associated with radioactive material shipments, which help to reduce incident-free transportation doses. Mitigation of consequences from transportation accidents would also be through emergency response programs.

C-3.3.8 Waste Management

Pollution prevention and waste minimization practices would be applied both to the throughput of various waste treatment facilities and also to the incidental waste generated during construction and operation of these and other foreseeable projects.

C-3.3.9 Socioeconomic Conditions

No mitigation measures are required for socioeconomics or noise. For INEL services, practices would be implemented to reduce inefficient use of utilities and energy services. Recycling of materials would be considered during planning of decontamination and decommissioning projects.

C-3.3.10 Other Impacts

With regard to visibility degradation of aesthetic and scenic resources (Section 5.19.2) due to operations, mitigation measures could include administrative controls on facility operation or use of combustion control equipment to further reduce nitrogen dioxide emissions.

Mitigation of consequences from facility accidents would be primarily through emergency planning, preparedness, and response programs. Response actions could include immediate and longer-term restricted access to and cleanup of contaminated land, as well as interdiction of agricultural products from such land.

C-3.4 Other Generic Issues

C-3.4.1 Cumulative and Indirect Impacts

Cumulative and indirect impacts are discussed in Section 5.15. The specific projects described in this appendix are included in the cumulative impact analysis in Section 5.15 for each of the four analyzed alternatives. Each project, and the alternative under which it would be implemented, is listed in Tables C-1-1 and C-3-1.

C-3.4.2 Beneficial and Adverse Effects

Adverse environmental effects which cannot be avoided are described in Section 5.16.

C-3.4.2.1 Water Resources. The foreseeable projects do not include comprehensive remediation of all contaminated media and areas. This impact is considered unavoidably adverse for water quality.

C-3.4.2.2 Wildlife and Habitat. As described in C-3.2.3, unavoidable impacts to biota for some foreseeable projects would include disturbance of undisturbed habitat and/or of previously disturbed habitat that is of low quality and limited use to wildlife. Short-term adverse impacts to biota could potentially include temporary elevated exposure to residual radionuclides and hazardous materials from past activities during and immediately after construction activities for foreseeable projects.

Utilization of an additional acreage outside the major facility areas would increase the amount of habitat loss and would have the potential to enhance habitat fragmentation on the INEL site.

C-3.4.2.3 Cultural Resources. Adverse impacts related to removal or alteration of potentially significant historic structures could occur. Adverse impacts may also occur to archaeological sites of importance to Native Americans and areas of traditional or religious importance. Although most adverse effects to sites can be mitigated through scientific study, effects to sites that are important to Native American groups may remain adverse. The number of potentially significant historic structures and archaeological sites is listed for each foreseeable project in its summary impact table and in Table 5.4-1, to the extent they have been surveyed.

C-3.4.2.4 Air Resources. Discharge of combustion products and particulate matter into the air from proposed projects would contribute to localized reduction of air quality. At the Craters of the Moon Wilderness Area, potential impacts on visibility impairment as a result of nitrogen dioxide emissions could be associated with some projects. If such impacts are confirmed by more refined analysis, control measures would be required before projects could proceed.

C-3.4.3 Irretrievable and Irreversible Commitments of Resources

Irretrievable and irreversible commitments of resources are described in Section 5.18.

Irreversible and irretrievable commitments of resources for certain foreseeable projects would potentially include land, aggregate, groundwater (areas of contamination), air resources, and energy resources. However, some materials (for example, structural and stainless steel) and resources (for example, water use) are considered recyclable and are not considered an irreversible and irretrievable commitment of resources.

Facilities for disposal of radioactive and/or hazardous wastes would cause irreversible and irretrievable commitments of land resources of previously open-space land. Local services potentially lost from the commitment of these acreages would include lost vegetation productivity, lost wildlife productivity, and lost multiple-use or alternative-use opportunities (for example, disposal sites would not undergo future decommissioning or decontamination and habitat reclamation).

Some of the aggregate resources (sand, gravel, pumice, and landscaping cinders) extracted on the site would be irreversibly and irretrievably committed in support of certain foreseeable projects. Aggregate quantities utilized during construction for concrete production and foundation preparation are listed on the individual project data sheets. Aggregate demands for these uses and for road construction and maintenance vary by EIS alternative, as shown on the data sheets for the Gravel Pit Expansion Project.

Activities at the INEL site have resulted in the irreversible and irretrievable commitment of groundwater in the Snake River Plain Aquifer that has been affected by chemical and radioactive contaminant plumes. Because of changed practices, this commitment is not expected to increase due to foreseeable projects. All potable water wells on the INEL site are monitored routinely to ensure that water withdrawn from the aquifer is utilized appropriately, as specified under Federal and State regulations.

Portions of air resources at the INEL site would be committed under some foreseeable projects. Lost services associated with commitments of air resources may include lower visitor use of portions of the regions because of lowered visual quality.

Commitment of energy resources (electricity, heating oil, diesel fuel, and propane) is quantified on individual project data sheets.

C-3.4.4 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The relationship between short-term use of the environment and the maintenance and enhancement of long-term productivity is discussed in Section 5.17.

Implementation of most foreseeable projects would cause some adverse impacts to the environment and would permanently commit certain resources. However, many of these uses of the environment would be of short duration and offset by long-term enhancements to the environmental productivity of the region. The following is a description of the generic short-term influences on the environment and the associated effects on the maintenance and enhancement of long-term productivity of the environment.

- General: Implementation of any of the alternatives would cause some adverse impacts to the environment and would permanently commit certain resources. However, under several of the alternatives these uses of the environment would be of short duration and offset by long-term enhancements to the environmental productivity of the region, as discussed as follows and in Section 5.17.

- Land Use: Even when environmental impacts include land disturbance and land-use category changes from open space to industrial uses (as for projects outside major facility areas), no effect on long-term productivity of the total INEL environment is expected.

- Geology: For foreseeable projects undergoing construction activities, some soil and aggregate/borrow loss would be expected. However, these activities would be of short duration and soil loss would be minimized by initiating the mitigation measures outlined in Section C-3.3.1. Therefore, no long-term effect on environmental productivity of the habitat surrounding these sites is expected.

- Wildlife and Habitat: The potential short-term productivity loss in habitats adjacent to individual INEL facilities and to major facility areas would be offset by a reduction in contaminant exposure to ecological resources, thereby increasing environmental productivity. There would be a long-term loss of productivity and biodiversity associated with the acreage that would be disturbed and used.

- Cultural Resources: Additional information gained during preactivity surveys for archaeological, historical, or paleontological resources could be compiled into a database or added to an existing database to improve the knowledge of area history. Also coordination with affected Native Americans would increase sensitivity to their concerns and show greater confidentiality of areas that hold cultural and religious significance for them. Increasing the historical knowledge and understanding of the area would provide a basis for the enhancement of future management of cultural resources in the region.

- Air Quality: Areas disturbed for construction activities would result in short-term, elevated levels of particulate matter in these areas of disturbance. Mitigation measures outlined in Section C-3.3.1 would reduce fugitive dust potential. No long-term effect on air quality is expected from construction.

C-3.4.5 Environmental Justice

As stated in Section 5.20, DOE has reviewed the projects to consider the extent to which minority or low-income populations could be affected. DOE's overall review indicated that the potential impacts calculated for each discipline under each of the proposed alternatives present no significant risk and do not constitute a reasonably foreseeable adverse impact to the surrounding population. Therefore, the impacts also do not constitute a disproportionately high and adverse impact on any particular segment of the population, including minorities or low-income communities in the area, and thus do not present an environmental justice concern.

C-3.4.6 Consultation with Other Agencies

Letters regarding consultation under Endangered Species Act and National Historic Preservation Act are included in Appendix B, Consultation Letters. A listing of agencies and persons consulted is also included in Appendix B.

C-4 FORESEEABLE PROJECTS—DESCRIPTIONS

Foreseeable proposed projects, whose detailed design or planning will not begin until the DOE has determined that the requirements of the National Environmental Policy Act process for the project have been completed, are listed in Table C-3-1 in Section C-3 and are described in this section.

C-4.1 PROJECTS RELATED TO SPENT NUCLEAR FUEL

C-4.1.1 EXPENDED CORE FACILITY DRY CELL PROJECT

PROJECT NAME: Expended Core Facility Dry Cell Project

GENERAL PROJECT OBJECTIVE: The general project objective of the Expended Core Facility Dry Cell project would be to increase the efficiency of naval spent nuclear fuel module preparation. If implemented, the new Dry Cell would improve module preparation efficiency, minimize transportation, preclude disturbances of other sites, and make efficient use of existing facilities.

Historically, naval spent nuclear fuel has been transported from the defueling location to the Idaho National Engineering Laboratory (INEL) where it is unloaded into water pools at Expended Core Facility. The spent nuclear fuel modules were prepared for examination and storage by removing the nonfuel structural sections in the Expended Core Facility water pools. After preparation and examination, the fuel bearing sections are shipped to the Idaho Chemical Processing Plant for storage. Removal of nonfuel structural sections is needed to facilitate examination and to minimize the amount of material managed as spent nuclear fuel.

PROJECT DESCRIPTION: Expended Core Facility

The Expended Core Facility is located within the confines of the Naval Reactors Facility at the INEL. It is a large laboratory facility used to receive, examine, and prepare for storage and transport naval spent nuclear fuel and irradiated test specimen assemblies. The information derived from the examinations performed at the Expended Core Facility provide engineering data on nuclear reactor environments, material behavior, and design performance. These data are used to develop longer-lived naval fuel and to ensure fuel already in use in warships can be operated as long as possible. Naval spent nuclear fuel is prepared at the Expended Core Facility for storage and shipment to the Idaho Chemical Processing Plant.

The building that houses the Expended Core Facility is a concrete block structure approximately 1,000 feet by 194 feet. This space provides offices and enclosed work areas, including an array of interconnected reinforced concrete water pools that permit visual observation of naval spent nuclear fuel during handling and inspection while shielding workers from radiation. Adjacent to the water pools are shielded cells used for operations that must be performed dry. Access to the Expended

Core Facility for receipt and shipping of large containers is provided by large rollup doors that allow railcar and truck entry.

The water pools are 430 feet long and about 40 feet wide. The depths of the different water pool zones vary from 20 feet to 45 feet. There are five crane bridges for routine movement of material within the pools. A network of walkways also serves as work platforms from which examination technicians control and manipulate the tools and measuring apparatus which must be used under water.

Walls and gates divide water pools into smaller work areas. This sectionalization makes it possible to drain only a small portion of the pool at a time for equipment maintenance and repair. The shielded cells are located to the north of the water pools. Transfer of irradiated material between the water pools and shielded cells is conducted via three transfer canals.

All water pools are watertight, reinforced concrete construction. The water pool floors are designed to support installed equipment and shielded shipping containers. The depths and sizes of individual water pool zones have been determined by shielding requirements, the size of the materials to be handled, and accommodation of the machine tools and operating equipment. All construction joints in the water pools contain water stops. Water pool walls and floors are coated with a thermal-setting plastic coating, which is highly resistant to radiation damage, is amenable to easy decontamination, and contributes to water tightness.

Liquid radioactive wastes are generated in the Expended Core Facility through the radioactive contamination of the water pool water by the introduction of corrosion products from the fuel and nonfuel materials from the irradiations test programs and the unloading of spent fuel shipping containers. The Expended Core Facility has developed a variety of techniques for treating liquid wastes and has achieved a zero discharge of liquid radioactive waste to the environment. The design basis for the Expended Core Facility liquid treatment system is to maintain zero discharge, maintain water clarity, minimize the amount of water-borne activity, and reduce exposures to personnel to as low a value as possible.

The shielded cells afford another major capability of the Expended Core Facility. There are 14 concrete cells used for examination of smaller components. The shielded cells are constructed of concrete with varying densities, normal (150 pounds per cubic foot), 195 pounds per cubic foot, and 280 pounds per cubic foot. Walls are 3 feet thick to provide the necessary shielding to reduce radiation in occupied areas. All work in the cells is done by remotely operated equipment controlled from the operating gallery and viewed through windows which are specially constructed to be nonbrowning and equal in shielding value to the concrete walls.

At the Expended Core Facility, the spent fuel is unloaded from shipping containers with special, heavily shielded transfer casks to protect the workers from radiation. The spent fuel is removed from the transfer cask in the water pool where the depth of the water is sufficient to shield the workers from the radiation of the exposed spent fuel modules. The subsequent machining operations and examinations of the spent fuel are performed in the water pool under the required depth of water where operations and examinations can be performed safely. After the work on the spent fuel is completed, the spent fuel is loaded into a shielded transfer cask (under water) for transit to the storage location, such as the Idaho Chemical Processing Plant. These are the main pieces of special equipment and facilities that are required to perform the necessary operations with naval spent nuclear fuel. There are many other pieces of equipment and apparatus that are also used along with the main equipment to do the necessary work safely and efficiently.

PROJECT DESCRIPTION:. Dry Cell Project:

Purpose and Need: This project would provide for the design, construction, and operation of a facility for the preparation of naval spent nuclear fuel modules for shipment to storage facilities. These operations are currently performed in the Expended Core Facility water pool. The primary function of the facility would be to examine fuel modules and remove nonfuel structures from the fuel modules, thereby reducing the volume of material that must be managed as fuel. Additionally, control rods would be fastened to the fuel modules to ensure shutdown conditions are maintained. This work would be performed in a shielded, radiologically controlled area with remotely operated equipment utilizing proven fuel handling methods. The facility would be designed for a 40-year life, built of structural steel and concrete, and would be integral with the existing Expended Core Facility building.

Location: The Naval Reactors Facility Expended Core Facility is located on the INEL site in Butte County which is part of the Eastern Idaho Intrastate Air Quality Control Region No. 61. The Naval Reactors Facility is in the southern portion of the INEL site, about 23 kilometers (14 miles) north of the southern site boundary. The Dry Cell Project would be a southeast extension of the Expended Core Facility building. The Universal Transverse Mercator coordinates for the Dry Cell Facility Main Exhaust Stack will be 4834625 meters north and 345550 meters east. The township, range, section coordinates are T4N R30E Section 30.

Type of Facility: The Expended Core Facility Dry Cell would be a shielded concrete structure with remotely operated equipment for preparing naval spent nuclear fuel modules for examination and shipment to storage facilities.

The major element of the Dry Cell Facility would be a large reinforced concrete shielded cell with interior dimensions of 22 feet wide by 84 feet long by 21 feet high, containing all the equipment necessary to inspect and disassemble fuel modules. Shielded decontamination and repair cells would be attached to the main shielded cell to allow remote decontamination and repair of equipment used throughout the Expended Core Facility.

Design Objectives: The facility would have the capability to prepare and load one fuel module per shift in a shipping cask. Based on a two shift per day operation (500 shifts per year), and an assumption that 25 percent of the time the facility would be shut down for maintenance, the Dry Cell Facility yearly capacity is expected to be about 375 modules.

The cell design would incorporate 4-foot-thick radiation shielding walls constructed of high-density and normal-density concrete. The shielding would be designed to limit radiation levels in normally occupied areas around the cell to 0.1 millirem per hour or less. At the INEL site boundary, there would be no measurable elevation above the naturally occurring background radiation levels. The Dry Cell design would meet the latest seismic requirements and would include negative pressure air ventilation for radiological contamination control. Shielded lead glass windows and viewing aids would be provided as required at the work stations. Power, lighting, and a fire suppression system would be provided.

The Dry Cell would also be designed to facilitate decontamination and decommissioning at some future date. This would be achieved by including cell liner contamination barriers, no fixed embedded piping, a minimum of cracks and crevices, smooth surfaces, and wall penetrations large enough to be radiologically surveyed to verify decontamination effectiveness.

The Dry Cell would be attached to the existing Expended Core Facility building and provisions would be made to transfer fuel modules between the Dry Cell and existing water pit facilities where similar work is presently performed. Operations of the Dry Cell would increase the efficiency of fuel module preparation at the Expended Core Facility by performing the operations dry instead of using the current underwater process.

Description of Dry Cell Physical Layout: The Dry Cell Project would include an east extension and a south extension of the existing Expended Core Facility building. The east extension would be 2,400 square feet and would be the same height as the existing Expended Core Facility High Bay which is 57 feet 8 inches. The east extension would house a truck bay and an overhead bridge crane. The 2,400 square feet east extension of the Expended Core Facility building would be constructed similar to the existing building. The design life of the building would be 40 years. Construction materials would be noncombustible and corrosion-resistant.

Critical items and systems (ventilation, electrical, fire protection, and utility systems) would be designed to provide confinement of radioactive materials under normal operations and Design Basis Accident conditions. Structural design, including loading combinations and construction of critical items, would, as a minimum, be in accordance with current editions of pertinent nationally recognized codes and standards as identified in DOE Order 6430.1A (DOE 1989a).

The 2,400 square foot southeast corner extension would be constructed of reinforced concrete block and metal sandwich panels. Roofs would be designed to resist vertical live, snow, and wind loads in accordance with ANSI Standard A58.1. The roof would also be designed as a part of the lateral force resisting system to make the building unit(s) act as an integral system.

The Expended Core Facility building extension to the south would be 8,210 square feet and would be a two-story construction approximately 36 feet high. The south extension would house on the first floor, the shielded cell operating gallery, a truck bay, support office spaces, restrooms, and spares storage. The second floor of the south extension would house an equipment support area above the operating gallery and general open storage space above the support office spaces. The east end of the second floor would contain the shielded cell ventilation system high efficiency particulate air (HEPA) filters and fans.

The building south extension structure would match that of the existing Expended Core Facility building. The building would have a structural steel frame and a steel truss supported roof with exterior walls of 12-inch reinforced concrete block up to a height of 10 feet above floor level.

The shielded cell would include a preparation cell, a decontamination cell, and a repair cell. Shielded cell viewing windows and master-slave manipulators would be installed for remote operations.

The shielded preparation cell would be fabricated of reinforced concrete with interior dimensions of 22 feet wide by 84 feet long by 21 feet high. The decontamination cell would be 22 feet wide by 21 feet 10 inches long by 21 feet high. The repair cell would be 22 feet wide by 28 feet 6 inches long by 21 feet high. The shielded cell walls would be constructed of high density concrete with a minimum density of 230 pounds per cubic foot. Shielded wall thickness would be 4 feet.

The Dry Cell shielding would be designed to limit radiation levels in normally occupied areas around the cell to 0.1 millirem per hour or less. At the INEL site boundary, there would be no measurable increase in radiation above the naturally occurring background radiation levels.

The spread of radioactivity would be minimized by confinement barriers: the shielded cells would contain a fully lined floor and partially lined wall of stainless steel and the building's ventilation exhaust system would be filtered. Confinement would also be achieved by providing air locks and otherwise regulating the differential pressures in the various areas of the building to maintain the air flow from uncontaminated areas toward areas of higher contamination and by HEPA filtration and carbon adsorber filtration.

The radioactive ventilation system has three exhaust fans with 7,500 cubic feet per minute capacity for each fan. Overall system capacity is sized for two fans to be running and one in standby to meet normal cell and zone differential pressure requirements and in-cell air change requirements. The in-cell requirements are a negative differential pressure of 1 to 2 inches of water and 7 air changes per hour.

The shielded cell would include a shipping cask transfer canal that extends underneath the east end of the main cell. The shipping cask transfer tunnel would be 27 feet deep, 17 feet wide, and 54 feet long. A shipping port and shield plug would be in the floor of the cell over the shipping cask transfer canal. The plug would be removed when a cask is placed beneath it for loading. The shipping cask transfer cart would be supported by two rails. Directly under the shipping port, provisions would be made for seismically restraining the transfer cart.

The Dry Cell facility shielded cell, and repair and decontamination cells would require several cell windows. A combination high-density glass and oil-filled viewing windows would be required. The window would be designed to remain unbroken and in place after a seismic event.

The Dry Cell facility east extension would have an overhead crane. The overhead bridge crane would have a minimum 130-ton capacity and a minimum hook height of 39 feet 6 inches above the Expended Core Facility building floor.

The Dry Cell shielded cell would have up to two overhead bridge cranes on a common rail that can lift a working load of 10 tons. The Dry Cell shielded cell would also have up to three electromechanical manipulators mounted on a common rail to perform remote handling and maintenance.

The design of the fire protection system would achieve a level of fire protection that meets or exceeds the "improved risk" level.

The shielded cell special suppression system is carbon dioxide. Agent quantity requirements and installation procedures shall comply with NFPA 12.

Fire screens would be installed upstream of the HEPA filters in the ventilation system to protect the filters from fire in-cell. The fire screens shall be accessible for replacement and cleaning.

The building extension facility fire sprinkler system would be a wet type and would be installed in accordance with NFPA 13. The new system shall be similar to the existing system and would be connected to the sprinkler alarm system. The standpipe system would conform to NFPA 14 and would include hose cabinets in required locations.

Schedule for Construction and Initial Operation: The schedule for the Dry Cell Project is to commence construction in May 1996 and complete construction in May 1998. Initial operation would be August 1998.

PROJECT-SPECIFIC OPTIONS

NOTE: The previous project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the spent nuclear fuel and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

The option to phase out examinations at the Expended Core Facility is evaluated in Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) of Volume 2 of this EIS. The following presentation and evaluation of options are specific to meeting the need to efficiently remove nonfuel structural sections at the Expended Core Facility. This need would only exist if an alternative were implemented that involves continued operation of the Expended Core Facility examination and preparation for storage of naval spent nuclear fuel.

No Action: Under this option, the Dry Cell would not be constructed. Naval spent nuclear fuel modules would be prepared with existing equipment at the Expended Core Facility. This option would not efficiently meet the need to handle the larger naval spent nuclear fuel modules that would be received at the Expended Core Facility over the next two decades. Performing this work in the Expended Core Facility water pools would be much more expensive.

Remove the Nonfuel Structural Sections at Servicing Facility: If this option were implemented, the naval spent nuclear fuel modules would be prepared at the location where it was removed from the reactor during servicing. This option would require additional handling of the spent nuclear fuel, construction of new facilities with specialized equipment (five facilities instead of one, with no reduction in environmental impact), and additional transportation for the nonfuel sections at each of the five servicing facilities. The Expended Core Facility already has the trained personnel, proven procedures, and specialized facilities and equipment necessary for this work. If the spent nuclear fuel modules were prepared at the Expended Core Facility, the fuel section could be transferred to another part of the Expended Core Facility for more detailed examination without having to load it into a transport cask for shipment to another location for examination.

Prepare the Modules at Another Location: If this option were carried out, naval spent nuclear fuel would be transported to a central location where it would be unloaded, the nonfuel structural sections removed, and the fuel section reloaded into a transport cask and shipped to the Expended Core Facility for examination. This option would require additional handling, construction of new facilities, installation of specialized equipment, and additional transportation.

Phase Out Removing Nonfuel Structural Sections: If this option were implemented, naval spent nuclear fuel would be examined and stored without removing the nonfuel structural sections. In some cases, this would make internal examination of the spent nuclear fuel modules more difficult. New equipment and procedures would need to be developed to perform the internal examinations. Implementing this option would increase the amount of material to be managed as spent nuclear fuel since the nonfuel structural sections can be disposed of as low-level waste when removed.

Increase Water Pit Capacity: Under this option all naval spent nuclear fuel modules would be prepared in the Expended Core Facility water pit; however, unlike the "No Action" option above additional action would be taken to efficiently support the shipping and handling of larger naval spent nuclear fuel modules that would be received at the Expended Core Facility over the next two decades.

Implementation of this option would require extensive engineering effort for equipment and fixture design and procurement. The option would also require refurbishment of existing water pits. The option would also impact ability of the Expended Core Facility to maintain ongoing materials test programs.

Implementation of the option would provide no significant advantage for reduced environmental impact and would increase costs of operations while reducing the capability of the Expended Core Facility to examine materials.

AFFECTED ENVIRONMENT: A general description of the area and existing industrial site is presented in Volume 1, Appendix D, Part A, Section 4.2. The Dry Cell Project would have negligible affect on the environment.

ENVIRONMENTAL CONSEQUENCES OF THE DRY CELL PROJECT:

Overview of Environmental Impacts: The following sections discuss the potential environmental consequences at the INEL site associated with the construction of the Dry Cell Project at the Expended Core Facility. The environmental consequences are based on the fact that the Expended Core Facility is currently in existence and operating within the perimeter of the Naval Reactors Facility at the INEL. The potential environmental effects of this project are discussed in the following paragraphs.

Review of the environmental effects of operation of the Expended Core Facility Dry Cell at the INEL site for the preparation of naval spent nuclear fuel has shown that the impact on the environment associated with this work is very small. The largest effect in the vicinity of INEL site is a small increase in radioactive airborne emissions. The differences in all other impacts in the vicinity of INEL site for the available alternatives are very small or nonexistent.

Number of Employees: Approximately 500 engineers, technicians, clerical, and maintenance personnel are employed in the receipt and examination of naval spent nuclear fuel at the Expended Core Facility or in direct support of these activities. The table below provides a summary of the direct jobs which would be associated with the Expended Core Facility if the Dry Cell Project is constructed. As shown in the table, there is an increase in workers in the period 1996 through 1998 for construction workers. The Dry Cell operation would not require any additional personnel and as shown in the table, the Expended Core Facility work force would return to 500 after construction of the Dry Cell is completed.

Summary of direct jobs for Dry Cell Project - Expended Core Facility.

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
574	574	550	500	500	500	500	500	500	500

Air Emissions: Small quantities of radioactivity are contained in the air released from the Expended Core Facility and prototype plant operations at the Naval Reactors Facility. The annual releases from Expended Core Facility total approximately 1.1 curies, composed primarily of 0.30 curie of krypton-85, 0.70 curie of carbon-14, 0.094 curie of tritium, 0.000011 curie of combined strontium-90 and yttrium-90, and 0.0000048 curie of iodine-131. These releases at the Naval Reactors Facility would be increased by 0.12 curies per year by the Dry Cell Project. The primary contribution to the small increase in curies would be from carbon-14.

The principal sources of current nonradioactive industrial gaseous effluents are air from offices, water vapor from cooling towers, and fuel combustion products from the three steam generating boilers used for heating. The Dry Cell operations would contribute a negligible amount of PM-10 and Volatile Organic Compounds (VOC). The PM-10 release from the Dry Cell would be 2.45×10^{-9} tons per year and the VOC less than 1,800 pounds per year.

Potential impacts to air quality from construction activities would include fugitive dust and exhaust emissions from support equipment. The modeling assessment showed that expected construction-related air quality impacts should be minor and temporary and, when added to the baseline concentrations, would be a small percentage of applicable standards (Section 5.7 of Volume 2).

Asbestos-containing material is present at the Naval Reactors Facility, but, as a result of the well-controlled conditions with regard to asbestos at the Naval Reactors Facility, releases would be unaffected by the Dry Cell Project.

Water Emissions: No radioactive liquids are discharged to the environment at the Naval Reactors Facility. The Dry Cell would not release any radioactive liquids and would have no effect on releases of radioactive liquids at the Naval Reactors Facility.

Since the water released to the industrial waste ditch does not include any effluents from the Expended Core Facility, the discharges to the ditch would be unaffected by the Dry Cell Project. Operation of Expended Core Facility produces about 25 percent of the total sewage discharge at the Naval Reactors Facility, and the Expended Core Facility discharge would remain the same with the Dry Cell Project since no additional personnel would be required for operations.

No hazardous wastes are disposed of at the Naval Reactors Facility site and all solid and liquid hazardous wastes are transported by vendors to treatment, storage, and disposal facilities approved by the Environmental Protection Agency and operating under approvals or permits granted by state and federal regulatory agencies. The Dry Cell Project would not generate any additional hazardous wastes and would therefore have no impact on water quality in the area.

A flood at the Expended Core Facility due to overflow of any surface water within the INEL site boundaries is a low probability event. Flooding of the Expended Core Facility building is possible should the Mackay Dam fail; however, there is adequate time following the dam break until the flood water reaches the Naval Reactors Facility to complete emergency procedure preparations.

Solid Waste: All nonhazardous solid wastes that cannot be recycled or used by other government agencies are transported to the INEL landfills at the Central Facilities Area. Operation of the Expended Core Facility makes little contribution to these wastes other than the trash associated with the approximately 500 persons who work at that facility. Except for the generation of approximately 500 cubic meters of solid waste during construction, the Dry Cell Project would not change the number of Expended Core Facility personnel and the impact in this area at the INEL site is little affected by the Dry Cell Project.

The use of hazardous materials in essential applications at the Expended Core Facility results in the generation of some hazardous wastes, including photographic solutions, solutions containing heavy metals, organic solvents, paint-related wastes, and laboratory wastes. All hazardous wastes are transported by vendors to treatment, storage, and disposal facilities approved by the Environmental Protection Agency and operating under approvals or permits granted by state and federal regulatory agencies, and none are disposed of at the INEL. When appropriate, wastes are recycled or provided to other federal agencies for use. No additional hazardous waste would be produced from the Dry Cell operation so the overall effect on the environment is unchanged by the alternative selected.

Energy and Water Consumption: Operations at the Expended Core Facility currently consume approximately 10,000 megawatt hours of electricity each year. The Dry Cell operation would increase consumption by 873 megawatt hours per year for new ventilation system fans and facility systems.

Annual water consumption by the Expended Core Facility is about 2.5 million gallons. The Dry Cell Project would have no discernible effect on water usage, because the groundwater withdrawn for Dry Cell operations would be small in comparison to the total INEL site water consumption. Expended Core Facility Dry Cell operation would have virtually no effect on surface waters.

Radioactive Waste: Operations at the Expended Core Facility contribute approximately 425 cubic meters (15,000 cubic feet) of radioactive solid waste each year. No high-level waste and almost no transuranic waste (less than 0.0001 cubic meter per year) are generated from current operations at the Expended Core Facility. The principal solid low-level waste generated by the Dry Cell would be approximately 113 cubic meters per year of radioactive nonfuel structures removed from the fuel modules in the Dry Cell. This material would be shipped to the Radioactive Waste Management Complex for disposal. This waste is part of the 425 cubic meters already contributed each year. The difference is that the 113 cubic meters is now generated in the water pit and would be generated in the Dry Cell when Dry Cell operations begin. An additional 2 cubic meters per year of radioactive waste would be generated from disposal of filters in the new Dry Cell radioactive ventilation system. The increased radioactive waste from the filter would be offset by reduced water pit resin filter waste since the nonfuel structural cutting would no longer be performed in the water pits. Consequently, the overall effect on the environment is essentially unchanged by the Dry Cell Project.

Project Data Sheet

Rev. 14 March 8, '95

Section	Item	Value
General Info.	Description/function:	ECF Dry Cell Project
	WAG	8
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	SNF
	Action type:	Expand
	Structure Type:	Building Expansion
	Size: (m2)	172
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside NRF
	Inside/outside of bldg.	Inside ECF NRF-618
Construction Info.	Cost($): PreConst.	$200 k
	Cost($): Const.	$47.446 Mil.
	Schedule Start /End: PreConst.	1988 - 1992
	Schedule Start /End: Const.	1993 / 1996 - 1998
	No. of workers: (new/exist)	66 Peak Subs.
	Heavy Equip. Equip. used:	
	Trips:	
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	Not Estimated
	Solid wastes: Type:	Ind.
	Quantity: (m3)	500
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Not Estimated
	Energy requirements: Electrical: (MWH/yr)	Not Estimated
	Fossil fuel: (liters)	Not Estimated
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	($3.74 Mil./yr Savings)
	Schedule Start /End:	1998 - TBD
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used:	None
	Trips:	
	Air Emissions: (no increase above present operational envelope)	Rad. 0.12 Ci/yr Particulate 2.45 x 10^{-9} tons/yr Volatile solvents <1800 lbs/yr
	Effluents: Type:	None
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	113 2
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No increase
	Energy requirements: Electrical: (MWH/yr)	873
	Fossil fuel: (liters/yr)	No increase
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.1.2 INCREASED RACK CAPACITY FOR CPP-666

PROJECT NAME: Increased Rack Capacity for CPP-666

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to ensure the near-term capability of the Idaho Chemical Processing Plant to continuously receive and store nuclear fuel by increasing the capacity for fuel storage in three storage pools in the Fuel Storage Area at CPP-666. This process is commonly called reracking and involves replacing fuel storage racks in Pools #1, #5, and #6. The need for this project comes from an analysis of Idaho Chemical Processing Plant fuel storage requirements that demonstrates additional storage capacity would be required under several of the alternatives. The results of the analysis show the following:

- Fuel Storage Area fuel storage in Pool #6 for aluminum clad (research) fuel would be filled by Spring 1993, but the date can be extended to 1994 or 1995 through revised Fuel Storage Area fuel management and limited, temporary storage of aluminum clad fuel in stainless steel racks.

- Fuel Storage Area fuel storage capacity for zirconium clad (primarily naval) fuel requiring small (that is, 10- or 12-inch square) fuel positions would allow receipt through 1995 and still permit reracking.

- Fuel Storage Area fuel storage capacity for zirconium clad (naval) fuel requiring large (that is, 16- or 18-inch square) fuel positions would allow receipt through 1997 and still permit reracking; receipt through 2000 would be accommodated if the safety analysis is approved allowing stacking of fuel.

For the proposed reconfiguration, reracking of CPP-666 fuel storage Pool #1 must occur before the pool is filled beyond the "manageable level"; otherwise, this project cannot be accomplished. The manageable level is dependent on operational safety requirements that restrict the movement of fuel storage racks containing fuel and the movement of heavy objects over, or in proximity to, loaded fuel racks.

PROJECT DESCRIPTION: This proposed project would involve replacing and rearranging existing fuel storage racks in three of the six Fuel Storage Area pools in CPP-666. These pools are in the Fluorinel Dissolution Process and Fuel Storage Facility (CPP-666). The fuel storage capacity would be increased by replacing existing racks in three storage pools with new racks. The new racks would be taller and in some cases would have different storage port dimensions and different spacing dimensions between ports. A minimum of eight feet of water shielding would be maintained over fuel being moved. Criticality safety requirements would be met in the design of the new fuel storage racks, and by criticality analysis of the new reconfigured fuel storage pools and administrative controls on their operation. The new racks would be designed to meet the High Hazard Facility Use Category requirements in DOE Order 6430.1A (DOE 1989a) and other applicable codes, standards, and regulations. Their layout and design would not exceed Fuel Storage Area structural limits. The existing design of the Fuel Storage Facility building provides protection from other natural phenomena, including high winds, tornadoes, and floods. The existing Fuel Storage Area water treatment systems and heating, ventilating, and air conditioning systems are adequate for the proposed reracking.

The project would also include decontamination of the racks being replaced and their disposition. The racks would initially be decontaminated underwater to remove as much of the loose contamination as possible using standard techniques, such as high-pressure water jets, brushing, or scrubbing, before they are lifted from the pool. An underwater vacuum system would be used to capture most of the material washed from the racks. Following their removal from the fuel storage pools, local decontamination of hot spots could be performed, if needed, and the racks would be bagged while damp to contain the potential release of airborne radionuclides. To limit free standing water in the bags, the racks would be allowed to drain prior to insertion into the bags and absorbent material may be placed at the bottom of the bags. Additionally, if required, the racks may be dried by circulating air through the bags. The bag exhaust would be through a high efficiency particulate air filter system designed for moist air.

Expanding the storage capacity would involve replacing fuel storage racks in Pools #1, #5, and #6. Increases in storage capacity would result from the following reconfiguration:

- Pool #1 would replace 27 racks containing 486 storage locations, which are approximately 10-feet tall, with 35 racks containing 925 storage locations, which are approximately 20-feet tall. The number of storage locations would increase because the spacing between storage locations would be less than that in the existing configuration.

- Pool #5 would replace 24 racks containing 384 storage locations, which are approximately 10-feet tall and 12-inches square, with 21 racks containing 294 storage locations, which are approximately 15-feet tall and 16-inches square. There are fewer storage locations in the proposed configuration, but the proposed storage locations would be larger and taller.

- Pool #6 would replace only 20 of the existing 32 racks in Pool #6. The 20 racks occupy only one half of the surface area of Pool #6 and contain 300 storage locations, which are 6-feet tall and 8-inches square. These racks would be replaced with 12 racks containing 300 storage locations, which would be approximately 15-feet tall and 8-inches square.

This project (Pools #1, #5, and #6) would increase the capacity of the Fuel Storage Area from approximately 18 metric tons of heavy metal (MTHM) to approximately 32 MTHM. This amount is only an approximation because the actual capacity depends upon such factors as the geometry of the individual fuel bundles and the characteristics of their heavy metal. The fuel receipt and storage in the Fuel Storage Area would then continue as follows:

- Receipt of aluminum-clad research reactor fuel could be extended from 1995 to between 2001 and 2009 (depending on fuel receipt).

- Naval fuel requiring small storage locations could be extended from 1995 to beyond year 2017.

- Naval fuel requiring large storage locations could be extended from 1997 to the year 2004.

In the preliminary plans, Pools #1 and #5 would be emptied of fuel before rack replacement. To reduce the consequences of accidentally dropping a rack or rack handling tool in Pool #6, a row of empty storage locations in the loaded racks between the loaded storage locations and the new racks would be used as a buffer zone during fuel rack replacement activities. Pool #6 would contain fuel in most of the 300 unchanged fuel rack storage locations and the storage locations closest to the new racks would remain empty.

Following reracking, operations in Pool #1 would resume in 1997, Pool #6 in 1998, and Pool #5 in 1999.

The 51 fuel racks from Pools #1 and #5 would be decontaminated and dispositioned to a licensed commercial vendor. The 20 racks from Pool #6 may be used in the south basin of Building CPP-603 or be dispositioned like the others. If Pool #6 racks need to be decontaminated and dispositioned, the low-level waste would increase by 235 cubic meters (305 cubic yards). The balance of the radioactive wastes would be packaged and disposed of at the Radioactive Waste Management Complex or incinerated at the Waste Experimental Reduction Facility, whichever is appropriate. The industrial waste would be disposed of in the Central Facilities Area landfill.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.2-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

Table C-4.1.2-1. Summary of potential environmental impacts of the Increased Rack Capacity for CPP-666 Project under Alternative B.

Impact attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Project will be in an existing facility
Water resources	Construction: 26,875 liters Operation: Usage within operational envelope of ICPP major facility area Effluents: 29,000 liters of low-level waste water to the ICPP Process Equipment Waste system	Storm Water Pollution Prevention Plan in place at the ICPP
Wildlife and habitat	None	Project will be in an existing facility
Historic, archaeological, or cultural resources	None	Storage will be in an existing facility
Air resources	Radiological operational emissions 1.4×10^{-5}% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Project would use existing facility stack with appropriate HEPA filtering capabilities
Human health	Radiation exposures and cancer risk Maximally exposed individual: 1.4×10^{-6} mrem/yr 7.0×10^{-13} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 7.4×10^{-6} person-rem/yr 3.7×10^{-9} latent cancer fatalities/yr Year 2010: 8.1×10^{-6} person-rem/yr 4.0×10^{-9} latent cancer fatalities/yr Nonradiological effects: No effects	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Transportation[d]	Construction (onsite truck trips): Nonradiological - 8 Radiological - 21 Operation (truck trips per year): Nonradiological - 1.4 onsite Radiological - 0.1 onsite Spent nuclear fuel - 14 onsite; 14 offsite	Use of approved transport vehicles and containers, qualified equipment operators, shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 300 low-level waste - 770 Operation (m^3/yr): industrial waste - 50 low-level ion resins waste - 0.3	Waste minimization and recycling programs in place at the ICPP and the INEL
Socioeconomic conditions	Construction: 40 existing workers Operation: No additional workers	None

a. Definition of acronyms: HEPA - high-efficiency particulate air; ICPP - Idaho Chemical Processing Plant; NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. All offsite shipments of naval spent nuclear fuel are allocated to this project.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the present fuel storage capacity in the Fuel Storage Area fuel storage pools would be retained. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Without changing the racks, the pools would fill to their capacity several years earlier than under the proposed alternative. During a three-year transition period, naval spent nuclear fuel would continue to be received and stored at the INEL. Filling the Fuel Storage Area storage pools beyond the manageable level would also preclude future fuel storage expansion by reracking of the Fuel Storage Area storage pools as an option in DOE evaluations and decisions on fuel management.

Provide New Storage - This option is presented in the Dry Fuel Storage Facility Summary. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. Depending upon the availability of other storage facilities and their appropriateness for the specific fuel types proposed for CPP-666 storage, this new storage could supplant the need for this project.

Use Existing Idaho Chemical Processing Plant Storage Facilities - New fuel receipts could be stored in the water-filled basins of CPP-603. This option is not evaluated in this EIS. This facility has significant environmental safety and health vulnerabilities that would be difficult to correct to allow for suitable interim storage. Storage in CPP-603 would violate the Court Order.

Use an Existing Non-Idaho Chemical Processing Plant Fuel Storage Facility - Existing non-Idaho Chemical Processing Plant storage facilities do not meet the near-term fuel storage requirements; therefore, this option is not evaluated in this EIS. Several miscellaneous fuel storage areas on the INEL were examined including fuel canals associated with the Advanced Test Reactor, the Engineering Test Reactor, the Materials Test Reactor, and the Advanced Reactivity Measurement Facility; and a Test Area North (TAN-607) basin used for storing fuel prior to disassembly and examination in the Test Area North Hot Cell. None were considered feasible because of their limited size and the work that would be required to ready them to store fuel (for example, structural, safety, and environmental evaluations and modifications; security measures for storing naval fuel). Consideration was also given to holding the fuel in storage for several years at the Naval Reactors Facility Expended Core Facility on the INEL.

Since the Expended Core Facility only holds spent nuclear fuel incidental to examination and thus has very limited storage capacity, there is insufficient existing storage space for the amount of fuel to be received under all alternatives without the addition of new racks to the water pools. Alternatives that involve phasing out receipt of naval fuel at the Expended Core Facility would be precluded by storage of fuel at this facility.

Fuel storage facilities at the Savannah River Site [that is, the Receiving Basin for Offsite Fuels and the basins associated with the individual production reactors (K, L, and P)] were also examined. The unfilled fuel storage space at the Receiving Basin for Offsite Fuels is very limited. New fuel storage facilities or acquisition and upgrade of an existing facility would be required prior to accepting naval reactor fuels or Idaho Chemical Processing Plant research reactor fuels at the Savannah River Site. The spent nuclear fuel would have to be transported to the DOE Savannah River Site from the Naval Reactors Facility at the INEL, where it would be initially received, examined, and prepared for transport.

Project Data Sheet

Rev. 9 January 5, '95

Section	Item	Value
General Info.	Description/function:	Increased Rack Capacity for CPP-666
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	SNF
	Action type:	Expand
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Fuel Storage Racks
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside CPP-666
Construction Info.	Cost($): PreConst.	$7.8 Mil.
	Cost($): Const.	$15.7 Mil.
	Schedule Start /End: PreConst.	1991 - 1993
	Schedule Start /End: Const.	1994 - 1999
	No. of workers: (new/exist)	40 Existing
	Heavy Equip. Equip. used: / Trips:	See Table C-4.1.2-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	LLW (water)
	Quantity: (liters)	29,000 to PEW
	Solid wastes: Type:	LLW; Ind.
	Quantity: (m3)	770; 300
	Haz./Toxic Chemicals: Storage/inventory	N/A

Section	Item	Value
Const.	Cultural resource effects:	N/A
	Pits/ponding created: (m2)	No
	Water usage: (liters)	26,875
	Energy requirements: Electrical: (MWH/yr)	No increase
	Fossil fuel: (liters)	No increase
	Nightlights used: Y/N	N/A
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	No increase
	Schedule Start /End:	1997 - 2027
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used: / Trips:	See Table C-4.1.2-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: / Quantity: (liters/yr)	Minimal increase
	Solid wastes: Type:	LLW (Ion resins); Ind.
	Quantity: (m3/yr)	0.3; 50
	Haz./Toxic Chemicals: Storage/inventory	N/A
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No increase
	Energy requirements: Electrical: (MWH/yr)	Minimal increase
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	N/A
	Generators: Night Y/N	No
	Day Y/N	No

C-4.1.3 ADDITIONAL INCREASED RACK CAPACITY (CPP-666)

PROJECT NAME: Additional Increased Rack Capacity (CPP-666)

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Additional Increased Rack Capacity Project would be to increase the capacity for fuel storage in at least two of the storage pools in the CPP-666 Fuel Storage Area at the Idaho Chemical Processing Plant without increasing the size of the storage pools.

PROJECT DESCRIPTION: This project would involve replacing and rearranging (commonly called reracking) existing fuel storage racks in at least two of the six Fuel Storage Area pools. The Fuel Storage Area pools are in the Fluorinel Dissolution Process and the Fuel Storage Facility (CPP-666). The pools that could be reracked with this project include Pools #2, #3, and #4. In addition, the empty cutting pool, which does not contain racks, would be considered for installation of racks under this project.

This project would increase the capacity of the Fuel Storage Area from approximately 32 metric tons of heavy metal (MTHM) to approximately 62 MTHM. This amount is only an approximation because the actual capacity depends upon such factors as the geometry of the individual fuel bundles, the characteristics of their heavy metal, if racks were installed in the fuel cutting pool, etc. The actual capacity increase would be to the maximum amount consistent with safety and regulatory requirements. The increased capacity would result from installing or replacing racks without increasing the size of the storage pools. New racks would be taller and in some instances would have different storage port dimensions and different spacing dimensions between ports. The new racks would provide flexibility for storing more fuel of different sizes and shapes in the existing pools.

Included in the project are (a) decontamination and disposition of the racks being removed and replaced and (b) continued operation of these pools with the increased capacity. Facility support functions such as ventilation and water treatment capability have been determined to be adequate for the increased capacity of the facility.

Liquid low-level waste generated by the project would be disposed of in the existing liquid waste processing systems at the Idaho Chemical Processing Plant. The solid radioactive wastes, except for the racks, would be packaged and disposed of at the Radioactive Waste Management Complex or incinerated at the Waste Experimental Reduction Facility, whichever is appropriate. The nonradioactive waste would be disposed of in the Central Facilities Area landfill.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.3-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the present fuel storage capacity in the Fuel Storage Area fuel storage pools would be retained. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Without changing the racks, the pools would fill to their capacity several years earlier than under the proposed alternative. As the existing racks approach their capacity, replacing them would no longer be an alternative in the Department of Energy evaluations and decisions on spent fuel management.

Provide New Storage - Under this option, additional spent fuel storage would be constructed. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. This option is presented in the Dry Fuel Storage Facility Project Summary. Depending upon the availability of other storage facilities and their appropriateness for the specific fuel types proposed for CPP-666 storage, this new storage could supplant the need for this project.

Table C-4.1.3-1. Summary of potential environmental impacts of the proposed Additional Increased Rack Capacity (CPP-666) Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Project would be in existing facility
Water resources	Construction: 27,000 liters Operation: None Effluent: 27,000 liters to ICPP Process Equipment Waste system (as low-level waste)	Storm Water Pollution Prevention Plan in place at ICPP
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	<u>Radiological operational emissions</u> 1.4×10^{-5}% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> - None <u>Prevention of Significant Deterioration (PSD)</u> None	Project would use existing facility stack with appropriate HEPA filtering capabilities
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 1.4×10^{-6} mrem/yr 7.0×10^{-13} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 7.4×10^{-6} person-rem/yr 3.7×10^{-9} latent cancer fatalities/yr Year 2010: 8.1×10^{-6} person-rem/yr 4.1×10^{-9} latent cancer fatalities/yr <u>Nonradiological effects</u> - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Transportation[d]	Construction (onsite truck trips): Nonradiological - 8 Radiological - 22 Operation (truck trips per year): Nonradiological - 1.4 onsite Radiological - 0.1 onsite Spent nuclear fuel - 272 onsite; 272 offsite	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 300 low-level waste - 800 Operation (m^3/yr): industrial waste - 50 low-level waste - 0.3	Waste minimization and recycling programs in place at the ICPP and the INEL
Socioeconomic conditions	Construction: 40 existing workers Operation: No additional workers	None required

a. Definition of acronyms: HEPA - high-efficiency particulate air; ICPP - Idaho Chemical Processing Plant; NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. All offsite shipments of spent nuclear fuel other than naval fuel and Fort St. Vrain fuel are allocated either to this project or the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Project.

Project Data Sheet

Rev. 9 January 5, '95

Section	Item	Value
General Info.	Description/function:	Additional Increased Rack Capacity (CPP-666)
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	SNF
	Action type:	Expand
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Storage Racks
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside CPP-666
Construction Info.	Cost($): PreConst.	$2 Mil.
	Cost($): Const.	$50 Mil.
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1995 - 1997
	No. of workers: (new/exist)	40 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.1.3-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	LLW (Water)
	Quantity: (liters)	27,000 to PEW
	Solid wastes:	
	Type:	LLW Ind
	Quantity: (m3)	800 300
	Haz./Toxic Chemicals: Storage/inventory	N/A

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	27,000
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	No information
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$200 k/yr
	Schedule Start /End:	2001 - 2021
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.1.3-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	Minimal increase
	Quantity: (liters/yr)	
	Solid wastes:	
	Type:	LLW Ind.
	Quantity: (m3/yr)	0.3 50
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	None
	Energy requirements:	
	Electrical: (MWH/yr)	No increase
	Fossil fuel: (liters/yr)	No increase
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.1.4 DRY FUEL STORAGE FACILITY; FUEL RECEIVING, CANNING/CHARACTERIZATION, AND SHIPPING

PROJECT NAME: Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping

GENERAL PROJECT OBJECTIVE: The general project objective of the proposed Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping project is to provide a multi-functional dry storage project that would accommodate the various fuel types and configurations in the current inventory of INEL fuels, projected naval and Advanced Test Reactor fuels, and spent nuclear fuel from miscellaneous offsite sources such as government, commercial, and university nuclear reactors. The project would assist DOE in safe, environmentally sound management of spent nuclear fuel during the estimated 40-year period (1995-2035) until final disposition can be achieved.

While the functions performed by a proposed Dry Fuel Storage Facility and a Fuel Receiving, Canning/Characterization, and Shipping Facility would be the same for several of the Volume 1 alternatives, the magnitude of the facilities would change depending on the alternative. The project cost would also vary with the alternative. The project would provide for the design, construction, and operation of the facilities.

PROJECT DESCRIPTION: The spent nuclear fuel materials at the Idaho Chemical Processing Plant have historically been stored in wet storage facilities (as has the spent nuclear fuel at other DOE sites) pending their reprocessing to recover the highly enriched uranium. In April 1992, the Secretary of Energy determined that the reprocessing of spent nuclear fuel for recovery of uranium was no longer required. This determination then changed the Idaho Chemical Processing Plant mission from reprocessing to fuel conditioning and interim storage.

The two facilities of this project would perform the following functions:

1. Receive fuel shipping casks from various INEL and/or offsite locations depending on the specific alternative considered.

2. Unload full casks into fuel unloading pools or directly into a dry hot cell depending on the specific alternative considered.

3. Inspect, dry, characterize, can, seal and test cans of fuel.

4. Load canned fuel into dry storage canisters.

5. Transport dry storage canisters to the Dry Fuel Storage Facility.

6. Retrieve dry storage canisters from the Dry Fuel Storage Facility.

7. After interim storage, transport full casks from the facility to a permanent disposal facility or to another facility for additional conditioning prior to disposal in a repository.

8. Monitor storage conditions as required.

The Fuel Receiving, Canning/Characterization, and Shipping Facility would be considered a nonreactor, nuclear facility. The facility would be a multilevel facility with a operating hot cell area near its center surrounded by the auxiliary and support areas. Depending on the required throughput capacity, the facility could range in size from 50,000 to 100,000 square feet. The major areas of the facility would include the following:

- The cask receiving area would contain a washdown capability for rail or truck mounted casks, overhead cranes for cask lifting and movement, transfer carts, cask maintenance area (for minor repairs on casks; for example, replacement of seals), and storage areas for lifting equipment, cask impact limiters, access platforms, and similar equipment.

- Capabilities required for characterization would include nondestructive evaluation of the fuel to determine its physical, chemical, and radiological properties. Sampling equipment would be provided to acquire small samples of fuel to send to the analytical laboratory if required.

- Common equipment in the hot cell would include shielded viewing windows, master-slave manipulators, electromechanical manipulators, and remote-operated bridge crane.

- An analytical laboratory for complete chemical and radiological analysis of received samples, rubble, or broken spent nuclear fuel. This laboratory would require a hot cell with remote handling capabilities for sample analysis and for removal of waste from the facility.

- A control room for overview of the automatic operations of the facility including the fuel handling hot cell and manual override of facility functions as required. The control room would contain monitors that report real-time data for selected systems and allow access to other parameters as necessary. Other monitors would allow viewing via remote cameras of hot cell activities and other selected activities.

- The facility would contain cold and hot shop areas to support building activities, such as equipment fabrication, maintenance, repair, and fabrication of new systems.

- Crane and electromechanical manipulator maintenance area for repair and preventive maintenance of this equipment.

- Administrative support areas (office, conference room, rest rooms, change rooms) and equipment and mechanical/electrical rooms to support overall operations in the facility.

The proposed Dry Fuel Storage Facility would be integrated with the Fuel Receiving, Canning/ Characterization, and Shipping Facility. This integration would alleviate the need to transfer the fuel to the dry storage in a transfer cask. The storage facility would consist of a Modular Aboveground Dry Storage system and a fenced storage yard. This system would eliminate the construction of new buildings or systems to provide active cooling, and would allow additional storage capacity to be purchased and added as needed to support long-term consolidation of the current DOE spent nuclear fuel inventory.

The number of Modular Aboveground Dry Storage units required would depend on the specific EIS alternative considered, as described in the following project-specific options.

The previous project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheets at the end of this project summary support the above project description.

The proposed project would be located within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Tables C-4.1.4-1 and C-4.1.4-2. These tables are complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, no new canning/characterization or dry storage capability would be constructed. This option corresponds to Alternative A (No Action) evaluated in this EIS. Existing facilities (CPP-603 Irradiated Fuel Storage Facility, CPP-749, and CPP-666) would be utilized to consolidate spent nuclear fuel on the INEL. During a three-year transition period, naval spent nuclear fuel would continue to be received and stored in CPP-666. No major upgrades or new facilities would be installed. Minor fuel conditioning would proceed for maintaining safe operation.

Receiving/Canning/Characterization in an Existing Facility, New Dry Storage Facility - Under this option, an existing Idaho Chemical Processing Plant facility would be used for spent nuclear fuel receiving/canning/characterization, and a new dry storage facility would be constructed. This option is comparable to Alternative B (Ten-Year Plan) evaluated in this EIS (data sheets on pages C-4.1.4-9 and C-4.1.4-10). The canning/characterization capability would be placed in an existing hot cell facility (CPP-666 Fluorinel Dissolution Process cell). The existing fuel receiving and transporting capabilities of CPP-666 Fuel Storage Area (pool storage with reracking accomplished) would be used

Table C-4.1.4-1. Summary of potential environmental impacts of the Dry Fuel Storage Facility segment of the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Project under Alternative B.

Impact area	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil	Disturbs 18.5 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Construction: water usage Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and report survey; mitigate according to applicable regulations (Section C-3.3.4)
Air resources	Radiological operational emissions 3.2×10^{-3}% of NESHAP dose limit[d] Toxic Air Pollutants (TAPs) - None Prevention of Significant Deterioration (PSD) - None	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 3.2×10^{-4} mrem/yr 1.6×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2010: 2.0×10^{-3} person rem/yr[d] 1.0×10^{-6} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation[e]	Construction (onsite truck trips): Nonradiological - 1 Operation (truck trips per year) Nonradiological - 1 onsite Radiological - 1 onsite	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 37.5 Operation (m^3/yr): low-level waste - 5 industrial waste - 10	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 50 subcontractor personnel Operation: 15 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. Includes dose associated with receiving, canning/characterization, and shipping activities specified in Table C-4.1.4-2.
e. Offsite shipments of spent nuclear fuel other than naval fuel and Fort St. Vrain fuel are allocated either to this project or the Additional Increased Rack Capacity (CPP-666) Project .

Table C-4.1.4-2. Summary of potential environmental impacts of the fuel receiving, canning/characterization, and shipping segment of the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Project under Alternative B.

Impact area	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil	None (no disturbed acreage)	Project would be in existing facility
Water resources	Construction: minimal water usage Operation: No information Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	Radiological operational emissions 3.2×10^{-3}% of NESHAP dose limit[d] Toxic Air Pollutants (TAPs) - None Prevention of Significant Deterioration (PSD) - None	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 3.2×10^{-4} mrem/yr 1.6×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2010: 2.0×10^{-3} person rem/yr[d] 1.0×10^{-6} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation[e]	Construction (onsite truck trips): Nonradiological - 1 Operation (truck trips per year) Nonradiological - 13.3 onsite Radiological - 6.0 onsite Spent nuclear fuel - 272 onsite; 272 offsite	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 37.5 Operation (m^3/yr): low-level waste - 220 industrial waste - 490	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 100 subcontractor personnel Operation: 20 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. Includes dose associated with storage segment of this project.
e. All offsite shipments of spent nuclear fuel other than naval fuel and Fort St. Vrain fuel are allocated to this project.

for these activities. A new storage facility would be developed for placement of dry storage containers of spent nuclear fuel.

Degradable spent nuclear fuel would be placed into dry storage using a canning facility in the CPP-666 Fluorinel Dissolution Process cell and procurement of modular dry storage containers (1,500 containers). The dry storage containers would be placed inside a concrete biological shield for radiation protection. Appropriate equipment would be provided to move the canned fuel and other fuels that have longer storage life in dry storage, from the CPP-666 Fuel Storage Area to the dry storage container and concrete shields. The Irradiated Fuel Storage Facility and CPP-749 vaults would continue to be used as appropriate.

<u>Canning/Characterization/Shipping in Existing Facility, No New Dry Storage</u> - Under this option, spent nuclear fuel stored at the INEL would be transported to another DOE site for conditioning/ storage pending disposal. This option corresponds to Alternative C evaluated in this EIS (data sheet on page C-4.1.4-11). INEL spent nuclear fuel would be placed into safe shipping packages and transported to a predetermined offsite location. Some Idaho Chemical Processing Plant fuels that are degraded would need to be canned before shipment. This would be performed in the CPP-666 Fluorinel Dissolution Process cell [as described in Alternative B (Ten-Year Plan) above] or in the CPP-603 Irradiated Fuel Storage Facility fuel handling cell (cave).

For transport of the spent nuclear fuel from the Irradiated Fuel Storage Facility, the facility would need some upgrades to accept the larger truck casks and to properly test the casks for verification of compliance with the safety analysis report. Shipments from the CPP-666 Fuel Storage Area, which has adequate cask handling capacity, may require some shipping cask testing capabilities.

Minor modifications might be needed at other INEL fuel storage facilities to load and test shipping casks. These modifications are expected to be covered by maintenance activities at these facilities.

<u>New Receiving/Canning/Characterization Facility and New Dry Fuel Storage</u> - Under this option, spent nuclear fuel storage in the DOE Complex would be centralized at the INEL. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS (data sheets on pages C-4.1.4-12 and C-4.1.4-13). A new Fuel Receiving, Canning/Characterization, and Shipping Facility, as well as a Dry Storage Facility, would be constructed to accommodate the

larger number of shipments of spent nuclear fuel from Hanford and Savannah River. Storage capacity in existing CPP-666 pools would be expanded under this alternative [see Sections C-4.1.2, Increased Rack Capacity for CPP-666, and Section C-4.1.3, Additional Increased Rack Capacity (CPP-666)] in order to provide storage for naval spent nuclear fuel and to provide interim storage capabilities for other spent nuclear fuel waiting transfer to dry storage. The CPP-666 receiving area and pools have a mission to receive naval fuel on a first-priority basis. Spent nuclear fuel packages that have been prepared for dry shipment should not be placed back into an underwater unloading environment; therefore, the receiving bays in the proposed new facility with a hot cell would be used so that the spent nuclear fuel would be unloaded in a dry environment and placed into the dry storage containers. Under the Centralization alternative (Volume 1), it was assumed that during the phase-in period, the CPP-666 Fluorinel Dissolution Process cell interim canning/ characterization capability would be needed for INEL water-stored fuels and potentially for wet-shipped fuels. The proposed dry storage system for this large volume of spent nuclear fuel would be a modular dry storage vault concept (approximately 5,500 modular aboveground dry storage containers).

Wet Storage - An alternative to the above-described dry storage would be to provide any required storage as wet storage. While nuclear industry and DOE experience has demonstrated a general benefit from avoiding the processing, storage, and handling complications in a wet environment, this alternative continues to be considered, but was not evaluated in this EIS.

Locate Facilities Elsewhere on the INEL - Under this option, canning/characterization and dry storage facilities would be constructed at a location other than the Idaho Chemical Processing Plant. This option was not evaluated in this EIS. The Test Area North facility has an existing hot cell with the capability to receive spent nuclear fuel shipments by rail or truck. However, spent nuclear fuel storage is being phased out at Test Area North (see Section C-2.1, Test Area North Pool Transfer), and the majority of spent nuclear fuel storage at the INEL is approximately 32 kilometers (20 miles) south of Test Area North at Idaho Chemical Processing Plant, part of the way on a public highway. Spent nuclear fuel canning/characterization and dry storage at Test Area North would probably require upgrade/modification to the Test Area North Hot Cell Complex, and would require construction of dry storage facilities at Test Area North.

Project Data Sheet

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Section	Item	Value
General Info.	Description/function:	Dry Fuels Storage Facility
	WAG	3
	EIS Alter. (A, B, C or D):	B
	SNF or Waste stream:	SNF
	Action type:	New
	Structure Type:	Building / Pad
	Size: (m2)	4,000
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside or Outside ICPP
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$24 Mil.
	Cost($): Const.	$287 Mil.
	Schedule Start /End: PreConst.	1994 - 1999
	Schedule Start /End: Const.	1999 - 2005
	No. of workers: (new/exist)	50 Subs.
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.1.4-1
	Acres Disturbed: New	0
	Previous	18.5
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	37.5
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value	
Const.	Cultural resource effects:	None	
	Pits/ponding created: (m2)	No	
	Water usage: (liters)	No information	
	Energy requirements:		
	Electrical: (MWH/yr)	20	
	Fossil fuel: (liters)	6,400 Diesel	
	Nightlights used: Y/N	Yes	
	Generators: Night Y/N	No	
	Day Y/N	Yes	
Operational Information	Cost($): Operation:	$4 Mil./yr	
	Schedule Start /End:	2005 - 2035	
	No. of workers: (new/exist)	15 Existing	
	Heavy Equip. Equip. used:	See Table	
	Trips:	C-4.1.4-1	
	Air Emissions: (None / Ref.)	See Appendix F, Section 3	
	Effluents:		
	Type:	LLW	
	Quantity: (liters/yr)	Minimal amounts	
	Solid wastes:		
	Type:	LLW	Ind.
	Quantity: (m3/yr)	5	10
	Haz./Toxic Chemicals: Storage/inventory	None	
	Pits/ponds used: Y/N (m2)	None	
	Water usage: (liters/yr)	No information	
	Energy requirements:		
	Electrical: (MWH/yr)	200	
	Fossil fuel: (liters/yr)	0	
	Nightlights used: Y/N	Yes	
	Generators: Night Y/N	No	
	Day Y/N	No	

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Section	Item	Value
General Info.	Description/function:	Fuel Receiving, Canning Characterization & Shipping
General Info.	WAG	3
General Info.	EIS Alter. (A, B, C or D):	B
General Info.	SNF or Waste stream:	SNF
General Info.	Action type:	Existing
General Info.	Structure Type:	Existing
General Info.	Size: (m2)	
General Info.	Other features: (Pits, ponds, power /water/sewer lines)	None
General Info.	Location: Inside/outside of fence	Inside ICPP
General Info.	Inside/outside of bldg.	Inside existing facility
Construction Info.	Cost($): PreConst.	$24 Mil.
Construction Info.	Cost($): Const.	$287 Mil.
Construction Info.	Schedule Start /End: PreConst.	1994 - 1999
Construction Info.	Schedule Start /End: Const.	1999 - 2005
Construction Info.	No. of workers: (new/exist)	100 Subs.
Construction Info.	Heavy Equip. Equip. used: / Trips:	See Table C-4.1.4-1
Construction Info.	Acres Disturbed: New	0
Construction Info.	Previous	0
Construction Info.	Revegetated	0
Construction Info.	Air Emissions: (None / Ref.)	See Belanger et al. 1995
Construction Info.	Effluents: Type:	Construction Water
Construction Info.	Quantity: (liters)	No information
Construction Info.	Solid wastes: Type:	Industrial
Construction Info.	Quantity: (m3)	37.5
Construction Info.	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value	
Const.	Cultural resource effects:	None	
Const.	Pits/ponding created: (m2)	None	
Const.	Water usage: (liters)	Minimal increase	
Const.	Energy requirements: Electrical: (MWH/yr)	30	
Const.	Fossil fuel: (liters)	10,000 Diesel	
Const.	Nightlights used: Y/N	Yes	
Const.	Generators: Night Y/N	N	
Const.	Day Y/N	Yes	
Operational Information	Cost($): Operation:	$20 Mil./yr	
Operational Information	Schedule Start /End:	2005 - 2035	
Operational Information	No. of workers: (new/exist)	20 Existing	
Operational Information	Heavy Equip. Equip. used: / Trips:	See Table C-4.1.4-1	
Operational Information	Air Emissions: (None / Ref.)	See Appendix F, Section 3	
Operational Information	Effluents: Type:	LLW	
Operational Information	Quantity: (liters/yr)	Minimal amounts	
Operational Information	Solid wastes: Type:	LLW	Ind.
Operational Information	Quantity: (m3/yr)	220	490
Operational Information	Haz./Toxic Chemicals: Storage/inventory	None	
Operational Information	Pits/ponds used: Y/N (m2)	None	
Operational Information	Water usage: (liters/yr)	No information	
Operational Information	Energy requirements: Electrical: (MWH/yr)	1,800	
Operational Information	Fossil fuel: (liters/yr)	300 k Fuel Oil	
Operational Information	Nightlights used: Y/N	Yes	
Operational Information	Generators: Night Y/N	No	
Operational Information	Day Y/N	No	

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Section	Item	Value
Generic Info.	Description/function:	Fuel Receiving, Canning Characterization & Shipping
	WAG	3
	EIS Alter. (A, B, C or D):	C
	SNF or Waste stream:	SNF
	Action type:	Modification
	Structure Type:	Existing
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside Existing
Construction Info.	Cost($): PreConst.	$2 Mil.
	Cost($): Const.	$15 Mil.
	Schedule Start /End: PreConst.	1995
	Schedule Start /End: Const.	1995 - 1996
	No. of workers: (new/exist)	50 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	2 Ind.
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	No increase
	Quantity: (liters)	
	Solid wastes: Type:	Ind.
	Quantity: (m3)	50
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None
	Pits/ponding created: (m2)	None
	Water usage: (liters)	Minimal increase
	Energy requirements:	
	Electrical: (MWH/yr)	10
	Fossil fuel: (liters)	3,000 Diesel
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$10 Mil./yr
	Schedule Start /End:	1996 - 2010
	No. of workers: (new/exist)	No new
	Heavy Equip. Equip. used:	Trucks
	Trips:	3/yr LLW, 348/yr SNF
	Air Emissions: (None / Ref.)	No increase
	Effluents: Type:	No increase
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW
	Quantity: (m3/yr)	100
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	None
	Water usage: (liters/yr)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	2,000
	Fossil fuel: (liters/yr)	300 k Fuel Oil
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	N
	Day Y/N	N

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Section	Item	Value
General Info.	Description/function:	Dry Fuels Storage Facility (Expanded)
	WAG	3
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	SNF
	Action type:	New
	Structure Type:	Building / Pad
	Size: (m2)	4,000
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside or Outside ICPP
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$24 Mil.
	Cost($): Const.	$550 Mil.
	Schedule Start /End: PreConst.	1994 - 1999
	Schedule Start /End: Const.	1999 - 2008
	No. of workers: (new/exist)	75 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	2 Ind.
	Acres Disturbed: New	0
	Previous	15
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	40
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	20
	Fossil fuel: (liters)	6,400 Diesel
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$4 Mil./yr
	Schedule Start /End:	2008 - 2038
	No. of workers: (new/exist)	15 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	7/yr Ind., 3/yr LLW
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	LLW
	Quantity: (liters/yr)	Minimal amounts
	Solid wastes:	
	Type:	LLW Ind.
	Quantity: (m3/yr)	110 250
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	None
	Water usage: (liters/yr)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	2,000
	Fossil fuel: (liters/yr)	225 k Fuel Oil
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

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G	Description/function:	Fuel Receiving, Canning Characterization & Shipping
e		
n	WAG	3
e	EIS Alter. (A, B, C or D):	D
r	SNF or Waste stream:	SNF
i	Action type:	New
c	Structure Type:	Building / Pad
	Size: (m2)	3,000
I		
n	Other features:	None
f	(Pits, ponds, power	
o	/water/sewer lines)	
.	Location:	
	Inside/outside of fence	Inside or outside ICPP
	Inside/outside of bldg.	Outside
C	Cost($): PreConst.	$24 Mil.
o	Cost($): Const.	$300 Mil.
n	Schedule Start /End: PreConst.	1994 - 1999
s	Schedule Start /End: Const.	1999 - 2008
t	No. of workers: (new/exist)	75 Subs.
r	Heavy Equip. Equip. used:	Trucks
u	Trips:	2 Ind.
c	Acres Disturbed: New	0
t	Previous	15
i	Revegetated	0
o	Air Emissions:	
n	(None / Ref.)	See Belanger et al. 1995
I	Effluents:	
n	Type:	Construction Water
f	Quantity: (liters)	No information
o	Solid wastes:	
.	Type:	Industrial
	Quantity: (m3)	60
	Haz./Toxic Chemicals:	None
	Storage/inventory	

C	Cultural resource effects:	None
o	Pits/ponding created: (m2)	None
n	Water usage: (liters)	Minimal increase
s	Energy requirements:	
t	Electrical: (MWH/yr)	30
.	Fossil fuel: (liters)	10,000 Diesel
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
O	Cost($): Operation:	$20 Mil./yr
p	Schedule Start /End:	2008 - 2038
e	No. of workers: (new/exist)	20 Existing
r	Heavy Equip. Equip. used:	Trucks 7/yr Ind.
a	Trips:	3/yr LLW, 2,717/yr SNF
t	Air Emissions:	
i	(None / Ref.)	See Appendix F, Section 3
o		
n		
a	Effluents:	
l	Type:	LLW
	Quantity: (liters/yr)	Minimal amounts
I	Solid wastes:	
n	Type:	LLW Ind.
f	Quantity: (m3/yr)	115 250
o	Haz./Toxic Chemicals:	None
r	Storage/inventory	
m	Pits/ponds used: Y/N (m2)	None
a	Water usage: (liters/yr)	No information
t	Energy requirements:	
i	Electrical: (MWH/yr)	2,000
o	Fossil fuel: (liters/yr)	300 k Fuel Oil
n	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.1.5 FORT ST. VRAIN SPENT NUCLEAR FUEL RECEIPT AND STORAGE

PROJECT NAME: Fort St. Vrain Spent Nuclear Fuel Receipt and Storage

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Fort St. Vrain Spent Nuclear Fuel Receipt and Storage project would be to complete the transportation, receipt, and storage of up to 1,464 blocks of Fort St. Vrain spent nuclear fuel from the Public Service Company of Colorado spent fuel storage facility in Platteville, Colorado, to the Idaho Chemical Processing Plant Irradiated Fuel Storage Facility at the INEL. In accordance with existing agreements between DOE and Public Service Company of Colorado, the spent fuel would be transported to the INEL by Public Service Company of Colorado in compliance with applicable transportation requirements using shipping casks certified by the U.S. Nuclear Regulatory Commission.

The Fort St. Vrain reactor is a High Temperature Gas-Cooled Reactor owned by Public Service Company of Colorado. The development, construction, and startup of the reactor was co-sponsored by the U.S. Atomic Energy Commission (now DOE) through Contract No. AT(04-3)-633, dated July 1, 1965. As part of the overall research and development effort related to High Temperature Gas-Cooled Reactors, the Atomic Energy Commission had planned to build a facility to demonstrate the reprocessing of High Temperature Gas-Cooled Reactor fuel. The Idaho Chemical Processing Plant was to be the location of the demonstration fuel reprocessing plant. Due to changes in the development of commercial High Temperature Gas-Cooled Reactor facilities, construction plans for the fuel reprocessing demonstration plant were not pursued. However, the Atomic Energy Commission designed and constructed the Irradiated Fuel Storage Facility (CPP-603) in 1975 at the Idaho Chemical Processing Plant to store the spent fuel from Fort St. Vrain. The environmental impacts for this facility were evaluated in the mid-1970s.

In modification No. M010 (effective April 1, 1980) to the 1965 contract, the parties made specific DOE's obligation to accept a total of eight segments of fuel from the Fort St. Vrain reactor. The contract does not include a ninth segment that is in storage at Fort St. Vrain. DOE is responsible for the eventual storage of the eight segments. DOE also agreed that, at the sole discretion of DOE and under certain conditions, DOE would accept additional spent fuel elements without further adjustment in the agreement. Effective April 1, 1980, DOE entered into Contract No. DE-SC07-79IDO1370, which incorporated the 1965 contract and defined the procedures and specifications for fuel receipt.

This spent fuel transportation project would involve movement of approximately 16 metric tons of heavy metal (spent Fort St. Vrain fuel) across public highways in U.S. Nuclear Regulatory Commission-licensed shipping casks to the INEL where the spent fuel would be unloaded by remote capabilities into existing storage space (Irradiated Fuel Storage Facility). Each Fort St. Vrain fuel segment contains about 240 blocks (or elements) and a small but variable number of test elements. Receipt of the fuel at the INEL is an existing DOE contractual commitment.

Three segments were transported and received at the INEL between 1980 and 1987. Six segments of spent fuel remain at the Fort St. Vrain Fuel Storage Facility, except three shipments totalling 18 blocks that were completed in 1991 following issuance of an environmental assessment (DOE/EA-0441) (DOE 1991b). Currently 744 blocks are in storage at the Irradiated Fuel Storage Facility. This project would involve transporting of the remaining six spent fuel segments to the INEL by Public Service Company of Colorado, and receipt and storage of the spent fuel in the Irradiated Fuel Storage Facility. These six segments contain approximately 1,464 blocks total. Each shipment would consist of one cask containing six spent fuel blocks, requiring a total of 244 shipments.

PROJECT DESCRIPTION: The Fort St. Vrain fuel is in the form of uranium and thorium carbide particles coated with layers of pyrolytic carbon and silicon carbide, bonded by a carbonaceous matrix material into fuel rods, which are subsequently inserted into graphite blocks. Fresh fuel blocks have variable uranium and thorium contents. The Fort St. Vrain design fuel life is 1800 effective full power days. However, the fuel which has been in the Fort St. Vrain reactor for the longest time has been irradiated to only 890 effective full power days, or less than half of the design life. Because of the designed, tested, and demonstrated retention characteristics of the fuel, and the reduced actual fuel service history, there is a high assurance that the Fort St. Vrain fuel proposed to be received at the INEL will have less than one percent coating failure rate.

Each shipment would consist of one TN-FSV cask containing six spent fuel blocks. The TN-FSV cask was designed by Transnuclear, Inc., and certified by the U.S. Nuclear Regulatory Commission for transport over public highways using semitractor trailer rigs (Certificate of Compliance No. 9253, Rev. 0) (Chappell 1994). Shipments of spent fuel would arrive at the Irradiated Fuel Storage Facility unloading facility. A sample of the cask atmosphere would be removed for analysis to verify there is no damage to a fuel block or its container. It should be noted that 744 fuel blocks have been transported, received, and stored and none have been damaged.

Receipt of the six remaining segments of spent fuel at the Irradiated Fuel Storage Facility would require the following operations:

1. Transport of the fuel from Fort St. Vrain to the INEL by Public Service Company of Colorado.

2. Relocation to CPP-749 or a new dry storage facility of some non-Fort St. Vrain fuel stored in the Irradiated Fuel Storage Facility.

3. A fuel handling sequence at the Irradiated Fuel Storage Facility to place the spent fuel blocks into storage.

4. Storage of fuel at the Irradiated Fuel Storage Facility.

Because of the previous use of the Irradiated Fuel Storage Facility for storage of other fuels (ROVER, BER-TRIGA, Peach Bottom, and TORY-IIC), space for a portion of the ninth segment will need to be made available. The space would be made available by transferring the ROVER and Peach Bottom fuels to other existing facilities or a new dry storage facility. Some of the Peach Bottom Core II fuel would be transferred to the CPP-749 Underground Dry Vaults where the Peach Bottom Core I is stored. The Peach Bottom fuel transfer would require purchase of stainless steel storage containers that would be loaded in the Irradiated Fuel Storage Facility and transported in existing INEL shipping casks.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented. The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.5-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

Retain the Fuel in the Independent Spent Nuclear Fuel Storage Facility at Fort St. Vrain - This option corresponds to Alternative A (No Action) evaluated in this EIS. The Public Service Company of Colorado built a spent nuclear fuel storage facility onsite and transferred all spent fuel from the reactor to that facility, and subsequently began converting the reactor building into a natural gas fueled electric generating facility. This option is not considered responsive to the DOE contractual commitment to take possession of the Fort St. Vrain fuel. Also, Public Service Company would not achieve its goal of becoming free of radioactive materials by 1998 under this option.

Receive Fort St. Vrain Fuel at Another DOE Facility - This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Under this option, existing or new storage capacity at another DOE site would be used for storage of the Fort St. Vrain fuel.

Receive Fort St. Vrain Fuel at Another INEL Facility - The consequences of this option are not bounded by the analysis performed for this project. No DOE facility other than Irradiated Fuel Storage Facility is specifically designed for dry storage of graphite reactor fuels. However, the Test Area North (TAN) Building TAN-607, built for the Aircraft Nuclear Propulsion Program, has the necessary space to accommodate the Fort St. Vrain fuels. This facility would be difficult to qualify to current standards for seismic performance, compliance with electrical, ventilation, and filtration codes, and other requirements that would be applicable to the storage of spent nuclear fuels. Construction programs would have to be undertaken to upgrade the facility to meet current requirements.

Table C-4.1.5-1. Summary of potential environmental impacts of the Fort St. Vrain Spent Nuclear Fuel Receipt and Storage Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Storage would be in existing facility
Water resources	None expected. The facility would not use any water and no effluents are generated	Dry storage configuration; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Storage would be in existing facility
Historic, archaeological, or cultural resources	None	Storage would be in existing facility
Air resources	Radiological operational emissions 4.9×10^{-5}% of NESHAP dose limit Toxic Air Pollutants (TAPs) 2.3×10^{-5}% of significance level for combined TAPs Prevention of Significant Deterioration (PSD) <0.1% for all pollutants, all classes, all locations	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 4.9×10^{-6} mrem/yr 2.5×10^{-12} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 4.2×10^{-5} person-rem/yr 2.1×10^{-8} latent cancer fatalities/yr Year 2010: 4.5×10^{-5} person-rem/yr 2.3×10^{-8} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected.	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Operation (truck trips per year): Spent nuclear fuel - 244 offsite	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Small amounts of waste generated from cask decontamination, facility inspection, and maintenance. No increase above current level of waste generation	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Operation: No additional workers	None required

a. Definition of acronym: NESHAP - National Emission Standard for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Receive Fort St. Vrain Fuel at Another Idaho Chemical Processing Plant Facility - The consequences of this option are not bounded by the analysis performed for this project. This option is to store some Fort St. Vrain fuel in the Underground Storage Facility or the Unirradiated Fuel Storage Facility, rather than relocate other fuels now stored in the Irradiated Fuel Storage Facility. The Unirradiated Fuel Storage Facility is designed to store only unirradiated fuel and would not provide proper storage for the Fort St. Vrain fuel which is irradiated. The Underground Storage Facility is designed to provide proper storage for both irradiated and unirradiated fuels. However, before the Underground Storage Facility could be used for the storage of Fort St. Vrain fuel, an upgrade construction project would be needed to construct additional underground dry fuel storage vaults.

Receive Fort St. Vrain Fuel at Newly Constructed Storage - The consequences of this option are not bounded by the analysis performed for this project.

Receive Only Contracted Amount of Fuel - This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. DOE is obligated to receive a total of five of the six fuel segments currently stored at the Fort St. Vrain spent fuel storage facility. Receipt of the sixth segment is at the discretion of the DOE. Under this option, Public Service Company of Colorado would continue to store the balance of the fuel at their spent fuel storage facility. This would require that Public Service Company of Colorado continue to employ a staff of operators, maintenance personnel, and a security force to operate the storage facility. If the sixth segment is not received, the Peach Bottom and ROVER fuels would continue to be stored in the Irradiated Fuel Storage Facility and would not require relocation to CPP-749 or a new dry storage facility. There would be a reduction in the quantity of fuel that the DOE must store.

SUMMARY OF IMPACTS: The cask design limits radioactive material releases following hypothetical accidents to satisfy the requirements of 10 CFR 71.51 for Type B packages. These requirements are summarized below:

1. No escape of krypton-85 in one week exceeding ten times the maximum krypton-85 activity value from 10 CFR Part 71, Table A-1.

2. No escape of other radionuclides exceeding the total amount specified in 10 CFR 71, Table A-1.

3. No external radiation dose rate exceeding one rem per hour at one meter from the external surface of the package.

The cask must be designed and prepared for shipment so that, for a cask transported as exclusive use by highway, radiation levels at any point two meters from the outer surface of the vehicle must not exceed 10 millirem per hour. The expected maximum number of vehicle round trips that would be required to complete the transfer of fuel from Fort St. Vrain to Irradiated Fuel Storage Facility would not exceed ten per week and would total approximately 250 round trips.

The project does not require new construction or excavation. Small quantities of radioactive, hazardous, or mixed wastes would be generated during cask decontamination activities. These wastes would be treated or disposed of according to procedures that are in compliance with applicable State and Federal requirements. Assuming air emissions from the Irradiated Fuel Storage Facility were to increase linearly from previously measured data as the facility were filled with Fort St. Vrain fuel, INEL site emissions would increase by approximately 40 microcuries per year.

Relocation of Peach Bottom and ROVER/Parka fuels from the Irradiated Fuel Storage Facility to the Underground Storage Facility and the Unirradiated Fuel Storage Facility would cause no increase in cumulative radioactive airborne emissions. Peach Bottom fuels would be placed inside sealed canisters before relocation to the underground vaults of the Underground Storage Facility. The vaults would be sealed after receiving the Peach Bottom fuel, except for two normally closed sample connections. ROVER/Parka fuel is unirradiated and makes no contribution to radioactive airborne emissions.

Project Data Sheet

Rev. 10 February 6, '95

General Info.	Description/function:	Fort St. Vrain SNF Receipt & Storage
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	SNF
	Action type:	Operation
	Structure Type: Size: (m2)	N/A
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside CPP-603
Operational	Cost($): Operation:	No increase
	Schedule Start /End:	1996 - 1997
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used: Trips:	See Table C-4.1.5-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: Quantity: (liters/yr)	None

Information	Solid wastes: Type: Quantity: (m3/yr)	None
	Haz./Toxic Chemicals: Storage/inventory	No
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	None
	Energy requirements: Electrical: (MWH/yr)	No increase
	Fossil fuel: (liters/yr)	No increase
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.1.6 SPENT FUEL PROCESSING

PROJECT NAME: Spent Fuel Processing

GENERAL PROJECT OBJECTIVE: For the purposes of analysis, a hypothetical Spent Fuel Processing project was assumed. The general project objective would be to provide the capability to process highly enriched spent nuclear fuel. Concerns about criticality during interim storage or in a Federal repository may dictate separation of the fissile material (uranium and plutonium) from the highly enriched fuel before storage or disposal. Aqueous dissolution and separation was assumed because DOE has data from past processing that could be used for analysis. This process was intended to be bounding for whatever processing that would actually be developed and used. Processing these fuels would alleviate some of the fuel storage and repackaging needs, as stated in the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping project summary (see Section C-4.1.4). Fuel processing could be done in order to stabilize the spent nuclear fuel and remove risks associated with storage and disposal, and to safely manage the resultant high-level waste in a cost-effective manner. For analysis purposes, it was assumed that restart of the Idaho Chemical Processing Plant processing and chemical separations facilities to condition the fuel for storage and disposal by removal of the fissile material would be the bounding case.

PROJECT DESCRIPTION: Historically, many DOE spent nuclear fuel types were processed by chemical dissolution and the fissile material segregated. Several processes were used because of the variety of materials making up the fuel elements: aluminum-clad fuels, stainless-steel-clad fuels, zirconium-clad fuels, and graphite fuels. Aluminum-clad and zirconium-clad fuels were processed by highly acidic aqueous dissolution. Stainless steel-clad fuels were electrolytically dissolved. Graphite fuels were first burned and then the ash dissolved. These processes generated solutions that included the radioactive fission products and the fissile material, usually uranium-235, which were subsequently separated to segregate the uranium-235. Once the fissile material is extracted, the remaining waste solution is referred to as high-level liquid waste.

For analysis purposes, it is assumed that this project would process the current inventory of fuel in the existing Fluorinel Dissolution Process facility (CPP-666) and Fuel Processing Building (CPP-601) in FY 1997 and provide upgraded and new facilities to support long-term fuel stabilization activities.

FY 1997 is the earliest time the facilities could be restarted and was used to maximize the impacts within its ten-year window.

Upgrades and new facilities would be required to support long-term processing of spent fuel. Upgrades have been identified to some facilities that would increase efficiency, safety, or throughput rates. These proposed improvements are described below with estimated costs.

Completion of maintenance activities, operation readiness reviews, and obtaining DOE approvals would be required before the existing facilities could be restarted. About two to three years would be required to accomplish these activities. Thus, FY 1997 would be the earliest the restart could be accomplished based on a June 1995 decision to start processing. Two or three processing campaigns could be accomplished before the fluorinel dissolution process would be shut down in FY 2000 to accomplish its upgrade.

The following paragraphs summarize the upgrades and new facilities that would be required.

The fluorinel dissolution process was run in the past to process zirconium fuel. For analysis purposes, upgrades were assumed to increase the throughput roughly 2 to 3 times the historical processing rate. The upgrade would be designed to include an electrolytic dissolution process for aluminum and stainless steel fuels. The old electrolytic stainless steel process is no longer operable. The new electrolytic process would also provide a more environmentally acceptable method for processing aluminum fuel. Hot operation is assumed by 2006. FY 2006 was assumed in this analysis because early processing would be the bounding case for impacts. A rough estimate of the fluorinel dissolution process upgrade including the new electrolytic process is $700 million.

The Fuel Processing Restoration project that was canceled in 1992 was to provide new facilities to extract the uranium from the dissolver product solutions. The increased capacity for solvent extraction operations would not be required until FY 2006 when the fluorinel dissolution process would begin hot operations. A cost estimate to restart the project and finish the facility is approximately $500 million.

Graphite fuel processing would require a new pilot plant/production facility at an estimated cost of $200 million.

These new and replacement facilities would be sufficient to stabilize essentially all the highly enriched fuels types that are in inventory at the INEL. Other fuels of different materials may require new or modified processes to produce acceptable waste forms.

If this alternative were to be pursued aggressively, the generated wastes may require additional high level waste tankage, which would be covered by the High-Level Tank Farm New Tanks project (see Section C-4.3.3).

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located mostly in existing facilities within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.6-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the existing facilities would not be restarted and new facilities would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. The no action option regarding processing of spent fuel is evaluated by each of the spent fuel storage alternatives. Processing fuels not historically processed at INEL (for example, N-Reactor or Fast Flux Test Facility fuels) is not presented here as an alternative, but is included as site-specific alternatives within Volume I.

Table C-4.1.6-1. Summary of potential environmental impacts of the Spent Fuel Processing Project under Alternative D.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Minimal previously disturbed soil, and in an existing facility	Most of the project would be in existing facilities
Water resources	Construction: 100,000 liters Operation: 48,000,000 liters per year	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Most of the project would be in existing facilities
Historic, archaeological, or cultural resources	None	Most of the project would be in existing facilities
Air resources	Radiological operational emissions 0.4% of NESHAP dose limit Toxic Air Pollutants (TAPs) 110% of significance level for combined TAPs Prevention of Significant Deterioration (PSD) - None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 0.04 mrem/yr 2.0×10^{-8} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: not in operation Year 2010: 0.29 person-rem/yr 1.5×10^{-5} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected Accidents - Handling and criticality: MEI cancer risk increases from 4.8×10^{-8}/yr (Alternative B) to 2.0×10^{-7}/yr due to this project	Access control, facility design, safety analysis, inspection and surveillance, annual reporting. Additional controls or measures may be required to control toxic air pollutant levels
Transportation	Construction (onsite truck trips): Nonradiological - 84.2 Operation (onsite truck trips per year): Nonradiological - 73.4 Radiological 8.4 Spent nuclear fuel - 16	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure.
Waste management	Construction (m^3): industrial waste - 3100 Operation (m^3/yr): high-level liquid waste - 4,500 low-level waste - 310 industrial waste - 2,700	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 450 peak subcontractor personnel; 50 existing Operation: 300 existing; 25 new workers	None required

a. Definition of acronyms: MEI - maximally exposed individual; NESHAP - National Emission Standards for Hazardous Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet				
General Info.	Description/function:	Spent Fuel Processing		
	WAG	INEL		
	EIS Alter. (A, B, C or D):	D		
	SNF or Waste stream:	SNF		
	Action type:	Use Fuel Processing Restoration Fac		
	Structure Type: Size: (m2)	FDP (existing CPP-666) FPR (partially complete) Graphite Pilot Plant (GPP)		
	Other features: (Pits, ponds, power /water/sewer lines)	None		
	Location: Inside/outside of fence Inside/outside of bldg.	Inside ICPP Inside FDP, FPR, GPP		
Construction Info.	Cost($): PreConst.	FDP	FPR	GPP
	Cost($): Const.	$700 M	$500 M	$200 M
	Schedule Start /End: PreConst.		99 - 01	
	Schedule Start /End: Const.	99-06	01-06	01-06
	No. of workers: (new/exist)	450 Peak Subs, 50 Existing		
	Heavy Equip. Equip. used: Trips:	See Table C-4.1.6-1		
	Acres Disturbed: New	0		
	Previous	0		
	Revegetated	0		
	Air Emissions: (None / Ref.)	See Belanger et al. 1995		
	Effluents: Type: Quantity: (liters)	None		
	Solid wastes: Type: Quantity: (m3)	Ind. 3,100		
	Haz./Toxic Chemicals: Storage/inventory	<10 m3		

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Const.	Cultural resource effects:	None identified	
	Pits/ponding created: (m2)	No	
	Water usage: (liters)	<100 k	
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	2000 38 k	
	Nightlights used: Y/N	Yes	
	Generators: Night Y/N Day Y/N	No Yes	
Operational Information	Cost($): Operation:	$20 Mil/yr	
	Schedule Start /End:	2006 - 2043	
	No. of workers: (new/exist)	300 Existing, 25 New	
	Heavy Equip. Equip. used: Trips:	See Table C-4.1.6-1	
	Air Emissions: (None / Ref.)	See Appendix F, Section 3	
	Effluents: Type: Quantity: (liters/yr)	HLW 4,500,000	
	Solid wastes: Type: Quantity: (m3/yr)	LLW 310	Ind. 2,700
	Haz./Toxic Chemicals: Storage/inventory	<5,000	
	Pits/ponds used: Y/N (m2)	No	
	Water usage: (liters/yr)	48,000 k	
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	6,500 0	
	Nightlights used: Y/N	Yes	
	Generators: Night Y/N Day Y/N	No No	

C-4.1.7 EXPERIMENTAL BREEDER REACTOR-II BLANKET TREATMENT

PROJECT NAME: Experimental Breeder Reactor-II Blanket Treatment

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Experimental Breeder Reactor-II Blanket Treatment Project would be to modify the Fuel Cycle Facility to treat the Experimental Breeder Reactor-II blanket fuel assemblies to a suitable form for safe, interim storage. Blanket fuel treatment is part of the electrometallurgical process under development at Argonne National Laboratory-West.

The fuel treatment project would condition the spent blanket fuel to a stable form for storage. Radioactive elements, including transuranic elements, would be separated and stabilized for storage pending eventual geologic disposal. Nearly pure depleted uranium metal would be separated for storage for disposal as low-level waste. This project would have the advantage of neutralizing the reactive constituent in the blanket fuel and would produce material that would be better suited for interim storage. The wastes produced from this activity would be treated for disposal in the same manner as other wastes at Argonne National Laboratory-West and would benefit from the common approach to waste disposal.

PROJECT DESCRIPTION: Argonne National Laboratory-West would treat Experimental Breeder Reactor-II fuel assemblies in the Fuel Cycle Facility following the electrometallurgical processing of the Experimental Breeder Reactor-II spent driver fuel assemblies located at either Argonne National Laboratory-West or the Idaho Chemical Processing Plant. The Experimental Breeder Reactor-II core contains 326 blanket fuel assemblies that will be removed from the core during Fiscal Years 1994-1996. Other blankets have previously been removed and are stored on the INEL site. The blanket fuel assemblies contain metallic depleted uranium fuel slugs immersed in sodium, within a stainless steel jacket/can. The sodium improves heat transfer between the fuel and stainless steel. A number of the fuel elements in stainless steel cans are clustered together to form an assembly. Electrometallurgical processing would turn the elemental sodium in the blankets into nonreactive sodium chloride while converting the blanket fuel to a form suitable for storage. The treatment would require shearing the stainless steel jackets to expose the fuel for treatment.

The Fuel Cycle Facility stabilizes the Experimental Breeder Reactor-II metallic spent driver fuel using the following treatment steps:

- A molten salt electrorefining process to separate the fission products from the depleted uranium using an electrochemical cell to drive the process.

- A furnace and mold system to cast the noble metal fission products and radioactive stainless steel cladding into a disposable form.

- Other processes to place the active fission products into zeolites, and vitrifying the zeolites into a mineral waste.

The uranium would be separated from most of the fission products. The fission products extracted from the fuel would be placed in two stable waste forms: a mineral waste containing the active fission products and a metal waste containing the noble metal fission products and the cladding alloys from the fuel elements. These waste forms would be thoroughly analyzed for subsequent repository disposal. The small amount of transuranic elements present in the fuel would be extracted with the active fission products into the zeolite or alloyed with the structural stainless steel recovered from the fuel assemblies to produce a stable material that could be stored for later disposition.

This project would modify the Fuel Cycle Facility element chopper to handle the larger blanket fuel assemblies, and add a high-throughput electrorefiner to handle the larger quantities of depleted uranium from the blankets. The increased capacity would allow the Fuel Cycle Facility to treat the 326 blanket fuel assemblies in the Experimental Breeder Reactor-II as well as the others in storage at the INEL, and would increase the treatment rate from 90 to 120 spent driver fuel assemblies per year. The actinides, fission products, and elemental sodium from the blankets would be treated in the same manner as those from the Experimental Breeder Reactor-II driver fuel assemblies. The treatment would convert the elemental sodium in the blankets to sodium chloride.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.7-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the present practice for blanket handling would be continued. As the blankets are removed from Experimental Breeder Reactor-II, they are transported to the Hot Fuel Examination Facility. The top and bottom section of the blanket fuel assemblies are machined off and the remaining assemblies with the blanket fuel elements are placed in a storage can. This can is inserted into another can and transported to the Radioactive Scrap/Waste Facility. The blanket assemblies would remain at the Radioactive Scrap/Waste Facility until a decision is made on processing or treatment for disposal. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

From an environmental perspective, this option would have disadvantages. The blanket fuel contains elemental sodium that will react with water and produce hydrogen gas. This characteristic categorizes this material as reactive. Reactive material is best handled by eliminating or stabilizing the reactive component. The storage option would only isolate the reactive component.

Develop a New Process - This option would be to develop a new process to stabilize the sodium in the blanket fuel assemblies. This option is not evaluated in this EIS. This option would require a new development program and then implementation of the process into a remote handling facility. This approach would require additional treatment and the fuel would have to be stored while this option was being implemented.

Table C-4.1.7-1. Summary of potential environmental impacts of the Experimental Breeder Reactor-II Blanket Treatment Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Project would be in existing facility
Water resources	No increase	Not required
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	Radiological operational emissions 5.7×10^{-3}% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 5.7×10^{-4} mrem/yr 2.9×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 0.012 person-rem/yr 6.0×10^{-6} latent cancer fatalities/yr Year 2010: 0.014 person-rem/yr 7.0×10^{-6} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Transportation	Construction: None Operation (onsite truck trips per year): Radiological - 4.9 Spent nuclear fuel - 11	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction: None Operation (m^3/yr): high-level waste - 3.5 transuranic - 4.0 low-level waste - 7.4 mixed low-level waste - 0.4	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 10 existing workers Operation: 12 existing workers	None required

a. Definition of acronym: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impaets are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 10 January 5, '95

Section	Item	Value
General Info.	Description/function:	EBR-II Blanket Treatment
	WAG	9
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	SNF
	Action type:	Expand
	Structure Type:	Existing
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Process Equipment
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Inside Bld-765
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$6 Mil. Total
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1995 - 1996
	No. of workers: (new/exist)	10 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.1.7-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	None
	Effluents: Type:	None
	Quantity: (liters)	
	Solid wastes: Type:	None
	Quantity: (m3)	
	Haz./Toxic Chemicals: Storage/inventory	No increase

Section	Item	Value			
Const.	Cultural resource effects:	No			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	No increase			
	Energy requirements: Electrical: (MWH/yr)	No increase			
	Fossil fuel: (liters)	No increase			
	Nightlights used: Y/N	Yes			
	Generators: Night Y/N	No			
	Day Y/N	No			
Operational Information	Cost($): Operation:	$1.2 Mil./yr			
	Schedule Start /End:	1997 - 1998			
	No. of workers: (new/exist)	12 Existing			
	Heavy Equip. Equip. used:	See Table			
	Trips:	C-4.1.7-1			
	Air Emissions: (None / Ref.)	See Appendix F, Section 3			
	Effluents: Type:	No increase			
	Quantity: (liters/yr)				
	Solid wastes: Type:	HLW	MLLW	LLW	TRU
	Quantity: (m3/yr)	3.5	0.4	7.4	4.0
	Haz./Toxic Chemicals: Storage/inventory	No increase			
	Pits/ponds used: Y/N (m2)	No			
	Water usage: (liters/yr)	No increase			
	Energy requirements: Electrical: (MWH/yr)	No increase			
	Fossil fuel: (liters/yr)	No increase			
	Nightlights used: Y/N	Yes			
	Generators: Night Y/N	No			
	Day Y/N	No			

C-4.1.8 ELECTROMETALLURGICAL PROCESS DEMONSTRATION

PROJECT NAME: Electrometallurgical Process Demonstration

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to allow the demonstration and testing of new spent nuclear fuel management processes. The goals of the project would be the following:

- Demonstrate the technical and economic feasibility of electrometallurgical processing for conditioning spent nuclear fuel for disposal.

- Demonstrate a waste product that is compatible with the expected acceptance criteria for a geologic repository.

- Explicitly quantify the volume reduction of the waste stream components.

PROJECT DESCRIPTION: Argonne National Laboratory-West would perform the process development and demonstrate the conditioning of Department of Energy (DOE) spent nuclear fuel for disposal or future energy use. Much of the spent nuclear fuel at the INEL is highly enriched, has seriously degraded during storage, contains chemically reactive material, or cannot be expected to retain its integrity during storage, thus making direct disposal into a repository potentially unacceptable. These concerns suggest consideration of stabilization processes such as electrometallurgical processing. An environmental assessment for some aspects of the proposed project has previously been prepared (DOE 1990a, 1990b).

Presently in storage at the INEL are 72 distinct and different DOE fuel types with still more at other sites. These fuel types include metal, hydride, metal alloy sodium bonded, graphite, aluminum, oxide, and naval fuel matrices. Demonstration fuels would be transported from other locations to Argonne National Laboratory-West as needed. Argonne would first complete process development and demonstration with unirradiated fuel containing representative fission product elements and then conduct a pilot scale demonstration of spent nuclear fuel stabilization in the Hot Fuel Examination Facility and Fuel Cycle Facility at the Argonne National Laboratory-West site. This demonstration would include electrometallurgical processing of representative DOE fuel types and cover the complete range of operations necessary to prepare the fuel for ultimate disposition. The only new equipment required for this demonstration would be the installation of a vessel for carrying out the reduction of oxide to metal. The waste forms produced in the course of stabilizing oxide fuel would be identical to those produced with other fuel types, except for minor compositional differences in the metal waste forms, which depend on the composition of the structural materials used in the particular fuel types. For metallic spent fuel, additional equipment and modifications to the present equipment would be required to disassemble fuel assemblies and chop the fuel.

Electrometallurgical processing generally includes processes such as molten salt-metal extractions, molten salt electrorefining and electrowinning, salt-metal retorting, and metal slagging and injection casting. The basic process steps consist of chopping the fuel rods, electrorefining the fuel material, performing cathode processing, and then injection casting the resulting material into metal ingots. The details of the process are as follows:

- The spent fuel assembly is introduced for processing into a remotely operated, shielded room called a hot cell. The assembly is taken apart, and the structural components (everything except the fuel rods themselves) are removed and discarded as waste. The rods are passed through a shear and chopped into short pieces. For oxide fuels, the pieces are placed in a reduction vessel to produce a metal product. This product or chopped metallic fuel segments are placed into an electrorefiner at 500°C. Electrorefining is an established industrial process used to purify metals like nickel. This type of electrometallurgical processing operates like a battery with an anode, cathode, and electrolyte. At the appropriate cell voltage, uranium is deposited on a solid metal cathode. The small percentage of plutonium in most DOE spent nuclear fuel would be collected with a mixture of uranium and fission products in a liquid cadmium cathode. The vast majority of fission products are left in the electrolyte.

- The next step involves separating the product from the electrolyte or cadmium. For the liquid cathode this means raising the temperature of the cathode product in a furnace to a temperature (1000 to 1200°C) that separates the uranium/plutonium from the cadmium and vaporizes the cadmium for collection and reuse. The uranium/plutonium product will be recycled into the electrorefiner for eventual removal with the fission products in the waste stream. Mechanical separation will be used to remove the salt from the uranium on the solid cathode.

- Raw metal ingots would then be produced by injection casting, a process similar to that used routinely in the manufacture of many plastic products. The raw fuel ingots would then be removed from molds and placed in storage for a three-to-five year period until a decision is made as to their final disposition.

- The principal process wastes would be from the electrorefiner. The fission products would be extracted and placed in two stable waste forms: a mineral waste containing the active fission products, and a metal waste containing the noble metal fission products and structural alloys from the fuel elements. These waste forms would be evaluated to determine whether they meet acceptance criteria for subsequent repository disposal. The waste volume would be 20 to 50 percent of the direct disposal volume, depending on the fuel type.

The naval spent nuclear fuel could also be electrometallurgically processed to recover uranium and separate out the fission products and transuranic elements in the same manner as the other fuel types discussed above. In this instance, an additional dissolution step at the beginning of the process would be required prior to processing. Process development would be required to establish a preferred means for accomplishing this dissolution; preliminary evaluations indicate that material could be readily dissolved by contact with a molten metal at normal process operating temperatures. Development of this process step would be conducted with irradiated fuel in the Hot Fuel Examination Facility and Fuel Cycle Facility. A separate vessel for the dissolution step may be required for this demonstration. The waste form from production and product recovery/disposition steps would be the same as with the metal and oxide fuels.

These processes could also apply to other DOE spent nuclear fuel. The facilities would be used to demonstrate electrometallurgical processing for the highest priority fuels.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the previous project description.

The proposed project would be located in an existing facility within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.1.8-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, electrometallurgical processing demonstration would not be provided. This option corresponds to Alternative A (No Action) evaluated in this EIS.

Table C-4.1.8-1. Summary of Potential Environmental Impacts of the Electrometallurgical Process Demonstration Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no acreage disturbed)	Project would be in existing facility
Water resources	Effluents: No increase	None required
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	Radiological operations emissions 0.036% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 3.6×10^{-3} mrem/yr 1.8×10^{-9} latent cancer fatalities/yr 80-km (50-mile) population Year 2000: 0.074 person-rem/yr 3.7×10^{-5} latent cancer fatalities/yr Year 2010: 0.081 person-rem/yr 4.0×10^{-5} latent cancer fatalities/yr Nonradiological effects: No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Transportation	Construction (onsite truck trips): Nonradiological - 5.8 Radiological - 1 Operation (onsite truck trips per year): Radiological - 7.8 Spent nuclear fuel - 11	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction: no increase Operation (m^3/yr): high-level waste - 2.7 mixed low-level - 0.4 low-level waste - 33 transuranic - 32 industrial - 212	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Operation: 25 existing workers	None required

a. Definition of acronym: NESHAP - National Emission Standard for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet			Rev. 11	February 17, '95

Section	Item	Value
General Info.	Description/function:	Electrometallurgical Process Demonstration
	WAG	9
	EIS Alter. (A, B, C or D):	B, C, D
	SNF or Waste stream:	SNF
	Action type:	Expand
	Structure Type:	Existing
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Electrochemical Process Equipment
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Inside Bld-765, & -785
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$5 Mil. Total
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1994 - 1996
	No. of workers: (new/exist)	No information
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.1.8-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	No increase
	Solid wastes: Type: Quantity: (m3)	No increase
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value				
Const.	Cultural resource effects:	None				
	Pits/ponding created: (m2)	No				
	Water usage: (liters)	None				
	Energy requirements: Electrical: (MWH/yr)	No increase				
	Fossil fuel: (liters)	No increase				
	Nightlights used: Y/N	No				
	Generators: Night Y/N	No				
	Day Y/N	No				
Operational Information	Cost($): Operation:	$600 k/yr				
	Schedule Start /End:	1996 - 2024				
	No. of workers: (new/exist)	25 Existing				
	Heavy Equip. Equip. used:	See Table				
	Trips:	C-4.1.8-1				
	Air Emissions: (None / Ref.)	See Appendix F, Section 3				
	Effluents: Type: Quantity: (liters/yr)	No increase				
	Solid wastes: Type:	HLW	MLLW	LLW	TRU	Ind.
	Quantity: (m3/yr)	2.7	0.4	33	32	212
	Haz./Toxic Chemicals: Storage/inventory	No information				
	Pits/ponds used: Y/N (m2)	No				
	Water usage: (liters/yr)	No information				
	Energy requirements: Electrical: (MWH/yr)	No information				
	Fossil fuel: (liters/yr)	No information				
	Nightlights used: Y/N	No				
	Generators: Night Y/N	No				
	Day Y/N	No				

C-4.2 PROJECTS RELATED TO ENVIRONMENTAL RESTORATION

C-4.2.1 CENTRAL LIQUID WASTE PROCESSING FACILITY DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Central Liquid Waste Processing Facility Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to remove excess, obsolete, contaminated equipment from the Central Liquid Waste Processing Area so that the Analytical Laboratory could use tbis floor space for other missions.

PROJECT DESCRIPTION: The Central Liquid Waste Processing Area is located in the southwest corner of tbe Analytical Laboratory in the first floor and basement levels of Building 752 at Argonne National Laboratory-West at tbe INEL. The area occupies approximately 14 square meters (150 square feet) on each floor. The Central Liquid Waste Processing Area was used by the Analytical Laboratory to treat radioactive liquid waste. Central Liquid Waste Processing Area operations were discontinued in July 1983 when the Radioactive Liquid Waste Treatment Facility began operating and partially assumed the previous Central Liquid Waste Processing Area mission. The Central Liquid Waste Processing Area has been declared an excess area per DOE Order 5820.2A, "Radioactive Waste Management" (DOE 1988). This proposed project would include the surveillance and maintenance and the decontamination and decommissioning of the Central Liquid Waste Processing Area.

The Central Liquid Waste Processing Area system was used to receive, store, and reduce radioactive liquid waste. The system is considered contaminated by mixed fission products, activation products, uranium, thorium, and tritium. Interior surfaces of piping, tanks, valves and pumps are likely to be contaminated with radioactive material. Some sludge residue in vessel bottoms and piping low points can be expected. This sludge would be removed only if tbe components do not meet tbe definition of an empty tank per 40 CFR 261.7(b)(1)(iii). Any removed waste would be characterized, and then stored, treated, and/or disposed of in accordance with that characterization. Some asbestos-containing waste may result because asbestos-bearing insulation adhesive was permitted during Central Liquid Waste Processing Area construction, even tbough asbestos was not specified as an insulation material. Other waste would be held at tbe Argonne National Laboratory-West Mixed Waste Storage Facility.

The Central Liquid Waste Processing Area would contain approximately 140 cubic meters (5,000 cubic feet) of low-level contaminated materials (a low percentage may be mixed waste) to be disposed. Types of media contaminated are (a) concrete; (b) steel in the form of piping, tanks, valves, electrical conduit, etc.; (c) electrical wiring; (d) instrumentation panels; and (e) asbestos.

The tasks for surveillance and maintenance include (a) daily visual inspections, with results, and any necessary preventive or corrective maintenance, documented; (b) monthly radiological surveys to document radiation and contamination levels, and (c) yearly status reports for the Central Liquid Waste Processing Area. These tasks would be continued only until the decontamination and decommissioning field work is begun.

The decontamination and decommissioning tasks would include (a) preparation of National Environmental Policy Act documentation, (b) waste sampling and analysis, (c) Title I and Title II design, and (d) decontamination and decommissioning field work and Title III engineering support. During Title I, preliminary design concepts would be developed to provide the basis for a detailed working cost estimate for the Title II design effort and a rough cost estimate for the decontamination and decommissioning work and Title III. During Title II design a detailed engineering package would be developed. This package would include (a) drawings, procedures, waste packaging and disposal plans for removing the radioactively contaminated process equipment (possibly mixed waste) and (b) a detailed working cost estimate for decontamination and decommissioning work and Title III.

All decontamination and decommissioning work would be done within temporary contamination containment enclosures in Building 752. The enclosures would discharge to existing filter and discharge systems for contaminated air/gases. Some particulates may pass through high efficiency particulate air filters during decontamination and decommissioning operations, but these discharges would be bounded by normal radioactive air emissions at Argonne National Laboratory-West. Other air emissions would be generated by trucks hauling the solid waste to the Radioactive Waste Management Complex, estimated to be 40 shipments.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, Argonne National Laboratory-West. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Central Liquid Waste Processing Facility would be deferred. This option corresponds with Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel, and this floor space would not be available to the Analytical Lahoratory for other missions.

Table C-4.2.1-1. Summary of potential environmental impacts of the Central Liquid Waste Processing Facility Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Project would be in existing building.
Water resources	Construction water usage	None
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological or cultural resources	None	Project would be in existing facility
Air resources	Radiological emissions Negligible Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	D&D emissions would be limited by existing offgas systems including HEPA filters
Human health	Negligible impact on health effects expected.	All D&D work will be done within temporary contamination enclosures in Building 752. The enclosures would discharge to existing filter and discharge systems for contaminated air/gases
Transportation	D&D (onsite truck trips): Nonradiological - 1.6 Radiological - 4	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): mixed low-level (solid) - 0.2 low-level waste - 142 industrial waste - 60	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 2 to 4 existing workers	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; HEPA - high-efficiency particulate air.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet			Rev. 9 January 5, '95		
General Info.	Description/function:	Central Liquid Waste Processing Facility D&D	D&D Info.	Solid wastes: Type: Quantity: (m3)	MLLW: 0.2; LLW: 142; Ind.: 60; Haz.: No info.
	WAG	9		Haz./Toxic Chemicals: Storage/inventory	None
	EIS Alter. (A, B, C or D):	B, D		Cultural resource effects:	None
	SNF or Waste stream:	ER		Pits/ponding created: (m2)	No
	Action type:	D & D		Water usage: (liters)	No information
	Structure Type:	Bld-752		Energy requirements:	
	Size: (m2)	14		Electrical: (MWH/yr)	No information
	Other features: (Pits, ponds, power /water/sewer lines)	None		Fossil fuel: (liters)	No information
	Location:			Nightlights used: Y/N	No
	Inside/outside of fence	Inside ANL-W		Generators: Night Y/N	No
	Inside/outside of bldg.	Inside Bld-752		Day Y/N	No
D&D Information	Cost($): Pre D&D	$110 k			
	Cost($): D&D	$1.5 Mil.			
	Schedule Start /End: Pre D&D	1994 - 1995			
	Schedule Start /End: D&D	2004 - 2005			
	No. of workers: (new/exist)	2 - 4 Existing			
	Heavy Equip. Equip. used: Trips:	See Table C-4.2.1-1			
	Acres Disturbed: New	0			
	Previous	0			
	Revegetated	0			
	Air Emissions: (None / Ref.)	See Belanger et al. 1995			
	Effluents: Type: Quantity: (liters)	None			

C-4.2.2 ENGINEERING TEST REACTOR DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Engineering Test Reactor Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Engineering Test Reactor Decontamination and Decommissioning Project would be to remove the Engineering Test Reactor and associated support structures from the INEL Surplus Facilities List in accordance with the DOE directives. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at this facility.

PROJECT DESCRIPTION: The Engineering Test Reactor was a 175-megawatt (thermal) pressurized light water test reactor that operated between 1957 and 1982. This surplus facility consists of the reactor building and about 10 support structures that are candidates for decontamination and decommissioning. The main concentration of radioactive contamination is in the reactor vessel and the experiment cubicles that contained the loop equipment for the various experiments.

The Engineering Test Reactor facility includes the following major buildings/structures:

1. Reactor Building - This building contains the reactor vessel and shielding, the reactor control room, a large water canal, and several areas and cubicles associated with the experimental in-pile loops. The reactor building is 42 meters (136 feet) in the east-west direction by 34 meters (112 feet) in the north-south direction. It extends 18 meters (58 feet) above grade level and 12 meters (38 feet) below grade level to the basement floor. Significant contamination levels exist and the reactor core components are highly radioactive.

2. Compressor Building - The compressor building houses the equipment that was used to supply large quantities of heated, hydrocarbon-free air to various experiments. In the building is the process control room that was used to control all plant services to the reactor and a sample laboratory that was used to conduct chemistry samples on the reactor primary and secondary coolant systems.

3. Heat Exchanger Building - The building includes (a) main room and lower level, (b) demineralizer wing, (c) degassing tank room, (d) cubicle exhaust booster blower room, and (e) secondary pipe pit. The primary function of the heat exchanger building main room was to house the 12 primary coolant/secondary coolant system heat exchangers and associated piping.

4. Secondary Coolant Pump House - The building houses four secondary coolant system pumps, four utility cooling water pumps, and a cooling tower fire water control and distribution system. The building also houses switchgear for the cooling tower fans, UCW pumps, a sump pump, and electrical heaters. It also contains the water treatment room which houses the chlorinator, chemical proportioning pumps, chemical day tanks, and chemical storage tanks.

5. Electrical Building - The electrical building consists of the 13.8-kV, 4160-V, and 480-V switchgear, No. 1 emergency diesel generator, five motor-generator units, and one lead-storage battery bank. The building is a two-level structure consisting of the upper story and a basement level referred to as the cable vault.

6. Engineering Test Reactor Office Building - This building housed the Reactor Control Room, Amplifier Room, and all the office space. This building continues to be utilized for office space including the control room area.

7. Critical Facility - This facility consisted of a low-power reactor that was a nuclear mock-up of the Engineering Test Reactor. The critical facility was housed in a building addition on the southeast corner of MTR-635. The critical facility was used to duplicate fuel and experiment arrangements before their use in the Engineering Test Reactor to facilitate calculation of neutron flux, flux patterns, excess reactivity, and associated operating parameters.

8. Exhaust Gas - A 76-meter (249-feet) high concrete exhaust stack, a monitoring building, and associated piping are contaminated.

9. Liquid Waste Storage - Several catch tanks inside the reactor building are highly contaminated.

Performance of this decontamination and decommissioning project would require a thorough chemical and radiological characterization, a decision analysis to determine the preferred decontamination and decommissioning mode, appropriate project planning documents, a safety analysis and the necessary National Environmental Policy Act documentation, and the execution of the field decontamination and decommissioning activities.

The mode, scope, and detail of the proposed decontamination and decommissioning cleanup activities needed for this project have not been determined and would depend to some extent upon the characterization results. Cleanup activities would probably range from the simple decontamination and reuse of a building to total structure demolition and disposal.

All actions related to this project would take place within the Test Reactor Area fenced area and involve about 0.8 hectares (2 acres). Soil disturbance would be caused by the removal of contaminated materials, including underground foundations, vaults, and piping. All soil disturbance would occur in previously disturbed areas (the same areas initially disturbed in the original facility construction in the 1950s), and would be followed by backfill, surface recontouring, and reseeding as required.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Test Reactors Area. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated

Table C-4.2.2-1. Summary of potential environmental impacts of the Engineering Test Reactor Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 5 acres of previously disturbed soil	Previously disturbed soil; project would be in major facility area
Water resources	Effluents: None expected	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed, no sites identified	None required
Air resources	Radiological operational emissions No information Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Measures depend on expected emissions; may include enclosures, filtration, stabilization
Human health	Radiation exposures and cancer risk No information Nonradiological effects No information	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	D&D (onsite truck trips): Nonradiological - 344 (0.1 asbestos) Radiological - 168.5	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level waste - 6,178 mixed low-level - 17 asbestos - 2 industrial - 12,658	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 30 to 40 existing workers and subcontractor personnel	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; NESHAP — National Emission Standards for Hazardous Air Pollutants.

b. Potential impacts are described further in Section C-3.2.

c. Mitigative measures are described further in Section C-3.3.

with this project are summarized in Table C-4.2.2-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Engineering Test Reactor would be deferred. This option corresponds with Alternatives A (No Action) and C (Minimum Treatment Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Project Data Sheet

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General Info.	Description/function:	Engineering Test Reactor D&D
	WAG	2
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	ER
	Action type:	D&D
	Structure Type: Size: (m2) Other features: (Pits, ponds, power /water/sewer lines)	Buildings (12) MTR-642, 643, 644, MTR-645, 647, 648 TRA-654, 655, 663, 752, 753, 755 None
	Location: Inside/outside of fence Inside/outside of bldg.	 Inside TRA Inside ETR
D&D Information	Cost($): Pre D&D	$4.8 Mil.
	Cost($): D&D	$39 Mil.
	Schedule Start /End: Pre D&D	1994 - 1996
	Schedule Start /End: D&D	1996 - 2005
	No. of workers: (new/exist)	30 - 40 Existing & Subs.
	Heavy Equip. Equip. used: Trips:	See Table C-4.2.2-1
	Acres Disturbed: New	0
	Previous	5
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	None

D&D Info.	Solid wastes:				
	Type:	LLW	MLLW	Asbestos	Ind.
	Quantity: (m3)	6.178	17	2	12.658
	Haz./Toxic Chemicals: Storage/inventory	None			
	Cultural resource effects:	None			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	No information			
	Energy requirements:				
	Electrical: (MWH/yr)	0			
	Fossil fuel: (liters)	0			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	Yes			

C-4.2.3 MATERIALS TEST REACTOR DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Materials Test Reactor Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Materials Test Reactor Decontamination and Decommissioning Project would be to remove the Materials Test Reactor and associated support structures from the INEL Surplus Facilities List in accordance with the DOE directives. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at this facility.

PROJECT DESCRIPTION: The Materials Test Reactor was a 40-megawatt (thermal) pressurized light water test reactor that operated between 1952 and 1970. This surplus facility consists of the reactor building and about 14 support structures that are candidates for decontamination and decommissioning. The main concentration of radioactive contamination is in the reactor vessel, which contains large amounts of beryllium and graphite that were used as reflector materials during operations.

The Materials Test Reactor facility includes the following major buildings and structures:

1. Reactor Building - This building contains the reactor vessel and shielding, the reactor control room, a large water canal, and several areas and cubicles associated with the experimental in-pile loops and neutron beam holes. The Materials Test Reactor Water Canal (previously entitled the Test Train Assembly Facility) would be a separate decontamination and decommissioning project. The structure is primarily concrete and is 40 meters square (130 feet square), 24 meters (80 feet) high, and has a 5 meter (17 feet) deep basement. Significant contamination levels exist and the reactor core components are highly radioactive.

2. Reactor Building Wing - This adjacent building was used for laboratory and office space, and remains in use at this time. The basement area has significant problems involving the radiologically contaminated liquid waste storage tanks and associated piping.

3. Process Water Building - A concrete structure containing the reactor primary coolant process equipment. This is a two-story building with a basement associated with a primary coolant pipe tunnel to the reactor building.

4. Plug Storage Facilities - These facilities were used to store highly radioactive materials in horizontal steel tubes shielded by concrete and earth fill.

5. Compressor Building - A single level, concrete block structure that originally contained equipment associated with the reactor air systems.

6. Services Building - A concrete block building located against the reactor building is being used for material storage and staging activities.

7. Liquid Waste Storage - There are several significant underground structures consisting of catch tanks, concrete vaults and pump pits, pump houses, retention basins, and associated piping that exist outside facility buildings and are highly contaminated.

8. Exhaust Gas - A 76-meter-high concrete exhaust stack, a monitoring building, and associated piping are contaminated.

9. Gamma Facilities Building - A single-story, concrete block structure containing a dry canal that was used to perform gamma irradiation experiments.

Performance of this proposed decontamination and decommissioning project would require a thorough chemical and radiological characterization, a decision analysis to determine the preferred decontamination and decommissioning mode, appropriate project planning documents, a safety analysis and the necessary National Environmental Policy Act documentation, and the execution of the field decontamination and decommissioning activities.

The mode, scope, and detail of the proposed decontamination and decommissioning cleanup activities needed for this project have not been determined and would depend to some extent upon the characterization results. It is expected that cleanup activities would range from simple decontamination and reuse of the building to total structure demolition and disposal.

All actions related to this project would take place within the Test Reactor Area fenced area and involve about 0.8 hectares (2 acres). Soil disturbance would be caused by the removal of contaminated materials, including underground foundations, vaults, and piping. All soil disturbance would occur in previously disturbed areas (the same areas initially disturbed in the original facility construction in the 1950s), and would be followed by backfill, surface recontouring, and reseeding as required.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Test Reactors Area. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.3-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Materials Test Reactor would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Table C-4.2.3-1. Summary of potential environmental impacts of the Materials Test Reactor Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 2.8 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Effluents: 454,200 liters to existing Test Reactor Area liquid low-level waste management system	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed, no sites identified	None required
Air resources	<u>Radiological operational emissions</u> No information <u>Toxic Air Pollutants (TAPs)</u> None <u>Prevention of Significant Deterioration (PSD)</u> None	Measures depend on expected emissions; may include enclosures, filtration, stabilization
Human health	<u>Radiation exposures and cancer risk</u> No information <u>Nonradiological effects</u> No information	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	D&D (onsite truck trips): Nonradiological - 424 (asbestos - 0.1) Radiological - 210.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level solid waste - 7,740 mixed low-level waste - 10 asbestos - 2 industrial waste - 15,598	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 30 to 40 existing workers and subcontractor personnel	None required

a. Definition of acronyms: D&D - decontamination and decommissioning.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

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Generic Info.	Description/function:	Materials Test Reactor D&D
	WAG	2
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	ER
	Action type:	D & D
	Structure Type:	Buildings (20)
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside TRA
	Inside/outside of bldg.	Inside MTR
D&D Information	Cost($): Pre D&D	$5.8 Mil.
	Cost($): D&D	$34 Mil.
	Schedule Start /End: Pre D&D	1994 - 1998
	Schedule Start /End: D&D	1998 - 2003
	No. of workers: (new/exist)	30 - 40 Existing & Subs.
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.2.3-1
	Acres Disturbed: New	0
	Previous	2.8
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	LLW
	Quantity: (liters)	454,200

D&D Info.	Solid wastes:				
	Type:	LLW	MLLW	Asbestos	Ind.
	Quantity: (m3)	7,740	10	2	15,598
	Haz./Toxic Chemicals: Storage/inventory	None			
	Cultural resource effects:	None identified			
	Pits/ponding created: (m2)	None			
	Water usage: (liters)	No information			
	Energy requirements:				
	Electrical: (MWH/yr)	0			
	Fossil fuel: (liters)	0			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	Yes			

C-4.2.4 FUEL PROCESSING COMPLEX (CPP-601) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Fuel Processing Complex (CPP-601) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of tbis proposed project would be to ensure tbe identified facility would be in a safe configuration, to determine and execute appropriate decontamination activities, and to decommission CPP-601 when it becomes surplus to the DOE's future programmatic needs. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, surveillance and maintenance.

PROJECT DESCRIPTION: This proposed project would address tbe characterization, decontamination and decommissioning of the Fuel Processing Complex (CPP-601) at tbe Idaho Chemical Processing Plant.

The CPP-601 facility contains chemical processing equipment tbat was used to recover uranium from various types of nuclear fuel. The facility is essentially rectangular (244 feet by 102 feet) and consists of five levels (up to 95 feet high, mostly below ground). The top level is above grade and contains an unpartitioned area tbat was used to transfer fuel elements to the process equipment and for chemical storage, makeup, and transfer. The top level is constructed of Transite panels (containing asbestos) and structural steel. The lower levels (largely below ground) are constructed of reinforced concrete with walls up to 5 feet thick.

The lower levels contain 29 process cells (most of which are about 20 feet square and 28 feet high), numerous corridors, and auxiliary cells that house equipment and controls. The largest cell is approximately 60 feet by 20 feet by 40 feet high. The floor and part of tbe walls of each cell are lined with stainless steel and most of the equipment is stainless steel. Most of tbe processing equipment in tbe building is located in tbe heavily shielded cells and was designed to be operated remotely and maintained hands-on. The in-cell equipment controls were installed in an operating corridor tbat runs tbe lengtb of the building between cells. A service (piping) corridor is located below the operating corridor and a cell access corridor is located below the service corridor. Sampling and cell ventilation corridors are located outside the row of cells.

Nuclear fuel reprocessing at CPP-601 was terminated in 1992 making the facility obsolete for its originally intended mission. Phaseout of facility operation is being conducted. This phaseout effort will remove all uranium from the facility and leave the facility in a stable, low-cost surveillance condition. The facility will be held in this surveillance and maintenance status until a decision is made to convert it to a new use or to dismantle it. The proposed project described in this section assumes no new use for CPP-601 will be identified and dismantlement of the facility would be conducted.

Upon satisfactory completion of the proposed deactivation effort, CPP-601 would be monitored to ensure contamination present in the facility would be contained and public and worker safety would be maintained. During this surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the decontamination and decommissioning operations phase of the project.

For the purposes of this EIS, it is assumed the CPP-601 decontamination and decommissioning project would

- Remove all contaminated equipment except the tanks identified with a WG or WH prefix, which are required for Idaho Chemical Processing Plant operation

- Decontaminate the remaining facility surfaces

- Remove the above-grade portion of the facility

- Entomb the concrete substructure in place.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B

(Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Idaho Chemical Processing Plant. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.4-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Fuel Processing Complex would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Fuel Processing Complex would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds with Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and transported to the appropriate waste handling facility on the INEL.

Table C-4.2.4-1. Summary of potential environmental impacts of the Fuel Processing Complex (CPP-601) Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 0.6 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Effluents: 423,000 liters to the ICPP Process Equipment Waste system	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at ICPP
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed, no sites identified	None required
Air resources	<u>Radiological/nonradiological emissions</u> No increase above ICPP operational envelope	None required
Human health	None	Monitor ECAs during D&D
Transportation	D&D (onsite truck trips): Nonradiological - 49.1 Radiological - 190	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level solid waste - 6,900 mixed low-level waste - 18 hazardous waste - 1 transuranic waste - 10 industrial waste - 1,800	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 50 to 75 existing workers and subcontractor personnel	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; ICPP - Idaho Chemical Processing Plant; ECA - environmentally controlled area.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

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General Info.	Description/function:	Fuel Processing Complex (CPP-601) D&D
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	ER
	Action type:	D & D
	Structure Type:	CPP-601
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside CPP-601
D&D Information	Cost($): Pre D&D	$1.7 Mil.
	Cost($): D&D	$8.3 Mil.
	Schedule Start /End: Pre D&D	1994 - 1996
	Schedule Start /End: D&D	1996 - 2000
	No. of workers: (new/exist)	50 - 75 Existing & Subs.
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.2.4-1
	Acres Disturbed: New	0
	Previous	0.6
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	LLW
	Quantity: (liters)	423,000

		LLW	MLLW	Haz.	TRU	Ind.
D&D Info.	Solid wastes: Type:	LLW	MLLW	Haz.	TRU	Ind.
	Quantity: (m3)	6900	18	1	10	1800
	Haz./Toxic Chemicals: Storage/inventory	None				
	Cultural resource effects:	None identified				
	Pits/ponding created: (m2)	No				
	Water usage: (liters)	No information				
	Energy requirements:					
	Electrical: (MWH/yr)	No information				
	Fossil fuel: (liters)	No information				
	Nightlights used: Y/N	No				
	Generators: Night Y/N	No				
	Day Y/N	Yes				

C-4.2.5 FUEL RECEIPT AND STORAGE FACILITY (CPP-603) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Fuel Receipt and Storage Facility (CPP-603) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of the proposed CPP-603 Decontamination and Decommissioning Project would be to reduce the risk of radiological exposure and to eliminate the need for extensive long-term surveillance and maintenance.

PROJECT DESCRIPTION: The proposed project would address the characterization and decontamination and decommissioning of the three water-filled storage basins and a nuclear Fuel Element Cutting Facility located in the CPP-603 Fuel Receipt and Storage Facility at the Idaho Chemical Processing Plant.

The CPP-603 underwater storage basins were operational 1953 through 1957 and were constructed of reinforced concrete with no liners or leak-detection systems. The basin storage portion of CPP-603, covering approximately 50,000 square feet, provides underwater storage for spent nuclear fuel involving approximately 1,500,000 gallons of filtered water. The three interconnected basins include support processes to treat and maintain the basin water quality, including filtration, ion exchange, chloride removal, reverse osmosis demineralization, and ultraviolet light sterilization. The integrity of the basin portion of the facility and its fuel handling monorail system has become suspect because the facility was constructed to seismic criteria of the late 1940s to early 1950s. The affected facility interior surfaces, equipment, structures, interior cell areas (Fuel Element Cutting Facility), and the building exterior require radiological and hazardous material decontamination.

Activities are being conducted that will transfer the spent fuel stored under water in CPP-603 to newer storage facilities at the Idaho Chemical Processing Plant. Upon satisfactory completion of the spent fuel transfer effort, CPP-603 would be monitored to ensure contamination present in the facility is contained and public and worker safety is maintained. The storage basin sludges would be removed and disposed of as part of the final operations activities and not as a part of this project. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed CPP-603 decontamination and decommissioning project would be assumed to accomplish the following tasks:

- Remove all contaminated equipment from the underwater storage portion of CPP-603 and its ancillary support systems

- Decontaminate the remaining affected facility surfaces

- Fill in (gravel) and seal entry to the affected basins

- Entomb the affected basins in place

- Initiate an appropriate level of surveillance and maintenance.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Idaho Chemical Processing Plant. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.5-1. This table is complemented by information on

Table C-4.2.5-1. Summary of potential environmental impacts of the Fuel Receipt and Storage Facility (CPP-603) Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 0.5 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Effluents: 7,570,000 liters low-level waste water; 370,000 liters sodium-bearing low-level waste to the ICPP Process Equipment Waste system	Engineered confinement systems, Storm Water Pollution Prevention Plan in place at ICPP
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey conducted, no sites identified	None required
Air resources	Radiological/nonradiological emissions No increase above ICPP operational envelope	None required
Human health	None	Monitor ECAs during D&D
Transportation	D&D (onsite truck trips): Nonradiological - 7.9 Radiological - 49.1	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level solid waste - 1,800 mixed low-level waste - 1 hazardous waste - 1 industrial waste - 288	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 30 existing and subcontractor personnel	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; ECA - environmentally controlled area ICPP - Idaho Chemical Processing Plant.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Fuel Receipt and Storage Facility would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Fuel Receipt and Storage Facility would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and transported to the appropriate waste handling facility on the INEL.

Project Data Sheet

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Generic Info.	Description/function:	Fuel Receipt/Storage Facility (CPP-603) D&D	
	WAG	3	
	EIS Alter. (A, B, C or D):	B, D	
	SNF or Waste stream:	ER	
	Action type:	D & D	
	Structure Type:	CPP-603	
	Size: (m2)	72 (6 x 12 x 5 m)	
	Other features: (Pits, ponds, power /water/sewer lines)	None	
	Location:		
	Inside/outside of fence	Inside ICPP	
	Inside/outside of bldg.	Inside CPP-603	
D&D Information	Cost($): Pre D&D	$2.3 Mil.	
	Cost($): D&D	TBD	
	Schedule Start /End: Pre D&D	1997 - 1998	
	Schedule Start /End: D&D	1998 - 2001	
	No. of workers: (new/exist)	30 Existing & Subs.	
	Heavy Equip. Equip. used:	See Table	
	Trips:	C-4.2.5-1	
	Acres Disturbed: New	0	
	Previous	0.5	
	Revegetated	0	
	Air Emissions: (None / Ref.)	See Belanger et al. 1995	
	Effluents:	LLW	LLW
	Type:	Water	NA bearing
	Quantity: (liters)	7,570 k	370 k

D&D Info.	Solid wastes:				
	Type:	LLW	MLLW	HW	Ind.
	Quantity: (m3)	1800	1	1	288
	Haz./Toxic Chemicals: Storage/inventory	None			
	Cultural resource effects:	None identified			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	No information			
	Energy requirements:				
	Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters)	No information			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	Yes			

C-4.2.6 HEADEND PROCESSING PLANT (CPP-640) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Headend Processing Plant (CPP-640) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of this proposed project would be to ensure the identified facility is in a safe configuration, determine and execute appropriate decontamination activities, and decommission the fuel processing systems within CPP-640 when it becomes surplus to the DOE's future programmatic needs. This proposed project would reduce the risk of radioactive exposure and cost of further surveillance and maintenance.

PROJECT DESCRIPTION: This proposed project would address an assessment and decontamination and decommissioning of two unique nuclear fuel processing systems housed in the CPP-640 facility at the Idabo Chemical Processing Plant. The proposed CPP-640 decontamination and decommissioning project would reduce the risk of radiological exposure, and eliminate the need for extensive long-term facility surveillance and maintenance.

The Headend Processing Plant contains approximately 1,395 square meters (15,000 square feet) of floor space and houses two unique spent fuel headend processing systems and a liquid waste collection system. The ROVER and ELECTROLYTIC headends operated in heavily shielded concrete and steel hot cell units with remote manipulation capabilities and some remote maintenance capabilities. The liquid waste collection system includes three tanks in heavily shielded concrete vaults situated below the hot cell units.

The processing systems (ROVER and ELECTROLYTIC) have been shut down since 1984 and 1981, respectively. Although much of the process chemical and radionuclide inventory has been removed from the headend systems, both systems remain highly contaminated and the ROVER system contains significant quantities of fissile material. The liquid waste system is included in the Resource Conservation and Recovery Act Part A permit and is planned for Resource Conservation and Recovery Act closure. An in-progress phaseout effort will remove the fissile material entrapped in the ROVER system and leave the facility in a stable, low-cost surveillance and maintenance status until a decision is made to convert it to a new use or to dismantle it. The proposed project assumes that no new use for the CPP-640 will be identified and that facility equipment would be dismantled.

Upon satisfactory completion of the fissile material removal effort, the CPP-640 would be monitored to ensure contamination present in the facility is contained and public and worker safety is maintained. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. The characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based on results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed CPP-640 decontamination and decommissioning project would be assumed to accomplish the following tasks:

- Remove all contaminated equipment remaining after completion of the fissile material removal activity

- Close the waste collection system under the terms of the Resource Conservation and Recovery Act

- Decontaminate the remaining affected facility surfaces

- Decommission the empty hot cell units.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Idaho Chemical Processing Plant. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.6-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Headend Processing Plant would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Headend Processing Plant would be decontaminated and decommissioned, followed by the demolition of the building's underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structures and associated embedded piping and electrical conduits would be removed and transported to the appropriate waste handling facility on the INEL

Table C-4.2.6-1. Summary of potential environmental impacts of the Headend Processing Plant (CPP-640) Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed soil)	Project would be within existing facility
Water resources	Effluents: Low-level decon solution: 1,900 - 7,600 liters to ICPP Process Equipment Waste system	Engineered confinement system; Storm Water Pollution Prevention Plan in place at ICPP
Wildlife and habitat	None	Project would be within existing facility
Historic, archaeological, or cultural resources	None	Project would be within existing facility
Air resources	<u>Radiological/nonradiological emissions</u> No increase above ICPP operational envelope	None required
Human health	None	None required
Transportation	D&D (onsite truck trips): Radiological - 2.2	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level solid waste - 80	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 50 existing and subcontractor personnel, 2 to 3 new workers	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; ICPP - Idaho Chemical Processing Plant.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 10 January 5, '95

Section	Item	Value
General Info.	Description/function:	Headend Processing Plant (CPP-640) D&D
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	ER
	Action type:	D & D
	Structure Type:	CPP-640
	Size: (m2)	1,400
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside CPP-640
D&D Information	Cost($): Pre D&D	$500 k
	Cost($): D&D	$16.7 Mil.
	Schedule Start /End: Pre D&D	1997 - 1999
	Schedule Start /End: D&D	1999 - 2002
	No. of workers: (new/exist)	50 Existing & Subs, 2-3 New
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.2.6-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	LLW
	Type:	Decon Solution
	Quantity: (liters)	1,900 - 7,600

Section	Item	Value
D&D Info.	Solid wastes:	
	Type:	LLW MLLW Haz. Ind.
	Quantity: (m3)	. 80 (No Information)
	Haz./Toxic Chemicals: Storage/inventory	None
	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements:	
	Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	No information
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	Yes

C-4.2.7 WASTE CALCINE FACILITY (CPP-633) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Waste Calcine Facility (CPP-633) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of this proposed project would be to assure the Waste Calcine Facility is in a safe configuration, determine and execute appropriate decontamination activities, and decommission the facility, which is surplus to the DOE's future programmatic needs.

PROJECT DESCRIPTION: This proposed project would address the assessment and decontamination and decommissioning of the Waste Calcine Facility located in CPP-633 at the Idaho Chemical Processing Plant. The Waste Calcine Facility decontamination and decommissioning project would reduce the risk of radiological exposure and eliminate the need for extensive long-term surveillance and maintenance. The project would determine and execute the appropriate decontamination and decommissioning activities at the Waste Calcine Facility.

The Waste Calcine Facility was the world's first plant scale facility built to achieve the safe, efficient disposal of high-level radioactive liquid wastes resulting from processing spent nuclear fuels for uranium recovery. From 1963 through 1981 the Waste Calcine Facility converted high-level radioactive liquid wastes into granular solids that were less corrosive, less mobile, and occupied less storage volume. The Waste Calcine Facility was designed for direct contact (hands-on) maintenance conducted during its periodic shutdowns, with remote capabilities for primary offgas filter change-out and process control.

The Waste Calcine Facility is a reinforced concrete structure encompassing approximately 1,860 square meters (20,000 square feet) of floor space. The facility includes a ground level and two subsurface levels, which include operating and access corridors. Within the Waste Calcine Facility are several areas of high radiation and extensive radiological contamination. These areas would require extensive remote and semi-remote decontamination efforts. The Waste Calcine Facility process system also includes five Resource Conservation and Recovery Act units (tanks) that are permitted under interim status on the Idaho Chemical Processing Plant Part A Resource Conservation and Recovery Act Permit.

Efforts to decontaminate the Waste Calcine Facility equipment and remove the residual hazardous material are under way. Upon completion of these ongoing phaseout activities, an assessment would be conducted to identify remaining hazards and ensure those hazards do not endanger the public or worker safety. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed decontamination and decommissioning project would be assumed to accomplish the following tasks:

- Remove all contaminated equipment remaining after completion of the phaseout activities
- Close the five permitted units (tanks) under the Resource Conservation and Recovery Act
- Decontaminate the remaining facility surfaces
- Decommission the Waste Calcine Facility and demolish to ground level and fill in the subsurface levels.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves decontamination and decommissioning of an existing facility within a major facility area, the Idaho Chemical Processing Plant. (See Figure C-1-1 for location and Section C-3.2 for a discussion of decontamination and decommissioning projects.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.2.7-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, decontamination and decommissioning of the Waste Calcine Facility would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Waste Calcine Facility would be decontaminated and decommissioned, followed by the demolition of the building's underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structures and associated embedded piping and electrical conduits would be removed and transported to the appropriate waste handling facility on the INEL.

Table C-4.2.7-1. Summary of potential environmental impacts of the Waste Calcine Facility (CPP-633) Decontamination and Decommissioning Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 0.5 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Effluents: Low-level decontamination solution 715,000 liters to ICPP Process Equipment Waste system	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at ICPP
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed, no sites identified	None required
Air resources	Radiological/nonradiological emissions No increase above ICPP operational envelope	None required
Human health	None	Monitor ECAs during D&D
Transportation	D&D (onsite truck trips): Radiological - 37	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	D&D waste (m^3): low-level solid waste - 1,350 mixed low-level waste - 10	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	D&D: 20 existing and subcontractor personnel	None required

a. Definition of acronyms: D&D - decontamination and decommissioning; ECA - environmentally controlled areas; ICPP - Idaho Chemical Processing Plant.

b. Potential impacts are described further in Section C-3.2.

c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet			Rev. 9 January 5, '95		
G e n e r i c I n f o .	Description/function:	Waste Calcine Facility (CPP-633) D&D	D & D I n f o .	Solid wastes: Type: Quantity: (m3)	LLW 1350; MLLW 10
	WAG	3		Haz./Toxic Chemicals: Storage/inventory	None
	EIS Alter. (A. B. C or D):	B. D		Cultural resource effects:	None
	SNF or Waste stream:	ER		Pits/ponding created: (m2)	No
	Action type:	D & D		Water usage: (liters)	757,000
	Structure Type: Size: (m2)	CPP-633 1,800		Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	No information No information
	Other features: (Pits, ponds, power /water/sewer lines)	None		Nightlights used: Y/N	No
	Location: Inside/outside of fence Inside/outside of bldg.	Inside ICPP Inside CPP-633		Generators: Night Y/N Day Y/N	No Yes
D & D I n f o r m a t i o n	Cost($): Pre D&D	$7 Mil.			
	Cost($): D&D	$17 Mil.			
	Schedule Start /End: Pre D&D	1994 - 1999			
	Schedule Start /End: D&D	1999 - 2003			
	No. of workers: (new/exist)	20 Existing & Subs.			
	Heavy Equip. Equip. used: Trips:	See Table C-4.2.7-1			
	Acres Disturbed: New Previous Revegetated	0 0.5 0			
	Air Emissions: (None / Ref.)	See Belanger et al. 1995			
	Effluents: Type: Quantity: (liters)	LLW (Decon Solution) 715,000			

C-4.3 PROJECTS RELATED TO HIGH-LEVEL WASTE

C-4.3.1 TANK FARM HEEL REMOVAL PROJECT

PROJECT NAME: Tank Farm Heel Removal Project

GENERAL PROJECT OBJECTIVE: Liquid waste at the Idaho Chemical Processing Plant has been stored in eleven tanks of a tank farm. Pursuant to a Federal Facilities Compliance agreement among the Environmental Protection Agency, the Department of Energy, and the State of Idaho, use of five tanks (VES-WM-182 through -186) must cease by March 2009, and of the remaining six tanks, by June 2015. A Resource Conservation and Recovery Act closure of these tanks and their ancillary systems would be required following the cease-use provision. The general objectives of this proposed project would be (a) to design, procure, and install equipment, and to perform necessary tank systems modifications in order to remove the liquid and solids heel from the storage tanks and (b) to support the subsequent closure.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of equipment to perform tank internal rinsing and removal of the 5,000-to-20,000-gallon heel (liquid and solids remaining when tanks have been emptied using the currently installed transfer jets) from the eleven 300,000-gallon storage tanks in the Idaho Chemical Processing Plant Tank Farm. The project would also provide for the design and modifications to existing ancillary piping systems to allow flushing and isolation in support of the Resource Conservation and Recovery Act Closure actions that would be required following cease-use of the eleven tanks.

The special heel removal equipment to be provided would be mixing pumps to mobilize the solids in the heel and keep them in suspension for transfer out of the tanks, and transfer pumps to replace the existing jets and transfer the mobilized heel solution from the tank being cleaned to another tank or to the New Waste Calcining Facility. This technology is currently being developed and used at other sites in the DOE complex.

Rinsing of the tank's interior walls and dome would be accomplished using a special utility arm to direct the spray of water or other solution onto the dome and walls. Robotic arms currently being developed within the DOE complex would probably be used.

A supplemental vessel offgas system would be provided to maintain a slight vacuum in the tank being worked on. This system, including demisters, high efficiency particulate air filters, blowers, and other cleanup components, would discharge into the existing offgas cleanup systems and then up the Idaho Chemical Processing Plant main stack. Because of the tank farm surface load limits (to avoid overloading existing vaults), special structural provisions would be provided to support the required heel removal equipment. Temporary weather enclosures over the work areas would be provided if required to achieve the Consent Order completion schedules.

Conversion of one of the remaining operating tanks to a heel receiver tank, by modifications to install mixing pumps, would be accomplished. A heel receiver tank would be required to allow the heel removal operations to be performed independently of New Waste Calcining Facility operation. Final drying of cleaned tanks would be accomplished by forced evaporation. Special equipment to blow dry air into the tanks and exhaust it through a vessel offgas system would be provided.

Transfer valving and piping modifications to allow some tanks to remain in service while other tanks are being removed from service would be provided. Provisions to sequentially flush ancillary piping and to physically isolate flushed piping and tanks from the remaining tanks would be provided. A comprehensive sequential action plan, with required supporting equipment and modifications, would be provided.

Handling and storage equipment for the special equipment, including the mixing and transfer pumps and the special utility arm, would be provided.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.3.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the tank heels would not be removed. This option corresponds to Alternative A (No Action) evaluated in this EIS because the Finding-of-No-Significant-Impact portion of the proposed project would not be included in Alternative A (No Action). The tanks cannot be emptied to the point that no heel remains. The heel contains high levels of radioactivity and is both toxic and corrosive. Unless heel removal equipment is installed and operated, the storage tanks cannot be emptied. DOE may not be able to comply with the Consent Order entered into by DOE, U.S. Environmental Protection Agency, and the State of Idaho that requires DOE to cease use of the first five storage tanks (VES-WM-182 through -186), and may not be able to complete closure of these Resource Conservation and Recovery Act storage tanks.

In Situ Stabilization - This option is not evaluated in this EIS. Under this option, the tank heels would be stabilized in place by adding some form of solidification material (for example, cement) to the tank and mixing it with the heel. This option is not further developed since no materials were found that were completely compatible with the tank heels, and the mechanisms required to ensure mixing would be more complicated than simple removal. Also, one cannot ensure that the grout would prevent migration of hazardous elements (that is, heavy metals) into the environment.

Delayed Heel Removal - The tanks would be removed from service per the Notice of Noncompliance cease-use requirement. The heels would then be part of closure and would be removed as the technology and equipment became available. This removal of the heels would then not be driven by the Consent Order dates. This option was not evaluated in this EIS because the Consent Order would need to be renegotiated.

Table C-4.3.1-1. Summary of potential environmental impacts of the Tank Farm Heel Removal Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb less than 10 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Construction: 500,000 liters decon solution (mixed low level) Operation: 2,000,000 liters decon solution (mixed low level)	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement, and mortality within major facility area	Previously disturbed area; prevent soil erosion; reseed
Historic, archaeological or cultural resources	Survey completed; no sites identified	None required
Air resources	<u>Operational emissions</u> Radiological and nonradiological emissions within operational envelope of ICPP <u>Construction emissions</u> (tons/yr) Total suspended particulates PM10 150 CO 3.2 NO_2 6.1 SO_2 0.47	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Potential impacts within operational envelope of the existing tank farm.	Access control, facility design, safety analysis, inspection and surveillance, annual reporting; monitor ECAs during construction
Transportation	Construction (onsite truck trips): Nonradiological - 0.1 Radiological - 0.1 Operations (onsite truck trips per year): Nonradiologieal - 0.1 Radiological - 0.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste Management	Construction (m^3) low-level waste (solid) - 2.0 industrial waste (solid) - 2.0 Operation (m^3/yr) mixed low-level waste (solid) - 2.0 low-level waste (solid) - 8.0 industrial waste (solid) - 5.0	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 2 existing, 25 subcontractor personnel Operation: 2 existing workers	None required

a. Definition of acronyms: ECA - environmentally controlled area; ICPP - Idaho Chemical Processing. Plant;
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

SUMMARY OF IMPACTS: The removal of the final approximately 5,000 to 20,000 gallons of high-level liquid waste (that is, the heel) from the five tanks proposed for replacement (VES-WM-182 through VES-WM-186) would be carried out as a normal Tank Farm operation. The heel removal equipment that would be installed by the High-Level Waste Tank Farm Project would tie into existing transfer systems. The heel, and subsequent high-level liquid waste produced during tank cleaning, would be transferred to the other Tank Farm storage tanks, the Process Equipment Waste Evaporator, or directly to the New Waste Calcining Facility, using existing operating procedures that include sampling of the waste to be transferred as appropriate. Drying of the tanks (passively or actively) would be performed after the tanks were cleaned and effluent air from drying would exit through the normal exhaust system. The removal of the heel, cleaning, and drying of tanks VES-WM-182 through VES-WM-186 would, therefore, be encompassed in the normal operation of the existing Tank Farm and would introduce no new environmental impact.

Project Data Sheet

Rev. 13 January 16, '95

Section	Item	Value
General Info.	Description/function:	Tank Farm Heel Removal Project
	WAG	3
	EIS Alter. (A, B, C or D):	B, C, D
	SNF or Waste stream:	HLW
	Action type:	(Consent Order Compliance)
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Transfer Equipment
	Location:	
	Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Inside Vaults (11)
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$37 Mil. total
	Schedule Start /End: PreConst.	1997 - 1999
	Schedule Start /End: Const.	2000 - 2015
	No. of workers: (new/exist)	25 Subs. / 2 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.3.1-1
	Acres Disturbed: New	0
	Previous	<10
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	MLLW
	Quantity: (liters)	500
	Solid wastes: Type:	LLW Ind
	Quantity: (m3)	2 2
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None
	Pits/ponding created: (m2)	None
	Water usage: (liters)	Minimal increase
	Energy requirements:	
	Electrical: (MWH/yr)	0
	Fossil fuel: (liters)	57 k Diesel
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	No information
	Schedule Start /End:	2000 - 2015
	No. of workers: (new/exist)	2 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.3.1-1
	Air Emissions: (None / Ref.)	None
	Effluents: Type:	MLLW
	Quantity: (liters/yr)	2,000
	Solid wastes: Type:	LLW MLLW Ind.
	Quantity: (m3/yr)	8 2 5
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	12 k
	Energy requirements:	
	Electrical: (MWH/yr)	<1
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.3.2 WASTE IMMOBILIZATION FACILITY

(Technology Selection for Treatment of Sodium-Bearing and Calcined Wastes)

PROJECT NAME: Waste Immobilization Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Waste Immobilization Facility Project would be to provide the processes and facilities to immobilize Idaho Chemical Processing Plant radioactive wastes (sodium-bearing liquid and solid calcine) into a form(s) suitable for permanent disposal. This Project Summary provides information to be used in the selection of technologies to treat sodium-bearing and calcined wastes. More comprehensive descriptions and analyses of the potential waste treatment technologies, that form the basis of this summary, are in *ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report* (WINCO 1994).

This project would involve mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already under way with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

DOE has identified two primary treatment technologies to address treatment of sodium-bearing wastes and calcine: (a) vitrification and (b) separation followed by vitrification and grouting. Within the separation technology, three options were identified: (a) radionuclide partitioning, (b) precipitation, and (c) freeze crystallization. Either of the two primary technologies could be implemented through the Waste Immobilization Facility. The emissions, effluents, and final waste forms from processes within the Waste Immobilization Facility would vary depending on the treatment technology selected. This project summary provides a preliminary analysis of the impacts of construction and operation of the Waste Immobilization Facility for each of the treatment technologies. The impact analyses presented bound the impacts that would result from each of the treatment technologies, and the options within the treatment technologies. The analyses are intended to support DOE decisions regarding technologies to treat sodium-bearing waste and calcine. Before a decision is made to proceed with the construction of the Waste Immobilization Facility, further National Environmental Policy Act review would be conducted, as appropriate.

High-activity waste is currently stored at the Idaho Chemical Processing Plant in liquid and granular solid calcine forms. These waste forms require engineered confinement systems because the radionuclides and hazardous materials would be mobile in the environment, and therefore cannot be disposed of directly without treatment. The Waste Immobilization Facility would be developed to process the high-activity waste inventory into a final form that would effectively isolate radionuclides and hazardous materials from the environment and therefore render the waste safer for storage, treatment, transport, and disposal. In addition, there are no certified transportation casks for liquid or calcine wastes, and the development of such casks would take considerable time at great cost. Following immobilization, waste would be stored at INEL pending transport offsite and disposal in a geologic repository.

The need to identify treatment technologies is primarily driven by the Resource Conservation and Recovery Act, and the Federal Facility Compliance Act (which amended the Resource Conservation and Recovery Act). The Federal Facility Compliance Act requires the DOE to identify treatment technologies for mixed waste, if treatment technologies are available. Sodium-bearing wastes and calcine wastes are mixed wastes for purposes of the Federal Facility Compliance Act. These wastes must meet both Resource Conservation and Recovery Act, Land Disposal Restriction requirements because of the hazardous constituents, and applicable U.S. Environmental Protection Agency and Nuclear Regulatory Commission requirements because of the radioactive constituents, before being permanently disposed.

PROJECT DESCRIPTION: This proposed project would involve technology selection for calcining or treating sodium-bearing liquid waste and for converting calcine waste into a waste form acceptable for disposal, followed by the design, construction, and operation of a Waste Immobilization Facility for processing these wastes. Such processing would produce a single high-activity waste form suitable for placement in a geological repository and potentially a low-activity waste form. This project is proposed to be located south and east of the existing Fluorinel Dissolution and Storage Facility in a previously disturbed area within the Idaho Chemical Processing Plant boundary, and to occupy an area of approximately 4,000 square meters (43,000 square feet). No disposal facilities would be provided by this project, but suitable interim storage for waste pending disposal would be constructed as part of this facility.

The primary treatment technologies to address Idaho Chemical Processing Plant radioactive liquid examined in this EIS (which consists primarily of sodium-bearing liquid waste) in the proposed Waste Immobilization Facility are direct vitrification [Alternative B (Ten-Year Plan)] and separation/ vitrification [Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal)]. Direct vitrification would involve treatment to produce a glass or glass-ceramic final waste form, and would produce a greater quantity of high-activity waste than options involving separation. Separation would be used to partition the waste into high- and low-activity fractions. The separation options include (a) radionuclide partitioning that would produce a small stream of high-activity waste and a large stream of low-activity waste, (b) precipitation that would produce a moderate amount of high-activity waste and low-activity waste, and (c) freeze crystallization that would also produce a moderate amount of high-activity and low-activity waste. Following separation, the high-activity portion of the waste would be prepared for final treatment (perhaps by calcining), followed by vitrification. The low-activity portion would be immobilized by grouting or vitrification and subsequently disposed of in a low-level waste disposal facility.

Radionuclide partitioning involves removing specific actinide and transuranic elements, and therefore the bulk of the radioactivity, by employing a solvent extraction technique previously developed for the recovery of plutonium (that is, TRUEX). Similar to freeze crystallization, this technology would result in a high-activity fraction requiring glass or glass ceramic stabilization. However, unlike freeze crystallization, this technology concentrates on isolating the radioactivity rather than isolating the sodium. This would result in a more concentrated, low-volume, high-activity fraction than freeze crystallization. Radionuclide partitioning would also likely require ion exchange to remove the cesium, employ a solvent-extraction technique for the removal of strontium (that is, SREX), and would require a solvent recovery system.

In the precipitation process, the transuranic elements, heavy metals (mercury, lead, cadmium, etc.), and most of the transition elements would be precipitated by adding the proper proportion of sodium hydroxide (or other neutralizing agent). The sodium, cesium, and some strontium would remain soluble in the liquid phase. The liquid would be separated from the solid and processed to remove cesium and strontium. Electrohydrolysis would be used to recycle some of the sodium hydroxide and the remainder would be grouted. The resulting high-activity fraction could be calcined without aluminum nitrate additives or it could be vitrified directly.

The freeze crystallization process would separate approximately 66 percent of the sodium from the waste stream; this low-activity fraction would be grouted or could be recycled using electrohydrolysis if productive uses of the solutions are found. The expected high-activity product from the freeze crystallizer could be calcined with aluminum nitrate in a reduced quantity. The low-activity stream would be depleted of transuranics, cesium, and strontium, as well as heavy metals, to produce a low-activity waste. Using transuranic separations, the transuranics could be recovered for re-use or storage in an approved transuranic waste storage facility.

The options for processing solid calcine waste examined in this EIS are direct vitrification, with or without separation, and immobilization following dissolution of the calcine. Direct vitrification would produce a larger amount of high-activity waste than options involving separation. Separation would be used to partition the waste into high- and low-activity fractions and if necessary, to remove heavy metals from the low-activity stream. The separation options include (a) radionuclide partitioning that would produce a small stream of high-activity waste and a large stream of low-activity waste and (b) precipitation that would produce a moderate amount of high-activity waste and low-activity waste. The choice of waste form would depend on which waste form type gives the highest waste loading per unit volume with respect to the separation process chemistry and overall cost. The technology for treating the calcine by separation followed by immobilization is considered feasible based on laboratory experiments and full-scale application of some processes. However, further development and verification testing of the technology would be required.

The process of directly incorporating the calcine material into a glass-ceramic would involve blending the dry calcine material to obtain a homogenous mixture, stabilizing the mixed calcine in a heated fluidized bed to remove residual nitrates and any absorbed water, and grinding the calcine to improve the glass-ceramic formation step. The pretreated calcine would then be mixed with glass-ceramic forming additives and processed under elevated temperature and pressure to produce the final waste form. The calcine could also be dissolved and slurried with glass-ceramic-forming additives to produce the final waste form. While the glass-ceramic process has been demonstrated on a laboratory scale using nonradioactive materials, the process would still need to be demonstrated on an engineering scale and verified using actual calcine material.

In the vitrification process, the calcine could be dissolved and slurried with glass-forming sands of varying composition (frit) and introduced to the melter. The dry calcine could also be blended with the frit and fed dry to a melter. In either case, the calcine would first have to be thoroughly mixed with the frit to obtain a homogeneous melter feed and might have to be stabilized and ground to improve the melter operation efficiency. As with the glass-ceramic process, the process of directly immobilizing the calcine to a glass would require further development and verification testing before the technology could be implemented for the wastes at issue.

The high-activity waste form would be glass or glass-ceramic, and the low-activity waste form would be grout, glass, or glass-ceramic. The high-activity waste and the low-activity stream separated from the waste at the INEL would be mixed wastes under Resource Conservation Recovery Act and must be treated before disposal. The specified land disposal restriction treatment standard for high-activity mixed waste under Resource Conservation Recovery Act regulations issued by U.S. Environmental Protection Agency (which are implemented by the State of Idaho under the Idaho Hazardous Waste Management Act) is "High-Level Vitrification" (40 CFR Part 268, Subpart D-Treatment Standards). Therefore, the INEL's vitrified high-level waste must be tested and demonstrated to meet the high-level vitrification treatment standard before disposal. Both the high-activity and low-activity waste forms could be delisted or, if appropriate, disposed of in a Resource Conservation Recovery Act-approved Subtitle C hazardous waste disposal site. In addition, under the Federal Facility Compliance Act of 1992, DOE and the State of Idaho are developing an INEL site treatment plan, which is scheduled to be issued in February 1995, and will include schedules and milestones for developing and implementing treatment technologies for mixed wastes at the INEL, including high-level mixed wastes. A signed Consent Order between DOE and the State of Idaho containing these schedules and milestones would be issued by October 1995. The selection of a high-level waste treatment technology is being closely coordinated with the State of Idaho as part of the Federal Facility Compliance Act negotiations.

Candidate high-level waste treatment technologies were evaluated by first identifying all technologies with the potential of treating and immobilizing Idaho Chemical Processing Plant sodium-bearing and calcine waste. Those technologies that either could not be developed in time to meet the regulatory requirements or were inferior to competing technologies were eliminated from further consideration. Examples of eliminated technologies include encapsulation of sodium-bearing waste in silica via the

Sol-Gel process, sodium removal by liquid extraction using crown ethers, and sodium removal via bioremediation.

As a result of this preliminary evaluation, a range of feasible candidate technologies were identified for converting sodium-bearing and calcine wastes into acceptable waste forms for disposal. Available information on each candidate technology was collected and documented, including expected range of performance, need for additional process development, facility capital costs, operation labor and material costs, treated waste volumes, interim storage costs, and projected waste disposal costs. This information was obtained from literature sources, benchmarking operating waste treatment systems, and bench-scale laboratory tests conducted at the Idaho Chemical Processing Plant, and is summarized in WINCO (1994).

As an aid to evaluation of the technologies, a systems analysis model was developed to compare the alternative candidate technologies against selection criteria. Selection criteria included (a) compliance with the Resource Conservation Recovery Act, and related Consent Orders with the State of Idaho, (b) five-year and life-cycle costs, (c) implementation time, and (d) expected performance of the final waste form and quantities and waste. In all instances, the comparisons were based on waste forms and waste loadings that would meet the high-level waste durability standards used at several other DOE sites (Savannah River, West Valley, Hanford); see DOE (1993e). The durability standard includes testing for metals leachability, waste form stability, and other physical parameters critical to long-term disposal.

Although the final waste acceptance criteria for a repository have not yet been developed, DOE has undertaken initial assessments of repository performance and waste acceptance criteria consistent with requirements already identified by the U.S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission for a final repository. Specifically, an initial repository performance assessment was conducted, and a preliminary waste acceptance criteria developed for the INEL-specific waste form. See *Initial Performance Assessment of the Disposal of Spent Nuclear Fuel and High-Level Wastes Stored at INEL*, Volumes I & II (Rechard 1993) and Preliminary Waste Acceptance Criteria for Idaho Chemical Processing Plant Spent Fuel and Waste Management Technology Development (Taylor and Shikasio 1993). Additional information regarding activities conducted to date may be found in the Westinghouse Idaho Nuclear, *ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report* (WINCO 1994).

After selecting a treatment technology, DOE would need to perform additional bench-scale and pilot-scale testing on actual waste solutions before designing and constructing the Waste Immobilization Facility. The final waste form treatment technologies in all cases would be subject to U.S. Environmental Protection Agency and State of Idaho approval.

Preliminary output from the systems analysis model is provided for four of several possible combinations of sodium-bearing and calcine waste treatment technologies in Table C-4.3.2-1 and Figures 4.3.2-1 through 4.3.2-4. The combinations presented include the three separations technologies identified for sodium-bearing waste and direct vitrification.

Table C-4.3.2-1. Waste immobilization cost and volume data for example options over the operational lifetime of the facility.

		Costs[a] (million dollars)		Final waste volume (cubic meters)	
Option	Cases[b]	Construction and operation	Waste disposal	High activity	Low activity
1	a	4,200	11,000	19,000	1,500
	b	3,300	2,900	4,400	230
2	a	3,800	5,500	9,000	11,000
	b	4,200	2,200	3,300	2,100
3	a	1,900	860	870	20,000
	b	3,200	300	220	4,700
4	a	4,200	12,000	21,000	None
	b	2,900	3,100	4,700	None

a. All costs are discounted to 1994 dollars.

b. For Case a, the high-activity waste form would be glass and the low-activity waste form would be normal grout. For Case b, the high- and low-activity waste forms would be glass-ceramic.

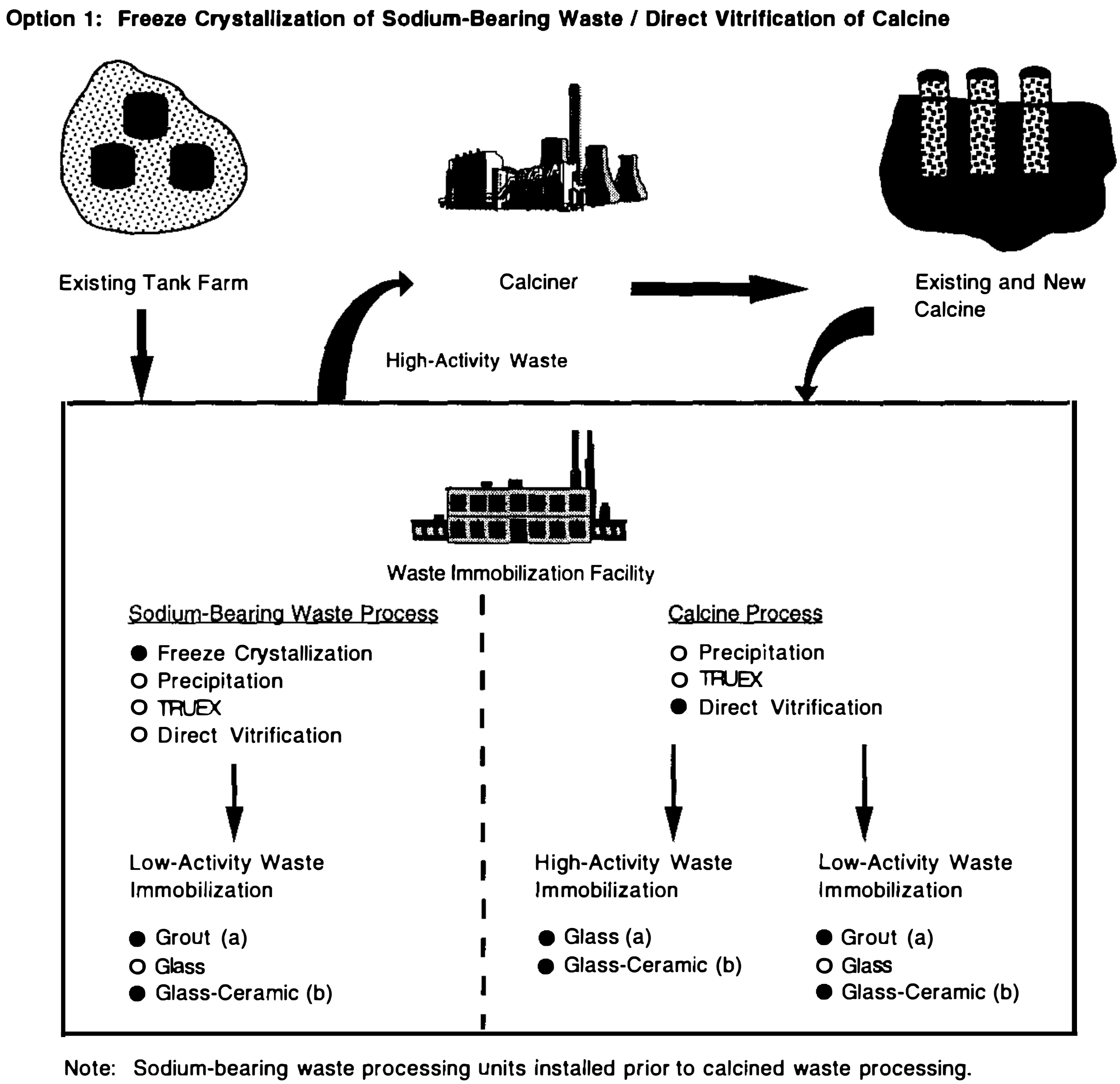
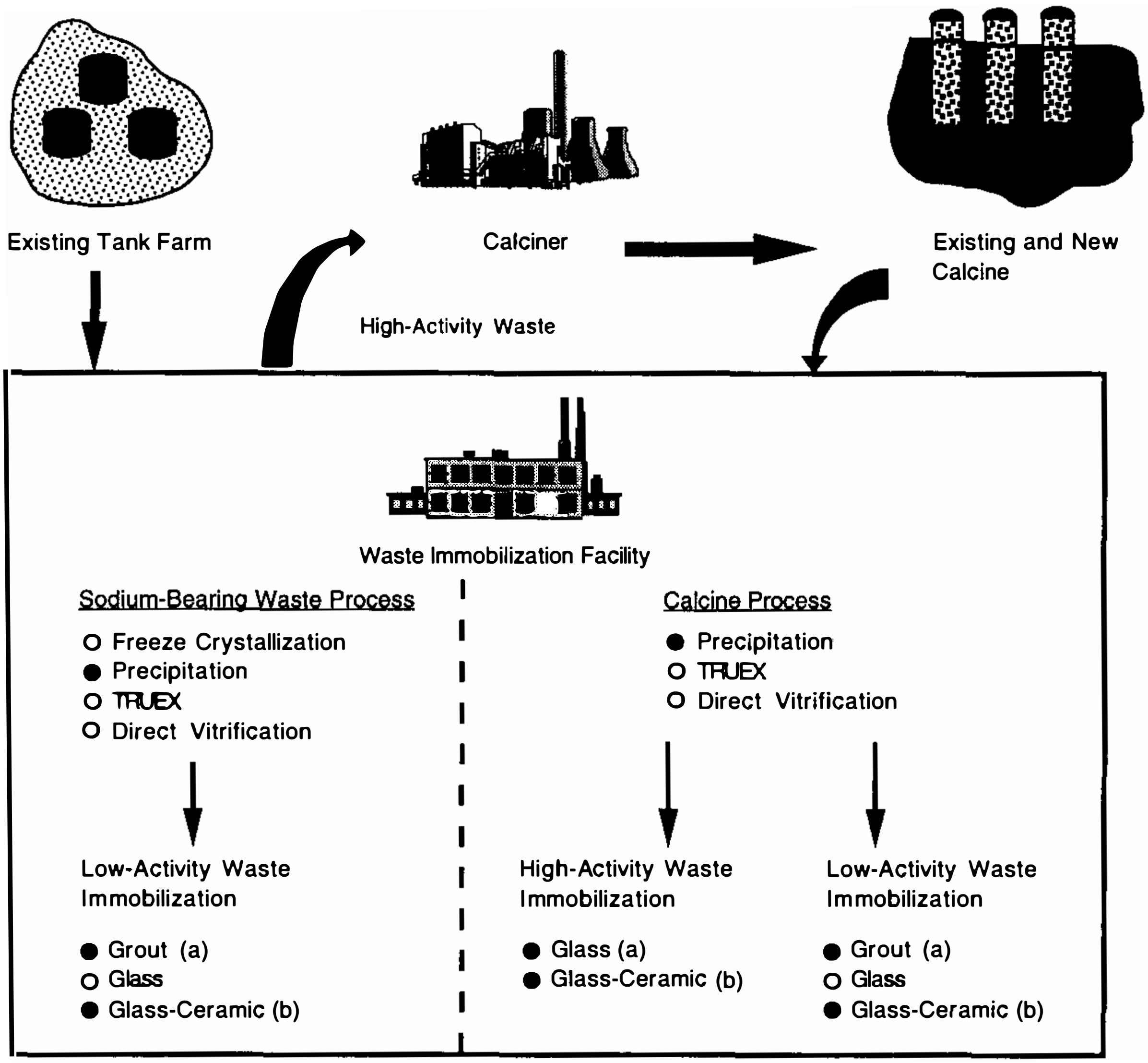


Figure 4.3.2-1. Waste Immobilization Facility: Option 1.

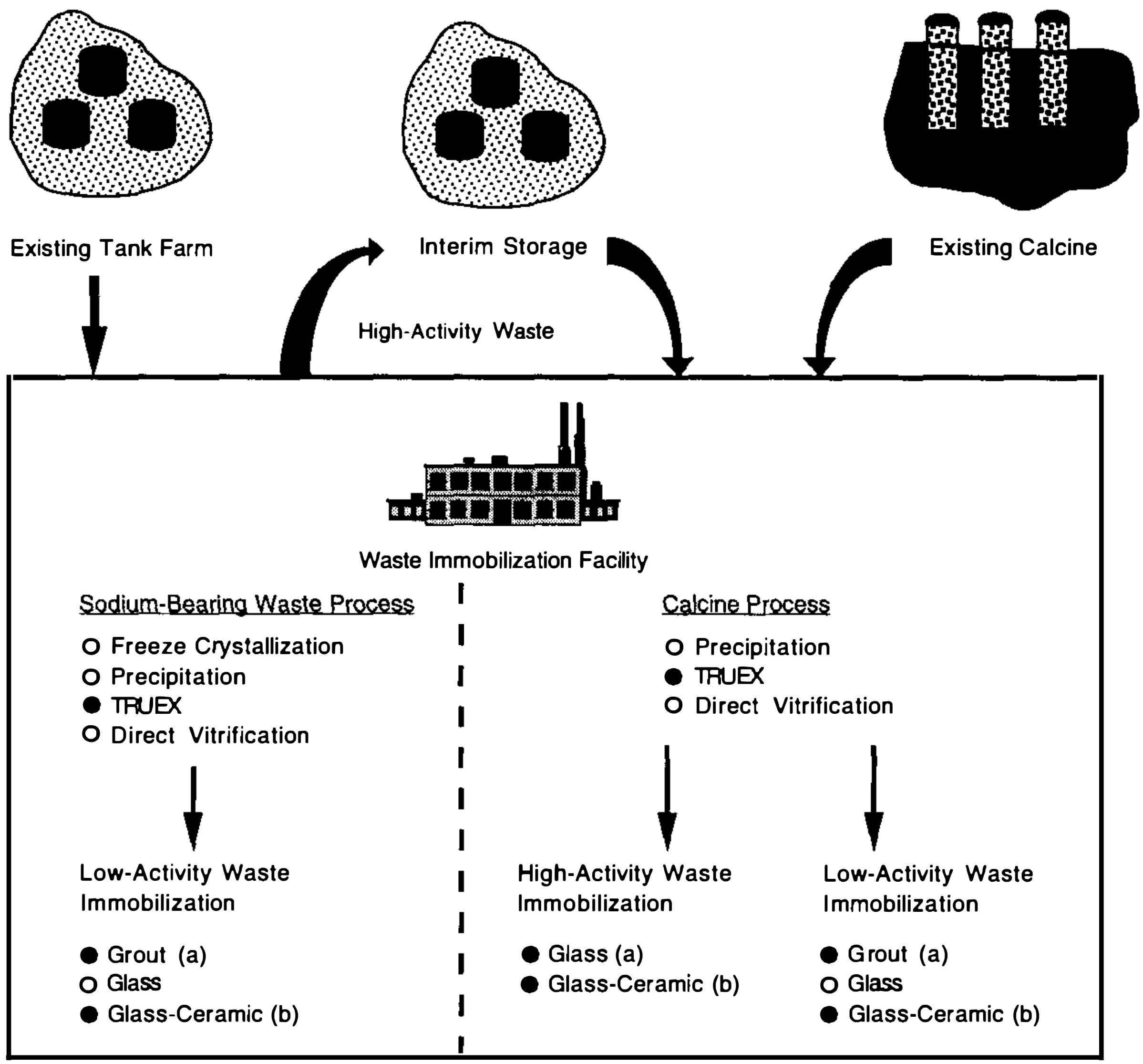
Option 2: Precipitation of Sodium-Bearing Waste / Precipitation of Calcine



Note: Sodium-bearing waste processing units installed prior to calcined waste processing.

Figure 4.3.2-2. Waste Immobilization Facility: Option 2.

Option 3: TRUEX of Sodium-Bearing Waste / TRUEX of High-Activity Waste and Dissolved Calcine



Note: Sodium-bearing waste processing units installed prior to high-activity waste / calcined waste processing.

Figure 4.3.2-3. Waste Immobilization Facility: Option 3.

Option 4: Direct Vitrification of Sodium-Bearing Waste and Calcine

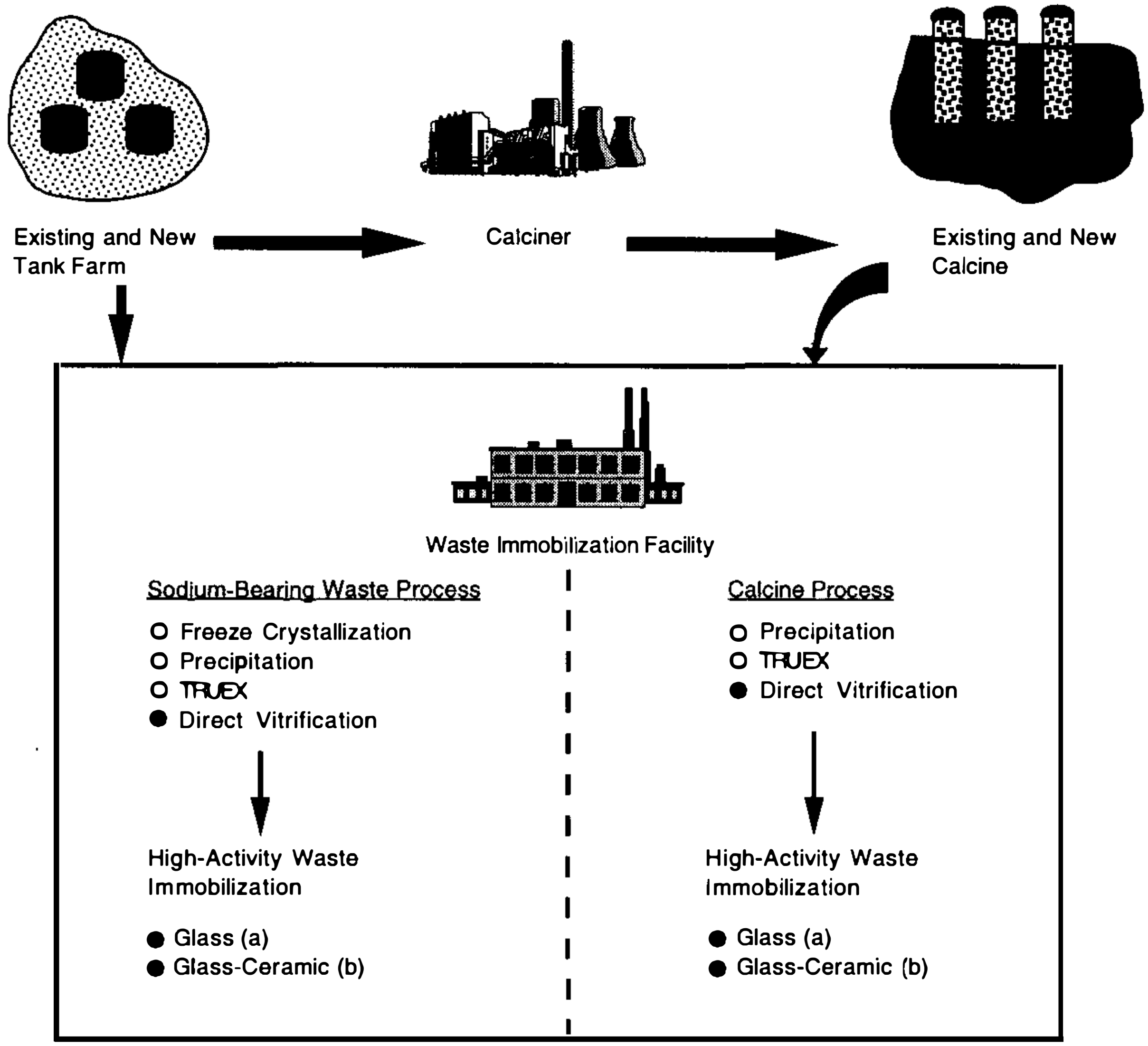


Figure 4.3.2-4. Waste Immobilization Facility: Option 4.

Table C-4.3.2-1 contains cost and volume output for each of the four combinations, and the figures describe the technologies and associated waste management assumed for each. Costs are provided for construction and operation, and final waste form disposal. Final volumes are also provided for both the high- and low-activity waste forms. For each of the combinations, output is also provided for a maximum and minimum final waste form volume (glass for high-activity waste and grout for low-activity waste for the maximum case, glass-ceramic for both wastes for the minimum case).

For each of the combinations presented, it is assumed that the existing sodium-bearing waste is first processed through the high-level waste evaporator to minimize the volume of high-activity waste. More detailed information on these and other treatment combinations is in WINCO (1994).

SUMMARY OF IMPACTS: Environmental consequences for this project would involve airborne emissions, generated wastes, and radiation exposures from routine operations and construction. Construction airborne emissions would be nonradioactive and would consist primarily of dust, paint fumes, and exhaust from trucks and construction equipment. Dust generation would be mitigated, and emissions during construction would comply with applicable Federal and State standards.

Nonradioactive airborne emissions during normal operations would consist primarily of NO_x. The amount of NO_x emitted would be approximately 1,650,000 kilograms per year. In addition, the facility may annually emit smaller quantities of other pollutants such as SO_2, particulate matter, hydrofluoric acid, and mercury. Particulate emissions would be mitigated using high efficiency particulate air filtration. Annual gaseous radioactive airborne emissions during normal operations would consist primarily of tritium (420 curies) and iodine-129 (0.15 curies). Particulate radioactive emissions are estimated at less than 0.1 curie due to effectiveness of high efficiency particulate air filtration. Total radioactive emissions would result in a maximum exposure to the public well below the U.S. Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants requirement of 10 mrem per year.

Liquid effluents produced during construction would consist of water from cleaning or pumping of trenches, and would be treated as necessary with Idaho Chemical Processing Plant facilities. During operations, all hazardous and radioactive liquid wastes would be treated within the facility or by other existing Idaho Chemical Processing Plant facilities.

Solid nonhazardous wastes in the form of paper, wood, and metal would be generated during the construction phase of the project. During operations, the facility would produce between 20 and 320 cubic meters per year of immobilized high-activity waste and between 10 and 1,250 cubic meters per year of immobilized low-activity waste, based on facility sizing and the technologies chosen. Both high-activity and low-activity wastes would be stored at the Waste Immobilization Facility pending ultimate disposition. It is important to note that these quantities are estimates only, and that the final design capacities could be higher or lower than the stated ranges depending again on the facility's size and the technologies chosen.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with the preferred alternative for this project are summarized in Table C-4.3.2-2. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under the no-action option, a Waste Immobilization Facility would not be constructed, and liquid high-activity waste and sodium-bearing liquid waste would be processed in the existing calciner. Calcine solids would continue to be stored in vaults at Idaho Chemical Processing Plant and would not be processed. This option corresponds with Alternative A (No Action) evaluated in this EIS. This option would not provide for compliance with the following:

Table 4.3.2-2. Summary of potential environmental impacts of the Waste Immobilization Facility Project - Separation with Vitrification under Alternatives C and D.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb up to 0.8 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Construction: 11,500,000 liters Operation: 150,000,000 liters per year, which includes 10,000,000 liters per year of evaporator overheads, and 3,500,000 liters of service water.	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	No sites identified	None required
Air quality	<u>Radiological operational emissions</u> 0.18% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> 11% of significance level for combined TAPs 44% of significance level for fluorides 260% of significance level for mercury <u>Prevention of Significant Deterioration (PSD)</u> 19% Annual average NO_2 - Class II, public highways <u>Visibility</u>: Control measures may be required to avoid degraded visibility at Craters of the Moon Wilderness Area	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual 0.018 mrem/yr 9.0×10^{-9} latent cancer fatalities/yr 80-km (50-mile) population Year 2000: Not in operation Year 2010: 0.099 person-rem/yr 5.0×10^{-5} latent cancer fatalities/yr <u>Nonradiological effects</u> Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting; monitor ECAs during construction. Project would have its own stack with appropriate HEPA filtering capabilities
Transportation	Construction (onsite truck trips): Nonradiological - 272 Operation (onsite truck trips per year): Nonradiological - 4 Radiological - 0.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 10,000 Operation (m^3/yr): low-level waste -10 industrial waste - 150	Waste minimization and recycling programs in place at the Idaho Chemical Processing Plant and the INEL
Socioeconomic conditions	Construction: 300 subcontractor personnel peak Operation: 180 existing workers	None required

a. Definition of acronyms: ECA - environmentally controlled area; HEPA - high-efficiency particulate air; NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

- Federal Facility Compliance Act, which requires the development of technologies and facilities for treating/disposing of mixed wastes

- December 22, 1993, court order (Amended Order Modifying Order of June 28, 1993), which requires that technologies be selected to process sodium-bearing liquid waste and calcine solids

- The Notice of Noncompliance Consent Order between the Department of Energy, State of Idaho, and the Environmental Protection Agency requiring DOE to cease use of the existing Idaho Chemical Processing Plant Tank Farm tanks by specified dates, unless alternate tankage is provided

- Modification of the Notice of Nonccompliance Consent Order between the DOE, March 17, 1994, State of Idaho, and the U.S. Environmental Protection Agency requiring that technologies be selected for processing sodium-bearing liquid waste and calcine solids at the Idaho Chemical Processing Plant into waste forms acceptable for final land disposal.

Direct Vitrification - Under this option (Figure 4.3.2-4), waste would be vitrified into glass or glass-ceramic waste form. This option was used for purposes of analysis for Alternative B (Ten-Year Plan) in this EIS. As previously discussed, direct vitrification would produce the largest amount of high-activity waste (Table C-4.3.2-I). The facility would be constructed at the Idaho Chemical Processing Plant or at an alternative location within the INEL. This option was chosen to bound the high-activity waste generation volume and emissions. Also, since it contains the minimum of pretreatment, it would require the least amount of time to construct and make operational.

Vitrification with Pretreatment - Under this option (Figures 4.3.2-1 through 4.3.2-3), the Waste Immobilization Facility would include pretreatment (a separation step) before vitrification. This option was used for purposes of analysis for Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal) in this EIS. Pretreatment would produce less high-activity waste but greater amounts of low-activity waste than direct vitrification (Table C-4.3.2-1). As analyzed, the Waste Immobilization Facility does not reflect the treatment of additional high-activity waste that would be generated by spent nuclear fuel processing under Alternative D (Maximum Treatment, Storage, and Disposal).

Treatment at Another Site - This alternative would require transportation of liquid and/or calcine solids to another site for treatment before disposal. If sited at a location other than the Idaho Chemical Processing Plant, costs would be high because of the need to design and/or certify transportation containers/casks for transport of the liquid and solid wastes. High costs would be incurred because of the need for extensive modifications to the existing processing facilities at Savannah River or Hanford to accommodate the unique characteristics of the Idaho Chemical Processing Plant wastes. For these reasons, DOE does not regard this as a reasonable alternative.

Project Data Sheet

Rev. 10 January 5, '95

Section	Item	Value
Generic Info.	Description/function:	Waste Immobilization Facility (WIF) [DIRECT VITRIFICATION]
	WAG	3
	EIS Alter. (A, B, C or D):	B
	SNF or Waste stream:	HLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	4,000
	Other features: (Pits, ponds, power /water/sewer lines)	7 year HLL waste storage 7 year LLW storage
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Outside FAST (south-east)
Construction Info.	Cost($): PreConst.	$90 Mil.
	Cost($): Const.	$1,400 Mil.
	Schedule Start /End: PreConst.	1996 - 2001
	Schedule Start /End: Const.	2002 - 2006 (Assumed for analysis)
	No. of workers: (new/exist)	300 Peak Subs.
	Heavy Equip. Equip. used: / Trips:	See Table C-4.3.2-1
	Acres Disturbed: New	0
	Previous	0.8
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	11,500 k
	Solid wastes: Type:	Industrial
	Quantity: (m3)	10,000
	Haz./Toxic Chemicals: Storage/inventory	Cutting Fluid 115 liters Paint 1,150 liters
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	11,500 k
	Energy requirements: Electrical: (MWH/yr)	2,000
	Fossil fuel: (liters)	490 k Diesel, 132 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$12 Mil./yr
	Schedule Start /End:	2008 - 2043 (Assumed for analysis)
	No. of workers: (new/exist)	70 Existing
	Heavy Equip. Equip. used: / Trips:	See Table C-4.3.2-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Evap. Overheads / Service water
	Quantity: (liters/yr)	10,000 k / 3,500 k
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	10 150
	Haz./Toxic Chemicals: Storage/inventory	Acids, Bases, misc. 115 k liter total
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	150,000 k
	Energy requirements: Electrical: (MWH/yr)	50,000
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

Project Data Sheet | Rev. 11 | January 16, '95

Section	Item	Value
Generic Info.	Description/function:	Waste Immobilization Facility (WIF) [VITRIFICATION with SEPARATION]
	WAG	3
	EIS Alter. (A, B, C or D):	C, D
	SNF or Waste stream:	HLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	4,000
	Other features: (Pits, ponds. power /water/sewer lines)	7 year HLL waste storage 7 year LLW storage
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Outside FAST (south-east)
Construction Info.	Cost($): PreConst.	$135 Mil.
	Cost($): Const.	$2,100 Mil.
	Schedule Start /End: PreConst.	1996 - 2001
	Schedule Start /End: Const.	2002 - 2006 (Assumed for analysis)
	No. of workers: (new/exist)	300 Peak Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	272 Ind.
	Acres Disturbed: New	0
	Previous	0.8
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	11,500 k
	Solid wastes: Type:	Industrial
	Quantity: (m3)	10,000
	Haz./Toxic Chemicals: Storage/inventory	Cutting Fluid 115 liters Paint 1,150 liters

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	11,500 k
	Energy requirements: Electrical: (MWH/yr)	2,000
	Fossil fuel: (liters)	490 k Diesel, 132 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$41 Mil./yr
	Schedule Start /End:	2015 - 2050 (Assumed for analysis)
	No. of workers: (new/exist)	180 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	1/yr Ind., 3/yr LLW
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Evap. Overheads / Service water
	Quantity: (liters/yr)	10,000 k / 3,500 k
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	10 150
	Haz./Toxic Chemicals: Storage/inventory	Acids, Bases, misc. 115 k liter total
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	150,000 k
	Energy requirements: Electrical: (MWH/yr)	40,000
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.3.3 HIGH-LEVEL TANK FARM NEW TANKS

PROJECT NAME: High-Level Tank Farm New Tanks

PURPOSE AND NEED FOR ACTION: The purpose of the proposed Idaho Chemical Processing Plant High-Level Tank Farm New Tanks project is to reduce the environmental health and safety risks associated with the current storage of high-level liquid waste at the Idaho National Engineering Laboratory (INEL) by providing sufficient replacement storage capacity, as required under Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal) in this Environmental Impact Statement (EIS).

The Notice of Noncompliance issued by the U.S. Environmental Protection Agency on January 28, 1990, supported the decision to construct replacement tanks by contending that the eleven tanks in the Idaho Chemical Processing Plant Tank Farm and much of their associated valves and piping were not in compliance with secondary containment requirements. The Notice of Noncompliance Consent Order, signed April 3, 1992, outlines a strict compliance schedule for the completion of several tasks that will ultimately result in the required permanent cessation of use of the five pillar and panel (segmented) tank vaults on or before March 31, 2009; and the remaining six cast-in-place (monolithic) vaults on or before June 30, 2015, among other provisions. The decision in April, 1992, to no longer reprocess spent fuel at the Idaho Chemical Processing Plant resulted in the tank replacement project being put on hold. The Amended Order Modifying (the District Court) Order of June 28, 1993 (signed December 22, 1993) calls for beginning construction of new tanks by the end of the 1996 construction season if new tanks are determined to be needed in the Record of Decision on this EIS.

For Alternative C (Minimum Treatment, Storage, and Disposal), this project would be needed because in this alternative the New Waste Calcining Facility would not be used to calcine liquid waste or to concentrate sodium-bearing waste, both of which would be generated in limited quantities primarily due to remediation efforts. For Alternative D (Maximum Treatment, Storage, and Disposal), this project would be needed if it were decided to process spent nuclear fuel before ultimate disposal.

PROPOSED ACTION AND ALTERNATIVES

The existing Tank Farm concrete containment vault designs include five with segmented construction (VES-WM-182 through VES-WM-186) and six with monolithic concrete construction (VES-WM-180, -181, -187 through -189, and the spare empty tank, -190). Based on the results of the best available mathematical models and scoping seismic evaluations (for example, Hashimoto 1988), the five segmented containment vaults do not meet the current seismic criteria. Although continuous monitoring of these five tanks and vaults has not yielded any evidence to suggest a leak of high-level liquid waste to the environment, their age (approximately 35 years), seismic deficiencies, and the inability to remotely inspect and maintain these systems to completely ensure continued tank integrity make their long term use unacceptable.

The liquid waste is subject to Resource Conservation and Recovery Act (RCRA) requirements, and the existing tanks do not meet all of the current INEL seismic requirements for secondary containment. The proposed project in the original environmental assessment (DOE 1993c) included (a) upgrading of existing tank cover gas piping and high-level waste transfer systems, (b) providing equipment for removing the so-called heel (the remaining liquid in each existing tank that cannot be removed by existing equipment), and (c) providing for replacement tankage. However, DOE approved that environmental assessment and issued a Finding of No Significant Impact only for the high-level waste tank upgrades portion of the original proposed action. These system upgrades are under construction [see Section C-2.7, High-Level Tank Farm Replacement (Upgrade Phase)]. The proposed Tank Farm Heel Removal Project is a separate proposed action (see Section C-4.3.1). The larger project to replace the tankage was suspended in 1992, when spent fuel reprocessing was curtailed at the Idaho Chemical Processing Plant.

The proposed action would be to replace five high-level liquid waste storage tanks and containment vaults with four new tanks, containment vaults, and support systems. Alternative A (No Action) would continue storage in the existing tanks. This alternative would conflict with the Notice of Noncompliance Consent Order, which alleges secondary containment violations of the RCRA and Hazardous Waste Management Act (Idaho) regulations. Three other project-specific alternatives are considered: (a) reduce high-level liquid waste storage capacity requirements (primarily by calcining), (b) retrofit existing tanks/vaults, and (c) locate the waste at other INEL facilities.

Proposed Action: The proposed action would replace the five segmented tank and vault systems (VES-WM-182 through VES-WM-186) that do not meet current INEL seismic criteria with four new 500,000-gallon storage tanks. The new tanks would be located in separate vaults within a common below-ground concrete containment vault structure. The primary stainless steel storage tanks would be erected inside a secondary containment barrier. The secondary containment barrier would consist of either a free-standing stainless steel vessel between the primary tank and the vault or a stainless steel liner attached directly to the interior of the vault. In either instance, a separate secondary containment system would be designed to accommodate 110 percent of the volume for each of the primary tanks. The primary tanks would be approximately 60 feet in diameter, with a shell height of about 24 feet and a dome height of about 7 feet. The tanks and containment vault structure would be designed for a 50-year life and would receive a RCRA permit from the State of Idaho.

Support systems for the tank and vaults would include solids handling, tank cooling, waste sampling, vessel offgas with associated high-efficiency particulate air filtration, vault ventilation, waste transfer, decontamination, fire protection, and remote maintenance. These systems would provide for the safe operation and maintenance of the proposed new facilities and would facilitate eventual decontamination and decommissioning. Since the new vessel offgas and vault ventilation systems would produce air flows that exceed the handling capacity of the existing Idaho Chemical Processing Plant main stack, it would be supplemented by a new stack not to exceed 65 meters (210 feet) in height. The new stack would be equipped with emission monitoring instrumentation meeting the specifications set forth in the National Emission Standards for Hazardous Air Pollutants permit and the State of Idaho Permit to Construct and Permit to Operate.

To supply electricity to operate the proposed facilities, two new feeder lines, of approximately 13.8 kVA, would be constructed from existing circuits. Alternate power would be supplied by a standby diesel generation system. A redundant, solid-state, uninterruptible power supply (batteries) is also proposed for instrumentation and lighting that require an uninterruptible power supply. Other electrical systems would include exterior, interior, and emergency lighting; grounding; lightning protection; and cathodic protection system. Other utility interfaces would include demineralized water, potable water, process equipment waste, steam, compressed air, decontamination systems, and steam condensate return.

The largest of three new enclosure buildings would be the weather enclosure building situated directly over the proposed new tanks. The weather enclosure building would support operation, inspection, and maintenance activities. A mechanical building would house and/or support mechanical systems, including ventilation and vessel offgas air filtration systems. An electrical building would house the standby diesel generator and electrical switchgear.

Low-level liquid mixed waste would either be stored at an approved interim mixed waste storage area on the INEL (outside of the Idaho Chemical Processing Plant facility area) or treated at the existing process equipment waste evaporator at the Idaho Chemical Processing Plant. The radioactive solid wastes would be disposed of at the Radioactive Waste Management Complex. The hazardous substances would be stored, treated, and disposed at permitted RCRA hazardous waste treatment, storage, and disposal facilities.

Site preparation activities for the proposed project would include demolition or relocation of several existing buildings, possible structural shoring in areas to be excavated, and relocation or shutdown and removal of utilities (Shaffer 1993). Subsequent to site preparation, overburden would be excavated to the top of bedrock and the bedrock would be removed to the required depth.

Once construction and acceptance testing were complete, operation of the Tank Farm would not differ substantially from current operations. The tanks would be operated so that one new and one existing tank are left empty to act as spares in case of emergency. The maximum heat generation rate of the waste in the new tanks would be limited to 100 watts per cubic meter.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

PROJECT-SPECIFIC OPTIONS:

No Action - No replacement waste storage tanks would be provided for the five tanks/vaults (VES-WM-182 through VES-WM-186). This option corresponds to Alternative A (No Action) evaluated in this EIS. Since the existing tank vaults do not meet the secondary containment requirements, a Notice of Noncompliance Consent Order between DOE, the U.S. Environmental Protection Agency, and the State of Idaho requires the use of the existing tanks to cease. Thus, adequate treatment must be provided to take waste from the existing tanks to meet the Consent Order dates or the Consent Order would not be met. There would be a continued risk of a leak or rupture in these five tanks/vaults in the event of a large earthquake. RCRA regulations allow for variances [40 CFR Part 265.193(g)], but obtaining a variance for the Tank Farm is perceived to be unlikely due to the difficulties in performing the annually required leak detection tests.

Reduce High-Level Liquid Waste Storage Capacity Requirements - A reduction in high-level liquid waste storage capacity requirements could be possible if generation of waste could be reduced or if the waste calcining processing capacity or rate were increased, thereby eliminating the necessity for new tanks.

Palmer et al. (1994) evaluated Tank Farm capacity and storage requirements to determine the most feasible options for emptying the existing Tank Farm and the need for replacement tanks. Because of the Notice of Noncompliance Consent Order requirements, the problem and the defined system became much larger than just the new tanks. Since determining the need for new tanks also includes evaluating emptying of the existing tanks, many other factors were considered. Some of these are liquid waste generation, liquid waste storage capacity, phased removal from service of existing tanks for heel removal activities, calcine storage capacity, and waste immobilization. The defined system becomes all of the Idaho Chemical Processing Plant involved in generation, storage, or treatment of Tank Farm or related wastes.

Therefore, simply calcining the wastes in the existing New Waste Calcining Facility would not allow ceasing use of the tanks by the specified dates to meet the requirements of the Notice of Noncompliance Consent Order. Other treatment of the wastes must also be provided. This project-specific alternative [similar to Case 4a in Palmer et al. (1994)] complies with the Notice of

Noncompliance Consent Order and corresponds to Alternative B (Ten-Year Plan) evaluated in this EIS. It would consist of running two New Waste Calcining Facility campaigns after 1996, operating the Waste Immobilization Facility (see Section C-4.3.2) in 2008, and using the High-Level Liquid Waste Evaporator at the maximum rate between 1996 and 2008.

Retrofit Existing Tanks/Vaults - The option of retrofitting the existing tank/vaults to meet current INEL seismic design criteria and secondary containment requirements has been thoroughly evaluated in an extensive study. Options evaluated in the study included internal bracing, driving pilings, removal of overburden, external support of vault roof, excavation and external bracing, filling the annular space, grout curtain, vault column post-tensioning, low-pressure grout, and the installation of a second containment barrier. No retrofit option was determined to be feasible based on the criteria of safety, occupational radiation exposure, reliability, construction risk, schedule, cost, waste minimization, and regulatory requirements. This option has not been included as either a project-specific alternative or an EIS alternative because it has been determined to be not practical or feasible with current technology, as documented in DOE (1993c).

Location at Other INEL Facilities - This option has not been pursued due to the extreme difficulty that would be encountered in transporting high-level liquid wastes and the requirement to construct transfer piping or transport casks and tank farm support. The location of existing liquid waste generation facilities and waste processing facilities dictates a close connection to replacement tankage.

AFFECTED ENVIRONMENT:

The proposed action would be located within a major facility area (the Idaho Chemical Processing Plant at the INEL). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.) The proposed project location is to a great extent already developed and utilized for current Idaho Chemical Processing Plant operations. The limited acreage outside the fence that would be disturbed during construction is predominantly in the sagebrush vegetative community, which is the dominant community type at the INEL.

Construction of part of the proposed project would take place in areas that have been designated as Environmentally Controlled Areas (ECAs). ECAs are defined regions within the Idabo Chemical Processing Plant boundaries where a hazardous and/or radioactive waste spill/release has been documented. The ECA designation remains in spite of cleanup actions following the spill/release.

Other information regarding the affected environment of the Idaho Chemical Processing Plant/INEL and surrounding area is covered by other sections of this EIS, as summarized and referenced in Section C-3.1.

ENVIRONMENTAL EFFECTS:

The potential environmental effects associated with the proposed project other than those identified below are summarized in Table C-4.3.3-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

Accidents: The radiological and nonradiological impacts from postulated reasonably foreseeable accidents (greater than 1×10^{-7} per year) are encompassed by those accidents analyzed in this EIS, Volume 2, Section 5.14. Specifically, in Section 5.14, due to a seismic event, a high-level waste tank failure with complete draining was analyzed to determine potential impacts on groundwater. This event is considered to be the bounding foreseeable accident for this project.

Cumulative Impacts: Because the proposed action would replace or upgrade existing Idaho Chemical Processing Plant Tank Farm facilities, there would be no significant additional cumulative effects subsequent to the construction, testing, and startup of the new facilities.

Decontamination and Decommissioning and RCRA Closure: The proposed new facilities (tanks, containment vaults, and ancillary systems) and the five tanks and piping systems being taken out of service would eventually require decontamination and decommissioning and RCRA closure. The

Table C-4.3.3-1. Summary of potential environmental impacts of the High-Level Tank Farm New Tanks Project under Alternative C.

Environmental attribute	Potential impact	Potential mitigative measures
Geology and soil, acres disturbed	Disturb up to 20 acres of previously disturbed soil	Previously disturbed soil; project would be within major facility area
Water resources	Construction: 2,000,000 liters Operation: No information	Storm Water Pollution Prevention Plan in place at INEL; a project specific plan would be prepared. The design elevation of the project is 0.4 ft higher than the Design Basis flood elevation. No excavation or construction within 400 ft of the Big Lost River channel.
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed; no sites identified	None required
Air resources	Operational radiological/nonradiological emissions No increase over current emissions Nonradiological construction emissions (kg/yr) CO - 1.90×10^3; NO_x - 5.89×10^3; SO_2 - 5.90×10^2; Particulate - 5.60×10^2	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: Construction: 1×10^{-3} mrem/yr 5.5×10^{-10} latent cancer fatalities/yr Normal operation: 2.8×10^{-1} mrem/yr 1.4×10^{-7} latent cancer fatalities/yr 80-km (50-mile) population: Construction: 5.2×10^{-3} person-rem/yr 2.6×10^{-6} latent cancer fatalities/yr Normal operation: 0.19 person-rem/yr 9.5×10^{-5} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting; monitor ECAs during construction
Transportation	Construction (onsite truck trips): Nonradiological - 82 Radiological - 18.6 Operation (onsite truck trips per year): Nonradiological - 0.5 Radiological - 0.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): low-level waste - 553; mixed low-level - 20; transuranic - 22 industrial - 3000 Operation (m^3/yr): low-level waste - 8; mixed low-level - 2; hazardous - 15; industrial - 5	Waste minimization and recycling programs in place at the INEL
Socioeconomic conditions	Construction: 150 subcontractor personnel Operation: No additional workers	None required

a. Definition of acronyms: ECA - environmentally controlled area.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

decontamination and decommissioning and RCRA closure of the existing facilities being replaced would be covered under a subsequent National Environmental Policy Act (NEPA) review.

In accordance with DOE Orders 5820.2A (DOE 1988) and 6430.1A, Section 1300-11 (DOE 1989a), the new facilities would be designed to facilitate decontamination and decommissioning. The future specific NEPA actions for decontamination and decommissioning of the proposed new facilities would be also be covered by a subsequent NEPA review.

Project Data Sheet

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General Info.	Description/function:	High-Level Tank Farm New Tanks
	WAG	3
	EIS Alter. (A, B, C or D):	C, D
	SNF or Waste stream:	HLW
	Action type:	New
	Structure Type: Size: (m2)	Storage Tanks (4) 757,000 liters each Buildings (3)
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence Inside/outside of bldg.	 Inside ICPP Outside (near existing tanks)
Construction Info.	Cost($): PreConst. Cost($): Const.	 $165 Mil. total
	Schedule Start /End: PreConst. Schedule Start /End: Const.	1995 - 1996 1996 - 2000
	No. of workers: (new/exist)	150 Subs
	Heavy Equip. Equip. used: Trips:	See Table C-4.3.3-1
	Acres Disturbed: New Previous Revegetated	0 <20 0
	Air Emissions: (None / Ref.)	 See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	 None
	Solid wastes: Type: Quantity: (m3)	 TRU LLW MLLW Ind. 22 553 20 3,000
	Haz./Toxic Chemicals: Storage/inventory	None

Const.	Cultural resource effects:	None
	Pits/ponding created: (m2)	Yes (temporary)
	Water usage: (liters)	2,000 k
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	 160 300 k Diesel
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No Yes
Operational Information	Cost($): Operation:	No information
	Schedule Start /End:	2001 - TBD
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used: Trips:	See Table C-4.3.3-1
	Air Emissions: (None / Ref.)	 None
	Effluents: Type: Quantity: (liters/yr)	 No increase
	Solid wastes: Type: Quantity: (m3/yr)	 LLW MLLW HW Ind. 8 2 15 5
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	 450 5,500
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No Yes

C-4.3.4 NEW CALCINE STORAGE

PROJECT NAME: New Calcine Storage

GENERAL PROJECT OBJECTIVE: The general objective of the proposed eighth Calcined Solids Storage Facility New Calcine Storage project at the Idaho Chemical Processing Plant would be to provide additional storage for calcine solids produced by the operation of the New Waste Calcining Facility. This storage capacity would be required to allow the continued processing of liquid wastes in the New Waste Calcining Facility until the final waste form is established and implemented.

PROJECT DESCRIPTION: This proposed project would provide for the design, construction, and startup of a new facility for the storage of calcined high-level radioactive waste resulting from the operation of the New Waste Calcining Facility. In the New Waste Calcining Facility, the liquid wastes are converted into granular solids via a fluidized bed process.

Five calcined solids storage facilities are currently filled at the Idaho Chemical Processing Plant, with a sixth still receiving calcine and a seventh ready to receive calcine. The eighth storage facility, proposed in this project, would be a near copy of the seventh facility, and would have a capacity of approximately 63,000 cubic feet.

The proposed eighth Calcined Solids Storage Facility would consist of seven annular stainless steel storage bins, arranged with six bins in a circle and the seventh in the middle, in a reinforced concrete vault. The vault base would be on bedrock, with approximately the top half of the vault projecting above grade. The vault walls and roof would provide required radiation shielding as well as structural support. The bins would be anchored into the vault base slab; the vault, bins, and all interconnecting piping would be designed to meet all applicable seismic, structural, and thermal requirements.

The calcined solids produced by the New Waste Calcining Facility would be pneumatically transported to the top of the proposed storage facility where the solids would be separated from the transporting air by a cyclone located in a separate cell. The transporting air would be returned to the New Waste Calcining Facility; the solids would fall by gravity through dual fill lines into each of the seven bins.

A combination natural and forced convection cooling system would be provided to maintain the stored calcine below its caking temperature and the facility structure below temperature limits. The cooling air would enter through a filter, be discharged at the bottom of the vault and flow upward around and through the annular space in the tanks, and be discharged to atmosphere through a stack on top of the vault. Detection of any radioactivity would automatically channel the exhaust air through in-line high efficiency particulate air filters and centrifugal exhaust blowers.

A bins vent and relief system would protect the bins from over or under pressurization. This system, located in a separate cell on top of the vault would vent to the atmosphere via high efficiency particulate air filters. This system would also allow the bins pressure to equilibrate with the atmosphere when the bins are isolated from the New Waste Calcining Facility.

To facilitate eventual retrieval of the calcine, each bin would have four retrieval pipes extending up to access hatches in the vault roof. Corrosion coupons, fabricated from the bins material, would be suspended into two of the bins and into the vault through separate access hatches.

Vault, bin, and calcine temperatures would be monitored by thermocouples installed on the vault wall and bins exterior surfaces, and by multipoint thermocouples installed in thermowells at the maximum calcine temperature zone in each of the bins. Other temperature and pressure instrumentation would be provided to monitor and control the performance of the cooling, pressure relief, and pneumatic transport systems. An instrument room on the vault roof would house the facility instrument recorders and facility control systems.

Plant utilities would provide the required steam, instrument air, and electrical power for facility operation. Special maintenance features, including small jib cranes, access hatches, and inspection ports, would also be provided.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative D

(Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.3.4-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, no additional calcine storage would be constructed. This option corresponds to Alternative A (No Action) evaluated in this EIS.

Eliminate or Reduce Generation of Calcine - Under this option, high-level liquid waste would be stored and not converted to calcine. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Convert Existing Calcine to Another Form - Under this option, a calcine conversion facility would be developed and constructed to convert the existing calcine to another form. This option corresponds to Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Storage facilities for the other waste form may need to be developed and constructed.

Store Idaho Chemical Processing Plant Calcine at Other DOE Facilities - Under this option, Idaho Chemical Processing Plant calcine would be transferred to another DOE facility for storage. If sited at a location other than the Idaho Chemical Processing Plant, costs would be high because of the need to design and/or certify transportation containers/casks for transport of the solid wastes. This option would involve transport of wastes that is not allowed by DOE orders and is not evaluated in this EIS.

Table C-4.3.4-1. Summary of potential environmental impacts of the New Calcine Storage Project under Alternative D.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 0.5 acres of previously disturbed soil	Project would be in major facility area; previously disturbed soil
Water resources	Construction: No information Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey completed, no sites identified	None required
Air resources	Radiological operational emissions 2.0×10^{-5}% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 2.0×10^{-6} mrem/yr 1.0×10^{-12} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: not operational Year 2010: 1.9×10^{-5} person rem/yr 9.5×10^{-9} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements; monitor ECAs during construction
Transportation	Construction (onsite truck trips): Nonradiological - 15.6 Operation (onsite truck trips per year): Nonradiological - 0.1 Radiological - 0.2	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 576 Operation (m^3/yr): low-level waste - 8 industrial waste - 1	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 35 to 40 subcontractor personnel Operation: No additional workers	None required

a. Definition of acronyms: ECA - environmentally controlled area; NESHAP - National Emission Standards for Hazardous Air Pollutants.

b. Potential impacts are described further in Section C-3.2.

c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

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Section	Item	Value
General Info.	Description/function:	New Calcine Storage
	WAG	3
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	HLW
	Action type:	New
	Structure Type:	Storage Bin
	Size: (m3)	1,700
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	Outside existing bins
Construction Info.	Cost($): PreConst.	$5 Mil.
	Cost($): Const.	$17 Mil.
	Schedule Start /End: PreConst.	2001 - 2004
	Schedule Start /End: Const.	2004 - 2006
	No. of workers: (new/exist)	35 - 40 Subs.
	Heavy Equip. Equip. used: / Trips:	See Table C-4.3.4-1
	Acres Disturbed: New	0
	Previous	0.5
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	576
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	Minimal
	Fossil fuel: (liters)	60,560 Diesel, 3,400 Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$200 k/yr
	Schedule Start /End:	2004 - TBD
	No. of workers: (new/exist)	no new
	Heavy Equip. Equip. used: / Trips:	See Table C-4.3.4-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: / Quantity: (liters/yr)	None
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	8 1
	Haz./Toxic Chemicals: Storage/inventory	N/A
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	None
	Energy requirements: Electrical: (MWH/yr)	None
	Fossil fuel: (liters/yr)	None
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.3.5 RADIOACTIVE SCRAP/WASTE FACILITY

PROJECT NAME: Radioactive Scrap/Waste Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to qualify the Radioactive Scrap/Waste Facility for interim storage of higb-level waste until a high-level waste repository is available.

PROJECT DESCRIPTION: Some of the material that would be a by-product from operation at the Fuel Cycle Facility may be classified as a high-level waste. Since no final repository is presently available for high-level waste, Argonne National Laboratory-West proposes to store the high-level waste generated in the Fuel Cycle Facility at the Radioactive Scrap/Waste Facility until a final repository is available. The existing Radioactive Scrap/Waste Facility has been used since 1965 to store radioactive and radioactive mixed waste and material containing recoverable quantities of nuclear material (that is, scrap) that can be reused or reprocessed. The Radioactive Scrap/Waste Facility is a 1.6-hectare (4-acre) facility in which waste or scrap is stored in carbon steel pipes, called liners. The Radioactive Scrap/Waste Facility has a grid of 27 rows with about 50 storage pipes per row, for a total capacity of approximately 1350 potential storage locations. Storage volume is about 193 cubic meters (6,800 cubic feet).

Because of the radioactive fields that would be associated with the waste (regardless of its classification; for example, mixed, low-level, transuranic, or high-level) and scrap stored at the Radioactive Scrap/Waste Facility, special handling and storage would be required. The waste and scrap would be placed into containers within shielded hot cells using remote methods. The containers would be sealed remotely and transferred to the Radioactive Scrap/Waste Facility in a shielded cask. The Radioactive Scrap/Waste Facility provides shielding to protect personnel working in the facility from gamma radiation fields associated with the waste or scrap. The necessary shielding is provided by a "shield ring" that provides a tight interface between the cask and the storage liner where the material is placed. Once filled, the liner would be closed with a 76-centimeter (30-inch) concrete shield plug that is welded to the liner. The top of the shield plug would be a maximum of 10 centimeters (4 inches) above the ground surface. The ground provides the necessary shielding.

After corrosion was detected in Radioactive Scrap/Waste Facility liners removed in 1988, an upgrade program for the facility was begun. The upgrade program calls for all the existing waste in the Radioactive Scrap/Waste Facility to be relocated into new steel liners equipped with an impressed-current cathodic protection system. In addition to this system, the new steel liners are further protected from the mildly to moderately corrosive nature of the soils at the Radioactive Scrap/Waste Facility by a 10-centimeter (4-inch) layer of noncorrosive sand slurry. This slurry is backfilled around the steel liners at the time of emplacement.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.3.5-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

<u>No Action</u> - Under this option, high-level waste would be accumulated in the Fuel Cycle Facility or the Hot Fuel Examination Facility. This option corresponds to Alternative A (No Action) evaluated in this EIS.

Table C-4.3.5-1. Summary of potential environmental impacts of the Radioactive Scrap/Waste Facility Project under Alternative B.

Environmental attribute	Potential impact[a]	Potential mitigative measures[b]
Geology and soil, acres disturbed	None (no disturbed soil)	Project would be in existing facility
Water resources	None expected	None required
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	No increase over existing facility	None required
Human health	No increase over existing facility	None required
Transportation	None expected	None required
Waste management	None (no new waste generated)	None required
Socioeconomic conditions	Operation: 5 existing workers	None required

a. Potential impacts are described further in Section C-3.2.
b. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

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General Info.	Description/function:	Radioactive Scrap/Waste Facility
	WAG	9
	EIS Alter. (A, B, C or D):	B, C, D
	SNF or Waste stream:	HLW TRU LLW MLLW
	Action type:	Operation w/ existing Fac.
	Structure Type: Size: (m2) Other features: (Pits, ponds, power /water/sewer lines)	Use Existing RSWF 16,000 (ANL-W Bld-771) None
	Location: Inside/outside of fence Inside/outside of bldg.	 Outside ANL-W 0.8 mile N.E. Outside ANL-771 (RSWF)
Operational	Cost($): Operation:	No increase
	Schedule Start /End:	1997 - TBD
	No. of workers: (new/exist)	5 Project
	Heavy Equip. Equip. used: Trips:	See Table C-4.3.5-1
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters/yr)	None

Information	Solid wastes: Type: Quantity: (m3/yr)	None
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	None
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	 989 2400
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No 480 V, 3 Phase

C-4.4 PROJECTS RELATED TO TRANSURANIC WASTE

C-4.4.1 PRIVATE SECTOR ALPHA-CONTAMINATED MIXED LOW-LEVEL WASTE TREATMENT

PROJECT NAME: Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Project would be to provide private sector treatment of alpha-contaminated mixed low-level wastes, and possibly transuranic waste, and small amounts of low-level waste and mixed low-level waste presently stored at the INEL. It might also provide treatment of similar buried wastes that may be retrieved during environmental restoration projects at the INEL. Wastes from other DOE sites and the commercial sector may also be treated at the facility. Treatment of alpha-contaminated mixed low-level wastes would be sufficient to allow disposal in accordance with DOE Order 5820.2A (DOE 1988) and Resource Conservation and Recovery Act Land Disposal Restrictions. Treatment of transuranic waste would be sufficient to allow disposal in the Waste Isolation Pilot Plant.

PROJECT DESCRIPTION: This project would provide for the processing of alpha-contaminated mixed low-level wastes, transuranic waste, and possibly small amounts of low-level waste and mixed low-level waste by the private sector.

The DOE-Idaho has solicited feasibility studies for this endeavor from private industry. The options could range from use of their own existing facility upgraded to treat the waste, to building a commercial regional waste treatment facility. It is expected that a nonreactor nuclear facility would be used to process and package alpha-contaminated mixed low-level wastes (for treatment purposes this is defined as anything less than 100 nanocuries per gram) and transuranic waste as required, as well as small amounts of low-level waste and mixed low-level waste.

The specifics of the treatment process and system components would be determined by the private sector supplier. Expected throughput volumes would be approximately 2,000 cubic meters per year (2,400 cubic yards per year) of alpha-contaminated low-level waste and 4,000 cubic meters per year (4,800 cubic yards per year) of transuranic waste. Based upon current descriptions of INEL wastes, likely requirements for disposal of the treated waste products, and known available treatment process technologies, the following general treatment process system technical description is provided.

- Treatment would begin upon receipt of the wastes at the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment plant site. A receiving inspection and appropriate characterization of the wastes would be conducted sufficient to ensure the wastes are acceptable for receipt and treatment within the constraints of the facility design and permits. Based upon inspection and characterization, waste containers would be sorted and segregated to expedite subsequent processing. Containers would likely be vented, opened, and contents dumped for further sorting and processing as needed.

- Bulk waste volume processing would proceed involving some combination of physical and chemical processing to remove or destroy hazardous organics, remove or stabilize toxic metals in a solid material, and stabilize radionuclides in a solid material as per specified treated waste disposal acceptance requirements. The most likely bulk volume treatment processes would include a combination of thermal treatments involving desorption and high-temperature oxidation/combustion of organics, followed by stabilization of ash and solid residues. A range of potential final stabilization media would be possible, such as cements, polymers, or glass/ceramics. One or more may be used to produce a final solid product for disposal.

- The treated solid waste products would be assayed, certified, and appropriately packaged for return transport from the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment to the Radioactive Waste Management Complex for storage awaiting disposal, or transported directly to an approved permanent repository, if available.

Future private sector initiatives would address additional INEL waste streams. These additional waste streams will be less hazardous and of smaller volume than the alpha-contaminated mixed low-level wastes and transuranic wastes.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would involve new construction assumed to be outside major facility areas. (See Figure C-1-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

A location outside the INEL site also might be chosen for this project. For assessing the transportation and air impacts, such a location was assumed because this location would be closer to offsite individuals and would involve both onsite and offsite transportation.

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.4.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - This option would be the deferral of treatment of alpha-contaminated mixed low-level wastes. This option corresponds to Alternative A (No Action) evaluated in this EIS. This option would involve the continued storage of the waste.

DOE Treatment - Under this option, the waste would be treated at a DOE operated facility. This option also corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. The Idaho Waste Processing Facility (see Section C-4.4.3) would treat the same waste streams and achieve the same treatment requirements as the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment. The primary differences between the Idaho Waste Processing Facility and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility are in how they are funded and operated: The Idaho Waste Processing Facility would be DOE funded and contractor operated, while the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be privately owned and operated. Upon completion of preliminary designs and associated evaluations, a single facility would be chosen to process the wastes. The selection of the treatment facility is scheduled to occur in 1997.

Table C-4.4.1-1. Summary of potential environmental impacts of the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 200 acres of previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Water use: No information Effluents: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record survey; mitigate according to applicable requirements (Section C-3.3.4)
Air resources[d]	<u>Radiological operational emissions</u> 0.046% of alpha or 4.2% of transuranic NESHAP dose limits <u>Toxic Air Pollutants (TAPs)</u> 86% of significance level for combined TAPs 68% of significance level for lead 60% of significance level for mercury <u>Prevention of Significant Deterioration (PSD)</u> 25% 24-hr SO_2 Class II, public highways	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health[d]	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 4.6×10^{-3} mrem/yr (alpha) 2.3×10^{-9} latent cancer fatalities/yr 4.2×10^{-1} mrem/yr (transuranic) 2.1×10^{-7} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 0.015 person-rem (alpha) 8.0×10^{-6} latent cancer fatalities/yr 1.4 person-rem (transuranic) 7.0×10^{-6} latent cancer fatalities/yr Year 2010: 0.017 person-rem (alpha) 9.0×10^{-6} latent cancer fatalities/yr 1.6 person-rem (transuranic) 8.0×10^{-4} latent cancer fatalities/yr <u>Nonradiological effects</u> Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation[e]	Construction (offsite truck trips): Nonradiological - 47.6 Operation (offsite truck trips per year): Nonradiological - 8.7 Radiological - 1022	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 1,750 Operation (m^3/yr): transuranic waste - 57; low-level waste - 100; mixed low-level waste - 170; industrial waste - 320	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 532 to 768 subcontractor personnel Operation: 71 subcontractor personnel	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants; RWMC - Radioactive Waste Management Complex.
b. Reference location for impact analysis except for transportation and air impacts; 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. For transportation and air impacts analyses, a location off the INEL site was assumed. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. Alpha low-level and transuranic waste would not be treated concurrently.
e. The number of shipments includes transportation of waste from the Transuranic Storage Area (TSA) Enclosure and Storage Project to the facility, and transportation of treated waste and minor amounts of generated waste back to the TSA Enclosure and Storage Project for interim storage pending offsite disposal.

Project Data Sheet

Rev. 13 January 16, '95

Section	Item	Value
General Info.	Description/function:	Private Sector Alpha-MLLW Treatment
	WAG	Private
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	TRU Alpha-MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	2,000
	Other features: (Pits, ponds, power /water/sewer lines)	Roads, water, power, sewer
	Location:	(For analysis purposes only)
	Inside/outside of fence	Outside RWMC
	Inside/outside of bldg.	(2.5 miles east)
Construction Info.	Cost($): PreConst.	$30 -50 Mil.
	Cost($): Const.	$250 - 350 Mil.
	Schedule Start /End: PreConst.	1995 - 1997
	Schedule Start /End: Const.	1997 - 2000
	No. of workers: (new/exist)	532 - 768 Subs
	Heavy Equip. Equip. used: / Trips:	See Table C-4.4.1-1
	Acres Disturbed: New	200
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	1,750
	Haz./Toxic Chemicals: Storage/inventory	No information

Section	Item	Value			
Const.	Cultural resource effects:	No information			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	No information			
	Energy requirements: Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters)	No information			
	Nightlights used: Y/N	Yes			
	Generators: Night Y/N	No			
	Day Y/N	Yes			
Operational Information	Cost($): Operation:	$7.8 Mil./yr Private Sector			
	Schedule Start /End:	2000 - 2005			
	No. of workers: (new/exist)	71 Subs. (Private Sector)			
	Heavy Equip. Equip. used: / Trips:	See Table C-4.4.1-1			
	Air Emissions: (None / Ref.)	See Appendix F, Section 3			
	Effluents: Type: / Quantity: (liters/yr)	None Released			
	Solid wastes: Type:	TRU	LLW	MLLW	Ind.
	Quantity: (m3/yr)	57	100	170	320
	Haz./Toxic Chemicals: Storage/inventory	No information			
	Pits/ponds used: Y/N (m2)	No			
	Water usage: (liters/yr)	No information			
	Energy requirements: Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters/yr)	No information			
	Nightlights used: Y/N	Yes			
	Generators: Night Y/N	No			
	Day Y/N	No			

C-4.4.2 RADIOACTIVE WASTE MANAGEMENT COMPLEX MODIFICATIONS TO SUPPORT PRIVATE SECTOR TREATMENT OF ALPHA-CONTAMINATED MIXED LOW-LEVEL WASTE

PROJECT NAME: Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide Radioactive Waste Management Complex facility enhancements on a schedule that supports private-sector treatment of alpha-contaminated mixed low-level waste and transuranic waste stored at the INEL.

PROJECT DESCRIPTION: Modifications to the Radioactive Waste Management Complex would be needed to support the transport of alpha-contaminated mixed low-level waste and transuranic waste to a privately owned and operated waste treatment facility. If such a facility were chosen for implementation, additional waste retrieval, venting, and examination facilities would be required to be operational by October 2000, to support both sending the waste offsite for treatment and receiving it back onsite after treatment.

Approval of treatment of alpha-contaminated mixed low-level waste and transuranic waste at a private facility would require that the following facilities be constructed at the Radioactive Waste Management Complex:

- New examination and assay facilities to supplement the Stored Waste Examination Pilot Plant

- Transportation facilities to stage drums and boxes for transport to the private facility and to receive returning drums of treated waste.

The new examination and assay facility built to support offsite private waste treatment would have capabilities to examine the contents of drums and other shipping containers and to obtain required samples for waste acceptance analyses. It would also have assay equipment for certification of low-level waste. The new transportation facility would be required only if treatment services were provided at a significant distance from the Radioactive Waste Management Complex. It would have the capability to stage and transport approximately 680 drum equivalents per day. It would have equipment and facilities for both sending and receiving and for providing necessary administrative support to these activities.

Because sending alpha-contaminated mixed low-level waste and transuranic waste to a private facility would accelerate retrieval of these wastes from storage, air emissions of radioactive and hazardous materials from the Transuranic Storage Area Retrieval Enclosure may increase over those expected during normal retrieval operations. Releases would be expected to occur because of the presence of breached waste containers. Control of any such potential emissions from the Transuranic Storage Area Retrieval Enclosure would be performed as a separate element of this project. Particulate emissions would be controlled by filtration. Volatile organic compound emission controls may also be required to maintain applicable standards. It is unlikely that accelerating the schedule by one order of magnitude would exceed a limit, but the accelerated retrieval schedule may increase the emissions unless control systems are installed.

The air emissions and air concentrations of hazardous constituents from the Transuranic Storage Area Retrieval Enclosure have been compared with applicable standards and in all instances the emissions were at least two orders of magnitude below the Idaho Toxic Air Pollutants Emission Limit. The effective dose equivalent from radiological emissions for this project is several orders of magnitude below the National Emission Standards for Hazardous Air Pollutants. Planned high-efficiency particulate air filtration during accelerated retrieval would prevent exceeding regulatory limits for radionuclides.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Radioactive Waste Management Complex) and would be integral with existing facilities. (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.4.2-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option Radioactive Waste Management Complex modifications would not be completed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Under this option, the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility (see Section C-4.4.1) would not be constructed, and therefore, the Radioactive Waste Management Complex modifications would not be required to support this effort.

Table C-4.4.2-1. Summary of potential environmental impacts of the Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb less than 1 acre of previously disturbed soil	Project would be within major facility area; previously disturbed soil
Water resources	Construction: water use minimal Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Project would be within major facility area; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and report survey; mitigate according to applicable requirements (Section C-3.3.4). Project would be in existing facility
Air resources	Radiological operational emissions 0.0077% of NESHAP dose limit Toxic Air Pollutants (TAPs) - None Prevention of Significant Deterioration (PSD) 16% - 24-hr PM, Class II, public highways	None required
Human health	Radiation exposures and cancer risk Maximally exposed individual: 7.7×10^{-4} mrem/yr (alpha) 3.8×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 2.4×10^{-3} person rem/yr Year 2010: 2.6×10^{-3} person rem/yr 1.3×10^{-6} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected.	None required
Transportation[d]	Construction (onsite truck trips): Nonradiological - 41 Operation (truck trips per year): Nonradiological - 2.7 onsite Radiological - 2.9 onsite; 1006 offsite	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 1500 Operation (m^3/yr): low-level waste - 50 mixed low-level waste - 50 industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 60 subcontractor personnel Operation: 100 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. All offsite shipments in support of the Private Sector Alpha Mixed Low-Level Waste Facility would be transported through this facility.

Project Data Sheet

Rev. 11 January 16, '95

General Info.	Description/function:	RWMC Modifications to Support Private Sector Treatment of Alpha-MLLW
	WAG	7
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	TRU Alpha-MLLW
	Action type:	New - Expand
	Structure Type: Size: (m2) Other features: (Pits, ponds, power /water/sewer lines)	Building upgrades & new Examination / Assay Facility Expand RWMC capabilities
	Location: Inside/outside of fence Inside/outside of bldg.	 Inside RWMC Outside / Inside
Construction Info.	Cost($): PreConst.	$38 Mil.
	Cost($): Const.	$85 Mil. total
	Schedule Start /End: PreConst.	1995 - 2000
	Schedule Start /End: Const.	1995 - 2000
	No. of workers: (new/exist)	60 Subs.
	Heavy Equip. Equip. used: Trips:	See Table C-4.4.2-1
	Acres Disturbed: New Previous Revegetated	0 <1 0
	Air Emissions: (None / Ref.)	 See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	 Construction Water No information
	Solid wastes: Type: Quantity: (m3)	 Industrial 1,500
	Haz./Toxic Chemicals: Storage/inventory	 No information
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Minimal
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	 No information No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No Yes
Operational Information	Cost($): Operation:	$188 Mil. Total
	Schedule Start /End:	2000 - 2005
	No. of workers: (new/exist)	100 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.4.2-1
	Air Emissions: (None / Ref.)	 See Belanger et al. 1995
	Effluents: Type: Quantity: (liters/yr)	 None
	Solid wastes: Type: Quantity: (m3/yr)	 LLW MLLW Ind. 50 50 100
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	 No information No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No No

C-4.4.3 IDAHO WASTE PROCESSING FACILITY

PROJECT NAME: Idaho Waste Processing Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Idaho Waste Processing Facility Project would be to design, construct, and operate a facility to provide treatment for alpha-contaminated low-level waste and transuranic waste stored at the INEL. Treatment would produce a final waste form acceptable for land disposal in accordance with applicable regulatory requirements.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idabo pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: The Idabo Waste Processing Facility would treat and process both alpha-contaminated and transuranic-contaminated wastes to meet applicable requirements for land disposal. The facility would be intended to provide treatment for waste stored at the INEL, but similar waste from other DOE sites and the commercial sector could be treated there. Because other available treatment facilities may lack the necessary capabilities, the INEL's annually generated volume of 1600 cubic meters (2100 cubic yards) of mixed low-level waste and incidental quantities of low-level beta/gamma wastes may also be treated at the Idabo Waste Processing Facility.

The Idabo Waste Processing Facility would be constructed and operated in two phases: *Phase I* would treat both mixed and nonmixed alpha-contaminated low-level waste, and *Phase II* would add treatment capabilities for mixed and nonmixed transuranic waste. Treatment of alpha-contaminated mixed low-level waste would be sufficient to allow land disposal in accordance with DOE Orders and Resource and Conservation and Recovery Act Land Disposal Restrictions. Treatment of transuranic waste would be sufficient to allow disposal at the Waste Isolation Pilot Plant.

A stand-alone Idaho Waste Processing Facility located near the Radioactive Waste Management Complex has been postulated for planning purposes and environmental impact analyses. Indeed, the required design elements and operational capabilities for the facility are still in the process of being established. The final facility design may consist of a single building or several small buildings housing selected processing or treatment technologies. If multiple buildings were selected, they may be located near the Radioactive Waste Management Complex or at various existing plant sites on the INEL. Existing buildings may be used to house some processing and treatment technologies.

Treatment capabilities for both alpha-contaminated low-level waste and transuranic waste could include opening and sorting, pretreatment and treatment, and immobilization. The design throughput would be 4,000 to 6,500 cubic meters per year (5,200 to 8,500 cubic yards per year). Each of these treatment processes is briefly described below:

- *Opening and Sorting*: Facilities would be provided for the capability to open and sort the various sizes of barrels, boxes, and bins of waste. The waste is both contact-handled and remote-handled; therefore, the systems to handle this waste will require some remote capability. After opening, the waste would be inspected and sorted and segregated for further processing.

- *Pretreatment and Treatment:* In this part of the process, the contact-handled waste would be sized in preparation for treatment of the hazardous constituents. This treatment could be thermal, nonthermal, or a combination of both. A thermal treatment would destruct the hazardous and toxic constituents. A nonthermal treatment could also be provided, similar to a chemical wash system. Treatment would probably also consist of a decontamination process. The decontaminated material could be recycled or sent to the immobilization process. An amalgamation process would probably also be provided for some metals, such as mercury. Some remote-handling capability would also be required in these processes.

- *Immobilization:* Immobilization processes would probably be provided whereby a waste material would be converted to an environmentally stable configuration. Immobilization treatments would probably include sulfur polymer cement, portland cement, or iron-enriched basalt. These processes would fix loose materials in place within a matrix of stable, inert material. Immobilization is a preferred treatment for a number of waste forms, such as ashes, resin fines, and substances contaminated with heavy metals.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project involves new construction assumed to be outside major facility areas. (See Figure C-1-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Tables C-4.4.3-1 (Phase I) and C-4.4.3-2 (Phase II). These tables are complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - This option would defer treatment of alpha-contaminated low-level waste. This option corresponds to Alternative A (No Action) evaluated in this EIS. This option would involve the continued storage of the waste.

Shipment Offsite - This option would provide for the transport and treatment of the waste at another DOE site and would require construction of a treatment facility at the offsite location. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Private Sector Treatment - A Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility (see Section C-4.4.1) would be designed and evaluated in parallel with the Idaho Waste Processing Facility. This option also corresponds with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. The Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility could treat the same waste streams and

Table C-4.4.3-1. Summary of potential environmental impacts of the Idaho Waste Processing Facility Phase I under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 20 acres of previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Construction: No information Operation: 20,000,000 liters/year water use Effluent: construction water	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record surveys; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	Radiological operational emissions 0.046% of NESHAP dose limit Toxic Air Pollutants (TAPs) 86% of significance level for combined TAPs 31% of significance level for lead 60% of significance level for mercury Prevention of Significant Deterioration (PSD) 34% 3-hr SO_2 - Class I, Craters of the Moon Wilderness Area Visibility: Control measures may be needed to avoid degraded visibility at Craters of the Moon Wilderness Area	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 4.6×10^{-3} mrem/yr (alpha) 2.3×10^{-9} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: Not operational Year 2010: 0.017 (alpha) person rem/yr 9×10^{-6} latent cancer fatalities/yr Nonradiological effects: Negligible impact expected.	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation[d]	Construction (onsite truck trips): Nonradiological - 47.6 Operation (onsite truck trips per year): Nonradiological - 8.7 Radiological - 340	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 1,750 Operation (m^3/yr): transuranic waste - 26 low-level waste - 20 mixed low-level waste - 19 industrial waste - 320	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 145 peak, 72 average subcontractor personnel Operation: 167 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. No offsite shipments are allocated to this project because the Transuranic Storage Area Enclosure and Storage Project was assumed to serve as the transfer point for offsite wastes.

Table C-4.4.3-2. Summary of potential environmental impacts of the Idaho Waste Processing Facility Phase II under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 20 acres of previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Construction: No information Operation: Water use 20,000,000 liters/year Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record survey; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	Radiological operational emissions 4.2% of NESHAP dose limit Toxic Air Pollutants (TAPs) parameter values 86% of significance level for combined TAPs 31% significance level for lead 60% significance level for mercury Prevention of Significant Deterioration (PSD) 34% 3-hr SO_2; Class I, Craters of the Moon Wilderness Area Visibility: Control measures may be needed to avoid degraded visibility at Craters of the Moon Wilderness Area	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 0.42 mrem/yr (transuranic) 2.1×10^{-7} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: Not operational Year 2010: 1.6 (transuranic) person-rem/yr 8.0×10^{-4} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation[d]	Construction (onsite truck trips): Nonradiological - 47.6 Operation (onsite truck trips per year): Nonradiological - 8.7 Radiological - 677	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 1,750 Operation (m^3/yr): transuranic waste - 31 low-level waste - 30 mixed low-level waste - 24 industrial waste - 320	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 55 peak, 28 average subcontractor personnel Operation: 167 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. No offsite shipments are allocated to this project because the Transuranic Storage Area Enclosure and Storage Project was assumed to serve as the transfer point for offsite wastes.

achieve the same treatment requirements as the Idaho Waste Processing Facility. The primary differences between the Idaho Waste Processing Facility and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be in how they would be funded and operated. The Idaho Waste Processing Facility would be DOE funded and contractor operated, while the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be privately owned and operated. Upon completion of preliminary designs and associated evaluations, a single facility would be chosen to process the wastes. The selection of the treatment facility is scheduled to occur in 1997.

Project Data Sheet

Rev. 11 January 11, '95

Section	Item	Value
General Info.	Description/function:	Idaho Waste Processing Facility (IWPF) (Phase I) (Alpha-MLLW)
	WAG	INEL
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	LLW MLLW Alpha-MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	3,200
	Other features: (Pits, ponds, power /water/sewer lines)	Support Facilities 2 mile road power, water, sewer
	Location:	(For analysis purposes only)
	Inside/outside of fence	Outside RWMC
	Inside/outside of bldg.	(2.5 miles east)
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$430 Mil. total
	Schedule Start /End: PreConst.	1994 - 2004
	Schedule Start /End: Const.	2004 - 2008
	No. of workers: (new/exist)	145 Peak, 72 Avg Subs
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.4.3-1
	Acres Disturbed: New	20
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	1,750
	Haz./Toxic Chemicals: Storage/inventory	No information

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	120 k Diesel, 25 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$40 Mil./yr
	Schedule Start /End:	2008 - TBD
	No. of workers: (new/exist)	167 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.4.3-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	No Liquids
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW TRU MLLW Ind.
	Quantity: (m3/yr)	20 26 19 320
	Haz./Toxic Chemicals: Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	20,000 k
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	771 k Propane, 2,119 k Fuel Oil
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

Project Data Sheet

Rev. 10 January 11, '95

Section	Item	Value
General Info.	Description/function:	Idaho Waste Processing Facility (IWPF) (Phase II) (TRU)
	WAG	INEL
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	TRU LLW MLLW Alpha-MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	2,000
	Other features: (Pits, ponds, power /water/sewer lines)	Support Facilities 2 mile road power, water, sewer
	Location:	(For analysis purposes only)
	Inside/outside of fence	Outside RWMC
	Inside/outside of bldg.	(2.5 miles east)
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$165 Mil. total
	Schedule Start /End: PreConst.	1994 - 2007
	Schedule Start /End: Const.	2007 - 2009
	No. of workers: (new/exist)	55 Peak, 28 Avg Subs
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.4.3-2
	Acres Disturbed: New	20
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	1,750
	Haz./Toxic Chemicals: Storage/inventory	No information

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	50 k Diesel, 10 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$40 Mil./yr
	Schedule Start /End:	2009 - TBD
	No. of workers: (new/exist)	167 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.4.3-2
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	No Liquids
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW TRU MLLW Ind.
	Quantity: (m3/yr)	30 31 24 320
	Haz./Toxic Chemicals: Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	20,000 k
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	771 k Propane, 2,119 kr Fuel Oil
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.4.4 SHIPPING/TRANSFER STATION

PROJECT NAME: Shipping/Transfer Station

GENERAL PROJECT OBJECTIVE: The general objective of the proposed INEL Shipping/Transfer Station Project would be to provide a centralized facility to accept waste directly from storage or from other INEL facilities for transport offsite to other DOE sites [EIS Alternative C (Minimum Treatment, Storage, and Disposal)]. The waste types would include alpha-contaminated low-level waste that would be handled the same as the transuranic wastes, low-level waste, and mixed low-level waste. The entire INEL inventory of alpha-contaminated low-level waste is presently stored at the Radioactive Waste Management Complex. This waste needs to be retrieved, inspected, and prepared for transportation before the waste can leave the Radioactive Waste Management Complex boundary. Low-level waste and mixed low-level waste are being generated at many sites throughout the INEL.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a Shipping/Transfer Station. All alpha-contaminated low-level wastes, low-level waste, and mixed low-level waste would be transported from this facility to treatment, storage, and disposal facilities under Alternative C (Minimum Treatment, Storage, and Disposal). In addition, an expansion of the existing Stored Waste Examination Pilot Plant facility located at the Radioactive Waste Management Complex would be required to identify alpha-contaminated low-level wastes for transport.

The new Shipping/Transfer Station would be designed to receive and transport all INEL alpha-contaminated low-level wastes, low-level waste, and mixed low-level waste. Waste would be received directly from storage, other INEL facilities, or the Stored Waste Examination Pilot Plant after completing characterization. The waste would be loaded for transport offsite. The capability of loading and unloading approximately 6 to 8 semitrailer trucks (680 drum equivalents per day total) each working day would be required. The new building would have four enclosed loading/unloading bays, each about one-half the size of the Stored Waste Examination Pilot Plant bay, and office and utility spaces. The new facility would be a pre-engineered metal structure with a total floor area of 2,800 square meters (3,300 square yards).

Under this project the Stored Waste Examination Pilot Plant building would be expanded (approximately three times) or a new, enlarged building of a similar type would be constructed. The expanded Stored Waste Examination Pilot Plant facility is needed to inspect waste packages (including boxes) to identify whether the waste is transuranic waste or alpha-contaminated low-level waste. The expanded Stored Waste Examination Pilot Plant facility would examine waste boxes that are not able to be examined in the existing Stored Waste Examination Pilot Plant facility. The building would be separated into three general areas: a two-story office and utility area, including a control room that overlooks the other two areas; an enclosed examination and testing area; and a large enclosed bay for transferring waste to and from the Shipping/Transfer Station. There would be three cranes in the building: a 5-ton bridge crane, a 3-ton gantry crane, and a 1-ton monorail crane.

The shipping facility would be located at the Radioactive Waste Management Complex (centralized shipping facility) where approximately 60 percent of the waste to be transported originates. The remaining 40 percent of the waste would be accumulated in existing storage facilities until subsequent transfer to the Shipping/Transfer Station and final shipment to the offsite treatment, storage, and disposal facility. The expanded Stored Waste Examination Pilot Plant facility would be located at the Radioactive Waste Management Complex since characterization of alpha-contaminated low-level waste is required before transportation activities.

A similar project is considered (for transport of waste to the private sector) as part of modifications to the Radioactive Waste Management Complex to support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste (see Section C-4.4.2).

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative C (Minimum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Radioactive Waste Management Complex), possibly integral to an existing facility. (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.4.4-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the Shipping/Transfer Station would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Direct Shipment of Low-Level Waste and Mixed Low-Level Waste - This option locates the shipping facility (for alpha-contaminated low-level wastes only) at the Radioactive Waste Management Complex and requires the existing sites to store and transport low-level waste and mixed low-level waste from the existing facilities (distributed shipping facilities). The expanded Stored Waste Examination Pilot Plant facility would be located at the Radioactive Waste Management Complex since this process is required before transportation activities. This option is bounded by the analysis in this EIS.

Table C-4.4.4-1. Summary of potential environmental impacts of the Shipping/Transfer Station Project under Alternative C.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 5 acres of previously undisturbed soil; no conflict with existing land use policies	Project would be within major facility area
Water resources	Construction: 3,200,000 liters Operation: 2,000,000 liters/year Effluents: 10,000,000 liters construction water	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record survey; mitigate according to applicable requirements (C-3.3.4)
Air resources	<u>Radiological operational emissions</u> No information <u>Toxic Air Pollutants (TAPs)</u> None <u>Prevention of Significant Deterioration (PSD)</u> None	Depends on expected emissions; may include enclosures, filtration, stabilization
Human health	<u>Radiation exposures and cancer risk</u> No information <u>Nonradiological effects</u> No information	Access control, facility design, safety analysis, inspection and surveillance, annual reporting
Transportation[d]	Construction (onsite truck trips): Nonradiological - 5.4 Operation (truck trips per year): Nonradiological - 2.7 onsite Radiological - 2.9 onsite; 1,459 offsite	Use of approved transport vehicles and containers, licensed casks, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 200 Operation (m^3/yr): low-level waste - 50 mixed low-level waste - 50 industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 25 workers average/50 peak subcontractor personnel Operation: 12 existing, 10 new workers	None required

a. Definition of acronyms: none.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.
d. All transportation of low-level and mixed low-level waste from the INEL under Alternative C (Minimum Treatment, Processing, and Disposal) are allocated to this project.

Project Data Sheet

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General Info.	Description/function:	Shipping / Transfer Station
	WAG	5
	EIS Alter. (A, B, C or D):	C
	SNF or Waste stream:	TRU (Alpha-LLW), LLW, MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	2,800
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	
	Inside/outside of fence	Inside RWMC
	Inside/outside of bldg.	Outside
Construction Info.	Cost($): PreConst.	$5 Mil.
	Cost($): Const.	$30 Mil.
	Schedule Start /End: PreConst.	1996 - 2002
	Schedule Start /End: Const.	2002 - 2004
	No. of workers: (new/exist)	50 Peak, 25 Avg. Subs.
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.4.4-1
	Acres Disturbed: New	5
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction Water
	Quantity: (liters)	10,000 k
	Solid wastes:	
	Type:	Ind.
	Quantity: (m3)	200
	Haz./Toxic Chemicals:	
	Storage/inventory	2,000 liters

Const.	Cultural resource effects:	None identified		
	Pits/ponding created: (m2)	None		
	Water usage: (liters)	3,200 k		
	Energy requirements:			
	Electrical: (MWH/yr)	4,000		
	Fossil fuel: (liters)	85 k Diesel, 17 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		
Operational Information	Cost($): Operation:	$2.0 Mil/yr		
	Schedule Start /End:	2004 - 2030		
	No. of workers: (new/exist)	12 Existing, 10 new		
	Heavy Equip. Equip. used:	See Table		
	Trips:	C-4.4.4-1		
	Air Emissions: (None / Ref.)	None		
	Effluents: Type: Quantity: (liters/yr)	No information		
	Solid wastes:			
	Type:	LLW	MLLW	Ind.
	Quantity: (m3/yr)	50	50	100
	Haz./Toxic Chemicals:			
	Storage/inventory	200 liters		
	Pits/ponds used: Y/N (m2)	No		
	Water usage: (liters/yr)	2,000 k		
	Energy requirements:			
	Electrical: (MWH/yr)	4,000		
	Fossil fuel: (liters/yr)	150 k Diesel, 30 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		

C-4.5 PROJECTS RELATED TO LOW-LEVEL WASTE

C-4.5.1 WASTE EXPERIMENTAL REDUCTION FACILITY INCINERATION

PROJECT NAME: Waste Experimental Reduction Facility Incineration

PURPOSE AND NEED FOR ACTION: The general objective of this proposed project is to provide volume reduction of low-level waste and treatment of mixed low-level waste to render it nonhazardous, or to meet land disposal restriction regulations.

The purpose of the proposed DOE action is to provide Resource Conservation and Recovery Act-compliant treatment capability for DOE mixed low-level waste and to reduce the volume of low-level waste before disposal. The action would reduce the volume and toxicity of mixed low-level waste and comply with Resource Conservation and Recovery Act regulations (40 CFR Part 268) and Idaho Hazardous Waste Management Act requirements. In addition, the action would support continued compliance with the following DOE Order 5820.2A (DOE 1988) requirement: "Waste treatment techniques such as incineration, shredding, compaction, and solidification or other Resource Conservation and Recovery Act-approved treatments to reduce volume and provide more stable waste forms shall be implemented as necessary to meet disposal facility performance requirements." The proposed action would also aid DOE in fulfilling its responsibility for providing long-term management of mixed low-level waste and low-level waste using methods that are technically and environmentally sound.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

Disposal of mixed low-level waste is constrained because of a shortage of treatment facilities and disposal sites. To dispose of mixed low-level waste in accordance with Resource Conservation and

Recovery Act land disposal restrictions, the hazardous constituents must be treated unless the disposal site(s) can demonstrate to U. S. Environmental Protection Agency that migration of hazardous constituents in the untreated waste will not occur. No site has been approved for disposal of mixed low-level waste without treatment. Certain types of mixed low-level waste must be incinerated to comply with the U. S. Environmental Protection Agency's technology-based treatment standards (40 CFR Part 268). Incineration is the technology-based treatment standard for most of the mixed low-level waste at the INEL.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES: The proposed action is to perform incineration of low-level and mixed low-level waste at the Waste Experimental Reduction Facility. Under the no action alternative, incineration of waste would not be performed at the Waste Experimental Reduction Facility. Two onsite alternatives were considered: (a) treat mixed low-level waste by methods other than incineration, and (b) construct and operate a new mixed low-level waste incinerator at the INEL. The offsite alternative involves treating low-level and mixed low-level waste at another DOE incinerator.

Proposed action: This project would provide low-level waste and mixed low-level waste incineration at the Waste Experimental Reduction Facility. It will also modify the existing organic liquid waste injection system to (a) provide the capability to incinerate either organic or aqueous waste through direct injection into the Waste Experimental Reduction Facility incinerator and (b) provide a location for liquid waste sampling, blending, and repackaging operations.

The Waste Experimental Reduction Facility is an existing Resource Conservation and Recovery Act interim status facility. The organic liquid waste injection system at the Waste Experimental Reduction Facility is being modified as part of the Resource Conservation and Recovery Act Part B permitting process. Compaction and sizing of low-level waste is an ongoing activity at the Waste Experimental Reduction Facility. An environmental assessment for these operations has been prepared (DOE/EA-0843) (DOE 1994b).

The incinerator is a dual-chambered, controlled-air, combustion unit with a maximum rated combustion capacity of 5.5 million Btu per hour. The incinerator system consists of the following:

- A solid waste feed system that automatically conveys the solid waste containers of low-level waste, hazardous waste, and mixed low-level waste

- A liquid waste feed system and a burner assembly for incinerating waste in the primary (lower) chamber

- Automatic waste feed cutoff systems for both solid and liquid wastes

- A primary (lower) chamber, where liquid and solid wastes are introduced and where combustion takes place at starved air conditions for solid waste and excess air conditions for liquid wastes

- A secondary (upper) chamber that acts as an afterburner for the unburned volatile gases from the wastes in the primary chamber, resulting in very little incomplete combustion product emissions

- A combination of two dilution air streams and a shell-and-tube heat exchanger for cooling combustion gas before it reaches the air pollution control equipment

- An air pollution control system using baghouse and high-efficiency particulate air filters

- A bottom-ash removal system to remove ash through a cooling hopper located in the rear of the lower chamber.

Solid wastes would be charged from a conveyor system. The wastes would be packed in cardboard boxes up to 2 by 2 by 2 feet. Boxes typically contain clothing, rags, plastics, and other combustible materials.

Liquid wastes would be fed to the incinerator through above-ground piping that is connected to drums located in the liquid waste feed shelter. The injection nozzle is designed to provide high-efficiency combustion by atomizing the liquid waste into fine droplets.

Liquid wastes would be repackaged in boxes before incineration, as appropriate. This would typically be done for wastes that cannot be fed through the liquid feed system. The in-box method of liquid waste incineration would consist of placing liquids in an approved absorbent and then processing them as solid waste.

To provide a greater capability for processing not only hazardous and mixed organic liquid waste, but also aqueous wastes, modifications to the existing organic liquid injection system would be required. These modifications would include (a) a dedicated ventilation system with redundant blowers exhausting to the Waste Experimental Reduction Facility north stack; (b) the capability to process flammable liquids (as defined in 29 CFR 1910.106); (c) the capability to sample, blend, and/or repackage liquid wastes in support of waste management/processing activities; (d) the capability to inject up to 30 gallons per hour of aqueous wastes as a finely atomized stream into the lower chamber of the Waste Experimental Reduction Facility incinerator; and (e) the capability to install blend and hold tanks.

The automatic waste feed cutoff system would prevent the feeding of waste into the incinerator primary chamber when key incineration conditions fall outside the predetermined range. The system would automatically lock out operation of the solid feed system and close valves in the liquid feed system until proper operating conditions are restored. All automatic waste feed cutoff parameters would be set up to cause solid and liquid waste feed to be interrupted. Additionally, parameters that require an immediate reduction in heat and/or offgas generation could be set up to also interrupt auxiliary burner operation. The parameters chosen for the automatic waste feed cutoff system are those listed as "Group A" in the U.S. Environmental Protection Agency's Hazardous Waste Incinerator Guidance. The operating limits for the automatic waste feed cutoff system (parameter set points) would be determined from conditions demonstrated in the trial burn.

Waste Experimental Reduction Facility operations were suspended in February 1991 to upgrade safety documentation, operating procedures, and management systems. The documentation is being revised to reflect actual Waste Experimental Reduction Facility configurations and to comply with recently issued DOE orders. The documentation and facility operational readiness would be evaluated and approved by DOE and contractor oversight teams before waste reduction operations are resumed.

DOE needs to treat mixed low-level waste to comply with Resource Conservation and Recovery Act requirements for storage and disposal, and to provide support for ongoing DOE activities that generate mixed low-level waste. The INEL generates and, under all alternatives, is expected to continue generating low-level waste and mixed low-level waste during energy, defense, and environmental restoration missions. In 1982, the Waste Experimental Reduction Facility was established to develop and demonstrate low-level waste volume reduction and stabilization processes. The Waste Experimental Reduction Facility began low-level waste incineration in 1984. Most of the waste processed at the Waste Experimental Reduction Facility has been low-level waste; however, a trial burn was conducted in 1986 for mixed low-level waste, demonstrating the Waste Experimental Reduction Facility's ability to meet Resource Conservation and Recovery Act incineration requirements, and eight pilot mixed low-level waste incineration campaigns were performed during 1989 and 1990. No incineration is currently being done. The facility has all required permits and is not expected to be evaluated under the EPA's new "combustion strategy." Incineration at the Waste Experimental Reduction Facility has been deferred pending the Record of Decision for this EIS. Low-level waste volume reduction activities are ongoing and are part of Alternative A (No Action).

Mixed low-level waste is generated at Test Area North, Test Reactor Area, Idaho Chemical Processing Plant, Central Facilities Area, Power Burst Facility, Radioactive Waste Management Complex, Naval Reactors Facility, Argonne National Laboratory-West, and the Idaho Falls Facilities. Sources include environmental restoration, production operations, laboratory activities, construction, maintenance, and research and development activities. The wastes consist of paint stripper and paint chips, protective clothing, rags, absorbent, filters, solvents, oils, sludges, and laboratory wastes. The hazardous constituents consist of Resource Conservation and Recovery Act characteristic materials and listed materials, including organics, inorganics, and metals.

Mixed low-level waste is currently stored at various INEL facilities. The current inventory includes 110 cubic meters (130 cubic yards) of incinerable mixed low-level waste. Based on Land Disposal Restriction requirements, this waste may be stored solely for the purpose of accumulating quantities sufficient to facilitate treatment. Currently, the Waste Experimental Reduction Facility is the only operable DOE facility capable of incinerating INEL mixed low-level waste; commercial incineration of INEL mixed low-level waste is not available. Future INEL activities are expected to generate approximately 1,500 cubic meters (1950 cubic yards) of incinerable mixed low-level waste each year. Existing permitted storage capacity is 1,800 cubic meters (2,300 cubic yards). Treatment capacities must be available for this newly generated mixed low-level waste.

The proposed action would involve incinerating mixed low-level waste at the Waste Experimental Reduction Facility incinerator beginning in 1996. With the incinerator operational treatment capacity of 1,700 cubic meters per year (2,200 cubic yards per year), the INEL permitted storage capacity for incinerable mixed low-level waste would not be exceeded through the year 2005 (Figure C-4.5.1-1).

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

Project-Specific Alternatives: The alternatives to the proposed action are described in the following sections

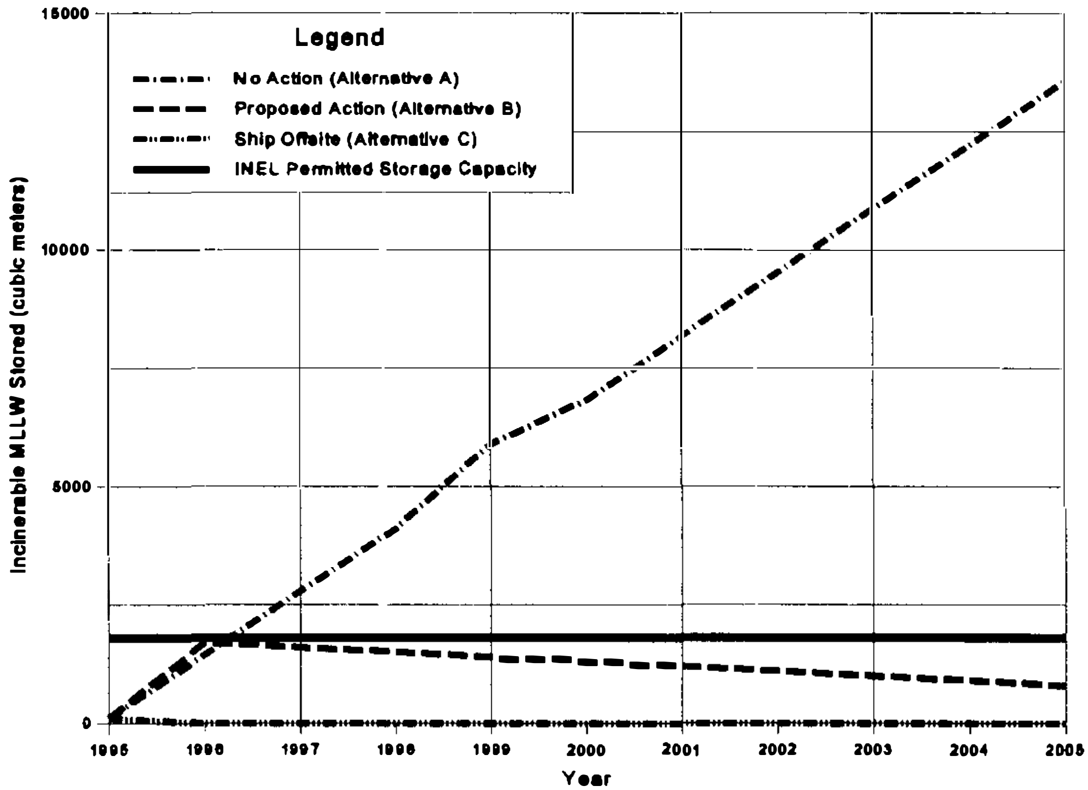

Figure C-4.5.1-1. Incinerable mixed low-level waste volumes stored at the Idaho National Engineering Laboratory under the proposed alternatives.

No Action - The no action alternative would be to continue storing INEL mixed low-level waste at INEL and process incinerable low-level waste at a commercial facility. Incineration of low-level waste and mixed low-level waste would not be performed at the Waste Experimental Reduction Facility. Therefore, existing and future generated INEL mixed low-level waste and small quantities (less than 5 cubic meters) of offsite-generated mixed low-level waste would require continued storage. Through 1994, approximately 110 cubic meters (140 cubic yards) of incinerable mixed low-level waste would be stored at the INEL. Based on projected generation rates, the INEL would exceed mixed low-level waste storage capacity by 1996. By the year 2005, approximately 12,000 cubic meters (15,700 cubic yards) of incinerable mixed low-level waste would be stored in noncompliance with the Resource Conservation and Recovery Act under the no action alternative (Figure C-4.5.1-1).

Treat Incinerable Mixed Low-Level Waste by Methods Other than Incineration - The treatment standards for most mixed low-level waste that have been established by the U.S. Environmental Protection Agency are based upon the demonstrated capabilities of incineration. Incineration is the technology-based treatment standard for most of the mixed low-level waste on the INEL. Few other technologies have been demonstrated that meet the standards. Therefore, the application of other technologies (that is, stabilization and biological or chemical treatments) would require a period of time (assumed to be beyond the year 2005) for testing, demonstration, and implementation on a production scale. The incinerable mixed low-level waste volumes requiring storage would be similar to Alternative A (Figure C-4.5.1-1). The proposed action and impacts for treatment of nonincinerable mixed low-level waste are described in Appendix C (Section C.4.6.4).

Construct and Operate a New Mixed Low-Level Waste Incinerator - This alternative would involve constructing a new incinerator to provide production-scale treatment of INEL mixed low-level waste. The incinerator would treat characteristic and listed hazardous constituents in mixed low-level waste. Mixed low-level waste would continue to be stored until the incinerator is operational, and thereafter, mixed low-level waste would be stored for a short time until sufficient quantities were accumulated for incineration. Long-term storage of mixed low-level waste would not be necessary after the incinerator became operational. The incinerator would require an approved Resource Conservation and Recovery Act Part B Permit, including a trial burn, before mixed low-level waste treatment operations commence. Construction of a new incinerator was included as part of Alternative D (Maximum Treatment, Storage, and Disposal). The proposed action and impacts of the new mixed low-level waste incinerator are described in Appendix C (Section C.4.5.3). However, the new facility is not planned to begin treating mixed low-level waste until after the year 2005. Therefore, if the Waste Experimental Reduction Facility is not operated, the incinerable mixed low-level waste volumes requiring storage would be similar to Alternative A (Figure C-4.5.1-1). Under Alternative D (Maximum Treatment, Storage, and Disposal), where additional mixed low-level waste would be generated, a new facility is proposed and the Waste Experimental Reduction Facility incinerator would be operated in the interim. Additional mixed low-level waste storage similar to the transuranic storage modules (Appendix C, Section C-2.8) may be needed on an interim basis under Alternative D, pending completion of the new facilities.

Treat Mixed Low-Level Waste and Low-Level Waste at Another DOE Incinerator - In addition to the Waste Experimental Reduction Facility, DOE has several existing or planned radioactive waste incinerators at defense program sites throughout the U.S. that could potentially be used for processing some wastes proposed for the Waste Experimental Reduction Facility. Incinerators are located at the Rocky Flats Plant in Colorado, Los Alamos National Laboratory in New Mexico, and Oak Ridge Reservation in Tennessee. Currently, the Waste Experimental Reduction Facility incinerator at the INEL and the Toxic Substance Control Act incinerator at the Oak Ridge Reservation K-25 site are the only operable incinerators in the DOE system capable of treating many forms of mixed low-level waste. The Rocky Flats Plant and Los Alamos National Laboratory incinerators are not presently operating. The Oak Ridge Reservation incinerator is not suitable for beta/gamma-contaminated wastes and is scheduled to operate at or near capacity for onsite wastes. DOE has also prepared an Environmental Assessment and issued a Finding of No Significance Impact for the Consolidated Incineration Facility, a proposed hazardous and mixed waste incinerator at the Savannah River Site. However, DOE will not operate the Consolidated Incineration Facility unless and until decisions on its future mission are made based on the Savannah River Site Specific Waste Management EIS. The designated missions and Resource Conservation and Recovery Act permits for other DOE incinerators generally prohibit receiving and treating INEL-generated wastes. This alternative to the proposed action is included as part of Alternative C (Minimum Treatment, Storage, and Disposal at INEL) in this EIS. The volumes of mixed low-level waste stored at the INEL under this option would be negligible as shown on Figure C-4.5.1-1.

DESCRIPTION OF THE AFFECTED ENVIRONMENT: The proposed action would be located in an existing facility within a major facility area, the Power Burst Facility/Auxiliary Reactor Area at the INEL (Figure C-1-1). Other information regarding the affected environment of the Power Burst

Facility/Auxiliary Reactor Area, INEL site, and surrounding area is covered by other sections of this EIS, as summarized and referenced in Section C-3.1.

ENVIRONMENTAL EFFECTS: The potential environmental effects associated with the proposed project other than those identified below are summarized in Table C-4.5.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4. Impacts from alternatives to the proposed action are summarized in Table C-4.5.1-2.

Atmospheric Emissions During Operations - Projected air emissions from the Waste Experimental Reduction Facility would result in air pollutant loading of both radiological and nonradiological emissions. The projected dose to the maximally exposed individual due to Waste Experimental Reduction Facility emissions is less than 0.01 mrem per year, below the applicable National Emission Standards for Hazardous Air Pollutants limit of 10 mrem per year. Nonradiological pollutant levels are below standards in all cases. A detailed listing (based on historical emissions) of the nonradiological criteria pollutant and toxic air pollutant constituents analyzed and the resulting air concentrations is provided in Appendix F, Section F-3.4, of this EIS.

Transportation Impacts - The potential impacts of the proposed low-level waste shipments to and from the Waste Experimental Reduction Facility would be extremely small. The maximum cumulative radiological health risk to transportation workers from incident-free waste transport over the 20-year campaign is estimated to be 0.09 deaths. The maximum radiological and nonradiological health risk to the public from incident-free waste transport over 20 years is estimated to be 0.82 deaths. Up to 0.77 deaths may also occur from transportation accidents. The analysis is considered conservative; actual effects would likely be less.

Because these shipments would involve very small quantities of mixed low-level waste, it is assumed that radiological impacts from transporting mixed low-level waste would be bounded by radiological impacts from transporting low-level waste. Transportation impacts from the hazardous (nonradioactive) component of mixed low-level waste would result only if an accident involving a spill were to occur. About 0.02 accidents per year, or one accident in 50 years, would be expected

Table C-4.5.1-1. Summary of potential environmental impacts of the Waste Experimental Reduction Facility Incineration Project under Alternative B.

Environmental attribute	Potential impact	Potential mitigative measures
Geology and soil, acres disturbed	None (no disturbed soil)	Project would be in an existing facility
Water resources	Operation: water use 600,000 liters/year Effluent: None	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Project would be in an existing facility
Historic, archaeological, or cultural resources	None	Project would be in an existing facility
Air resources	<u>Radiological operational emissions</u> 0.3% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> 46% of significance level for combined TAPs <u>Prevention of Significant Deterioration (PSD)</u> 1.5 % of 24-hr SO_2 - Class II, public highway <u>Visibility</u>: Control measures may be needed to avoid degraded visibility at Craters of the Moon Wilderness Area	Primary mitigation measure would be control of the content of waste feed through Waste Acceptance Criteria. Engineered Atmospheric Protection System consisting of offgas cooling, baghouse filters, and HEPA filters. On-line offgas monitoring instrumentation for radiological emissions. RCRA permitting and annual reporting requirements
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 0.029 mrem/yr 1.4×10^{-7} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 0.21 person-rem/yr 1.1×10^{-4} latent cancer fatalities/yr Year 2010: 0.23 person-rem/yr 1.2×10^{-4} latent cancer fatalities/yr <u>Nonradiological Effects</u> Negligible impact on human health expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 0.3 Operation (onsite truck trips per year): Nonradiological - 2.7 Radiological - 97.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 10 Operation (m^3/yr): low-level waste - 15 mixed low-level waste - 15 industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: Not applicable Operation: No additional workers	None required

a. Definition of acronyms: HEPA - high-efficiency particulate air; NESHAP - National Emission Standards for Hazardous Air Pollutants; RCRA - Resource Conservation Recovery Act.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Table C-4.5.1-2. Impacts of the project-specific options.[a]

Impact	Option 1 Continue to store INEL-generated mixed low-level waste	Option 2 Treat mixed low-level waste by methods other than incineration	Option 3 Construct and operate a new mixed low-level waste incinerator	Option 4 Treat mixed low-level waste at another DOE incinerator
Environmental compliance	Existing and future generated INEL mixed low-level waste would require continued storage	Treatments other than incineration may not meet RCRA standards for mixed low-level waste. During the U.S. Environmental Protection Agency approval process, INEL-generated mixed low-level waste would require continued storage	Refer to Section C-4-5.3 in this appendix for a project-specific description of impacts	Compliance would be similar to incineration at Waste Experimental Reduction Facility if other DOE incinerators were licensed to treat INEL mixed low-level waste
Socioeconomic conditions	Small work force needed to operate mixed low-level waste storage facilities	Similar work force to incineration.		Small workforce needed to operate mixed low-level waste storage facilities
Land use,	Possible increase for storage of mixed low-level waste awaiting treatment	Possible increase for storage of mixed low-level waste awaiting treatment		No change
Health effects	Near-term risks would be less than for incineration; long-term risks would be higher than for incineration	Near-term risks would be less than for incineration. Due to the possibility of reclaiming waste, long-term risks would be higher than for incineration		Processing risks would be similar to incineration. Mixed low-level waste transportation risks would increase
Wildlife and habitat	Possible expanded mixed low-level waste storage in previously disturbed areas	Possible expanded mixed low-level waste storage in previously disturbed areas		None
Archaeological and historical sites	Possible impacts due to expanded mixed low-level waste storage	Possible impacts due to expanded mixed low-level waste storage		None
Accidents and occupational risks	Mixed low-level waste near-term risk is less than for incineration; long-term risk is greater due to extended storage	Mixed low-level waste near-term risk is less than for incineration; long-term risk is greater due to extended storage		Processing risks would be similar to incineration at Waste Experimental Reduction Facility. Mixed low-level waste transportation risks would increase

a. With respect to Waste Experimental Reduction Facility incineration, any discussion of mixed low-level waste in this table encompasses low-level waste except where the Resource Conservation and Recovery Act is involved.

involving mixed low-level waste shipments to the INEL. This low frequency, along with the very low quantities, makes the likelihood of injuries from hazardous material releases in an accident very low.

Impact of Accidents - DOE considered a range of reasonably foreseeable accidents at the Waste Experimental Reduction Facility, including earthquakes, an ash spill, a compactor fire, and a baghouse high-efficiency particulate air filter fire (DOE/EA-0843) (DOE 1994b). The maximum reasonably foreseeable accident associated with Waste Experimental Reduction Facility operations would be an earthquake near the end of an incineration campaign. The probability of occurrence is estimated to be 8.5×10^{-5}. Based on conservative estimates, a nearby worker would receive a dose of 1.3 rem, and doses to the public would be 2.7 mrem. No health effects are expected to anyone onsite or offsite resulting from radiation doses. Concentrations of metals would be less than levels that would be immediately dangerous to life and health. Workers would be expected to exit the area before exposure levels above occupational limits would be reached. No health effects would result to other individuals onsite or offsite. The Waste Experimental Reduction Facility mixed low-level waste incineration campaigns have treated approximately 26 cubic meters of flyash from previous campaigns, 11 cubic meters of waste from the Mixed Waste Storage Facility, and 28 cubic meters of classified waste from offsite. These campaigns were conducted efficiently and there were no unusual events or system upsets.

Cumulative Impacts - The cumulative impacts of the proposed Waste Experimental Reduction Facility incineration project and other existing and proposed actions are described in Section 5.15 of the Final EIS. Considering reasonably foreseeable actions for each alternative, less than one fatal cancer would result from radiation dose or toxic chemical exposure received by the population within 50 miles (80 km) of the INEL site from 1995 to 2005.

Decontamination and Decommissioning and Resource Conservation and Recovery Act Closure - The Waste Experimental Reduction Facility incinerator facility would eventually require decontamination and decommissioning and Resource Conservation and Recovery Act closure. The decontamination and decommissioning and Resource Conservation and Recovery Act closure would be covered under separate National Environmental Policy Act (NEPA) review.

REQUIRED PERMITS, APPROVALS, AND CONSULTATIONS

The Waste Experimental Reduction Facility incinerator is a Resource Conservation and Recovery Act interim status unit (40 CFR 265). A Resource Conservation and Recovery Act Part B application was submitted to the State of Idaho in October 1992 (DOE-ID 1992). The Idaho Department of Health and Welfare Rules and Regulations for the Control of Air Pollution in Idaho require owners or operators of stationary air pollution sources to obtain a permit to construct and/or a permit to operate. An application for Waste Experimental Reduction Facility was submitted June 1993 (Grey et al. 1993). Approval from the U.S. Environmental Protection Agency under the National Emission Standards for Hazardous Air Pollutants (NESHAP) is also required for the Waste Experimental Reduction Facility incinerator. The risk assessment in the Resource Conservation and Recovery Act Part B Permit Application was based on adjusted Tier 1 methodology.

Consultations with Federal and state agencies have been initiated by the U.S. Department of Energy pursuant to the preparation of this EIS. Letters regarding consultation under the Endangered Species Act and National Historic Preservation Act have been received (see Appendix B, Consultation Letters). In addition, in early 1993, review by the State of Idaho and the Shoshone-Bannock Tribes was performed on the initial Waste Experimental Reduction Facility environmental assessment (DOE/EA-0843) (DOE 1994b). These comments have been considered in the preparation of this project summary.

Project Data Sheet

Rev. 9 January 5, '95

Section	Item	Value
General Info.	Description/function:	WERF Incineration
	WAG	5
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	LLW MLLW
	Action type:	Expand, Operations
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Incinerator upgrades
	Location:	
	Inside/outside of fence	Inside PBF
	Inside/outside of bldg.	Inside PBF-609
Construction Info.	Cost($): PreConst.	$100 k
	Cost($): Const.	$500 k
	Schedule Start /End: PreConst.	1995 - 1996
	Schedule Start /End: Const.	1996 - 1997
	No. of workers: (new/exist)	N/A
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.5.1-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	None
	Effluents: Type:	None
	Quantity: (liters)	
	Solid wastes: Type:	Ind.
	Quantity: (m3)	10
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value		
Const.	Cultural resource effects:	None		
	Pits/ponding created: (m2)	No		
	Water usage: (liters)	0		
	Energy requirements:			
	Electrical: (MWH/yr)	0		
	Fossil fuel: (liters)	0		
	Nightlights used: Y/N	No		
	Generators: Night Y/N	No		
	Day Y/N	No		
Operational Information	Cost($): Operation:	$9 Mil./yr		
	Schedule Start /End:	1996 - 2015		
	No. of workers: (new/exist)	60 Existing		
	Heavy Equip. Equip. used:	See Table		
	Trips:	C-4.5.1-1		
	Air Emissions: (None / Ref.)	See Appendix F, Section 3		
	Effluents: Type:	No Liquids		
	Quantity: (liters/yr)			
	Solid wastes: Type:	LLW	MLLW	Ind.
	Quantity: (m3/yr)	15	15	100
	Haz./Toxic Chemicals: Storage/inventory	None		
	Pits/ponds used: Y/N (m2)	No		
	Water usage: (liters/yr)	600 k		
	Energy requirements:			
	Electrical: (MWH/yr)	3,600		
	Fossil fuel: (liters/yr)	750 k Diesel		
	Nightlights used: Y/N	No		
	Generators: Night Y/N	No		
	Day Y/N	250 KW - 30 Min/wk		

C-4.5.2 IDAHO WASTE PROCESSING FACILITY

See description in Section C-4.4.3.

C-4.5.3 MIXED/LOW-LEVEL WASTE TREATMENT FACILITY

PROJECT NAME: Mixed/Low-Level Waste Treatment Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide for the design, construction, and operation of a new facility to treat low-level wastes and mixed low-level waste (Resource Conservation and Recovery Act wastes mixed with low-level beta-gamma wastes). The waste would be treated before disposal at the Radioactive Waste Management Complex or other facility. This project is proposed under Alternative D (Maximum Treatment, Storage, and Disposal).

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: The Mixed/Low-Level Waste Treatment Facility would provide a permitted treatment facility that would treat both mixed low-level waste and low-level waste at the INEL.

Mixed low-level waste has both a radioactive constituent and a Resource Conservation Recovery Act hazardous constituent. This waste is generated during operations at the INEL and is being stored for treatment. Under Alternative D (Maximum Treatment, Storage, and Disposal), mixed low-level waste would be received from other DOE sites. Mixed wastes are required to be treated before disposal in accordance with U.S. Environmental Protection Agency Land Disposal Restrictions regulations. U.S. Environmental Protection Agency regulations prohibit storage of Land Disposal Restrictions waste unless the storage is for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the needed treatment capacity would exceed currently planned low-level waste and mixed low-level waste treatment facilities without the addition of the Mixed/Low-Level Waste Treatment Facility.

The Mixed/Low-Level Waste Treatment Facility would include several processes to treat low-level waste and mixed low-level waste, including incineration, thermal desorption, stabilization, decontamination, macroencapsulation, chemical precipitation, neutralization, and amalgamation.

- *Incineration:* A process that consumes combustible waste materials. It can destroy toxic and biological components and minimize organic content in the noncombustible residue and ash. Incineration can greatly reduce the mass and volume of waste. This is the proposed treatment for many organic solvents, aqueous solutions, material contaminated with organic constituents, and combustible debris.

- *Thermal Desorption:* A process that consists of heating the feed material in the first (primary) chamber of a two-chamber device. Water and volatile (usually organic) compounds are vaporized in the primary chamber and flow to the secondary chamber where the volatiles are combusted. The feed usually consists of inert material like soil, contaminated with aqueous or volatile substances. This is the proposed treatment for mixed low-level waste debris (parts of pipes, glass, bricks, pieces of concrete, soil) contaminated with toxic organic material.

- *Stabilization:* A process where waste is converted to a more stable or environmentally safe configuration. This can include chemical reaction, to transform the waste to a less chemically active form; solidification, to make a liquid into a solid; and immobilization, which takes loose material and fixes it in place within a matrix of inert material. This is the proposed treatment for ash, resin fines, and substances contaminated with heavy metals not amenable to other treatments.

- *Decontamination:* A process that removes radioactive, toxic, or organic substances from the surfaces of structures, parts, components, or debris. Waste stream decontamination generally deals with debris and rubble composed of metal, plastics, concrete, rubber, glass, or ceramic material.

- *Macroencapsulation:* A process where a waste piece or agglomerate is isolated by enclosure in another substance such as a polyethylene epoxy. This is the proposed treatment for lead, cadmium solids, and debris that cannot be decontaminated.

- *Chemical Precipitation*: A process where a soluble substance is converted to an insoluble form by a chemical reaction or by changes in the solvent. The precipitated solids are removed. This process is applied to the removal of toxic metals from aqueous wastes. Such metals include mercury, lead, arsenic, and cadmium.

- *Neutralization:* A process where corrosive wastes, both acidic and caustic, are chemically deactivated to meet pH standards.

- *Amalgamation:* A process where a base metal such as zinc or copper is blended with liquid elemental mercury to form a solid alloy. Amalgamation is the specified treatment for liquid mercury containing waste.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project might be located at an existing site or at a previously undisturbed site. For planning purposes, a typical location was assumed about 2.5 miles east of the Radioactive Waste Management Complex, thus would involve new construction assumed to be outside major facility areas. (See Figure C-1-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.5.3-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

Table C-4.5.3-1. Summary of potential environmental impacts of the Mixed/Low-Level Waste Treatment Facility Project under Alternative D.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 200 acres previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Construction: 20,000,000 liters Operation: 4,600,000 liters/year Effluent: 20,000,000 liters construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record survey; mitigate according to the applicable requirements (Section C-3.3.4)
Air resources	Radiological operational emissions 1.0% of NESHAP dose limit Toxic Air Pollutants (TAPs) 0.3% of significance level for combined TAPs Prevention of Significant Deterioration (PSD) 5.7% 24-hr PM-10 - Class II, public highways	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 0.1 mrem/yr 5×10^{-8} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: Not operational Year 2010: 0.33 person-rem/yr 1.6×10^{-4} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected Accidents Handling and fire: MEI cancer risk increases from 2.8×10^{-9} (Alt. B) to 1.4×10^{-8} due to this project	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements.
Transportation	Construction (onsite truck trips): Nonradiological - 55 Operation (onsite truck trips per year): Nonradiological - 5.4 Radiological - 2485	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 2,000 Operation (m^3/yr): low-level waste - 195; mixed low-level waste - 300;industrial waste - 200	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 360 peak/90 average subcontractor personnel Operation: 42 existing/15 new workers	None required

a. Definition of acronyms: MEI - maximally exposed individual; NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

PROJECT-SPECIFIC OPTIONS:

No Action - This option would defer construction of the Low-Level Waste and Mixed Low-Level Waste Treatment Facility. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Modify and Operate the Waste Experimental Reduction Facility - This option would modify the Waste Experimental Reduction Facility. This option corresponds to Alternative B (Ten-Year Plan) and supplements Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Offsite Treatment - This option would provide for the private sector treatment of low-level waste and mixed low-level waste. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Project Data Sheet

Rev. 11 January 11, '95

Section	Item	Value
Generic Info.	Description/function:	Mixed/Low-Level Waste Treatment Facility
	WAG	INEL
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	LLW MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	10,000
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location:	(For analysis purposes only)
	Inside/outside of fence	Outside RWMC
	Inside/outside of bldg.	(2.5 miles east)
Construction Info.	Cost($): PreConst.	$9 Mil.
	Cost($): Const.	$141 Mil.
	Schedule Start /End: PreConst.	1999 - 2003
	Schedule Start /End: Const.	2006 - 2008
	No. of workers: (new/exist)	360 Peak, 90 Avg Subs
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.5.3-1
	Acres Disturbed: New	3 bldg. (200 acres)
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	20,000 k
	Solid wastes: Type:	Industrial
	Quantity: (m3)	2,000
	Haz./Toxic Chemicals:	Paint/curing compounds
	Storage/inventory	4,000 liter

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	20,000 k
	Energy requirements: Electrical: (MWH/yr)	4,000
	Fossil fuel: (liters)	300 k Diesel, 60 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$25 Mil./yr
	Schedule Start /End:	2010 - 2035
	No. of workers: (new/exist)	42 Existing + 15 New
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.5.3-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	None
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW MLLW Ind.
	Quantity: (m3/yr)	195 300 200
	Haz./Toxic Chemicals: Storage/inventory	380 liters
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	4,600 k
	Energy requirements: Electrical: (MWH/yr)	4,400
	Fossil fuel: (liters/yr)	1,000
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.5.4 MIXED/LOW-LEVEL WASTE DISPOSAL FACILITY

PROJECT NAME: Mixed/Low-Level Waste Disposal Facility

GENERAL PROJECT OBJECTIVE: The Mixed/Low-Level Waste Disposal Facility would meet the future INEL disposal needs for low-level waste, mixed low-level waste, and alpha-contaminated low-level waste. In addition, under Alternative D (Maximum Treatment, Storage, and Disposal), the Mixed/Low-Level Waste Disposal Facility would provide disposal for selected DOE complex low-level waste, mixed low-level waste, and alpha-contaminated low-level waste.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a new permanent radioactive waste disposal facility. The facility would provide permanent disposal capacity for waste generated from routine operations, waste generated from environmental restoration activities, waste generated from decontamination and decommissioning activities, and waste that is in storage at the INEL. Under EIS Alternative D (Maximum Treatment, Storage, and Disposal), the Mixed/Low-Level Waste Disposal Facility would receive waste for disposal from other DOE sites.

The proposed facility would be designed and permitted to accept low-level waste; treated mixed low-level waste, which is low-level waste mixed with hazardous contaminants, as defined by the Resource Conservation and Recovery Act; and alpha-contaminated low-level waste, which is low-level waste (or mixed low-level waste) that contains transuranic isotopes at concentrations ranging from 10 to 100 nanocuries per gram of waste.

The Resource Conservation and Recovery Act requires that waste containing hazardous contaminants be treated to meet certain criteria before it can be accepted for disposal.

The Mixed/Low-Level Waste Disposal Facility would have acceptance criteria established before operation. All wastes accepted for disposal would have to meet applicable parts of the acceptance criteria. These criteria would include the Resource Conservation and Recovery Act criteria for mixed low-level waste. Types of treatment that could be required before acceptance include sorting and segregation, characterization, repackaging, macroencapsulation, melt recycling, decontamination, chemical precipitation, stabilization, size reduction, and incineration.

The facility would use a combination of waste forms (such as immobilized in calcine, glassite, or concrete); engineered barriers (such as enclosures, pads, layers of clay, or uses of other nonpermeable material); and hydrogeologic setting (soil characteristics, distance above aquifer, and area of low rainfall) to provide for isolation of waste.

As the Mixed/Low-Level Waste Disposal Facility would be starting up, the current disposal site (Radioactive Waste Management Complex) would be reaching capacity and cutting back. The Radioactive Waste Management Complex is currently accepting low-level waste for disposal. Even though it contains a large amount of mixed waste and alpha-contaminated low-level waste, the Radioactive Waste Management Complex is no longer accepting mixed low-level waste or alpha-contaminated low-level waste for disposal.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal). The project data sheets at the end of this project summary support the above project description.

The proposed project might be located at an existing site or at a previously undisturbed site. For planning purposes, a typical location was assumed about 2.5 miles east of the Radioactive Waste Management Complex, thus would involve new construction assumed to be outside major facility areas. (See Figure C-I-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project under Alternative B are summarized in Table C-4.5.4-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

Table C-4.5.4-1. Summary of potential environmental impacts of the Mixed/Low-Level Waste Disposal Facility Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 200 acres previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Construction: 2,000,000 liters Operation: 2,500,000 liters/year Effluents: 2,000,000 liters construction water; 2,500,000 liters/year operation water	Engineered confinement systems; Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites, located in archaeologically sensitive area, known site in vicinity.	Conduct and record survey; mitigate according to the requirements (Section C-3.3.4)
Air resources	Radiological operation emissions No information available. (Implementation not until after 2004) Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	TBD
Human health	No information available. Implementation not until after 2004	TBD
Transportation	Construction (onsite truck trips): Nonradiological - 27 Operation (onsite truck trips per year): Nonradiological - 4 Radiological - 206	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 1,000 Operation (m^3/yr): low-level waste - 17 industrial waste - 150	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 174 subcontractor personnel Operation: 50 existing workers	None required

a. Definition of acronyms: TBD - to be determined.
b. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, no changes would be made to current low-level waste disposal practices at the INEL. This option corresponds to Alternative A evaluated in this EIS. Shallow land burial of low-level waste would continue until all available space at the Radioactive Waste Management Complex is occupied. Once available space at the Radioactive Waste Management Complex was used up, either generation of the waste would have to cease, or alternative storage or disposal practices would have to be investigated. This alternative would not provide Resource Conservation and Recovery Act permitted disposal capacity for treated mixed low-level waste, and would not allow disposal of the INEL's inventory of alpha-contaminated low-level waste. This alternative also would not provide for projected low-level waste and mixed low-level waste inventories generated from potential decontamination and decommissioning activities.

Expand Radioactive Waste Management Complex - Under this option, the boundaries of the Radioactive Waste Management Complex would be expanded. This option is not evaluated in this EIS. The expansion would include additional space for future quantities of low-level waste, permitted space for treated mixed low-level waste, and space for alpha-contaminated low-level waste. This alternative requires many of the same programmatic steps as the proposed action, including National Environmental Policy Act review, safety analysis, Resource Conservation and Recovery Act permitting, and performance assessment. This alternative would allow use of the existing Radioactive Waste Management Complex infrastructure, including support facilities, utilities, and roads, but would not allow potential benefits of a different site with more favorable hydrogeologic characteristics, such as flooding elevation with respect to the 100-year probable flood, and distance from basalt formations.

Transport to Offsite Facility for Disposal - Under this option, INEL low-level waste and mixed low-level waste would be packaged and transported to a non-INEL facility for disposal. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would require acceptance by the "host" state and would require transporting the waste across hundreds of miles of public roads, introducing some new health and safety risks to the public. This option would also require a change in current restrictions that DOE-generated waste be disposed of at the site where generated or at another DOE site.

Indefinite Storage Onsite - Under this option, the waste would be put into monitored storage until a permanent disposal option is identified. The monitoring would check the integrity of the storage configuration and verify compliance with a large number of recent requirements applicable to such storage. This option would require design and construction of monitored storage buildings at some location on the INEL. Impacts from construction would be similar to those anticipated for the proposed action. This option allows additional time to implement permanent disposal of the waste.

Project Data Sheet

Rev. 12 January 19, '95

Section	Item	Value
General Info.	Description/function:	Mixed/Low-Level Waste Disposal Facility
	WAG	7
	EIS Alter. (A, B, C or D):	B
	SNF or Waste stream:	LLW MLLW Alpha-MLLW
	Action type:	New
	Structure Type: Size: (m2)	Building 2,462 Vaults 10,173
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence Inside/outside of bldg.	(For analysis purposes only) Outside RWMC (2.5 miles east)
Construction Info.	Cost($): PreConst.	$7 Mil.
	Cost($): Const.	$79 Mil.
	Schedule Start /End: PreConst.	1996 - 2000
	Schedule Start /End: Const.	2002 - 2004
	No. of workers: (new/exist)	174 Subs.
	Heavy Equip. Equip. used: Trips:	See Table C-4.5.4-1
	Acres Disturbed: New	1.5 bldg. (200 area)
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	2,000 k
	Solid wastes: Type:	Industrial
	Quantity: (m3)	1,000
	Haz./Toxic Chemicals: Storage/inventory	Paint, curing compounds 4,000 liters
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	2,000 k
	Energy requirements: Electrical: (MWH/yr)	5,000
	Fossil fuel: (liters)	600 k Diesel, 140 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operation Information	Cost($): Operation:	$247 Mil./40 yr
	Schedule Start /End:	2004 - 2044
	No. of workers: (new/exist)	50 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.5.4-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Waste Water (sewer)
	Quantity: (liters/yr)	2,500 k
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	17 150
	Haz./Toxic Chemicals: Storage/inventory	380 liters
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	2,500 k
	Energy requirements: Electrical: (MWH/yr)	17,000
	Fossil fuel: (liters/yr)	40 k
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

Project Data Sheet

Rev. 14 January 19, '95

Section	Item	Value
General Info.	Description/function:	Mixed/Low-Level Waste Disposal Facility (Expanded)
	WAG	7 or Offsite
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	LLW MLLW Alpha-MLLW
	Action type:	New
	Structure Type: Size: (m2)	Building 5,000 Vaults 25,000
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence Inside/outside of bldg.	(For analysis purposes only) Outside RWMC (2.5 miles east)
Construction Info.	Cost($): PreConst.	$7 Mil.
	Cost($): Const.	$110 Mil.
	Schedule Start /End: PreConst.	1998 - 2004
	Schedule Start /End: Const.	2004 - 2008
	No. of workers: (new/exist)	174 Subs.
	Heavy Equip. Equip. used:	Trucks
	Trips:	30 Ind.
	Acres Disturbed: New	1.5 bldg. (400 area)
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	2,000 k
	Solid wastes: Type:	Industrial
	Quantity: (m3)	1,100
	Haz./Toxic Chemicals:	Paint, curing compounds
	Storage/inventory	5,000 liters

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	4,000 k
	Energy requirements: Electrical: (MWH/yr)	5,000
	Fossil fuel: (liters)	800 k Diesel, 140 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$350 Mil./40 yr
	Schedule Start /End:	2008 - 2048
	No. of workers: (new/exist)	50 Existing, 30 New
	Heavy Equip. Equip. used:	Trucks 41/yr Ind.
	Trips:	970/yr LLW, 160/yr MLLW
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Waste Water (sewer)
	Quantity: (liters/yr)	4,000 k
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	340 1,500
	Haz./Toxic Chemicals: Storage/inventory	380 liters
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	4,000 k
	Energy requirements: Electrical: (MWH/yr)	30,000
	Fossil fuel: (liters/yr)	50 k
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.5.5 SHIPPING/TRANSFER STATION

See description in Section C-4.4.4.

C-4.6 PROJECTS RELATED TO MIXED LOW-LEVEL WASTE

C-4.6.1 WASTE EXPERIMENTAL REDUCTION FACILITY INCINERATION

See description in Section C-4.5.1.

C-4.6.2 IDAHO WASTE PROCESSING FACILITY

See description in Section C-4.4.3.

C-4.6.3 MIXED/LOW-LEVEL WASTE TREATMENT FACILITY

See description in Section C-4.5.3.

C-4.6.4 NONINCINERABLE MIXED WASTE TREATMENT

PROJECT NAME: Nonincinerable Mixed Waste Treatment

GENERAL PROJECT OBJECTIVE: The general objectives of this project would be to upgrade existing facilities at the Waste Engineering Development Facility and provide treatment capabilities for some of the mixed low-level wastes that are not suitable for incineration. Mixed low-level wastes are required to be treated before disposal in accordance with U.S. Environmental Protection Agency Land Disposal Restrictions regulations. Quantities and types of specific waste streams that would be treated in this facility would depend on the outcome of the Federal Facility Compliance Act process.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

DOE needs to treat specific waste types that cannot be treated at the Waste Experimental Reduction Facility because they don't meet the Waste Acceptance Criteria for the facility. Also, incineration would not be appropriate for all waste types such as soils. U.S. Environmental Protection Agency regulations prohibit storage of Land Disposal Restrictions waste unless the storage is for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal. Mixed waste is generated during operations at the INEL, and is being stored. Under Alternative D (Maximum Treatment, Storage, and Disposal), similar waste would be received from other DOE sites and increase the waste volumes that would be treated.

PROJECT DESCRIPTION: Treatment developed to meet Land Disposal Restrictions standards would be implemented at the Waste Engineering Development Facility near the Power Burst Facility. While full-scale, these modules would be of modest size. The Waste Engineering Development Facility would possibly be modified to implement new technology as larger treatment facilities are constructed and operated under Alternative D (Maximum Treatment, Storage, and Disposal).

The Waste Engineering Development Facility is located at the Power Burst Facility in the former Special Power Excursion Reactor Test-II reactor building. The building is a two-story structure with masonry exterior walls, and a concrete and steel frame. The reactor high bay area is about 9 meters (30 feet) high. The facility was previously used for severe-damage testing of nuclear fuels and materials used in nuclear reactors.

The main floor would be used for receiving, storage, and inspection areas. The various Waste Engineering Development Facility processes would be installed in the basement as the processes were developed and implemented. The main floor is approximately 510 square meters (600 square yards), and the basement floor space is about 320 square meters (400 square yards). There is an 11-foot, 10-inch rollup door on each end of the building. A 10-ton overhead bridge crane is already installed in the Special Power Excursion Reactor Test-II building and is being used to lower drums into the basement through access hatches.

Approximately 880 cubic meters (1,100 cubic yards) of the total mixed low-level wastes in storage would be treated under this program; 290 cubic meters (380 cubic yards) would be solidified. About 550 cubic meters (720 cubic yards) would be decontaminated or macroencapsulated; ten cubic meters would be neutralized or deactivated; 40 cubic meters (50 cubic yards) would be processed by ion-exchange. A small quantity of waste would be processed by mercury roast or retorting. Mercury roasting, retorting is a process where waste is heated to evaporate the mercury that is condensed and recovered for reuse.

Treatment processes for this type of stored waste and for similar mixed low-level wastes to be generated in the future are being developed and would be implemented at the Waste Engineering Development Facility. These U.S. Environmental Protection Agency-approved treatment processes include ion exchange, stabilization, macroencapsulation, gamma-ray degradation treatment for polychlorinated biphenyls, neutralization, and amalgamation.

- *Ion exchange:* This process removes dissolved ions from aqueous wastes. Ion-exchange treatment is provided by the existing processes at the Portable Water Treatment Unit.

- *Stabilization:* In this process, waste is converted to a more stable or environmentally safe configuration. This process can include chemical reaction to transform the waste to a less chemically active form; solidification to make a liquid into a solid; and immobilization to fix loose material in place within a matrix of inert material. Immobilization is the proposed treatment for ash, resin fines, and substances contaminated with heavy metals that are not amenable to other treatments.

- *Lead Decontamination:* Several decontamination techniques are being evaluated. However, insufficient data are available at this time to select a specific option. Sufficient information is expected to be available by the time this EIS is submitted.

- *Macroencapsulation:* In this process, a waste piece or agglomerate is isolated by enclosure in another substance such as polyethylene epoxy. This treatment is proposed for lead, cadmium solids, and debris that cannot be decontaminated.

- *Gamma-ray Degradation for Polychlorinated Biphenyls Compounds:* This process exposes polychlorinated biphenyls contaminated mixed waste to gamma-rays from spent fuel.

- *Neutralization:* In this process, corrosive wastes, both acidic and caustic, are chemically deactivated to meet pH standards.

- *Amalgamation:* In this process a base metal, such as zinc or copper, is blended with liquid elemental mercury to form a solid alloy. Amalgamation is the specified treatment for liquid mercury containing waste.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal). The project data sheets at the end of this project summary support the above project description.

The proposed project would be located in an existing facility within a major facility area (the Power Burst Facility/Auxiliary Reactor Area). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project under Alternative B are summarized in Table C-4.6.4-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the Nonincinerable Mixed Waste Treatment project would not be constructed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Resource Conservation Recovery Act regulations require that treatment be developed for mixed low-level wastes in storage. Not performing this project would be in violation of U.S. Environmental Protection Agency regulations.

Offsite Treatment at Another DOE Facility - Under this option, the waste would be treated at an offsite DOE facility. This option is not evaluated in this EIS. At this time, no offsite or other DOE facility for treatment of the mixed low-level wastes in storage is available. These plans would become more fully developed through ongoing efforts under the Federal Facility Compliance Act, at other DOE sites, INEL, and DOE Headquarters. Several sites have announced plans to construct facilities with the same or similar capability. Transportation of the waste offsite is evaluated in Alternative C (Minimum Treatment, Storage, and Disposal).

Offsite Treatment at a Private Sector Facility - Under this option, stabilization would be performed at a private sector treatment unit. Available treatment capabilities would not meet the requirement of treating all waste types; therefore, this specific option was not analyzed. However this option is bounded by analyses performed for the Idaho Waste Processing Facility and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facilities.

Table C-4.6.4-1. Summary of potential environmental impacts of the Nonincinerable Mixed Waste Treatment Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed acreage)	Project would be in existing facility
Water resources	Construction: water use minimal Operation: 200,000 liters/yr	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	Radiological operational emissions 9.9×10^{-3}% of NESHAP dose limit Toxic Air Pollutants (TAPs) 9.7×10^{-8}% of significance level for combined TAPs Prevention of Significant Deterioration (PSD): None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 9.9×10^{-4} mrem/yr 5.0×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 7.5×10^{-3} person-rem/yr 3.8×10^{-6} latent cancer fatalities/yr Year 2010: 8.3×10^{-3} person-rem/yr 4.2×10^{-6} latent cancer fatalities/yr Nonradiological effects Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 11.7 Operation (onsite truck trips per year): Nonradiological - 2.8 Radiological - 147.1	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 430 Operation (m^3/yr): low-level waste - 4 mixed low-level waste - 5 industrial waste - 100 hazardous waste - <1	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 4 to 6 existing workers Operation: 4 to 6 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Use Other Technologies at Waste Engineering Development Facility - A number of technology options were considered for implementation at the INEL. Technologies were ranked based on their relative complexity, their level of development, and their amenability to variations in waste. Based on the overall ranking in all three of these areas, the proposed technologies were selected. As options for stabilization and ion exchange, technologies such as chemical extraction, precipitation, chemical reduction, and biological extraction were considered. As alternatives for carbon absorption and gamma degradation, thermal desorption, biodegradation, wet oxidation, ozone and ultra-violet radiation oxidation were considered.

Macroencapsulation, amalgamation, and neutralization are specified technologies. Since substitutes for these technologies would require additional U.S. Environmental Protection Agency approval, such substitutes were not considered.

Locate the Proposed Activities or Other Technologies Onsite at Facilities Other than the Waste Engineering Development Facility - Other onsite locations considered for permitted treatment operations include Waste Engineering Development Facility; Power Burst Facility; Manufacturing, Assembly, and Hot Shop/Cells at Test Area North; New Waste Calcining Facility at the Idaho Chemical Processing Plant; and the Fuel Cycle Facility and Hot Fuel Examination Facility at Argonne National Laboratory-West. These facilities were not deemed as available for these proposed activities.

Project Data Sheet

Rev. 10 January 5, '95

General Info.	Description/function:	Non-Incinerable Mixed Waste Treatment
	WAG	INEL
	EIS Alter. (A, B, C or D):	B
	SNF or Waste stream:	MLLW
	Action type:	Expand
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Treatment Process Equipment
	Location:	
	Inside/outside of fence	Inside PBF
	Inside/outside of bldg.	Inside WEDF
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$2.93 Mil total
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1994 - 1996
	No. of workers: (new/exist)	4-6 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.6.4-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	None
	Effluents:	
	Type:	None
	Quantity: (liters)	
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	430
	Haz./Toxic Chemicals: Storage/inventory	None

Const.	Cultural resource effects:	N/A			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	Minimal			
	Energy requirements:				
	Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters)	No information			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	No			
Operational Information	Cost($): Operation:	$500 K/yr			
	Schedule Start /End:	1996 - 2006			
	No. of workers: (new/exist)	4-6 Existing			
	Heavy Equip. Equip. used:	See Table			
	Trips:	C-4.6.4-1			
	Air Emissions: (None / Ref.)	See Appendix F, Section 3			
	Effluents:				
	Type:	None			
	Quantity: (liters/yr)				
	Solid wastes:				
	Type:	LLW	MLLW	Ind.	Haz.
	Quantity: (m3/yr)	4	5	100	<1
	Haz./Toxic Chemicals: Storage/inventory	Portland cement, Acids, Bases, & precipitation reagents			
	Pits/ponds used: Y/N (m2)	No			
	Water usage: (liters/yr)	200 k			
	Energy requirements:				
	Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters/yr)	No information			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	No			

Project Data Sheet

Rev. 11 January 16, '95

General Info.	Description/function:	Non-Incinerable Mixed Waste Treatment
	WAG	INEL
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	MLLW
	Action type:	Expand
	Structure Type:	N/A
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Treatment Process Equipment
	Location:	
	Inside/outside of fence	Inside PBF
	Inside/outside of bldg.	Inside WEDF
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$6 Mil total
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1994 - 1996
	No. of workers: (new/exist)	4-6 Existing
	Heavy Equip. Equip. used:	Trucks
	Trips:	12 Ind.
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	None
	Effluents: Type:	None
	Quantity: (liters)	
	Solid wastes: Type:	Industrial
	Quantity: (m3)	430
	Haz./Toxic Chemicals: Storage/inventory	None

Const.	Cultural resource effects:	N/A			
	Pits/ponding created: (m2)	No			
	Water usage: (liters)	Minimal			
	Energy requirements:				
	Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters)	No information			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	No			
Operational Information	Cost($): Operation:	$1 Mil./yr			
	Schedule Start /End:	1996 - 2006			
	No. of workers: (new/exist)	8-12 Existing			
	Heavy Equip. Equip. used:	Trucks			
	Trips:	6/yr Ind, 147/yr MLLW, 1/yr LLW			
	Air Emissions: (None / Ref.)	See Appendix F, Section 3			
	Effluents: Type:	None			
	Quantity: (liters/yr)				
	Solid wastes: Type:	LLW	MLLW	Ind.	Haz.
	Quantity: (m3/yr)	8	10	200	1
	Haz./Toxic Chemicals: Storage/inventory	Portland cement, Acids, Bases, & precipitation reagents			
	Pits/ponds used: Y/N (m2)	No			
	Water usage: (liters/yr)	400 k			
	Energy requirements:				
	Electrical: (MWH/yr)	No information			
	Fossil fuel: (liters/yr)	No information			
	Nightlights used: Y/N	No			
	Generators: Night Y/N	No			
	Day Y/N	No			

C-4.6.5 MIXED/LOW-LEVEL WASTE DISPOSAL FACILITY

See description in Section C-4.5.4.

C-4.6.6 REMOTE MIXED WASTE TREATMENT FACILITY

PROJECT NAME: Remote Mixed Waste Treatment Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Remote Mixed Waste Treatment Facility Project would be to construct and operate a facility to remove sodium metal from radioactive wastes and convert the sodium to a disposable waste form.

PROJECT DESCRIPTION: This project would design, construct, and operate a new facility to remove and convert sodium and other hazardous waste from radioactive scrap and waste components. The facility's size and handling capabilities would meet all requirements for removing sodium metal from the Experimental Breeder Reactor-II components (up to the size of a coldtrap), items stored at the Radioactive Scrap/Waste Facility, and items stored at the Hot Fuel Examination Facility. The method proposed to remove and process sodium from the scrap and waste is the melt-drain-evaporation-carbonation process. This process would remove sodium metal from components by melting and draining bulk sodium, followed by evaporating residual sodium under vacuum conditions, and finally, by converting the removed sodium to sodium carbonate (Na_2CO_3).

Waste disposal and storage sites, including the Radioactive Waste Management Complex at the Idaho INEL, do not accept sodium-containing wastes. The same policy also exists for the storage of transuranic waste at the Waste Isolation Pilot Plant.

Reprocessing sites do not accept sodium-containing fissile materials. Savannah River does not accept plutonium fuel fused with sodium, and the Idaho Chemical Processing Plant does not accept uranium fuel fused with sodium. Therefore, a facility is needed to remove sodium from transuranic and non-transuranic waste and scrap so that it can be handled and processed.

The waste sodium carbonate from the proposed process could be discarded at a disposal site or could be made into a glass or other form suitable for storage. The sodium-free low-level radioactive waste would be suitable for disposal at the Radioactive Waste Management Complex and the sodium-free fissile material could be stored or reprocessed. Until final repositories become available, contact-handled transuranic waste would be shipped to the Radioactive Waste Management Complex, and remote-handled transuranic waste would be stored at Argonne National Laboratory-West in the Radioactive Scrap/Waste Facility.

The proposed facility would be 50 meters (55 yards) long, 26 meters (30 yards) wide, and 13 meters (15 yards) high. The Remote Mixed Waste Treatment Facility would have an inert-atmosphere cell, hot repair area, covered truck loading area, equipment access area, control room and operating corridor, equipment transfer tunnel, and a decontamination cell. The use of existing Argonne National Laboratory-West capabilities, such as shielded radioactive material shipping casks in conjunction with the Remote Mixed Waste Treatment Facility and the Radioactive Liquid Waste Treatment Facility, would result in a simpler facility.

The inert-atmosphere cell would be gas-tight and would contain the sodium process equipment in a nitrogen atmosphere. Some of the nine standard hot-cell work stations in the cell would be fully equipped with a viewing window and master-slave manipulators. The remaining stations would be available for processing other forms of mixed waste debris. Functions for these stations would include waste can unloading, waste sorting, fuel subassembly dismantling, fuel-rod decanning, and waste packaging.

Direct transfers could be made to and from this cell from either top- or bottom-loading casks. Remote transfers could be made between the hot cell and the decon cell for decontamination of equipment before contact maintenance in the hot-repair area or packaging for transport.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.6.6-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, a remote mixed waste treatment facility would not be implemented. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Offsite Treatment - This option would provide for the transport of mixed low-level waste to an offsite treatment facility. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. A treatment facility would need to be constructed at an offsite location for this option.

Modify Existing Facility - This option would modify an existing facility to treat mixed low-level waste. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Table C-4.6.6-1. Summary of potential environmental impacts of the Remote Mixed Waste Treatment Facility Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 1 acre of previously disturbed soil	Project would be within major facility area; previously disturbed soil
Water resources	Construction: water use minimal Operation: [unknown] Effluent: construction water; operation (cleaning solutions to RLWTF)	Storm Water Pollution Prevention Plan in place at INEL.
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record surveys; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	<u>Radiological operational emissions</u> 0.17% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> None <u>Prevention of Significant Deterioration (PSD)</u> None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 0.017 mrem/yr 9.0×10^{-9} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 0.25 person-rem/yr 1.2×10^{-4} latent cancer fatalities/yr Year 2010: 0.27 person-rem/yr 1.4×10^{-4} latent cancer fatalities/yr <u>Nonradiological effects</u> - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements.
Transportation	Construction (onsite truck trips): Nonradiological - 54 Operation (onsite truck trips per year): Nonradiological - 0.6 Radiological - 0.3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 2,000 Operation (m^3/yr): low-level waste - 7 mixed low-level waste - 3 industrial waste - 25	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 300 peak/160 average subcontractor personnel Operation: 12 existing workers	None required

a. Definition of acronyms: National Emission Standards for Hazardous Air Pollutants; RWMC - Radioactive Waste Management Complex; RLWTF - Radioactive Liquid Waste Treatment Facility.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 10 January 5, '95

General info.	Description/function:	Remote Mixed Waste Treatment Facility
	WAG	9
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	1,280
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Outside HFEF (north)
Construction info.	Cost($): PreConst.	$2.8 Mil.
	Cost($): Const.	$49.3 Mil.
	Schedule Start /End: PreConst.	1981 - 1997
	Schedule Start /End: Const.	1997 - 2000
	No. of workers: (new/exist)	300 Peak, 160 Avg Subs
	Heavy Equip. Equip. used: Trips:	See Table C-4.6.6-1
	Acres Disturbed: New	0
	Previous	1
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Construction Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	2,000
	Haz./Toxic Chemicals: Storage/inventory	None
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Minimal
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	209 k Diesel, 47 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$5 Mil./yr
	Schedule Start /End:	2000 - 2020
	No. of workers: (new/exist)	12 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.6.6-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	Cleaning Solutions
	Quantity: (liters/yr)	(to RLWTF)
	Solid wastes: Type:	MLLW LLW Ind.
	Quantity: (m3/yr)	3 7 25
	Haz./Toxic Chemicals: Storage/inventory	Lead 5,000 lb; Sodium 2,000 lb
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.6.7 SODIUM PROCESSING PROJECT

PROJECT NAME: Sodium Processing Project

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to construct and operate a process system to convert sodium hydroxide to a disposable waste form, sodium carbonate.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already under way with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: This project would provide for the modification of the Sodium Processing Facility to provide a system to convert sodium hydroxide to sodium carbonate. The sodium conversion system would be sized to process sodium hydroxide at the equivalent rate that elemental sodium is converted to sodium hydroxide in the Sodium Processing Facility.

The Sodium Processing Facility was designed and built to convert the FERMI Reactor sodium to 50 weight percent sodium hydroxide, which would be used for neutralizing acidic plutonium, uranium extraction waste at the Hanford Site. DOE terminated all plutonium, uranium extraction operations before any processing of FERMI sodium could be accomplished. This facility could be used to convert sodium hydroxide to sodium carbonate from other sources. In 1994 DOE terminated operation of the Experimental Breeder Reactor-II and power plant at the INEL. The Sodium Processing Facility would be used to treat the contaminated sodium from the primary and secondary systems of the Experimental Breeder Reactor-II.

Sodium hydroxide is considered a "characteristic hazardous waste" for disposal by the U.S. Environmental Protection Agency. Therefore, it is desirable to convert the sodium hydroxide to a nonhazardous waste for disposal. This could be accomplished by modifying the Sodium Processing Facility to include a process system to perform the necessary conversion.

The process for the conversion would consist of a system to process the sodium hydroxide through a thin-film evaporator operating under a carbon dioxide atmosphere. The sodium hydroxide upon exposure to the carbon dioxide atmosphere would be converted to a sodium carbonate compound. The excess water would be evaporated in the thin-film evaporator and the sodium carbonate would be discharged into a 55-gallon drum as a solid. The water would be condensed and recovered for reuse in the conversion of sodium to sodium hydroxide.

The process system would be located in the Sodium Processing Facility caustic loading room if sufficient space were available. If not, it would be located on the south side of the Sodium Processing Facility. The proposed facility would be approximately 8 meters (8.7 yards) wide, 8 meters (8.7 yards) long, and 5 meters (5.5 yards) high. The facility would contain all the equipment for converting sodium hydroxide to sodium carbonate, for packaging the sodium carbonate for disposal, and for recovering the water from the process and transferring the water to the sodium-sodium hydroxide process.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project may be located in an existing facility within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.6.7-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

Table C-4.6.7-1. Summary of potential environmental impacts of the Sodium Processing Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturbs 0.03 acres of previously disturbed soil	Project would be within major facility area; previously disturbed soil
Water resources	Water use minimal	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey conducted, no sites identified	None required
Air resources	<u>Radiological operational emissions</u> 2.2×10^{-3}% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> None <u>Prevention of Significant Deterioration (PSD)</u> None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 2.2×10^{-4} mrem/yr 1.1×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 1.4×10^{-3} person-rem/yr 7.0×10^{-7} latent cancer fatalities/yr Year 2010: 1.5×10^{-3} person-rem/yr 7.5×10^{-7} latent cancer fatalities/yr <u>Nonradiological effects</u> - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 1 Operation (onsite truck trips per year): Nonradiological - 0.1 Radiological - 0.8	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 30 Operation (m^3/yr): low-level waste - 30 industrial waste - 2	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 6 existing workers Operation: 20 existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the sodium processing project would not be implemented. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Project Data Sheet

Rev. 9 January 5, '95

Section	Item	Value
General Info.	Description/function:	Sodium Processing Project
	WAG	9
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	MLLW
	Action type:	New
	Structure Type:	Building
	Size: (m2)	60
	Other features: (Pits, ponds, power /water/sewer lines)	Sodium Process Equipment
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Outside SPF (South)
Construction Info.	Cost($): PreConst.	$365 K
	Cost($): Const.	$1.5 Mil.
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1995 - 1996
	No. of workers: (new/exist)	6 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.6.7-1
	Acres Disturbed: New	0
	Previous	0.03
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type:	Water
	Quantity: (liters)	No information
	Solid wastes: Type:	Industrial
	Quantity: (m3)	30
	Haz./Toxic Chemicals: Storage/inventory	No information

Section	Item	Value
Const.	Cultural resource effects:	N/A
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Minimal
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	2.7 k Diesel, 583 Propane
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Info.	Cost($): Operation:	$4.91 Mil./3 yrs.
	Schedule Start /End:	1997 - 1999
	No. of workers: (new/exist)	20 Existing
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.6.7-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	None
	Quantity: (liters/yr)	
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	30 2
	Haz./Toxic Chemicals: Storage/inventory	No information
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.6.8 SHIPPING/TRANSFER STATION

See description in Section C-4.4.4.

C-4.7 PROJECT RELATED TO GREATER-THAN-CLASS-C WASTE

C-4.7.1 GREATER-THAN-CLASS-C DEDICATED STORAGE

PROJECT NAME: Greater-Than-Class-C Dedicated Storage

GENERAL PROJECT OBJECTIVE: The objective of this proposed project would be to provide for the DOE receipt and storage of greater-than-Class-C low-level waste sealed radiation sources from the commercial sector. Other greater-than-Class-C low-level waste would also be received on an as-needed basis.

Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240), the Federal government is responsible for the disposal of greater-than-Class-C low-level waste generated by licensees of the U.S. Nuclear Regulatory Commission and Agreement States. DOE was identified as the Federal agency responsible for this effort. In February 1989, a report to Congress (DOE/LLW-77T) (DOE 1989b) stated that DOE plans to accept and manage limited quantities of greater-than-Class-C low-level waste until a disposal facility is developed. DOE has assigned the management responsibility for greater-than-Class-C low-level waste to the INEL.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a Greater-Than-Class-C Low-Level Waste Dedicated Storage Facility. The Greater-Than-Class-C Storage Facility would provide for the consolidated management and storage of the greater-than-Class-C low-level waste at one centralized storage location.

Greater-than-Class-C low-level waste is low-level waste that contains long-lived and/or short-lived radionuclides in concentrations greater than the Class C concentrations as specified in 10 CFR Part 61. Class C is the most radioactive low-level waste that is acceptable for disposal by shallow land burial, while greater-than-Class-C low-level waste is generally unacceptable for shallow land burial.

DOE plans to accept and manage greater-than-Class-C low-level waste only on an as-needed basis before the time that a greater-than-Class-C low-level waste disposal facility becomes available. Estimates indicate that only a small fraction of the projected greater-than-Class-C low-level waste inventory (if any) would require transfer to DOE before disposal. However, a need for DOE acceptance of excess sealed radiation sources has been stated by the U.S. Nuclear Regulatory

Commission, based on public health and safety concerns. The receipt and management of these sources would be the primary near-term function of this project. Most of the sealed sources to be received would be classified as greater-than-Class-C low-level waste if disposal were intended. However, nearly all of these sealed sources would be received and managed as radioactive material suitable for recycle and reuse, rather than as greater-than-Class-C low-level waste, because of their continuing functionality and value.

The U.S. Nuclear Regulatory Commission has estimated that DOE acceptance of up to 2,000 sealed sources over a five-year period may be required. Under this limited receipt scenario, any needed facility modifications or expansions would be much less extensive than the estimates presented in this project summary. Because these sealed sources are now planned to be managed as reusable material rather than waste, they could be stored in existing facilities without special pre-storage packaging operations. Over 1,000 similar DOE sealed sources are already being managed and stored at the INEL.

For conservatism in assessing the environmental impacts of this project, a receipt scenario of 30,000 sealed sources over a 30-year period was assumed, for a baseline rate of 1,000 sources per year. This quantity is considered to be a bounding case because it represents approximately the total inventory of commercially held sealed sources that would be classified as greater-than-Class-C low-level waste if they were to become waste.

The sealed sources would be received inside the devices in which they were used. The sources are typically small leaktight capsules containing Sr-90, Cs-137, AmBe, PuBe, or other radionuclides. These devices are planned to be stored in existing facilities without further dismantling or packaging. However, to provide a conservative bounding case for the environmental impact assessments, the design basis in this project includes a repackaging operation and storage in casks on a concrete pad.

The design basis for the Greater-Than-Class-C Storage Facility would be an outdoor above-grade concrete laydown pad on which appropriately shielded casks would be placed. For storage, the project would involve the expansion of an existing concrete pad, or the construction of a new concrete pad, and the procurement of numerous concrete storage casks. Existing facilities and grounds could be modified and used for waste receiving and handling operations; for example, the Test Area North or Test Reactor Area hot cells could be used for the waste handling operations.

One cask design adapted from the Test Area North Pool Fuel Transfer Project (see Section C-2.1) would nominally be 9 feet outside diameter by 16 feet high. It has an internal cavity 7 feet in diameter by 12 feet high. Ninety-four (94) casks would be needed if each one holds thirty-two (32) 55-gallon drums (four layers of eight drums each). Each drum would hold an average of ten (10) sealed sources/devices within an appropriate packaging medium.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (either the Test Area North or Test Reactors Area). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.7.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, DOE would continue to store the greater-than-Class-C low-level waste at a variety of sites. This option corresponds to Alternative A (No Action) evaluated in this EIS. Under this option, no new storage facilities would be constructed, nor would any existing facilities be expanded for storage.

Offsite Storage - Under this option, DOE would transport all greater-than-Class-C low-level waste to another DOE site. This option corresponds with Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Table C-4.7.1-1. Summary of potential environmental impacts of the Greater-Than-Class-C Dedicated Storage Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	Disturb 1.7 acres of previously disturbed soil	Project would be within major facility area; previously disturbed soil
Water resources	Operations effluents: No information	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Survey conducted, no sites identified	None required
Air resources	Radiological operational emissions 6.3×10^{-3}% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 6.3×10^{-4} mrem/yr 3.2×10^{-10} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 0.019 person-rem/yr 9.5×10^{-6} latent cancer fatalities/yr Year 2010: 0.021 person-rem/yr 1.0×10^{-5} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 0.8 Operation (truck trips per year): Nonradiological - 3 onsite Radiological - 0.7 onsite; 200 offsite	Use of approved transport vehicles and containers, licensed casks if necessary, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial - 28 Operation (m^3/yr): low-level waste - 25 industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 15 subcontractor personnel Operation: 20 part-time existing workers	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Multiple Storage Sites - Under this option, DOE would transfer greater-than-Class-C low-level waste to regional storage locations created at two to five DOE sites. New storage facilities would be constructed at each regional site as required. If the INEL were selected as one of the sites, this option is bounded by Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Project Data Sheet

Rev. 10 February 17, '95

Section	Item	Value
General Info.	Description/function:	GTCC Dedicated Storage
	WAG	INEL
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	GTCC-LLW
	Action type:	New
	Structure Type: Size: (m2)	Building 3,344
	Other features: (Pits, ponds, power /water/sewer lines)	Storage Vaults & Concrete Pad
	Location: Inside/outside of fence Inside/outside of bldg.	Inside TRA or TAN Outside
Construction Info.	Cost($): PreConst.	$1.5 Mil.
	Cost($): Const.	$5 Mil.
	Schedule Start /End: PreConst.	1994 - 1996
	Schedule Start /End: Const.	1997 - 1998
	No. of workers: (new/exist)	15 Subs.
	Heavy Equip. Equip. used: Trips:	See Table C-4.7.1-1
	Acres Disturbed: New	0
	Previous	1.7
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	None
	Solid wastes: Type: Quantity: (m3)	Ind. 28
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	25,550 Diesel
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$1 Mil./yr
	Schedule Start /End:	1998 - 2028
	No. of workers: (new/exist)	20 part-time Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.7.1-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type:	LLW (cleaning solutions)
	Quantity: (liters/yr)	No information available
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	25 100
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters/yr)	No information
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.8 PROJECT RELATED TO HAZARDOUS WASTE

C-4.8.1 HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

PROJECT NAME: Hazardous Waste Treatment, Storage, and Disposal Facilities

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide facilities necessary to treat, store, and dispose of hazardous waste generated onsite as a result of INEL operations [Alternative D (Maximum Treatment, Storage, and Disposal)].

PROJECT DESCRIPTION: Facilities would consist of a modern hazardous waste storage facility, and treatment facilities capable of treating INEL Resource Conservation and Recovery Act regulated hazardous waste streams so that onsite disposal can be achieved at a Resource Conservation and Recovery Act approved INEL facility.

The storage facility would be a Resource Conservation and Recovery Act permitted facility that is also in compliance with all applicable DOE orders and guidance. The facility would include the following features not in the present facility: eight segregation areas separated by fire walls, containment for hazardous waste leaks, fire protection areas, collection systems for firewater in the event of system activation, appropriately ventilated spaces for sampling and inspection, safety showers, change rooms, and safety equipment.

The treatment facility would use organic destruction stabilization, neutralization, and organic removal/recovery technologies to treat approximately 80 percent of INEL-generated hazardous waste (100 percent of organic hazardous waste).

The disposal facility would use a combination of waste form (such as immobilization in concrete); engineered barriers (such as enclosures, pads, layers of clay, or uses of other nonpermeable material); and hydrologic setting (soil characteristics, distance above aquifer, and area of low rainfall) to provide for isolation of waste.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative D

(Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would involve new construction assumed to be outside major facility areas. (See Figure C-1-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.8.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the Hazardous Waste Treatment, Storage, and Disposal Facility would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continued use of the Hazardous Waste Storage Facility, and the continued transport of the waste to an offsite disposal facility.

Table C-4.8.1-1. Summary of potential environmental impacts of the Hazardous Waste Treatment, Storage, and Disposal Facilities Project under Alternative D.

Environmental attribute	Potential impact[a]	Potential mitigative measures[b]
Geology and soil, acres disturbed	Disturb 5 acres of previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	Construction: 10,000,000 liters usage Operation: None Effluents: 2,000,000 liters construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resourees, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites	Conduct and record survey; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	No information available. Implementation not until after 2005	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	No information available; Implementation not until after 2005	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 14 Operation (onsite truck trips per year): Nonradiological - 58	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 500 Operation (m^3/yr): industrial waste - 500 hazardous waste - 5	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 50 peak/15 average subcontractor personnel Operation: 15 new workers	None required

a. Reference location for impact analysis: 4 kilometers (2.5 miles) east of the Radioactive Waste Management Complex. Potential impacts are described further in Section C-3.2.
b. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 11 January 18, '95

General Info.	Description/function:	Hazardous Waste Treatment, Disposal & Storage Facilities
	WAG	INEL
	EIS Alter. (A, B, C or D):	D
	SNF or Waste stream:	Haz.
	Action type:	New
	Structure Type:	Buildings (2)
	Size: (m2)	2,000 & 560
	Other features: (Pits, ponds, power /water/sewer lines)	Roads, power, water, sewer
	Location:	(For analysis purposes only)
	Inside/outside of fence	Outside RWMC
	Inside/outside of bldg.	(2.5 miles east)
Construction Info.	Cost($): PreConst.	$11 Mil.
	Cost($): Const.	$105 Mil.
	Schedule Start /End: PreConst.	1999 - 2002
	Schedule Start /End: Const.	2005 - 2008
	No. of workers: (new/exist)	50 Peak, 15 Avg. Subs
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.8.1-1
	Acres Disturbed: New	5
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents:	
	Type:	Construction water
	Quantity: (liters)	2,000 k
	Solid wastes:	
	Type:	Industrial
	Quantity: (m3)	500
	Haz./Toxic Chemicals:	Paint, curing compound
	Storage/inventory	2000 liter

Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	10,000 k
	Energy requirements:	
	Electrical: (MWH/yr)	2,000
	Fossil fuel: (liters)	78 k Diesel, 16 k Propane
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	$6.2 Mil. /yr
	Schedule Start /End:	2008 - 2032
	No. of workers: (new/exist)	15 New
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.8.1-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents:	
	Type:	None
	Quantity: (liters/yr)	
	Solid wastes:	
	Type:	Industrial HW
	Quantity: (m3/yr)	500 5
	Haz./Toxic Chemicals:	
	Storage/inventory	41.6 k Liters
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	None
	Energy requirements:	
	Electrical: (MWH/yr)	3,000
	Fossil fuel: (liters/yr)	10 k
	Nightlights used: Y/N	Yes
	Generators: Night Y/N	No
	Day Y/N	No

C-4.9 PROJECTS RELATED TO INFRASTRUCTURE

C-4.9.1 INDUSTRIAL/COMMERCIAL LANDFILL EXPANSION

PROJECT NAME: Industrial/Commercial Landfill Expansion

GENERAL PROJECT OBJECTIVE: The general objective of tbis proposed project is to provide continued solid waste disposal for the INEL for a 30-year landfill life by (a) disposing the waste in landfills tbat comply witb regulatory requirements, (b) monitoring for hazardous and radioactive contaminants in the waste, and (c) closing and monitoring for tbe existing INEL sanitary landfill. The Landfill Complex would comply witb Federal regulations 40 CFR Parts 257 and 258 as applicable, and tbe State of Idaho Department of Healtb and Welfare regulations.

PROJECT DESCRIPTION: This project would extend tbe boundaries of tbe Central Facilities Area Landfill Complex to provide 91 additional hectares (225 acres) of land for INEL industrial solid waste disposal and operations through tbe year 2025 as a minimum. The complex would use the existing administrative facilities. The landfill complex extension would encompass activities and operations associated witb INEL solid waste disposal including recycling. The facility would accommodate at least 48,000 cubic meters per year (63,000 cubic yards per year) of waste.

The Landfill Complex extension would provide a centralized area for tbe following functions:

- Landfill operations witb disposal cells for nonradioactive, nonhazardous INEL industrial solid waste and asbestos

- Waste minimization area including recycling and volume reduction operations

- Ancillary operations functions including construction/maintenance of roads; litter control; utilities; cover and closure of completed landfill cells; drainage control; seeding and erosion control; and traffic control

- Treatment and disposal of petroleum-contaminated media

- Waste or recyclable collection/transportation to and from tbe landfill complex.

The previous project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be integral to an existing facility within a major facility area (the Central Facilities Area). (See Figure C-1-1 for location and Section C-3.2 for a discussion of new construction in a major facility area.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.9.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, an Industrial/Commercial Landfill Expansion would not be provided and landfill needs would continue with incremental assessments under the National Environmental Policy Act, as is the current practice. This option corresponds to Alternative A (No Action) evaluated in this EIS. The existing solid waste disposal cells would continue to operate for this option. Under the current estimate, these cells would fill to capacity during 1998, thus leaving the INEL without a waste disposal area.

Transfer Station - Under this option, a waste transfer station would be constructed to consolidate the waste prior to transport to an offsite landfill. This option is not evaluated in this EIS. An INEL industrial landfill would continue to be operated for disposal of bulky waste items such as concrete and asphalt. Two pre-engineered metal buildings would be constructed to house the waste transfer operations and to provide offices and support facilities. The transfer station would be designed to receive 48,600 cubic meters (64,000 cubic yards) of solid waste annually, of which 20 percent would be recycled or disposed of at the INEL industrial landfill with the remainder to be consolidated for

Table C-4.9.1-1. Summary of potential environmental impacts of the Industrial/Commercial Landfill Expansion Project under Alternative B.

Environmental attribute	Potential impact[a]	Potential mitigative measures[b]
Geology and soil, acres disturbed	Disturb 112 acres of previously undisturbed soil (no conflict with existing land use policies); disturb 168 acres of previously disturbed soil	Prevent soil/wind erosion; partly previously disturbed soil
Water resources	None	None required
Wildlife and habitat	For previously undisturbed soil: Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation For previously disturbed soil: Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously undisturbed soil: Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed. Previously disturbed soil: prevent soil erosion; reseed
Historic, archaeological, or cultural resources	Unknown number of sites, located in an archaeologically sensitive area, known sites in the vicinity	Conduct and record surveys; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	Radiological operational emissions - None Nonradiological emissions - No increase in emissions over present operation	Unknown
Human health	No information	Unknown
Transportation	Construction (onsite truck trips): None Operation (onsite truck trips per year): Nonradiological - 1630	Use of approved transport vehicles and containers and qualified equipment operators
Waste management	None (no waste generated)	None required
Socioeconomic conditions	Operation: 9 existing workers	None required

a. Potential impacts are described further in Section C-3.2.
b. Mitigative measures are described further in Section C-3.3.

transport to a licensed offsite landfill operated by others. This option would be subject to the continued availability of an offsite landfill. The 30-year cost for construction and operation of this option is estimated at $105 million.

Municipal Landfill - Under this option, a municipal landfill would be provided instead of an INEL industrial landfill. The environmental impacts of this option are bounded by the proposed project evaluated in this EIS. This option would be similar to the proposed action for operations and extension of disposal operations. However, the landfill would be operated in compliance with additional regulatory requirements (40 CFR 258, "Criteria for Municipal Solid Waste Landfills"). The 30-year cost for construction and operation of this option is estimated at $180 million.

Incineration - Under this option, a solid waste incinerator would be constructed at the INEL. This option is not evaluated in this EIS. This option was eliminated from further study because the volume of solid waste generated at the INEL is too low to efficiently operate an incinerator. The volume of waste could be increased by transporting solid waste from the surrounding communities to the INEL, but incinerating this waste would have potential environmental and liability issues because it contains hazardous waste materials.

Shipment to Another DOE Site - Under this option, the INEL solid waste would be transported to another DOE site for disposal. This option is not evaluated in this EIS. This option was eliminated from further study because of the high cost of constructing a transfer station and transporting the waste to the other site.

Project Data Sheet

Rev. 8 January 5, '95

General Info.	Description/function:	Industrial / Commercial Landfill Expansion
	WAG	4
	EIS Alter. (A, B, C or D):	B, C, D
	SNF or Waste stream:	Infrastructure
	Action type:	Expand
	Structure Type: Size: (m2) Other features: (Pits, ponds, power /water/sewer lines)	Excavations in old gravel pit Land treatment of PCM
	Location: Inside/outside of fence Inside/outside of bldg.	 Inside CFA Outside
Construction Info.	Cost($): PreConst.	$30 k (Ops. Plan)
	Cost($): Const.	N/A
	Schedule Start /End: PreConst.	1992 - 1993
	Schedule Start /End: Const.	N/A
	No. of workers: (new/exist)	N/A
	Heavy Equip. Equip. used: Trips:	See Table C-4.9.1-1
	Acres Disturbed: New Previous Revegetated	112 168 225
	Air Emissions: (None / Ref.)	None
	Effluents: Type: Quantity: (liters)	None
	Solid wastes: Type: Quantity: (m3)	None
	Haz./Toxic Chemicals: Storage/inventory	None

Const.	Cultural resource effects:	None identified, clearance requested
	Pits/ponding created: (m2)	Yes (temporary)
	Water usage: (liters)	None
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	 None None
	Nightlights used: Y/N	No
	Generators: Night Y/N Day Y/N	No No
Operational Information	Cost($): Operation:	$1.9 Mil./yr
	Schedule Start /End:	1998 - 2025
	No. of workers: (new/exist)	9 Existing
	Heavy Equip. Equip. used: Trips:	See Table C-4.9.1-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: Quantity: (liters/yr)	None
	Solid wastes: Type: Quantity: (m3/yr)	No information
	Haz./Toxic Chemicals: Storage/inventory	Asbestos (TSCA) 671
	Pits/ponds used: Y/N (m2)	Yes
	Water usage: (liters/yr)	No information
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters/yr)	 8 0
	Nightlights used: Y/N	Yes
	Generators: Night Y/N Day Y/N	No No

C-4.9.2 GRAVEL PIT EXPANSIONS

PROJECT NAME: Gravel Pit Expansions

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to expand existing gravel borrow pit operations to provide gravel and fill material for existing and future road and other construction activities at the INEL during the ten-year period of June 1995 to June 2005.

The pits provide sand, gravel, and aggregate for construction and maintenance, and the spreading area provides borrow material consisting primarily of soil, silt, and sand for lining ponds and capping areas such as Radioactive Waste Management Complex Pad A and landfills.

PROJECT DESCRIPTION: This project would reopen and/or expand the use of natural resources contained within several gravel pits and one borrow area on the INEL. These natural resources consist of sand, gravel, aggregate, and borrow (eolian and alluvial sediments). Future operations would be conducted under "Infrastructure" and "Excavation" programs that would be managed by facility landlords, operating contractors, and waste management and environmental restoration organizations. The following describes the gravel pits and borrow area that are located on the INEL:

1. Test Area North gravel pit - This pit is located approximately 1.2 kilometers (0.75 miles) north of the Test Area North Containment Test Facility. The excavation has an approximate area of 60 acres. The pit would be expanded approximately 0.4 acres.

2. Lincoln Boulevard pit - This pit is located along Lincoln Boulevard approximately 13 kilometers (8 miles) north of the Naval Reactors Facility. The excavation at this pit has an approximate area of 70 acres. The pit would be expanded approximately 0.34 acres.

3. Naval Reactors Facility pit - There are three small pits in the Naval Reactors Facility area. Pit #1 is located near the intersection of Lincoln Boulevard and Washington Boulevard. Pit #2 is located just south of the Naval Reactors Facility fence adjacent to the railroad tracks. Pit #3 is located approximately 0.4 kilometer (0.25 mile) west of

Washington Boulevard. The excavations at these pits have a total approximate area of 5 acres. No expansion of the Naval Reactors Facility pits is proposed.

4. Test Reactor Area/Idaho Chemical Processing Plant pit - This pit is located near the intersection of Lincoln Boulevard and Monroe Street between the Test Reactor Area and the Idaho Chemical Processing Plant. The excavation at this pit has an approximate area of 30 acres. The pit would be expanded approximately 0.65 acres.

5. Central Facilities Area pit - This pit is located east of Lincoln Boulevard approximately 0.8 kilometer (0.5 mile) north of the intersection with Portland Ave. The excavation of this pit has an area of less than 10 acres. The pit would be expanded approximately 2.4 acres.

6. Boiling Water Reactor Experiment pit - This pit is located north of Adams Boulevard approximately 0.6 kilometer (0.4 mile) west of the intersection with Van Buren Boulevard. The excavation of this pit has an approximate area of 30 acres. The pit would be expanded approximately 3.7 acres.

7. Radioactive Waste Management Complex pit - This pit is located approximately 5 kilometers (3 miles) west of Radioactive Waste Management Complex on the T-12 road. The excavation of this pit has an approximate area of 30 acres. The pit would be expanded approximately 3.8 acres.

8. Radioactive Waste Management Complex Spreading Area B - This spreading area is located approximately 5 kilometers (3 miles) south of Radioactive Waste Management Complex. This excavation has an approximate area of 200 acres. The pit would be expanded approximately 120 acres.

Under all alternatives, minor fugitive dust emissions would be produced during onsite loading of gravel/borrow and transportation on unpaved roads. Expansion of existing gravel pits or opening of new gravel/borrow area would not impact INEL wetlands, floodplains, surface water, or groundwater. A stormwater discharge plan would be prepared for all active gravel/borrow pits. DOE-ID has prepared a Clean Water Act Section 404 permit application for the continued removal of borrow material from INEL Spreading Area B. These activities become subject to Section 404 permitting requirements August 23, 1994, as a result of regulations that modified the definition of discharge of dredged materials.

No known critical wildlife habitats are located on the INEL, but there are occasional migratory endangered or threatened species on the INEL. An additional 40 acres at each gravel pit and 60 acres at Spreading Area B have been intensively surveyed for cultural resources. The results of these cultural surveys are available for review, and any questions or concerns after reviewing the results may be discussed with the DOE. Removal of resources from existing gravel pits under all alternatives within the surveyed area would not disturb significant cultural resources. However, nine prehistoric resources were identified in Spreading Area B. Therefore, as recommended by the Idaho State Historic Preservation Office, a program of subsurface archaeological testing has been initiated to formally determine the National Register eligibility of these resources and thereby assess the effects of borrow activities within Spreading Area B under all alternatives.

Under all alternatives, excavation from gravel/borrow pits would be sloped in accordance with Occupational Safety and Health Administration regulations. Soil erosion and stormwater discharge would be controlled as identified in a stormwater discharge plan written to address a consolidated source of stormwater requirements for gravel/borrow users and for all active gravel/borrow pits.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would involve new construction outside major facility areas. (See Figure C-1-1 for assumed location and Section C-3.2 for a discussion of new construction outside major facility areas.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.9.2-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - This alternative (A) is evaluated because it represents baseline conditions against which the potential impacts of the other alternatives are compared. Under this alternative, infrastructure and excavation projects would maintain schedule, cost, and staffing at current levels. These operations would require approximately 158,000 cubic meters (207,000 cubic yards) gravel/borrow onsite.

Ten-Year Plan - Under this alternative (B) and in support of SNF and INEL ER&WM activities, infrastructure, and excavation projects would increase schedule, cost, and staffing above current levels. These operations would require approximately 392,000 cubic meters (513,000 cubic yards) gravel/borrow onsite through project life cycles.

Minimum Treatment, Storage, and Disposal - Under this alternative (C) and in support of SNF and INEL ER&WM activities, infrastructure and excavation projects would maintain schedule, cost, and staffing at nearly current levels. These operations would require approximately 296,000 cubic meters (387,000 cubic yards) gravel/borrow onsite through project life cycles.

Maximum Treatment, Storage, and Disposal - Under this alternative (D) and in support of INEL spent nuclear fuel and ER&WM activities, infrastructure and excavation projects would require schedule modifications and an increase in cost and staffing levels above Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). These operations would require approximately 1,772,000 cubic meters (2,317,000 cubic yards) gravel/borrow onsite through project life cycles and necessitate the expansion of existing pits and the opening of a new borrow area. The preparation of a storm water pollution prevention plan, and the determination of an air permitting action would be required for each gravel pit and borrow area before proposed actions commence.

Table C-4.9.2-1. Summary of potential environmental impacts of the Gravel Pit Expansion Project.

Environmental attribute	Potential impact[a]	Potential mitigative measures[b]
Geology and soil, acres disturbed	Disturb 20.12 acres of previously undisturbed soil; no conflict with existing land use policies	Prevent soil/wind erosion
Water resources	None	None required
Wildlife and habitat	Loss of biodiversity and habitat productivity; animal displacement and mortality; potential for habitat fragmentation	Avoid wetlands, aquatic resources, and critical habitats; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	23 sites have been partially surveyed	Complete and record surveys; mitigate according to applicable requirements (Section C-3.3.4)
Air resources	<u>Radiological operational emissions</u> - None <u>Nonradiological emissions</u> - No net increase in emission rate over current gravel pit operations	None required
Human health	<u>Radiation exposures and cancer risk</u> - None <u>Nonradiological effects</u> - No emissions	None required
Transportation	Truck trips included in individual projects	Excavation and transport by qualified equipment operators
Waste management	None (no waste generated)	None required
Socioeconomic conditions	Construction: No additional workers	None required

a. Potential impacts are described further in Section C-3.2.
b. Mitigative measures are described further in Section C-3.3.

Cease Use of Gravel/Borrow - This option would cease use of gravel/borrow resources on the INEL. This option was not evaluated in this EIS. Maintenance of the INEL infrastructure and performance of environmental restoration and waste management activities require these resources, even under the No Action alternative.

Obtain Gravel/Borrow from an Offsite Commercial Source - Under this option, DOE would purchase and import 3,800 cubic meters (5,000 cubic yards) or less of crushed gravel for roadbase material, concentrated aggregate (screened), and gravel for plant mix from an outside source. Over 5,000 cubic yards becomes more cost efficient to allow subcontractor access to INEL gravel and an onsite crusher.

Identify New, Onsite Sources of Gravel/Borrow - This option would allow DOE to develop a new borrow source. Terreton Lake beds south of Test Area North are an example. These lake beds are largely sandy and clayey silt, with lesser amounts of relatively pure clay and would suffice as an alternative to Spreading Area B.

Project Data Sheet

Rev. 11 — February 23, '95

Section	Item	Value
Generic	Description/function:	Gravel Pit Expansions
	WAG	INEL
	EIS Alter. (A, B, C or D):	B, D (expanded)
	SNF or Waste stream:	Infrastructure
	Action type:	Expand
	Structure Type:	Pits
	Location: Inside/outside of fence; Inside/outside of bldg.	Outside TAN, NRF, TRA, CFA, & RWMC
Construction Info.	Cost($): PreConst.	N/A
	Cost($): Const.	
	Schedule Start /End: PreConst.	
	Schedule Start /End: Const.	
	No. of workers: (new/exist)	No increase
	Heavy Equip. Equip. used: / Trips:	Included in individual projects
	Acres Disturbed:	Additional acres disturbed
	All disturbed areas new:	
	NRF	0.00
	TAN	0.40
	TRA/ICPP	0.65
	CFA	2.40
	Lincoln Blvd.	0.34
	Borax	2.70
	RWMC Pit Run	3.80
	RWMC Spreading Area B	120.00

Section	Item	Value
Construction Information	Gravel Removed (m3)	
	Alternative B	392,000
	Alternative D	1,772,000
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: / Quantity: (liters)	None
	Solid wastes: Type: / Quantity: (m3)	None
	Haz./Toxic Chemicals: Storage/inventory	None
	Cultural resource effects:	Yes
	Pits/ponding created: (m2)	Yes
	Water usage: (liters)	None
	Energy requirements:	
	Electrical: (MWH/yr)	None
	Fossil fuel: (liters)	None
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.9.3 CENTRAL FACILITIES AREA CLEAN LAUNDRY AND RESPIRATOR FACILITY

PROJECT NAME: Central Facilities Area Clean Laundry and Respirator Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to use an existing facility for a new use, continue use as intended, or to decontaminate and decommission the facility.

PROJECT DESCRIPTION: This project would provide several alternatives for the existing Building CFA-617, Clean Laundry and Respirator Facility, located in the northeast part of the Central Facilities Area at the INEL. Other than for No Action, the selection of an appropriate alternative for Building CFA-617 is a "proposed action." This project would implement one of the following five alternative actions:

1. Hazardous Waste Storage Facility
2. Quality Assurance Testing Facility
3. Radiological Development & Research Laboratory Facility
4. Decontaminate and decommission the Facility
5. Resume operation of the Clean Laundry and Respirator Facility.

The Clean Laundry and Respirator Facility is a one-story, cement block building built in 1981 with an area of 1,067 square meters (11,494 square feet). Seven functional areas are within this area:

1. Respirator processing
2. Hot laundry processing
3. Special hot laundry monitoring
4. Health Physics office and monitoring area
5. Cold laundry processing
6. Office, lunch room, and rest rooms
7. Mechanical system room.

A parking lot is on the west side of the building, with three loading docks on the east and north sides. The facility is presently not operating and is in an interim shutdown condition per a National Environmental Policy Act categorical exclusion.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (the Central Facilities Area). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.9.3-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the Central Facilities Area Clean Laundry and Respirator Facility would not be reused. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve continued surveillance and maintenance of an existing facility under a National Environmental Policy Act categorical exclusion status. The National Environmental Policy Act categorical exclusion was not written to support such a long-term action.

Build Treatment, Storage, and Disposal Facility - Under this option, the facility would not be available (except possibly on an interim basis) for use as a Hazardous Waste Storage Facility if the Hazardous Waste Treatment and Storage and Disposal Facility were to be built. This option corresponds with Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Table C-4.9.3-1. Summary of potential environmental impacts of the Central Facilities Area Clean Laundry and Respirator Facility Project under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None (no disturbed soil)	Project would be in existing facility
Water resources	Depends on option selected	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Project would be in existing facility
Historic, archaeological, or cultural resources	None	Project would be in existing facility
Air resources	<u>Radiological operational emissions</u> None <u>Nonradiological emissions</u> None	Measures depend on expected emissions; may include enclosures, filtration, stabilization.
Human health	No information	TBD
Transportation	Construction (onsite truck trips): Nonradiological - 11 Operation onsite truck trips per year): Nonradiological - 3	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 400 low-level waste - (depends on option) Operation (m^3/yr): industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Operation: No additional workers	None required

a. Definition of acronyms: TBD - to be determined.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 11 February 17, '95

General Info.	Description/function:	CFA Laundry & Respirator Facility
	WAG	INEL
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	Infrastructure
	Action type:	Expand
	Structure Type:	Existing
	Size: (m2)	1,067
	Other features: (Pits, ponds, power /water/sewer lines)	None
	Location: Inside/outside of fence	Inside CFA
	Inside/outside of bldg.	Inside CFA-617
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$1.8 Mil. Total
	Schedule Start /End: PreConst.	1995
	Schedule Start /End: Const.	1995 - 1997
	No. of workers: (new/exist)	No information
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.9.3-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	Depends on option selected.
	Effluents: Type:	LLW
	Quantity: (liters)	No information
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3)	(No info. avail) 400
	Haz./Toxic Chemicals: Storage/inventory	Decon Solutions No information

Const.	Cultural resource effects:	None
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Depends on option selected.
	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)	Depends on option selected.
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	No increase
	Schedule Start /End:	1998 - TBD
	No. of workers: (new/exist)	existing / no new
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.9.3-1
	Air Emissions: (None / Ref.)	Depends on option selected.
	Effluents: Type: Quantity: (liters/yr)	None
	Solid wastes: Type:	Ind.
	Quantity: (m3/yr)	100
	Haz./Toxic Chemicals: Storage/inventory	See Project Summary HWSF Source Term data sheet
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	0
	Energy requirements: Electrical: (MWH/yr)	No increase
	Fossil fuel: (liters/yr)	No increase
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.10 PROJECTS RELATED TO TECHNOLOGY DEVELOPMENT

C-4.10.1 CALCINE TRANSFER PROJECT (BIN SET #1)

PROJECT NAME: Calcine Transfer Project (Bin Set #1)

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to provide facilities and equipment for the safe retrieval and transport of high-level waste calcine from the existing storage at Bin Set #1 to a fully qualified storage facility.

PROJECT DESCRIPTION: Retrieval of calcine from Bin Set #1 is necessary to comply with an existing Federal Court Order, Federal laws, and DOE orders governing the handling, storage, and disposal of high-level waste. The retrieval of calcine from Bin Set #1 and transport to a fully qualified location would entail the following tasks. The top of the vault chamber would be accessed by removing the support structure, backfilled soil, and equipment housed above the vault. The vault roof would be thickened with an additional reinforced concrete slab for shielding and increased support capacity. A containment structure would be placed over the vault. A pneumatic transport line and support facilities at the receiving location would be constructed concurrently. Within the containment structure, penetrations would be made through the vault roof and access risers would be remotely attached at appropriate locations to the enclosed bins and pressure tested. The bins would then be penetrated through the riser, and retrieval devices would be deployed via the riser to remove the 8,000 cubic feet of calcine. The components would be designed to be portable and compatible with all bin sets at the Idaho Chemical Processing Plant as these calcine solids would be retrieved and treated as part of the Idaho Chemical Processing Plant High-Level Waste Calcine Immobilization Program.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located within a major facility area (the Idaho Chemical Processing Plant). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.10.1-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the technology to transfer calcine from older bin sets would not be demonstrated. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Table C-4.10.1-1. Summary of potential environmental impacts of the Calcine Transfer Project (Bin Set # 1) under Alternative B.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, disturbed area	Disturb 0.5 acre of previously disturbed soil	Project would be within major facility area; previously disturbed soil
Water resources	Construction/operation: water use minimal Effluent: construction water	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	Minimal short-term impact on biodiversity, productivity, and animal displacement and mortality within major facility area	Previously disturbed soil; prevent soil erosion; reseed
Historic, archaeological, or cultural resources	No sites identified	None required
Air resources	Radiological operational emissions 1.0×10^{-4}% of NESHAP dose limit Toxic Air Pollutants (TAPs) None Prevention of Significant Deterioration (PSD) None	Facility design, safety analysis, inspection and surveillance, annual reporting
Human health	Radiation exposures and cancer risk Maximally exposed individual: 1.0×10^{-5} mrem/yr 5×10^{-12} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 8.4×10^{-5} person rem/yr 4.2×10^{-8} latent cancer fatalities/yr Year 2010: 9.3×10^{-5} person rem/yr 4.6×10^{-8} latent cancer fatalities/yr Nonradiological effects - No emissions	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements; monitor ECAs during construction
Transportation	Construction (onsite truck trips): Nonradiological - 3 Operation (onsite truck trips per year): None	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 100	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 15 subcontractor personnel Operation: No additional workers	None required

a. Definition of acronyms: ECA - environmentally controlled area; NESHAP - National Emission Standards for Hazardous Air Pollutants.

b. Potential impacts are described further in Section C-3.2.

c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

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Section	Item	Value
General Info.	Description/function:	Calcine Transfer Project (Bin Set #1)
	WAG	3
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	HLW
	Action type:	New, Demonstration
	Structure Type:	Containment Enclosure
	Size: (m2)	200
	Other features: (Pits, ponds, power /water/sewer lines)	Transfer equipment
	Location: Inside/outside of fence	Inside ICPP
	Inside/outside of bldg.	
Construction Info.	Cost($): PreConst.	
	Cost($): Const.	$65 Mil. total
	Schedule Start /End: PreConst.	1994 - 1999
	Schedule Start /End: Const.	1999 - 2004
	No. of workers: (new/exist)	15 Subs.
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.10.1-1
	Acres Disturbed: New	0
	Previous	0.5
	Revegetated	0
	Air Emissions: (None / Ref.)	None
	Effluents: Type:	Construction water
	Quantity: (liters)	No information
	Solid wastes: Type:	Ind.
	Quantity: (m3)	100
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	None identified
	Pits/ponding created: (m2)	No
	Water usage: (liters)	Minimal
	Energy requirements: Electrical: (MWH/yr)	No information
	Fossil fuel: (liters)	11.3 k Diesel, 760 Propane
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	Yes
Operational Information	Cost($): Operation:	None
	Schedule Start /End:	2006 - 2007
	No. of workers: (new/exist)	no new above current level
	Heavy Equip. Equip. used:	See Table
	Trips:	C-4.10.1-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: Quantity: (liters/yr)	None
	Solid wastes: Type: Quantity: (m3/yr)	No information
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	No
	Energy requirements: Electrical: (MWH/yr)	Minimal
	Fossil fuel: (liters/yr)	0
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

C-4.10.2 PLASMA HEARTH PROCESS PROJECT

PROJECT NAME: Plasma Hearth Process Project

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to demonstrate the full-scale Plasma Hearth Process on actual mixed low-level waste that is difficult to treat by conventional thermal technologies.

PROJECT DESCRIPTION: The Plasma Hearth Process is a high-temperature thermal treatment process using a plasma arc torch in a refractory-lined chamber that destroys organics and stabilizes the residuals in a nonleaching, vitrified waste form. Plasma arc technology is used commercially, primarily for production of high purity alloys. This project would involve the adaptation of that existing, commercially available technology. The key elements of this technology are (a) extremely high temperature operation that completely destroys organics while stabilizing inorganics; (b) the ability to accept a very wide range of waste types without pretreatment; (c) the ability to treat waste without removing it from the container; (d) generation of separate slag and metallic phases, allowing segregation and possible reuse of the metal; and (e) the preference of many radionuclides (especially the actinides) and toxic heavy metals to migrate to the stable slag phase.

The term "plasma" refers to a highly ionized gas. The type of plasma that would be considered in this application is known as a direct-current arc-generated plasma. This type of plasma would be generated with a plasma "torch." Basically, the torch uses a flowing gas to stabilize an electrical discharge (arc) between two electrodes. One or both of these electrodes is contained within the torch. For treatment of solid materials, the second electrode is usually the material being processed. Energy is dissipated in the form of heat and light as the electrical current flows through the gas. Through resistance heating (Joule heating), this process creates a high-temperature gas as well as directly heating the work piece.

The plasma hearth process system would consist of the following functional units: a feed system, a primary plasma chamber, a secondary combustion chamber, an offgas treatment system, and a slag removal system. Waste would be fed to the primary chamber where heat from the plasma torch would be used to initiate a variety of chemical and physical changes. Organic compounds in the waste would be decomposed, volatilized, pyrolized, and/or oxidized. The remaining inorganic material in the waste would be heated to a high temperature where it would melt and separate into molten slag and metal phases. Actinides and oxidized heavy metals would migrate to the slag phase; cooling and solidification of this material would result in the final waste form.

Offgas from the primary process chamber would be transported to a secondary chamber where high temperature, excess oxygen, turbulence, and delay time of the offgas in the secondary chamber would ensure 99.99 percent destruction and removal efficiency of any remaining organic compounds. The offgas would then be cooled by use of an evaporative cooler before entry into the system baghouse and high-efficiency particulate air filters where particulates would be filtered from the offgas at an efficiency of 99.97 percent per filter.

The Plasma Hearth Process technology is chiefly applicable to solid or sludge wastes where a stabilized byproduct is required for disposal. The application for which the Plasma Hearth Process is currently being developed is both solid mixed low-level waste and transuranic waste.

The Transient Reactor Test reactor building (Building 720) is a metal-sided, steel-framed structure and features two high bay sections (north and south) and two low bay sections (east and west). The Plasma Hearth Process field-scale unit (that is, plasma furnace system, offgas system, and support equipment) would be sized and configured for installation in the south high bay area (70 feet wide by 114 feet long by 75 feet high) of the building and would tie into the reactor offgas system at a location not yet determined. Field-scale unit experiments would be conducted as nonreactor experiments in the Transient Reactor Test facility.

The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal). The project data sheet at the end of this project summary supports the above project description.

The proposed project would be located in an existing facility within a major facility area (Argonne National Laboratory-West). (See Figure C-1-1 for location and Section C-3.2 for a discussion of projects within an existing facility.)

Information regarding the environment affected by this project is covered by other sections of this EIS, as summarized and referenced in Section C-3.1. The potential environmental effects associated with this project are summarized in Table C-4.10.2-1. This table is complemented by information on environmental impacts in Section C-3.2 and on mitigation of impacts in Section C-3.3. Other applicable issues are discussed in Section C-3.4.

PROJECT-SPECIFIC OPTIONS:

No Action - Under this option, the Plasma Hearth Process would not be developed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Table C-4.10.2-1. Summary of potential environmental impacts of the Plasma Hearth Process Project under Alternatives B and D.

Environmental attribute	Potential impact[a,b]	Potential mitigative measures[a,c]
Geology and soil, acres disturbed	None expected	Project would be within existing facility
Water resources	Construction: 30,000 liters Operation: 70,855 liters/year	Storm Water Pollution Prevention Plan in place at INEL
Wildlife and habitat	None	Project would be within existing facility
Historic, archaeological, or cultural resources	None	Project would be within existing facility
Air resources	<u>Radiological operational emissions</u> 5.7×10^{-6}% of NESHAP dose limit <u>Toxic Air Pollutants (TAPs)</u> 0.62% of significance level for combined TAPs <u>Prevention of Significant Deterioration (PSD)</u> 0.01% 24-hr SO_2 - Class I, Craters of the Moon Wilderness Area	Facility design, waste acceptance criteria, safety analysis, inspection and surveillance, annual reporting
Human health	<u>Radiation exposures and cancer risk</u> Maximally exposed individual: 5.7×10^{-7} mrem/yr 2.8×10^{-13} latent cancer fatalities/yr 80-km (50-mile) population: Year 2000: 7.5×10^{-6} person-rem/yr 4.0×10^{-8} latent cancer fatalities/yr Year 2010: Not operational <u>Nonradiological effects</u> Negligible impact on health effects expected	Access control, facility design, safety analysis, inspection and surveillance, annual reporting requirements
Transportation	Construction (onsite truck trips): Nonradiological - 0.5 Operation (onsite truck trips per year): Nonradiological - 1.4 Radiological - 37.6	Use of approved transport vehicles and containers, qualified equipment operators, and shipment manifesting procedure
Waste management	Construction (m^3): industrial waste - 20 Operation (m^3/yr): low-level waste - 23 industrial waste - 50	Waste minimization and recycling programs in place at INEL
Socioeconomic conditions	Construction: 5 to 10 subcontractor personnel for 3 months Operation: 6 subcontractor personnel	None required

a. Definition of acronyms: NESHAP - National Emission Standards for Hazardous Air Pollutants.
b. Potential impacts are described further in Section C-3.2.
c. Mitigative measures are described further in Section C-3.3.

Project Data Sheet

Rev. 9 January 19, '95

Section	Item	Value
General Info.	Description/function:	Plasma Hearth Process Project
	WAG	8
	EIS Alter. (A, B, C or D):	B, D
	SNF or Waste stream:	TRU MLLW HW
	Action type:	New
	Structure Type:	Existing
	Size: (m2)	
	Other features: (Pits, ponds, power /water/sewer lines)	Plasma Hearth Equipment
	Location: Inside/outside of fence	Inside ANL-W
	Inside/outside of bldg.	Inside Bld-720
Construction Info.	Cost($): PreConst.	$4 Mil.
	Cost($): Const.	$11 Mil.
	Schedule Start /End: PreConst.	1994 - 1995
	Schedule Start /End: Const.	1995 - 1996
	No. of workers: (new/exist)	5 - 10 Subs. (3 months)
	Heavy Equip. Equip. used: Trips:	See Table C-4.10.2-1
	Acres Disturbed: New	0
	Previous	0
	Revegetated	0
	Air Emissions: (None / Ref.)	See Belanger et al. 1995
	Effluents: Type: Quantity: (liters)	None
	Solid wastes: Type:	Ind.
	Quantity: (m3)	20
	Haz./Toxic Chemicals: Storage/inventory	None

Section	Item	Value
Const.	Cultural resource effects:	N/A
	Pits/ponding created: (m2)	None
	Water usage: (liters)	30 k
	Energy requirements: Electrical: (MWH/yr)	1
	Fossil fuel: (liters)	0
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No
Operational Information	Cost($): Operation:	$10 Mil. Total
	Schedule Start /End:	1996 - 2000
	No. of workers: (new/exist)	6 Subs.
	Heavy Equip. Equip. used: Trips:	See Table C-4.10.2-1
	Air Emissions: (None / Ref.)	See Appendix F, Section 3
	Effluents: Type: Quantity: (liters/yr)	None
	Solid wastes: Type:	LLW Ind.
	Quantity: (m3/yr)	23 50
	Haz./Toxic Chemicals: Storage/inventory	None
	Pits/ponds used: Y/N (m2)	No
	Water usage: (liters/yr)	70,855
	Energy requirements: Electrical: (MWH/yr)	4,688
	Fossil fuel: (liters/yr)	69,822 Propane
	Nightlights used: Y/N	No
	Generators: Night Y/N	No
	Day Y/N	No

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APPENDIX D
ACRONYMS AND ABBREVIATIONS

A

A1W	Large Ship Reactor Prototype
AAC	acceptable air concentration
AACC	acceptable air concentration of carcinogens
AAQS	Idaho Ambient Air Quality Standards
ACGIH	American Conference of Government Industrial Hygienists
AE	architectural engineering
AEA	Atomic Energy Act of 1954
AIRFA	American Indian Religious Freedom Act
ALARA	as low as reasonably achievable
ANL-W	Argonne National Laboratory-West
ANSI	American National Standards Institute
APCE	air pollution control equipment
App.	Appendix
APS	atmospheric protection system
ARA	Auxiliary Reactor Area
ARAR	applicable or relevant appropriate requirement
ARMF	Advanced Reactivity Measurement Facility
ARN	Asbestos Removal Notification
ARPA	Archeological Resources Protection Act
ARVFS	Army Reentry Vehicle Entry Facility Site
ASB	Air Support Building
ASWS	air support weather shield
ATR	Advanced Test Reactor

B

BA	Bachelor of Arts Degree
BACT	best available control technology
BEIR V	Biologic Effects of Ionizing Radiation (NAS-NRC committee)
BLEVE	boiling liquid-expanding vapor explosion
BLM	U.S. Bureau of Land Management
BORAX	Boiling Water Reactor Experiment
BS	Bachelor of Science Degree

C

CAA	Clean Air Act
CEQ	Council on Environmental Quality

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFC	chlorofluorocarbons
CFR	Code of Federal Regulations
CFRMF	Coupled Fast Reactivity Measurement Facility
CH-TRU	contact-handled transuranic waste
CHP	certified health physicist
Ci	curies
cm	centimeters
COCA	Consent Order and Compliance Agreement
COE	Corps of Engineers
CPP	Chemical Processing Plant
CTF	Core Test Facility
CWA	Clean Water Act

D

D&D	decontamination and decommissioning
dBA	decibel A-weighted
DBA	design basis accident
DCG	Derived Concentration Guide
DEIS	Draft Environmental Impact Statement
DEQ	Division of Environmental Quality (State of Idaho)
DOE	U.S. Department of Energy
DOE-CH	U.S. Department of Energy-Chicago Operations Office
DOE-Chicago	U.S. Department of Energy-Chicago Operations Office
DOE-ID	U.S. Department of Energy-Idaho Operations Office
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DRCT	Dry Rod Consolidation Technology
DVF	Drum Venting Facility

E

EA	environmental assessment
EBR-I	Experimental Breeder Reactor I
EBR-II	Experimental Breeder Reactor II
ECF	Expended Core Facility
EDE	effective dose equivalent
EDF	Engineering Design File
EIS	Environmental Impact Statement
EM	Environmental Restoration and Waste Management (DOE Headquarters)
EMT	emergency medical technician
EO	Executive Order (U.S. president)

EP	environmental program
EPA	Environmental Protection Agency
ER&WM	Environmental Restoration and Waste Management
ERPG	Emergency Response Planning Guide
ERPG3	Emergency Response Planning Guide Level 3
ES	executive summary
ESF	engineered-safety features
exp.	exposure

F

FAST	Fluorinel Dissolution Process and Fuel Storage
FDM	frequency division multiplex
FDM	Fugitive Dust Model
FDP	fluorinel dissolution process
FECF	Fuel Element Cutting Facility
FEIS	Final Environmental Impact Statement
FFA/CO	Federal Facility Agreement and Consent Order
FFC Act	Federal Facility Compliance Act
FMC	Food, Machinery, and Chemical Corporation
FONSI	finding of no significant impact
FPR	fuel processing restoration
FR	*Federal Register*
FSA	Fuel Storage Area
FSV	Fort St. Vrain
FTE	full-time employee
FWHA	Federal Highway Administration
FWS	U.S. Fish and Wildlife Service
FY	fiscal year

G H

GPP	General Plant Project
GTCC	greater-than-Class-C (waste)
haz.	hazardous
HEPA	high-efficiency particulate air (filter)
HFEF	Hot Fuel Examination Facility
HLLW	high-level liquid waste
HLW	high-level waste
HPIL	Health Physics Instrument Laboratory
HTRE-3	Heat Transfer Reactor Experiment No. 3
HW	hazardous waste
HWMA	Hazardous Waste Management Act
HWSF	Hazardous Waste Storage Facility

I

IAEA	International Atomic Energy Agency
IAG	Interagency Agreement
IAQB	Idaho Air Quality Bureau (now known as Division of Environmental Quality)
IBO	Idaho Branch Office (of Pittsburgh Naval Reactors)
IC	industrial/commercial waste
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission on Radiation Protection
IDE	Idaho Department of Education
IDHW	Idaho Department of Health and Welfare
IDLH	immediate danger to life or health
IDO	Department of Energy-Idaho Operations Office reports
IDWR	Idaho Department of Water Resources
IET	Initial Engine Test
IFSF	Irradiated Fuel Storage Facility
ILTSF	Intermediate-Level Transuranic Storage Facility
ind.	industrial
INEL	Idaho National Engineering Laboratory
INPS	Idaho Natural Plant Society
IPC	Idaho Power Company
IRC	INEL Research Center
ISC2	Industrial Source Complex 2
ISDE	Idaho State Department of Employment
ISU	Idaho State University
IWPF	Idaho Waste Processing Facility

J K L

JD	Juris Doctor (Doctor of Law)
K	one thousand
kl	kiloliters
km	kilometers
kV	kilovolt
l	liters
LDR	land disposal restrictions
LLW	low-level waste

M

μg	micrograms
m	meters
m^3	cubic meters
MA	Master of Arts Degree
MACT	maximum achievable control technology
MCL	maximum containment level

MCW	maximally exposed co-located worker
MEI	maximally exposed individual
mil.	millions
MLLW	mixed low-level waste
MLLWTF	Mixed Low-Level Waste Treatment Facility
MPA	Master's Degree in Public Affairs
mrem	millirem
MRW	mixed radioactive waste
MS	Master of Science Degree
MTHM	metric tons of heavy metal
MTR	Materials Test Reactor
MW	mixed waste
MWh	megawatt hours

N

NA, N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	National Association of Science
NCR	notification of change report
NCRP	National Council on Radiation Protection
NDE/NDA	nondestructive examination/ nondestructive analysis
NEC	National Electrical Code/ Nuclear Energy Center
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standard for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NOA	notice of availability
NOAA	National Oceanic and Atmospheric Association
NODA	Naval Ordnance Disposal Area
NOI	Notice of Intent
NON	Notice of Noncompliance
NOO	Notice of Opportunity
NPDES	National Pollutant Discharge Elimination Systems
NPL	National Priority List
NPR	New Production Reactor
NPRD	New Production Reactor Department
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NSC	National Security Council
NTIS	National Technical Information Service

NUREG	Nuclear Regulatory Guide
NWCF	New Waste Calcining Facility
NWPA	Nuclear Waste Policy Act of 1982
NYSERDA	New York State Energy Research and Development Authority
PSD	prevention of serious deterioration
PSD	plant safety document
PTC	permit to construct
PTI	Protection Technology Idaho
PTO	permit to operate

OP

OCRWM	Office of Civilian Radioactive Waste Management
OIP	operating internal pressure
ops.	operations
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PCB	polychlorinated biphenyl
pCi	picocuries
PEIS	programmatic environmental impact statement
PEW	process equipment waste
PhD	a doctoral degree
PMF	probable maximum flood
PNL	Pacific Northwest Laboratory
PREPP	Process Experimental Pilot Plant
PSAWT	private sector alpha low-level waste treatment

QR

R&D	research and development
RCRA	Resource Conservation and Recovery Act
RESL	Radiological and Environmental Sciences Laboratory
RFP	Request for Proposal
RI/FS	Remedial Investigation/ Feasibility Study
RLWTF	Radioactive Liquid Waste Treatment Facility
RMWSF	Radioactive Mixed Waste Storage Facility
ROD	Record of Decision
ROI	region of influence
RSAC-5	Radiological Safety Analysis Computer Program
RSWF	Radioactive Scrap and Waste Facility
RW	radioactive waste
RWMC	Radioactive Waste Management Complex

RWMIS	Radioactive Waste Management Information System

S

S1W	Submarine Thermal Reactor
S5G	Submarine Reactor
SAA	Satellite Accumulation Area (process waste)
SAIC	Science Applications International Corporation
SAR	Safety Assessment Report
SARA	Superfund Amendments and Reauthorization Act
scfm	standard cubic feet per minute
SDA	Subsurface Disposal Area
SDWA	Safe Drinking Water Act
SF	support facilities
SL-1	Stationary Low-Power Reactor No. 1
SMC	Specific Manufacturing Complex
SNF	spent nuclear fuel
SNF and INEL EIS	Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement
SPERT	Special Power Excursion Reactor Test
SPF	Sodium Process Facility
spp.	species
SSC	species of special concern (State of Idaho)
SWEPP	Solid Waste Examination Pilot Plant
SWMU	solid waste management unit

T

TAN	Test Area North
TBD	to be determined
TCE	tetrachloroethylene
TCLP	toxicity characterization leeching procedure
TEDE	total effective dose equivalent
THEF	Thermal Hydraulic Experiment Facility
TLD	thermoluminescent dosimeters
TLV-TWA	threshold limit valve/time-weighted average
TMI	Three-Mile Island
TPSP	TAN (Test Area North) Pool Stabilization Project
TRA	Test Reactor Area
TRANSAX	transportation accident exercise
TRD	Technical Resource Document
TRU	transuranic waste
TRUPACT	transuranic packaging container
TSA	Technical Support Annex

TSA	Transuranic Storage Area
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage, or Disposal (Facility)
TSD	Technical Support Document
TSF	Technical Support Facility

U

UCRL	University of California Research Laboratory
UCW	utility cooling water
USBC	U.S. Bureau of tbe Census
USC	United States Code
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator

VW

VOC	volatile organic compound
VVE	vapor vacuum extraction
WAG	Waste Area Group
WCC	Warning Communication Center
WCF	Waste Calcining Facility
WEC	Westinghouse Electric Corporation
WEDF	Waste Engineering Development Facility
WERF	Waste Experimental Reduction Facility
WHF	Waste Handling Facility
WIF	Waste Immobilization Facility
WINCO	Westinghouse Idaho Nuclear Company
WIPP	Waste Isolation Pilot Plant
WM	waste management
WMO	Waste Management Office
WMO	World Meteorological Organization
WNYNSC	Western New York Nuclear Service Center
WRRTF	Water Reactor Research Test Facility
WTD	waste technology development
WVDP	West Valley Demonstration Project
WWSB	Waste Experimental Reduction Facility Waste Storage Building

XYZ

ZPPR	Zero Power Physics Reactor

APPENDIX E
GLOSSARY

Terms in this glossary are defined based on the context in which they are used in this EIS.

100-year flood A flood event of such magnitude it occurs, on average, every 100 years (equates to a 1 percent probability of occurring in any given year).

500-year flood A flood event of such magnitude it occurs, on average, every 500 years (equates to a 0.2 percent probability of occurring in any given year).

absorbed dose The energy imparted by ionizing radiation per unit mass of irradiated material. The unit of absorbed dose is the rad.

accelerator produced radioactive material Radioactive material that was produced in a charged particle accelerator.

acceptable ambient concentration for a carcinogen (AACC) Ambient air quality standards based on the probability of developing excess cancers over a 70-year lifetime exposure to one microgram per cubic meter ($1 \mu g/m^3$) of a given carcinogen and expressed in terms of a screening emission level or an acceptable ambient concentration for a carcinogenic toxic air pollutant.

acceptable ambient concentration for a noncarcinogen (AAC) Ambient air quality standards based on occupational exposure limits for airborne toxic chemicals expressed in terms of a screening emission level or an acceptable ambient concentration for a noncarcinogenic toxic air pollutant.

accident An unplanned sequence of events that results in undesirable consequences.

actinide Any of a series of chemically similar, mostly synthetic, radioactive elements with atomic numbers ranging from actinium-89 through lawrencium-103.

acute exposure The absorption of a relatively large amount of hazardous material (or intake of hazardous material) over a short period of time.

adsorption The attraction and adhesion of ions or molecules in a gaseous or aqueous state to a solid surface.

air pollutant Any substance including, but not limited to, dust, fumes, gas, mist, odor, smoke, vapor, pollen, soot, carbon, or particulate matter that is regulated.

air quality The specific measurement in the ambient air of a particular air pollutant at any given time.

air quality criteria The varying amounts of pollution and lengths of exposure at which specific adverse effects to health and welfare take place.

air quality standard The prescribed level of a pollutant in the outside air that cannot be exceeded during a specified time in a specified geographical area. Established by both Federal and State governments.

alluvium Sedimentary material deposited by flowing water, as in a river bed or delta.

alpha-emitter A radioactive substance that decays by releasing an alpha particle.

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. This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste.

alpha-particle A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2.

ambient air That portion of the atmosphere outside of buildings to which the general public has access.

applicable or relevant and appropriate requirements (ARARs) Requirements, including cleanup standards, standards of control, and other substantive environmental protection requirements and criteria for hazardous substances as specified under Federal and State law and regulations, that must be met when complying with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

aquifer A body of rock or sediment sufficiently permeable to conduct groundwater and to yield significant quantities of water to wells and springs.

as low as reasonably achievable (ALARA) A process by which a graded approach is applied to maintaining dose levels to workers and the public and releases of radioactive materials to the environment as low as reasonably achievable.

attainment area Any area which is designated, pursuant to 42 U.S.C. Section 7407(d) of the Clean Air Act, as having ambient concentrations equal to or less than national primary or secondary ambient air quality standards for a particular air pollutant or air pollutants.

atomic number The number of positively charged protons in the nucleus of an atom and the number of electrons on an electrically neutral atom.

background level The value assigned to the quantity of particulate or gaseous material in ambient air which originates from natural sources uninfluenced by the activity of man.

background radiation Radiation from cosmic sources, naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices.

basalt A general term for dark-colored, fine-grained igneous rock. Commonly extrusive and composed primarily of calcic plagioclase and pyroxene minerals.

baseline For purposes of this EIS, the conditions projected to exist in June 1995, the scheduled date for the Record of Decision, against which the environmental consequences of the various alternatives are evaluated.

below regulatory concern A definable amount of low-level waste that is sufficiently small that it can be deregulated with minimal risk to the public.

best available control technology (BACT) An emission standard (including fuel cleaning or treatment or innovative fuel combination techniques) for control of such contaminants. BACT shall be determined on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, and shall be at least as stringent as any applicable Sections of 40 CFR Part 60 and 40 CFR Part 61. If an emissions standard is infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed as BACT.

beta-emitter A radioactive substance that decays by releasing a beta particle.

beta-particle A charged particle emitted from a nucleus during radioactive decay, with a mass equal to 1/1837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

beyond design basis accidents Accidents of the same type as a distinct design basis accident (fire, earthquake, and so forth) but defined by parameters that exceed in severity the parameters defined for the distinct design basis accident.

bound To estimate or describe an upper limit on a potential environmental consequence when uncertainty exists.

bounding That which represents the maximum reasonably foreseeable event or impact. All other reasonably foreseeable events or impacts would have fewer and/or less severe environmental consequences.

breeder reactor A type of nuclear reactor that creates more fissionable fuel than it uses.

buffer zone An area designed to separate. Specifically, the portion of a disposal site that is controlled by the licensee and that lies under and between the disposal units and the boundary of the site.

by-product material (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (b) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content [Atomic Energy Act 11(e)]. By-product material is exempt from regulation under the Resource Conservation and Recovery Act.

calcination The process of converting high-level waste to unconsolidated granules or powder (also called calcining).

calcine The materials produced by calcination.

canning The process of placing spent nuclear fuel in canisters to retard corrosion, contain radioactive releases, or control geometry.

certification plan See waste certification plan.

certified waste Waste that has been confirmed to comply with the waste acceptance criteria of the treatment, storage, or disposal facility for which it is intended under an approved waste certification program.

certifying authority or official An organization or person outside the waste generator line organization who is responsible for certifying that the waste being sent to a treatment, storage, or disposal facility meets the requirements of the receiving facility's waste acceptance criteria.

characterization The determination of waste composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done for the purpose of determining appropriate storage, treatment, handling, transportation, and disposal requirements.

chronic exposure The absorption of hazardous material (or intake of hazardous materials) over a long period of time (for example, over a lifetime).

cladding The outer jacket of fuel elements and targets usually made of aluminum, stainless steel, or zirconium-aluminum alloy, used to prevent fuel corrosion and retain fission products during reactor operation, or to prevent releases into the environment during storage.

Class I area Under the Clean Air Act, any Federal land that is classified or reclassified "Class I." The designation applies to pristine areas, such as national parks and wilderness areas, where substantial growth is effectively precluded in order to avoid any degradation of the air quality.

clean waste Waste products that are neither radioactive nor hazardous but require appropriate disposal in a solid waste landfill.

closure Deactivation, stabilization, and surveillance of a waste management unit, landfill, or other facility. Closure often refers to the process under the Resource Conservation and Recovery Act involving the preparation and signing of a Closure Plan.

cold nuclear fuel Nuclear reactor fuel which has not been exposed to a neutron flux in a nuclear reactor.

collective dose The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation. The units of collective dose are person-rem.

co-located workers Workers in a fixed population outside the day-to-day process safety management controls of a given facility area. In practice, this fixed population is normally the workers at an independent facility area located some distance from the reference facility area.

commercial waste management facility A facility located off DOE-controlled property that is not managed by DOE to which DOE sends waste for treatment, storage, and/or disposal.

committed dose equivalent (H_{50}) The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake. The International Commission on Radiological Protection defines this as the committed equivalent dose.

committed effective dose See committed effective dose equivalent.

committed effective dose equivalent ($H_{E,50}$) The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues. The International Commission on Radiological Protection defines this as the committed effective dose.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) A Federal law (also known as "Superfund") that provides a comprehensive framework to deal with past or abandoned hazardous materials. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment that could endanger public health, welfare, or the environment, as well as the cleanup of inactive hazardous waste disposal sites. CERCLA has jurisdiction over any release or threatened release of any "hazardous substance" to the environment. Under CERCLA, the definition of "hazardous" is much broader than under the Resource Conservation and Recovery Act, and the hazardous substance need not be a waste. If a site meets the CERCLA requirements for designation, it is ranked along with other "Superfund" sites and listed on the National Priorities List. This ranking and listing is the U. S. Environmental Protection Agency's way of determining which sites have the highest priority for cleanup.

committed equivalent dose See committed dose equivalent.

confinement General control of contaminants through engineering design, such as heating and ventilation systems that use high-efficiency particulate air (HEPA) filters to remove contaminants before discharge to the atmosphere. Such systems may break down or experience a loss of electric power that would "lose confinement" temporarily. This may require evacuation of the structure but would not lead to significant consequences to workers or a significant release.

Consent Order and Compliance Agreement (COCA) A legally binding agreement signed in 1987 between the U.S. Department of Energy Idaho Field Office (DOE-ID), U.S. Environmental Protection Agency Region 10 (EPA Region 10), and the U.S. Geological Survey (USGS). This agreement addressed environmental restoration activities at the INEL. The COCA was superseded by the Federal Facilities Agreement/Consent Order, among DOE-ID, EPA Region 10, and the State of Idaho, signed in December 1991.

contact-handled waste Packaged waste whose external surface dose rate does not exceed 200 millirem per hour.

containerization The process of placing radioactive or other hazardous material in a confining receptacle for storage or transport. For spent nuclear fuel, this is called canning.

containment The provision of a gastight shell or other enclosure around a reactor to confine fission products that otherwise might be released into the atmosphere in the event of an accident.

contamination The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.

contingency plan A document setting out an organized, planned, and coordinated course of action to be followed in case of unanticipated events such as fire, explosion, or other events that may release toxic chemicals, hazardous wastes, or radioactive materials to threaten human health or the environment. The goal of the contingency plan is the containment or mitigation of the impacts resulting from the event.

continuity of operations Activities that include developing strategic and long-range waste management plans, surveillance and maintenance of facilities and equipment, waste certification, proper training programs for personnel, and record/information administration.

control equipment Any method, process or equipment which removes, reduces, or renders less noxious, air pollutants discharged into the atmosphere.

coolant A gas or liquid circulated through a nuclear reactor to remove or transfer heat.

core The central portion of a nuclear reactor containing the fuel elements, moderator, neutron poisons, and support structures.

criteria air pollutant Under the Clean Air Act, and the State of Idaho air quality regulations, any air pollutant for which there is a State or national ambient air quality standard.

cumulative impact The impact on the environment which results from incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impact can result from individually minor but collectively significant actions taking place over a period of time.

curie (Ci) The basic unit used to describe the intensity of radioactivity in a sample of material. The curie is equal to 37 billion disintegrations per second, which is approximately the rate of decay of 1 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 37 billion disintegrations per second.

decay, radioactive The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha or beta particles, often accompanied by gamma radiation. (See half-life; radioactive.)

decommissioning The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

decontamination The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

defense waste Radioactive waste from any activity performed in whole or in part in support of DOE atomic energy defense activities; excludes waste from DOE nondefense activities or waste under the purview of the U. S. Nuclear Regulatory Commission or generated by the commercial nuclear power industry.

delta E A parameter used to define color shift in visual impact modeling. It is the primary basis for determining perceptibility of plume visual impact in screening analyses.

design basis accident (DBA) Accidents that are postulated for the purpose of establishing functional requirements for safety significant structures, systems, components, and equipment.

diffusion The process by which a pollutant plume is diluted by turbulent eddies.

discharge Under principles of hydrogeology, the amount of water passing through (or leaving) a given cross-sectional area in a given period of time. Under the Clean Water Act, discharge of a pollutant, which includes any addition of any pollutant or combination of pollutants to waters of the United States from any point source. This definition includes additions of pollutants into waters of the United States from: surfaced runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

dispersion In air pollution, the process of transport and diffusion of airborne contaminants in the atmosphere.

disposal Emplacement of waste in a manner that ensures protection of human health and the environment within prescribed limits for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste.

disposal facility A facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water and at which waste will remain after closure.

dissolution The ability of water to take a substance into solution.

DOE orders Requirements internal to the U.S. Department of Energy (DOE) that establish DOE policy and procedures, including those for compliance with applicable laws.

DOE site boundary A geographic boundary within which public access is controlled and activities are governed by the U.S. Department of Energy (DOE) and its contractors, not by local authorities. Based on the definition of exclusion zone, a public road traversing a DOE site is considered to be within the DOE site boundary if DOE or the site contractor has the capability to control the road at any time necessary.

dose (or radiation dose) A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined elsewhere in this glossary.

dose conversion factor Any factor that is used to change an environmental measurement to dose in the units of concern. Frequently used as the factor that expresses the committed effective dose equivalent to a person from the intake (inhalation or ingestion) of a unit activity of a given radionuclide.

dose equivalent The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The unit of dose equivalent is the rem. The International Commission on Radiation Protection defines this as the equivalent dose.

dose rate The radiation dose delivered per unit of time; measured, for example, in *rem* per hour.

dry storage Storage of spent nuclear fuel in environments where the fuel is not immersed in liquid for purposes of cooling and/or shielding.

earthquake magnitude A measure of earthquake size, determined by taking the common logarithm (base 10) of the largest ground motion recorded during the arrival of a seismic wave type and applying a standard correction for distance to the epicenter. Three common types of magnitude are Richter (or local) (M_L), P body wave (m_b), and surface wave (M_s).

effective dose See effective dose equivalent.

effective dose equivalent (EDE) The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that is irradiated. It includes the dose from radiation sources internal and/or external to the body and is expressed in units of rem. The International Commission on Radiation Protection defines this as the effective dose.

effluent The wastewater, treated or untreated, that flows out of a facility. Generally, effluent is discharged into surface waters.

emission Any controlled or uncontrolled release or discharge into the outdoor atmosphere of any air pollutants or combination thereof. Emission also includes any release or discharge of any air pollutant from a stack, vent, or other means into the outdoor atmosphere that originates from an emission unit.

emission standard A permit or regulatory requirement established by the Idaho Department of Health and Welfare, or a requirement contained in 40 CFR Part 60, 40 CFR Part 61, or the Idaho State Implementation Plan (SIP), which limits the quantity, rate, or concentration of emissions on a continuous basis, including any requirements which limit opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures to assure continuous emission control.

engineered barriers Manmade components of a waste management system or facility designed to prevent or impede the release of radionuclides or other waste material into the biosphere. This includes the waste form, radioactive waste containers, and other materials placed over and around such containers, and physical features of the system or facility.

enriched uranium Uranium that has greater amounts of the fissionable isotope uranium-235 than occurs naturally. Naturally occurring uranium is 0.72 percent uranium-235.

environmental monitoring The process of sampling and analysis of environmental media in and around a facility being monitored for the purpose of (a) confirming compliance with performance objectives and (b) early detection of any contamination entering the environment to facilitate timely remedial action.

environmental restoration 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.

environmental restoration program A DOE subprogram concerned with all aspects of assessment and cleanup of both contaminated facilities in use and of sites that are no longer a part of active operations. Remedial actions, most often concerned with contaminated soil and groundwater, and decontamination and decommissioning are responsibilities of this program.

eolian Applied (a) to deposits arranged by the wind, (b) to the erosive action of the wind, and (c) to deposits which are due to the transporting action of the wind.

equivalent dose See dose equivalent.

existing facilities Facilities that are projected to exist as of the Record of Decision for this EIS, scheduled for June 1995.

exposure Being exposed to ionizing radiation or to hazardous material. Alternatively, a measure of the ionization produced in air by X or gamma radiation; the unit of exposure in air is the roentgen.

external accident Accidents initiated by manmade energy sources not associated with operation of a given facility. Examples include airplane crashes, induced fires, transportation accidents adjacent to a facility, and so forth.

external dose That portion of the dose equivalent received from radiation sources outside the body.

facility (a) Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft; or (b) any site or area where a hazardous substance has been deposited, stored, disposed of, placed, or otherwise come to be located.

facility area The area within the DOE site boundary immediately surrounding a facility or group of facilities that functions under process safety management programs and a common emergency response plan. This definition covers any building within such an area regardless of whether it is dedicated to production, waste handling, or administrative issues; for example, an office building, a cafeteria, a production facility, a machine shop, and a waste handling facility all contained within a common boundary. If programs such as radiation protection, training, auditing, and evaluation are an integral part of safety management at each facility and emergency response plans cover the potential responses of individuals at all buildings, then the collection of buildings constitutes a facility area. All personnel in the area are facility workers, not co-located workers.

facility area boundary The geographic boundary of an area controlled on a daily basis by process safety management and a common emergency response plan.

facility security plan In the context of waste management, a security plan is one that provides the measures required by law, regulation, or good judgment for prevention of unknowing or unauthorized entry into a treatment, storage, or disposal facility; or operation of facility equipment and systems; or access to waste material or spent nuclear fuel.

facility worker Any worker whose day-to-day activities are controlled by process safety management programs and a common emergency response plan associated with a facility or facility area. This definition includes any individual within a facility/facility area or its 0.4-mile exclusion zone. This definition can also include those transient individuals or small populations outside the exclusion zone but inside the radius defined by the maximally exposed co-located worker if reasonable efforts to account for such people have been made in the facility or facility area emergency plan. For facility accident analyses, the facility worker is defined as an individual located 100 meters (328 feet) downwind of the facility location where an accidental release occurs.

feasibility study (FS) A step in the environmental restoration process specified by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The objectives are to identify the alternatives for remediation and describe a remedial action that satisfies applicable or relevant appropriate requirements (ARARs) for mitigating confirmed environmental contamination. The FS presents a series of specific engineering or construction alternatives for cleaning up a site; for each alternative presented, there will be a detailed analysis of the costs, effects, engineering feasibility, and environmental impacts. The FS is based on infonnation provided in the remedial investigation (RI). Successful completion of an FS should result in a decision (Record of Decision) selecting a remedial action alternative and the subsequent development of a remedial design for implementation of the selected remedial action.

Federal Facility Compliance Act (FFCA) Federal law signed in October 1992 amending the Resource Conservation and Recovery Act. The objective of the FFCA is to bring all Federal facilities into compliance with applicable Federal and State hazardous waste laws, to waive Federal sovereign immunity under those laws, and to allow the imposition of fines and penalties. The law also requires the U. S. Department of Energy to submit an inventory of all its mixed waste and to develop a treatment plan for mixed wastes.

Federal Facility Agreement and Consent Order (FFA/CO) A hinding agreement, negotiated pursuant to Section 120 of CERCLA, signed by DOE, the Environmental Protection Agency Region 10, and the State of Idaho, to coordinate cleanup activities at the INEL. The FFA/CO and its Action Plan outline the remedial action process that will encompass all investigation of hazardous substance release sites. The FFA/CO superseded the Consent Order and Compliance Agreement (COCA).

Federal land manager The Secretary of the Federal department with authority over any Federal lands in the United States.

field offices An administrative division of the DOE that operates facilities that are in its jurisdiction.

fiscal year (FY) The time frame specified by any public or private entity to separate one year's financial (fiscal) activities from the next year's. The 1994 Federal Fiscal Year (FY 1994) began on October 1, 1993, and ended on September 31, 1994.

fissile material Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by thermal (slow) neutrons. The three primarily fissile materials are uranium-233, uranium-235, and plutonium-239.

fission The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

fission products The nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclides formed by the fission fragments' radioactive decay.

fissionable material Commonly used as a synonym for fissile material, the meaning of this term has been extended to include material that can be fissioned by fast neutrons, such as uranium-238.

fluorides Gaseous or solid compounds containing fluorine emitted into the air from a number of industrial processes.

free liquid Liquid that is not absorbed into host material such that it could readily separate from the solid portion of a waste under ambient temperature and pressure and spill or drain from its container.

fugitive dust Dust that is stirred up and released into the atmosphere during construction activities. Fugitive emissions composed of particulate matter.

fugitive emissions Those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

gamma-emitter A radioactive substance that decays by releasing gamma radiation.

gamma ray (gamma radiation) High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.

generator (generation) Organizations of the DOE that produce waste.

geologic repository A system that is intended to be used for, or may be used for, the disposal of radioactive waste or spent nuclear fuel in excavated geologic media. A geologic repository includes (a) the geologic repository operations area, and (b) the portion of the geologic setting that provides isolation. A near-surface disposal area is not a geologic repository.

geothermal energy The energy available from natural sources of heat, such as hot springs and near-surface heat sources in volcanically active areas.

graded approach A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with (a) the relative importance to safety, safeguards, and security; (b) the magnitude of any hazard involved; (c) the life-cycle stage of a facility; (d) the programmatic mission of a facility; (e) the particular characteristics of a facility; and (f) any other relevant factor.

graphite fuel Fuel that consists of small pellets of highly enriched uranium (HEU)-carbide fuel surrounded by protective layers of other carbide compounds. These pellets are dispersed in much larger graphite structures for handling and neutron moderation.

greater-than-Class-C waste (GTCC) 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 10 CFR 61. DOE is responsible for the disposal of greater-than-Class-C wastes from DOE nondefense programs.

groundwater Generally, all water contained in the ground. Water held below the water table available to freely enter wells.

grouting Grouting is the process of immobilizing or fixing solid forms of waste so they can be more safely stored or disposed.

half-life The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from millionths of a second to billions of years. Also called physical half-life.

hazard classification A safety classification based on potential onsite consequences. Criteria for this classification are discussed in DOE Order 5480.23 (Nuclear Safety Analysis Reports).

hazardous air pollutant Any air pollutant subject to a standard promulgated under 42 U.S.C. Section 7412 or other requirements established under 42 U.S.C. Section 7412 of the Clean Air Act, including 42 U.S.C. Section 7412(g), (j), and (r) of the Clean Air Act.

hazardous substance Any substance that when released to the environment in an uncontrolled or unpermitted fashion becomes subject to the reporting and possible response provisions of the Clean Water Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

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, or 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.

hazardous waste landfill A disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, or a cave.

heavy metals Metallic elements with high atomic weights (for example, mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations and tend to accumulate in the food chain.

heterogeneous Pertaining to a substance having different characteristics in different locations. A synonym is nonuniform.

high-efficiency particulate air (HEPA) filter A filter with an efficiency of at least 99.95 percent used to separate particles from air exhaust streams prior to releasing that air to the atmosphere.

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.

Holocene In the geological scale of time, the more recent of the two epochs of the Quaternary period (10,000 years ago to the present); that period of time since the last ice age.

hot cell/hot cell facility A heavily shielded enclosure for handling and processing (by remote means or automatically) or storing highly radioactive materials.

hydraulic conductivity Capacity of a porous media to transport water.

hydraulic gradient The slope of the water table per unit of distance, resulting in groundwater movement.

hydrogeochemistry The study of the chemical interactions between the earth's components, including rocks, minerals, and water.

hydrogeology The study of the geological factors relating to water.

hydrology The study of water, including groundwater, surface water, and rainfall.

infiltrate Water passing from the land surface through the vadose zone into the aquifer.

intermittent surface water A stream, creek, or river which does not contain water during part or all of the year.

inadvertent intrusion The inadvertent disturbance of a disposal facility or its immediate environment by a potential future occupant that could result in loss of containment of the waste or exposure of personnel. Inadvertent intrusion is a significant consideration that shall be included either in the design requirements or waste acceptance criteria of a waste disposal facility.

incineration The efficient burning of combustible solid and liquid wastes to destroy organic constituents and reduce the volume of the waste. Incinerators are designed to burn with an extremely high efficiency. The greater the burning efficiency, the cleaner the air emission. Incineration of radioactive materials does not destroy the radionuclides but does significantly reduce the volume of these wastes. High-efficiency particulate air (HEPA) filters are used to prevent radionuclides and heavy metals from going out of the stack and into the atmosphere.

industrial commercial waste Material that is not subject to Resource Conservation and Recovery Act Subtitle C or Atomic Energy Act regulation. It is generated by manufacturing or industrial processes. Industrial commercial waste is also known as solid waste and is regulated by Resource Conservation and Recovery Act, Subtitle D.

INEL industrial waste Industrial commercial waste generated at the INEL is categorized as INEL industrial waste.

institutional control The control of waste management facilities by human institutions.

Interagency Agreement (IAG) See Federal Facility Agreement and Consent Order.

interim status facility See RCRA interim status facility.

interim action (CERCLA) A remedial action undertaken to clean up or contain a potential threat to human health and the environment that can or should be addressed within a short timeframe. The study associated with an interim action may be completed within an "umbrella" remedial investigation/feasibility study. Interim actions are completed on an accelerated schedule and generally deal with well-defined contamination problems that present a significant, although not immediate, threat to human health and the environment.

interim action (NEPA) An action that may be undertaken while work on a required program EIS is in progress and the action is not covered by an existing program statement. An interim action may not be undertaken unless such action: (a) is justified independently of the program; (b) is itself accompanied by an adequate EIS or has undergone other NEPA review; and (c) will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

internal accidents Accidents that are initiated by man-made energy sources associated with the operation of a given facility. Examples include process explosions, fires, spills, criticalities, and so forth.

inversion In the atmosphere, a condition in which air temperature warms with increasing altitude.

isotope One of two or more atoms with the same number of protons, but different numbers of neutrons, in their nuclei. Thus, carbon-12, carbon-13, and carbon-14 are isotopes of the element carbon, the numbers denoting the approximate atomic weights. Isotopes have very nearly the same chemical properties, but often different physical properties (for example, carbon-12 and -13 are stable, carbon-14 is radioactive).

Kjeldahl nitrogen A method of nitrogen analysis designed to measure nitrogen present as part of organic compounds.

lacustrine Pertaining to, produced by, or formed in a lake or lakes; growing in or inhabiting lakes.

Land Disposal Restrictions A Resource Conservation and Recovery Act (RCRA) program that restricts land disposal of RCRA hazardous and RCRA mixed wastes and requires treatment to promulgated treatment standards. Land Disposal Restrictions identify hazardous wastes that are restricted from land disposal and define those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.

land-use planning A decisionmaking process to determine the future or end use of a parcel of land, considering such factors as current land use, public expectations, cultural considerations, local ecological factors, legal rights and obligations, technical capabilities, and costs.

lapse In the atmosphere, a condition in which air temperature cools with increasing altitude.

less-than-90-day storage The onsite accumulation and/or storage of hazardous waste for a period of less than 90 days by a generator subject to the requirements of 40 CFR 262.34(a).

life cycle The entire time period from generation to permanent disposal or elimination of waste.

liquid metal fast breeder reactor A reactor that operates using a type of fission known as fast fission where the neutrons that are used to split the atoms are not slowed down or moderated, as is usually the case with normal fission. It creates more fissionable material than it consumes and uses liquid metal as a coolant. Liquid sodium is a common metal used to cool this type of reactor.

listed waste Under the Resource Conservation and Recovery Act, waste listed in 40 CFR 261, Subpart D, as hazardous. Listed hazardous wastes include wastes from specific sources, nonspecific sources, and discarded commercial chemical products. These wastes have not been subjected to the toxicity characterization leaching procedure because the dangers they present are considered selfevident.

loess A homogeneous deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay.

long-term storage The storage of hazardous waste (a) onsite (a generator site) for a period of 90 days or greater, other than in a satellite accumulation area, or (b) offsite in a properly managed treatment, storage, or disposal facility for any period of time.

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.

mafic Pertaining to or composed predominantly of the magnesian rock-forming silicates; said of some igneous rocks and their constituent minerals; synonymous with "dark minerals."

major radionuclides The radioisotopes that together comprise 95 percent of the total curie content of a waste package by volume and have a half-life of at least 1 week. Radionuclides that are important to a facility's radiological performance assessment and/or a safety analysis and are listed in the facility's waste acceptance criteria are considered major radionuclides.

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.

maximally exposed co-located worker (MCW) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for co-located workers. This individual is located at whichever is the greater of 0.4 miles from the facility area boundary (that is, the exclusion zone boundary) or 75 percent of the distance to the nearest independent facility area (that is, the low population zone boundary). The MCW is irrelevant if the DOE site boundary is closer than the MCW location.

maximally exposed individual (MEI) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed offsite individual (MOI).

maximally exposed offsite individual (MOI) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed individual (MEI).

maximum concentration level These are the maximum concentrations of radionuclides in water estimated to correspond to a lifetime cancer risk of 1/10,000, assuming a lifetime daily consumption of 2 liters of water. These concentrations assume radionuclides emit only one type of radiation. For nonradioactive, noncarcinogenic compounds, maximum concentration levels are based on no observable effect levels.

maximum contaminant level (MCL) Under the Safe Drinking Water Act, the maximum permissible concentrations of specific constituents in drinking water that are delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set as maximum contaminant levels take into account the feasibility and cost of attaining the standard.

meteorological classifications Categories defining various states of atmospheric turbulence (dispersion and dilution) that are used to estimate diffusion of radioactive material concentrations for accident scenarios. The criteria consider the relationship of wind speed, insolation (amount of incoming solar radiation), and cloudiness (see Brenk et al. 1983).

> **Average (50 percent) meteorology:** Average meteorological dispersion conditions; more favorable and less favorable to dispersion conditions will each occur 50 percent of the time.
>
> **Conservative (95 percent) meteorology:** Adverse meteorological dispersion conditions (unfavorable to dispersion) which will not occur more than 5 percent of the time.
>
> **Neutral meteorology:** Pasquill Stability Class D, conditions which neither enhance nor inhibit vertical diffusion in the atmosphere.
>
> **Stable meteorology:** Pasquill Stability Class F, moderately stable conditions; the atmospheric condition existing when the temperature of the air rises rather than falls with altitude. It allows for little or no vertical air movement.

metric tons of heavy metal (MTHM) Quantities of unirradiated and spent nuclear fuel and targets are traditionally expressed in terms of metric tons of heavy metal (typically uranium), without the inclusion of other materials, such as cladding, alloy materials, and structural materials. A metric ton is 1,000 kilograms, which is equal to about 2,200 pounds.

millirem One thousandth of a rem (see rem).

mitigation Those actions that avoid impacts altogether, minimize impacts, rectify impacts, reduce or eliminate impacts, or compensate for the impact.

mixed waste Waste that contains both hazardous waste under the Resource Conservation and Recovery Act and source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954.

mixing depth The height to which pollutants can freely disperse, above which inversion conditions exist.

moment magnitude A measure of earthquake size. The rigidity of the rock times the area of faulting times the amount of slip.

M_s Surface wave magnitude; motion is restricted to near the ground surface. Such waves correspond to ripples of water that travel across a lake. Most of the wave motion is located at the outside surface itself; and, as the depth below this surface increases, wave displacements become less and less.

nanocurie One billionth of a curie (see curie).

National Environmental Policy Act of 1969 (NEPA) A law that requires Federal agencies to include in their decisionmaking processes appropriate and careful consideration of all potential environmental effects of proposed actions, analyses of their alternatives, and measures to avoid or minimize adverse effects of a proposed action that have the potential for significantly affecting the environment. These analyses are presented in either an environmental assessment (EA) or in an environmental impact statement (EIS).

National Oceanic and Atmospheric Administration (NOAA) A Federal agency that collects and analyzes information on the weather. NOAA has an office at INEL for collecting weather information. NOAA also is involved with the environmental monitoring programs at INEL.

National Priorities List (NPL) A formal listing of the nation's worst hazardous waste sites, as established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), that have been identified for remediation.

natural phenomena accidents Accidents that are initiated by phenomena such as earthquakes, tornadoes, floods, and so forth.

near-surface disposal Disposal in the uppermost portion of the earth, approximately 30 meters. Near-surface disposal includes disposal in engineered facilities that may be built totally or partially above-grade provided that such facilities have protective earthen covers. A near-surface disposal facility is not considered a geologic repository.

nearest public access For facility accident analyses, the location of the nearest public highway where members of the public could be present.

new facilities Any facility that is not an existing facility or an existing hazardous waste management facility.

nitrogen oxides (NO_x) Gases formed in great part from atmospheric nitrogen and oxygen when combustion takes place under conditions of high temperature and high pressure; considered a major air pollutant. Two major nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), are important airborne contaminants. In the presence of sunlight, nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide, which in high enough concentrations can cause lung damage.

nonattainment area Any area which has been designated as not meeting (or contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.

noncertifiable waste Waste that is not able to meet the waste acceptance criteria for the intended treatment, storage, or disposal facility; transportation requirements; or waste that may be too difficult to characterize adequately to prove that it meets the applicable criteria.

nonreactor nuclear facility Those activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or to the general public. These activities or operations include producing, processing, or storing radioactive liquid or solid waste, fissionable materials, or tritium; conducting separation operations; conducting inspections of irradiated materials, fuel fabrication, decontamination, or recovery operations; conducting fuel enrichment operations; or performing environmental remediation or waste management activities involving radioactive materials.

nonhazardous Waste that does not pose risks to human health and the environment. Industrial/commercial waste is an example (see hazardous waste).

normal conditions All activities associated with a facility mission, whether operation, maintenance, storage, and so forth, which are carried out within a defined envelope. This envelope can be design process conditions, performance in accordance with procedure, and so forth.

normal operation All normal conditions and those abnormal conditions that frequency estimation techniques indicate occur with a frequency greater than 0.1 events per year.

NO_x A generic term used to describe the oxides of nitrogen (see nitrogen oxides).

nuclear criticality A self-sustaining chain reaction that releases neutrons and energy and generates radioactive by-product material.

nuclear fuel Materials that are fissionable and can be used in nuclear reactors to make energy.

nuclide A general term referring to all known isotopes, both stable (279) and unstable (about 5,000), of the chemical elements.

off-link doses Doses to members of the public within 800 meters (2,625 feet) of a road or railway.

offsite facility A facility located at a different site or location than the shipper.

offsite population For facility accident analyses, the collective sum of individuals located within an 80-kilometer (50-mile) radius of the INEL facility and within the path of the plume with the wind blowing in the most populous direction.

on-link doses Doses to members of the public sharing a road or railway.

onsite The same or geographically contiguous property that may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing as opposed to going along the right-of-way. Non-contiguous properties owned by the same person but connected by a right-of-way that he/she controls and to which the public does not have access is also considered onsite property.

onsite facilities Buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed onsite.

operable unit A discrete portion of a Waste Area Group (WAG) consisting of one or many release sites considered together for assessment and cleanup activities. The primary criteria for placement of release sites into an operable unit include geographic proximity, similarity of waste characteristics and site types, and the possibilities for economy of scale.

operator The organization that operates a facility.

organic compounds Chemicals containing mainly carbon, hydrogen, and oxygen. Petroleum products, petroleum-based solvents, and pesticides are examples of organic compounds. Exposure to some organic compounds can produce toxic effects on body tissues and processes.

orphan wastes Wastes in a classification that currently have no long-term disposal scheduled or anticipated. An example of an orphan waste is low-level mixed waste. Orphan waste is probably not radioactive enough to qualify for disposal at the Waste Isolation Pilot Plant and it cannot be disposed of onsite because it has hazardous components.

orthophosphate The phosphate ions including H_2O_4, HPO_4^{2-}, and PO_4^{3-}.

overpack A secondary container placed around a primary container to provide additional protection to or from the contents of a waste package or enclose a damaged primary container.

package The packaging plus its contents.

packaging A receptacle and any other components or materials necessary for the receptacle to perform its required containment function.

particulate matter Any material, except water in uncombined form, that exists as a liquid or a solid at standard conditions.

passivation The process of making metals inactive or less chemically reactive. For example, to passivate the surface of steel by chemical treatment.

perched water A discontinuous saturated water body above the water table with unsaturated conditions existing both above and below.

perennial surface water A stream, creek, lake, pond, or river which contains water year round.

performance assessment A systematic analysis of the potential risks posed by waste management systems to the public and environment and a comparison of those risks to established performance objectives.

performance assessment limited waste Special-case waste comparable to greater-than-Class-C waste but generated by the government. This is a low-level waste but has unique characteristics that make it unsuitable for shallow land burial.

performance-assessment-limited alpha waste Any alpha-contaminated waste, not meeting the definition of transuranic waste, that cannot be disposed of by shallow land burial, based on a documented site-specific performance assessment approved by the DOE Operations Office and Headquarters.

performance objectives Parameters within which a facility must perform to be considered acceptable.

permeability The degree of ease with which water can pass through a rock or soil.

person-rem A unit of collective radiation dose applied to populations or groups of individuals (see collective dose).

playa The shallow central basin of a desert plain in which water gathers and then evaporates.

Pleistocene The older of the two epochs of the Quaternary period (2 million to 10,000 years ago).

plume The three-dimensional area containing measurable concentrations of a compound or element which has migrated from its source point.

PM-10 All particulate matter in the ambient air with an aerodynamic diameter less than or equal to a nominal ten (10) micrometers.

pollutant migration The movement of a contaminant away from its initial source.

pollution prevention The use of any process, practice, or product that reduces or eliminates the generation and release of pollutants, hazardous substances, contaminants, and wastes, including those that protect natural resources through conservation or more efficient utilization.

polychlorinated biphenyls (PCBs) A class of chemical substances formerly manufactured as an insulating fluid in electrical equipment that is highly toxic to aquatic life. In the environment, PCBs exhibit many of the characteristics of dichloro diphenyl trichloroethane (DDT); they persist in the environment for a long time and accumulate in animals.

population dose The overall dose to the offsite population.

porosity (n) Porosity is an index of the relative pore volume. It is the total unit volume of the soil or rock divided into the void volume.

preferential pathways Preferred pathways for fluid flow. They are dependent upon the moisture content of the porous media.

pressurized water reactor A nuclear power reactor that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.

primary ambient air quality standard That air quality that, allowing an adequate margin of safety, is requisite to protect the public health.

probable maximum flood The largest flood for which there is any reasonable expectancy in a specific area. The probable maximum flood is normally several times larger than the largest flood of record.

process knowledge The set of information that is used by trained and qualified individuals who are cognizant of the origin, use, and location of waste-generating materials and processes in sufficient detail so as to certify the identity of the waste.

processing (of spent nuclear fuel) Applying a chemical or physical process designed to alter the characteristics of a spent nuclear fuel matrix.

public Anyone outside the DOE site boundary at the time of an accident or during normal operation. With respect to accidents analyzed in this EIS, anyone outside the DOE site boundary at the time of an accident.

quality assurance All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or components will perform satisfactorily and safely in service. Quality assurance includes quality control, which is all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.

quality factor (Q) The modifying factor that is used to derive dose equivalent from absorbed dose.

Quaternary The younger of the two geologic periods in the Cenozoic Era (2 million years ago to the present). Quaternary is subdivided into the Pleistocene and Holocene epochs.

rad The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram.

radiation (ionizing radiation) Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as it is used in this EIS, does not include nonionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

radiation worker A worker who is occupationally exposed to ionizing radiation and receives specialized training and radiation monitoring devices to work in such circumstances.

radioactive waste Waste that is managed for its radioactive content.

radioactivity The property or characteristic of material to spontaneously "disintegrate" with the emission of energy in the form of radiation. The unit of radioactivity is the curie (or becquerel).

radioisotope An unstable isotope, of an element, that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

radiological survey The evaluation of the radiation hazards accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from unexpected or possible changes in materials or equipment.

Radiological and Environmental Sciences Laboratory (RESL) A facility involved in environmental monitoring of INEL onsite and offsite radiation and research on its effects.

radionuclide See radioisotope.

RCRA See Resource Conservation and Recovery Act.

RCRA accumulation point There are two types of accumulation areas allowed under the Resource Conservation and Recovery Act (RCRA):

> **Satellite Accumulation Areas (SAAs):** Locations where hazardous waste generators are allowed to accumulate waste at or near the point of generation. Generators may accumulate up to 55 gallons of hazardous waste or one quart of acutely hazardous waste at or near the point of generation. Upon reaching 55 gallons, the generator has 72 hours to move the hazardous waste to either a temporary accumulation area or a permitted facility.
>
> **Temporary Accumulation Areas (TAAs):** Under RCRA, the location where hazardous waste may be stored by a generator without a RCRA permit, TAAs are limited by the amount of time they can store a hazardous waste. Generators may store hazardous wastes for up to 90 days without a permit if the generator complies with other safety and storage requirements,

including a personnel training plan, a contingency plan, and an emergency preparedness and response plan.

RCRA interim status facility Hazardous waste management facilities (that is, treatment, storage, or disposal facilities) subject to Resource Conservation and Recovery Act requirements that were in existence on the effective date of regulations are considered to have been issued a permit on an interim basis as long as they have met notification and permit application submission requirements. Such facilities are required to meet interim status standards until they have been issued a final permit or until their interim status is withdrawn.

RCRA storage A facility used to store Resource Conservation and Recovery Act (RCRA) hazardous waste for greater than 90 days. To be in compliance with the regulatory requirements of RCRA, the facility must meet both documentation requirements (for example, contingency and waste analysis plans) and physical requirements (for example, specific aisle widths and separation of incompatible wastes).

reclassified low-level waste See alpha low-level waste.

Record of Decision (ROD) A public document that records the final decision(s) concerning a proposed action. The Record of Decision is based in whole or in part on information and technical analysis generated either during the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process or the National Environmental Policy Act (NEPA) process, both of which take into consideration public comments and community concerns.

recycling Recycling techniques are characterized as use, reuse, and reclamation techniques (resource recovery). Use or reuse involves the return of a potential waste material either to the originating process as a substitute for an input material or to another process as an input material. Reclamation is the recovery of a useful or valuable material from a waste stream. Recycling allows potential waste materials to be put to a beneficial use rather than going to treatment, storage, or disposal.

regulated substances A general term used to refer to materials other than radionuclides that are regulated by Federal, State, (or possibly local) requirements.

release site A location at which a hazardous, radioactive, or mixed waste release has occurred or is suspected to have occurred. It is usually associated with an area where these wastes, or substances contaminated with them, have been used, treated, stored, and/or disposed of.

rem The dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray exposure.

remedial investigation (RI) The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations. The RI provides the site-specific information for the feasibility study (FS).

remediation Process of remedying a site where a hazardous substance release has occurred.

remote-handled waste Packaged waste whose external surface dose rate exceeds 200 millirem per hour.

remote handling The handling of wastes from a distance so as to protect human operators from unnecessary exposure.

repository A permanent deep geologic disposal facility for high-level or transuranic wastes and spent nuclear fuel.

representative sample A sample of a universe or whole (for example, waste pile, lagoon, ground water) that can be expected to exhibit the average properties of the universe or whole.

reprocessing (of spent nuclear fuel) Processing of reactor irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle such materials primarily for defense programs. Historically, reprocessing has involved aqueous chemical separations of elements (typically uranium or plutonium) from undesired elements in the fuel.

research reactor A nuclear reactor used for research and development.

Resource Conservation and Recovery Act (RCRA) A Federal law addressing the management of waste. Subtitle C of the law addresses hazardous waste under which a waste must either be "listed" on one of the U. S. Environmental Protection Agency's (EPA's) hazardous waste lists or meet one of EPA's four hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity, as measured using the toxicity characterization leaching procedure (TCLP). Cradle-to-grave management of wastes classified as RCRA hazardous wastes must meet stringent guidelines for environmental protection as required by the law. These guidelines include regulation of transportation, treatment, storage, and disposal of RCRA-defined hazardous waste. Subtitle D of the law addresses the management of nonhazardous, nonradioactive, solid waste, such as municipal wastes.

retrieval The process of recovering wastes that have been stored or disposed of onsite so they may be appropriately characterized, treated, and disposed of.

rhyolite A very acid volcanic rock that is the lava form of granite.

risk Quantitative expression of possible loss that considers both the probability that a hazard causes harm and the consequences of that event.

roentgen A unit of exposure to ionizing radiation. It is that amount of gamma or X-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions.

safe and secure Storage with design and operational features that maintain the integrity of the fuel cladding, prevent criticalities, preclude diversion, and so forth. Safe and secure storage would generally meet the intent of DOE Orders, but waivers may be required and granted for some requirements on a case-by-case basis where warranted.

safety analysis report A report, prepared in accordance with DOE Orders 5481.1B and 5480.23, that summarizes the hazards associated with the operation of a particular facility and defines minimum safety requirements.

safety class structures, systems, and components Those systems, structures, or components whose functioning is necessary to keep maximally exposed offsite individual (MOI) exposure below a dose of 25 rem or an Emergency Response Planning Guideline-2 dosage for design basis accidents and evaluation basis accidents.

sanitary landfill A facility for the disposal of solid waste where there is no reasonable probability of adverse effects on health or the environment from disposal of the solid waste at the facility. This facility is not an open dump and is not for disposal of hazardous waste.

sanitary waste Liquid or solid wastes that are generated as a result of routine operations of a facility and are not considered hazardous or radioactive.

satellite accumulation See RCRA accumulation point.

saturated zone That part of the earth's crust in which all naturally occurring voids are filled with water.

scaling factor A multiplier that allows the inference of one radionuclide concentration from another that is more easily measured.

scientific notation A notation adopted by the scientific community to deal with very large and very small numbers by moving the decimal point to the right or left so that only one number above zero is to the left of the decimal point. Scientific notation uses a number times ten and either a positive or negative exponent to show how many places to the left or right the decimal place has been moved. For example, in scientific notation, 120,000 would be written as 1.2×10^5, and 0.000012 would be written as 1.2×10^{-5}. In a variation of scientific notation often used in computer printouts, the multiplication sign and number 10 are replaced by the letter E. The above numbers would be written as 1.2E5 and 1.2E-5, respectively.

scrubber A device that uses a liquid spray to remove aerosol and gaseous pollutants from an airstream. The gases are removed either by absorption or chemical reaction. Solid and liquid particulates are removed through contact with the spray.

secondary ambient air quality standard That air quality which is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air.

secondary emissions Emissions which would occur as a result of the construction, modification, or operation of a stationary source or facility but do not come from the stationary source or facility itself.

sedimentary interbeds Rock layers composed of materials, such as sand or gravel, which are derived from the breakdown of various rocks that are layered between other rock types.

segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

seismicity The phenomenon of earth movements; seismic activity. Seismicity is related to the location, size, and rate of occurrence of earthquakes.

site inspection The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process to acquire the necessary data to confirm the existence of environmental contamination and to assess the associated potential risks to human health, welfare and the environment. The data collected must be sufficient to support the decision either for continuing with a remedial investigation/feasibility study (RI/FS) or for removing the site from further investigation through a decision document.

site waste management organization The functional organization at a DOE site whose responsibility it is to manage waste generated by that site's operations.

sizing The process of reducing the size of various types of solid wastes by compaction, melting, or mechanical reduction.

small quantity generator A generator who generates less than 1,000 kilograms of hazardous waste in a calendar month.

sodium-bearing waste Liquid radioactive waste generated from decontamination of process equipment and other miscellaneous activities at the Idaho Chemical Processing Plant.

sole source aquifer A designation granted by the U. S. Environmental Protection Agency when groundwater from a specific aquifer supplies more than 50 percent of the drinking water for the area overlying the aquifer. Sole source aquifers have no alternative source or combination of sources which could physically, legally, and economically supply all those who obtain their drinking water from the aquifer. Sole source aquifers are protected from federally financially assisted activities determined to be potentially unhealthy for the aquifer.

solid waste Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges, which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended [Public Law 94-580, 1004(27) (Resource Conservation and Recovery Act)].

solid waste management units (SWMU) Any site, excluding Land Disposal Units, that received or handled solid waste, whether or not hazardous constituents were involved.

solvents Liquid chemicals, usually organic compounds, that are capable of dissolving another substance. Exposure to some organic solvents can produce toxic effects on body tissues and processes.

source material (a) Uranium, thorium, or any other material that is determined by the Nuclear Regulatory Commission pursuant to the provisions of the Atomic Energy Act of 1954, Section 61, to be source material; or (b) ores containing one or more of the foregoing materials, in such concentration as the Nuclear Regulatory Commission may by regulation determine from time-to-time [Atomic Energy Act 11(z)]. Source material is exempt from regulation under the Resource Conservation and Recovery Act.

source term The type and quantity of pollutants emitted to air from a specific source or group of sources.

SO_x A generic term used to describe the oxides of sulfur. The combination of sulfur oxides with water vapor produces acid rain (see sulfur oxides).

special nuclear material (a) Plutonium or uranium enriched in the isotope 233, or in the isotope 235, and any other material that the U. S. Nuclear Regulatory Commission, pursuant to the provisions of the Atomic Energy Act of 1954, Section 51, determines to be special nuclear material; or (b) any material artificially enriched by any of the foregoing, but does not include source material. Special nuclear material is exempt from regulation under the Resource Conservation and Recovery Act (RCRA).

special-case waste Radioactive waste owned or generated by DOE that does not fit into typical management plans developed for the major radioactive waste types.

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

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.

stabilized waste (stability) Treatment or packaging of a waste stream that is intended to ensure that the waste does not structurally degrade and affect overall stability of the disposal site through slumping, collapse, or other types of failures that will lead to water infiltration into the waste. Stabilization is also a factor in limiting exposure to an inadvertent intruder since it provides a recognizable and nondispersible waste.

stable Low potential for vertical mixing.

stakeholder Any person or organization with an interest in or affected by DOE activities. Stakeholders may include representatives from Federal agencies, State agencies, Congress, Native American Tribes, unions, educational groups, industry, environmental groups, other groups, and members of the general public.

stationary source Any building, structure, emissions unit, or installation which emits or may emit any air pollutant.

storage The collection and containment of waste or spent nuclear fuel in such a manner as not to constitute disposal of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity (that is, not short-term accumulation).

storativity Storativity of a saturated aquifer is defined as the volume of water that a unit volume of the aquifer releases from storage under a unit decline in hydraulic head.

sulfur oxides Pungent, colorless gases formed primarily by the combustion of fossil fuels; considered major air pollutants, sulfur oxides may damage the respiratory tract as well as vegetation (see SO_x).

subsurface The area below the land surface (including the vadose zone and aquifers).

superfund The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and its amendments.

superfund site Any site that has been listed on the National Priority List (NPL) because it has been identified by the EPA as having the potential to harm human health and the environment. Study and cleanup activities at these sites are regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). "Superfund" sites at Federal facilities must be cleaned up by the operating agency (lead agency) under the oversight of the U. S. Environmental Protection Agency and other parties to a Federal Facility Agreement.

surface dose The radiological dose emanating from a container of material (waste), usually expressed as a measurement at contact and at one meter.

tank A stationary device designed to contain an accumulation of waste, which is constructed primarily of non-earthen materials (for example, wood, concrete, steel, plastic) which provide structural support.

target A tube, rod, or other form containing material that, on being irradiated in a nuclear reactor, would produce a designed end product (that is, uranium-238 produces plutonium-239 and neptunium-237 produces plutonium-238).

technical safety requirement Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and reduce the potential risk to the public and co-located workers from uncontrolled release of radioactive materials, radiation exposure due to inadvertent criticality, or uncontrolled release of nonradiological material or energy hazards.

tectonics Geological structural features as a whole, or a branch of geology concerned with the structure of the crust of a planet and especially with the formation of folds and faults in it.

tephra Solid material ejected into the air during a volcanic eruption, including volcanic dust, ash, and cinders.

Tertiary The older of the two geologic periods in the Cenozoic Era (63 to 2 million years ago).

thermal treatment The treatment of hazardous waste in a device which uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Examples of thermal treatment processes are incineration, molten salt, pyrolysis, calcination, wet air oxidation, and microwave discharge.

total effective dose equivalent The sum of the external dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

total suspended particulates All particulate matter in the ambient air as measured by the method described in Appendix B of 40 CFR Part 50.

toxic air pollutant Under the Idaho Air Quality Control Regulations, any air pollutant that is determined by the Idaho Department of Health and Welfare to be, by its nature, toxic to human or animal life or vegetation.

toxic air pollutant reasonably available control technology (T-RACT) An emission standard based on the lowest emission of toxic air pollutants that a particular source is capable of meeting by the application of control technology that is reasonably available, as determined by the Idaho Department of Health and Welfare, considering technological and economic feasibility.

toxicological hazard Any material defined in 40 CFR 355 Appendix A as an extremely hazardous substance.

transient A change in the reactor coolant system temperature and/or pressure. Transients can be caused by adding or removing neutron poisons, by increasing or decreasing the electrical load on the turbine generator, or by accident conditions.

transmissivity The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is a function of properties of the liquid, the porous media, and the thickness of the porous media.

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

transuranium radionuclide Any radionuclide having an atomic number greater than 92.

treatment Any method, technique, or process designed to change the physical or chemical character of the waste to render it less hazardous, safer to transport, store or dispose of, or reduced in volume.

treatment facility Land area, structures, and/or equipment used for the treatment of waste or spent nuclear fuel.

ultimate disposition The final step in which a material is either processed for some use or disposed of.

United States Geological Survey (USGS) A Federal agency that collects and analyzes information on geology and geological resources including ground and surface water.

vadose zone The zone between the land surface and the water table. Saturated bodies, such as perched groundwater, may exist in the vadose zone. Also called the zone of aeration and the unsaturated zone.

vapor vacuum extraction (VVE) A technology that applies a vacuum to a well field to remove volatile organic contamination from soils and permeable rock layers in that well field.

vitrification The process of immobilizing waste material that results in a glass-like solid.

volatile organic compound (VOC) Chemical containing mainly carbon, hydrogen, and oxygen that readily evaporates at ambient temperature. Exposure to some organic compounds can produce toxic effects on body tissue and processes.

Volcanic Rift Zones Linear belts of basaltic vents marked by open fissures, monoclines, and small normal faults. Volcanic rift zones were produced during the propagation of vertical molten basaltic dikes that fed surface eruptions.

vulnerabilities Conditions or weaknesses that may lead to radiation exposure to the public, unnecessary or increased exposure to the workers, or release of radioactive materials to the environment. For example, some DOE facilities have had leakage from spent fuel storage pools, excessive corrosion of fuel causing increased radiation levels in the pool, or degradation of handling systems. Vulnerabilities are also caused by loss of institutional controls, such as cessation of facility funding or reductions in facility maintenance and control.

waste Any waste defined as solid waste by 40 CFR 261.2. Solid waste excluded from regulation by the Resource Conservation and Recovery Act (RCRA) is still considered a waste. This includes wastes of all types (solid, liquid, gaseous, hazardous, radioactive, sanitary, and so forth).

waste acceptance criteria (WAC) The requirements specifying the characteristics of waste and waste packaging acceptable to a waste receiving facility; and, the documents and processes the generator needs to certify that waste meets applicable requirements.

waste acceptance specifications The functions to be performed and the technical requirements for a Waste Acceptance System for accepting spent nuclear fuel and high-level waste into the Civilian Radioactive Waste Management System according to the *Waste Acceptance System Requirements Document* (DOE/RW-0352P, January 1993, Office of Civilian Radioactive Waste Management).

waste analysis plan (WAP) A plan that specifies the parameters for which each waste will be analyzed. These include a testing and sampling method(s), timing, and the rationale of the generator or the facility operator responsible for treatment, storage, or disposal. It ensures that accurate waste type and composition determinations are made as required by law, regulation, or good judgment.

waste area group (WAG) Ten groupings of release sites under the INEL Federal Facility Agreement and Consent Order (FFA/CO). Groupings are for efficiency in managing the assessment and cleanup process. Nine of these WAGs are associated with specific facilities, and the tenth is associated with the remaining miscellaneous facilities. Each WAG may be broken down into individual operable units.

waste certification A process by which a waste generator certifies that a given waste or waste stream meets the waste acceptance criteria of the facility to which the generator intends to transport waste for treatment, storage, or disposal. Certification is accomplished by a combination of waste characterization, documentation, quality assurance, and periodic audits of the certification program.

waste certification plan A plan or collection of plans used by a generator to specify the means by which waste is prepared and certified to meet applicable waste acceptance and safety criteria; hazardous and radiological waste handling, treatment, transportation, and packaging regulations; and other local or site requirements. Certification plans result in developing the information that the receiving facility needs to confirm the suitability of waste for acceptance.

waste certification program A systematic approach to ensure that waste characterization is conducted in a manner to provide reasonable assurance that the receiving facility's waste acceptance criteria are met. A waste certification program consists of all the functional elements, organizations, and activities necessary to provide reasonable assurance that waste characterization is done with sufficient accuracy to ensure proper handling. These functions can be performed by various organizations.

waste characterization See characterization.

waste container A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal.

waste generation Any waste (after being declared a waste, see "waste") produced during a particular calendar year. This does not include waste produced in previous years that is being repacked, treated, or disposed of in the current calendar year. It does include any secondary waste (for example, clothing, gloves, waste from maintenance operations, and so forth) generated by treatment, storage, or disposal activities of previously generated wastes.

waste generator organization Any organization that is responsible for the individual generators of waste.

Waste Isolation Pilot Plant (WIPP) A facility near Carlsbad, New Mexico, authorized to demonstrate safe disposal of defense-generated transuranic waste in a deep geologic medium.

waste management The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

waste management facility All contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of waste or spent nuclear fuel. A facility may consist of several treatment, storage, or disposal operational units (for example, one or more landfills, surface impoundments, or combinations of them).

waste management program A systematic approach to organize, direct, document, and assess activities associated with waste generation, treatment, storage, or disposal. A waste management program consists of all the functional elements, organizations, and activities that comprise the system needed to properly manage waste. These functions and activities can be performed by various organizations.

waste management systems assessment A systems assessment of the entire low-level waste management (or all of waste management) structure/program at a given site that considers treatment, storage, and disposal, as well as onsite and offsite points of generation with an emphasis on optimization of all aspects of the operations, including, but not limited to, protection of human health and the environment, regulatory compliance, and cost effectiveness.

waste minimization An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

waste receiving facility A facility that formally accepts waste from a waste generator organization for treatment, storage, or disposal.

waste segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

waste stream A waste or group of wastes with similar physical form, radiological properties, U. S. Environmental Protection Agency waste codes, or associated land disposal restriction treatment standards. It may be the result of one or more processes or operations.

waste type The waste types being considered in this EIS are high-level waste, transuranic waste, mixed low-level waste, low-level waste, hazardous waste, or nonhazardous waste.

water pool A type of facility usually used for the storage of irradiated nuclear materials and spent fuel. The water shields the material being stored while allowing it to be accessible for handling. Sometimes referred to as a water pit.

water table The surface below which is saturated with water (an aquifer) and above which is not saturated with water (the vadose zone).

weathering The process by which rocks are broken down and decomposed by the physical and chemical actions of wind, rain, temperature change, plant colonization, and bacterial activity.

weighing factor (W_T) For an organ or tissue, (W_T) is the proportion of the risk of health effects (cancer fatalities) resulting from irradiation of that organ or tissue to the total risk of health effects (cancer fatalities) when the whole body is irradiated uniformly.

wet storage Storage of spent nuclear fuel in a pool of water, generally for the purposes of cooling and/or shielding.

zone of aeration See vadose zone.

zone of saturation That part of the earth's crust in which all voids are filled with water.

SECTION F-1 CONTENTS

TABLES

F-1 SOCIOECONOMICS

The socioeconomic impact analysis conducted for this Environmental Impact Statement examines the potential effects of the proposed Idaho National Engineering Laboratory (INEL) alternatives on the social and economic resources of the region of influence, defined in terms of employment, income, population, housing, education, and community services. The changes in U.S. Department of Energy (DOE) expenditures, workforce, and payroll that would occur under each of the alternatives impact the community through their effects on regional business activity and employment. Changes in DOE expenditures for regional goods and services, as well as changes in household expenditures made by INEL employees, affect the level of local business activity generated within the region of influence, the demand for community services (such as health care and public education), and the ability of local government agencies to fund such services.

This analysis evaluates the effects of the proposed alternatives relative to the baseline socioeconomic conditions described in Section 4.3, Socioeconomics, in Volume 2 of this Environmental Impact Statement. The existing and projected economic conditions in the region of influence provide the framework for assessing the impacts of the socioeconomic effects that may result from implementation of each of the alternatives. The impact analysis, as described in the following methodology section, estimates the effects of the alternatives on regional employment (the number of direct and secondary jobs) and earnings (the sum of wages and salaries, proprietors' income, and other labor income). These employment and earnings effects then generate potential changes in regional population and demand for housing and community services.

In general, the results of the impact analysis indicate that each of the proposed alternatives would generate initial increases in employment within the region of influence, primarily due to planned construction activities. Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), which include phaseout of the Expanded Core Facility, would result in employment declines by 2004, while Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would result in employment increases. However, the projected decreases in baseline expenditures and employment at INEL are of sufficient magnitude to offset any increases projected as a result of the proposed alternatives. As a consequence, the cumulative socioeconomic impact of INEL activity over the forecast horizon would be a decline in regional employment and economic activity.

F-1.1 Region of Influence

The analysis of socioeconomic impacts is limited to the seven-county area surrounding the INEL comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison counties. This region of influence was determined according to the following criteria:

- Counties that contain the residences of at least 85 percent of the current INEL operations and construction workforce

- Counties in which the resident INEL workforce comprises 5 percent or greater of the county's civilian labor force.

F-1.2 Methodology and Key Assumptions

The analysis of socioeconomic impacts considers both impacts on economic activity, as measured by changes in employment and earnings, and the community, as measured by changes in population and the demand for housing and community services. The impact analysis conducted for Volume 2 of the Spent Nuclear Fuel and INEL Environmental Restoration and Waste Management Environmental Impact Statement (SNF and INEL EIS) estimates the potential social and economic impacts expected to occur within the region of influence as a result of implementation of any of the proposed INEL environmental restoration and waste management alternatives.

The socioeconomic impacts estimated in this analysis would be generated by the proposed changes in expenditures and employment at INEL, which includes employment at DOE and site-related contractors and subcontractors, and would consider both direct and secondary effects. Direct impacts are the estimated changes in INEL employment and earnings that occur during the construction and operations phases of each alternative over the period of analysis and the resultant effects on regional population, housing, and community services.

Secondary impacts include both indirect and induced impacts. Indirect impacts are the effects on regional economic activity that result from changes in DOE purchases of goods and services within the region expected to occur under any of the alternatives. Induced impacts are the additional changes in regional economic activity that result from changes in the household spending of employees whose jobs are affected by (a) the change in employment at INEL and (b) the change in employment at regional businesses resulting from the indirect impacts to regional economic activity.

F-1.2.1 Economic Activity

Analysis of socioeconomic effects utilized total output, employment, and earnings multipliers for the region of influence, obtained from the U.S. Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS II). Interindustry multipliers were prepared by the Bureau of Economic Analysis, using the United States input-output table in combination with the most recent region-specific information describing the relationship of the regional economy to the national economy. The Bureau of Economic Analysis's RIMS II model is based on research by Cartwright et al. (1981).

The direct economic impacts of each alternative were estimated based on project summary descriptions developed by DOE, INEL contractors, and their representatives. The project summary descriptions identify employment and expenditure requirements during the preconstruction, construction, and operations phases of each alternative. (For the purposes of this analysis, preconstruction and construction activities were combined.) Direct earnings were estimated based on average INEL wages and salaries. The direct employment impact under each alternative represents only the additional or new employment at INEL expected to occur under implementation of an alternative. The reassignment of existing employees at INEL would not represent a change in total INEL staffing; therefore is not included as part of the employment impact.

These direct effects were then multiplied, using RIMS II coefficients specific to the regional economy, to provide estimated total employment and earnings associated with the proposed alternatives. Input-output sectors were selected to appropriately reflect the activities associated with the proposed alternatives in order to capture the economic characteristics of each scenario within the region of influence. For the purposes of this analysis, the construction activities under each alternative are represented by the New Construction Industry, and the operations phase activities are represented by the Chemicals and Petroleum Refining Industry.

The number of in-migrant or out-migrant workers associated with implementation of each alternative was estimated according to a set of proportional assumptions. Most INEL employees are in skilled positions, which increases the likelihood of migration from the area. Construction and related employees generally are employed under service contracts at the site, many of which are in lower-skilled positions, which decreases the likelihood of out-migration.

F-1.2.2 Population and Housing

Population changes associated with projected baseline conditions and the proposed alternatives are an important determinant of other socioeconomic and environmental impacts. These population changes have three key components: (a) baseline growth, (b) relocation of workers and their dependents, and (c) natural increase of population (births minus deaths) over the long term. The projected population trends for the region of influence, as presented in Section 4.3, assumed continuation of current operations at INEL. The forecasts were then adjusted to reflect the impacts of projected baseline decreases in INEL activity, as well as the potential effects of each of the alternatives.

The relocation of workers in response to the projected declines in baseline activity and implementation of each of the alternatives was determined by utilizing the methods and assumptions discussed in Section F-1.2.1. The number of dependents expected to relocate with these workers was estimated based on household-size parameters derived from U.S. Census Bureau demographic data.

The population changes associated with the alternatives would result in further changes in housing demand. Housing demand impacts were estimated from migration projected for each scenario, assuming each in-migrating household would require one unit and each out-migrating household would relinquish one unit. The number of relocating households was determined assuming that each relocating worker represented a single household.

Expected housing availability was considered for the region of influence and key communities based on recent housing market conditions and vacancy trends. Projected demands associated with each alternative were then assessed in the context of recent housing construction trends and vacancies in key communities.

F-1.2.3 Community Services and Public Finance

Potential impacts to local community services due to changes in demand associated with the proposed alternatives were determined for the region's key public services. Impacts were determined for the jurisdictions that have the closest linkages to INEL personnel and their dependents, as well as jurisdictions likely to be most affected by the activities planned under the alternatives.

Projected changes in public school enrollments were estimated based on the results of the population analysis. The effects on public schools was based on the number of school-age children present in migrating households, current enrollment projections, and existing student/teacher ratios. Likewise, the effect on other public services was determined based on the current levels and service and the expected change in the size of the population to be served.

Local jurisdiction finances were evaluated based on changes in historic revenues and expenditure levels, changes in fund balances, and reserve bonding capacities. The effects of implementation of the alternatives and projected declines in baseline INEL activity were evaluated based on:

- Gains (or losses) of jobs in the region
- Population increases (or decreases) in each jurisdiction, including school districts
- Earnings and income gains (or losses)
- Potential changes in each jurisdiction's property tax base.

F-1.3 Key Assumptions

The following section documents the key assumptions used to establish baseline conditions and estimate economic and community impacts.

F-1.3.1 Idaho National Engineering Laboratory Employment and Earnings

- The Argonne National Laboratory-West (ANL-W) workforce was assumed to be constant from Fiscal Year 1999 to Fiscal Year 2004.

- Baseline workforce data for INEL include tbe effects of contractor consolidation and assume tbat tbe West Valley Demonstration Project is not included.

- The baseline workforce is assumed to be nonconstruction-related.

- All construction workers were assumed to be new personnel for tbe four alternatives. Based on information received from construction contractors, 85 percent of construction workers would be hired from existing labor force in tbe region of influence.

- Construction staffing was based on project descriptions. Where no staffing information was available, tbe construction staff was assumed to be one full-time employee for every $2.35 million in expenditure. (The average expenditure per one full-time construction employee was derived from tbose projects tbat had construction staffing data).

- 97.45 percent of new operation and construction employees were expected to live in the region of influence.

- Preconstruction staffing levels were determined by assuming one full-time employee for each million dollars in construction expenditure.

- Operations staff requirements were based on information provided by project descriptions and were assumed to be per year for tbe life of tbe project.

- Employees classified as existing were assumed to be transferred from existing duty stations at INEL. Existing employees were considered to be part of tbe baseline employment.

- Operations staffing requirements that would be filled by reassignment of existing INEL personnel were not considered in the impact analysis. The impact analysis only includes new personnel.

- An average annual wage of $27,168 was assumed for construction employees. An average annual wage of $43,304 was assumed for operation employees at INEL (U.S. Bureau of Economic Analysis, INEL Finance Office).

- 19.7 percent of all nonpayroll expenditures were assumed to be spent within the region of influence.

F-1.3.2 Idaho National Engineering Laboratory Funding

- Funding for environmental restoration and waste management does not include the West Valley Demonstration Project.

- Ongoing projects identified by Science Applications International Corporation are assumed to be part of the baseline activities at INEL.

- Projects included under the alternatives were not included in baseline funding numbers. Funding data received from DOE were adjusted to take into account the exclusion of such projects.

- Duration of projects was rounded down to the nearest full year.

- For projects for which the funding period was not provided, funding was evenly distributed over the project period.

- Funding for the Office of Civilian Radioactive Waste Management does not include the West Valley Demonstration Project.

- Argonne National Laboratory-West was assumed to operate at projected levels until Fiscal Year 1999 and then hold constant through 2004.

F-1.3.3 Idaho National Engineering Laboratory Related Population

- One household per INEL employee is assumed.

- The average household size per INEL household is assumed to be 3.47 people.

- An 80-percent migration rate is assumed for population effects related to changes in direct employment. A 10-percent migration rate is assumed for population effects related to change in secondary employment.

F-1.3.4 Project Information

- Construction and Operations schedule, cost, and staffing data were obtained from the project summaries found in Appendix C of Volume 2 of this Environmental Impact Statement.

- Preconstruction and construction phases were combined for this analysis.

- Project schedules were based on project summaries. If not provided, the operations end date was assumed to be 2004 (last year in analysis timeframe).

F-1.4 Data Analysis

The following tables summarize the detailed economic data upon which the socioeconomic impact analysis was based. Table F-1-1 presents employment data derived from the project data sheets (see Appendix C). The employment data presented in the data sheets were categorized by existing, subcontract, and new workers for each project and then aggregated by alternative. Table F-1-2 summarizes the new employment expected under each alternative and represents the direct employment impact. Table F-1-3 presents the results of the multiplier effects, summarizing direct, secondary, and total employment expected under implementation of each alternative. Table F-1-4 presents the direct, secondary, and total earnings expected under implementation of each alternative. Table F-1-5 presents the change in population in the region of influence that could occur under each alternative, including a breakdown of the direct-related and secondary-related effects.

Table F-1-6 presents the population change expected in the region of influence due to the declines in baseline INEL activity and the cumulative effect of the alternatives. Finally, Table F-1-7 presents historical and projected INEL baseline employment, INEL-related secondary employment, and total direct and secondary employment.

F-1.5 References

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USBEA (U.S. Bureau of Economic Analysis), 1993, *Regional Input-Output Modeling System (RIMS II)*, machine-readable regionalized input-output multipliers for the INEL region of influence, U.S. Department of Commerce, Washington, D.C.

Table F-1-1. Construction and operations employment (existing and new) at the Idabo National Engineering Laboratory under each alternative by category and by fiscal year.[a,b,c]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Construction	409	424	223	77	155	80	0	0	0	0
Existing	44	43	27	2	0	0	0	0	0	0
Subcontractors	365	381	196	75	155	80	0	0	0	0
Operations	10	10	67	58	-92	-146	-390	-410	-410	-410
Existing	10	10	20	61	61	161	103	103	103	103
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	47	-3	-153	-307	-493	-513	-513	-513
Alternative B (Ten-Year Plan)										
Construction	592	778	718	595	720	630	310	574	524	536
Existing	217	284	244	207	200	160	130	85	60	30
Subcontractors	375	494	474	388	520	470	180	489	464	506
Operations	10	10	171	251	252	432	280	280	277	277
Existing	10	10	118	198	196	276	230	230	230	230
Subcontractors	0	0	6	6	6	6	0	0	0	0
New hires	0	0	47	47	50	150	50	50	47	47
Alternative C (Minimum Treatment, Storage, and Disposal)										
Construction	501	659	418	272	350	300	70	202	202	202
Existing	86	78	72	47	45	45	45	2	2	2
Subcontractors	415	581	346	225	305	255	25	200	200	200
Operations	10	10	97	97	-53	-107	-351	-371	-371	-371
Existing	10	10	50	100	100	200	142	142	142	142
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	47	-3	-153	-307	-493	-513	-513	-513
Alternative D (Maximum Treatment, Storage, and Disposal)										
Construction	642	933	873	754	1121	1036	746	826	801	936
Existing	267	289	249	216	251	216	216	161	121	80
Subcontractors	375	644	624	538	870	820	530	665	680	856
Operations	10	10	177	257	258	438	286	286	283	283
Existing	10	10	124	204	202	282	236	236	236	236
Subcontractors	0	0	6	6	6	6	0	0	0	0
New hires	0	0	47	47	50	150	50	50	47	47

a. Source: Project data sheets found in Volume 2, Appendix C, of this Environmental Impact Statement.
b. See Section F-1.3 for assumptions regarding existing and new personnel.
c. Totals may not add due to rounding.

Table F-1-2. Direct construction and operations employment impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year.[a,b,c]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Direct employment	347	362	232	68	-2	-223	-480	-500	-500	-500
Construction	347	362	186	71	147	76	0	0	0	0
Subcontractors	347	362	186	71	147	76	0	0	0	0
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-500	-500
Alternative B (Ten-Year Plan)										
Direct employment	356	469	502	420	548	598	220	513	487	527
Construction	356	469	450	369	494	447	171	465	441	481
Subcontractors	356	469	450	369	494	447	171	465	441	481
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	52	52	54	152	49	49	46	46
Subcontractors	0	0	6	6	6	6	0	0	0	0
New hires	0	0	46	46	49	146	49	49	46	46
Alternative C (Minimum Treatment, Storage, and Disposal)										
Direct employment	394	552	375	211	141	-57	-457	-310	-310	-310
Construction	394	552	329	214	290	242	24	190	190	190
Subcontractors	394	552	329	214	290	242	24	190	190	190
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-500	-500
Alternative D (Maximum Treatment, Storage, and Disposal)										
Direct employment	356	612	644	563	881	931	552	680	692	859
Construction	356	612	593	511	827	779	504	632	646	813
Subcontractors	356	612	593	511	827	779	504	632	646	813
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	52	52	54	152	49	49	46	46
Subcontractors	0	0	6	6	6	6	0	0	0	0
New hires	0	0	46	46	49	146	49	49	46	46

a. Source: project data sheets found in Appendix C, Volume 2, of this Environmental Impact Statement.
b. See Section F-1.3 for assumptions regarding existing and new personnel.
c. Totals may not add due to rounding.

Table F-1-3. Direct and secondary employment impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year.[a,b,c]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Total employment	835	872	566	164	-28	-585	-1233	-1283	-1283	-1283
Direct	347	362	232	68	-2	-223	-480	-500	-500	-500
Construction	347	362	186	71	147	76	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Secondary	489	510	334	96	-26	-361	-752	-783	-783	-783
Construction-related	489	510	262	100	207	107	0	0	0	0
Operations-related	0	0	72	-5	-233	-468	-752	-783	-783	-783
Alternative B (Ten-Year Plan)										
Total employment	858	1130	1217	1020	1330	1465	537	1244	1179	1275
Direct	356	469	502	420	548	598	220	513	487	527
Construction	356	469	450	369	494	447	171	465	441	481
Operations	0	0	52	52	54	152	49	49	46	46
Secondary	502	661	715	600	781	867	317	731	693	749
Construction-related	502	661	634	519	696	629	241	654	621	677
Operations-related	0	0	81	81	85	238	76	76	72	72
Alternative C (Minimum Treatment, Storage, and Disposal)										
Total employment	950	1330	909	507	315	-184	-1175	-825	-825	-825
Direct	394	552	375	211	141	-57	-457	-310	-310	-310
Construction	394	552	329	214	290	242	24	190	190	190
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Secondary	555	778	535	297	175	-127	-719	-515	-515	-515
Construction-related	555	778	463	301	408	341	33	268	268	268
Operations-related	0	0	72	-5	-233	-468	-752	-783	-783	-783
Alternative D (Maximum Treatment, Storage, and Disposal)										
Total employment	858	1474	1560	1363	2131	2266	1338	1647	1674	2076
Direct	356	612	644	563	881	931	552	680	692	859
Construction	356	612	593	511	827	779	504	632	646	813
Operations	0	0	52	52	54	152	49	49	46	46
Secondary	502	862	916	801	1250	1335	786	966	982	1217
Construction-related	502	862	835	720	1164	1079	709	890	910	1146
Operations-related	0	0	81	81	85	238	76	76	72	72

a. Sources: USBEA (1993) and project data sheets found in Volume 2, Appendix C, of this Environmental Impact Statement.

b. See Section F-1.3 for assumptions regarding population migration.

c. Totals may not add due to rounding.

Table F-1-4. Direct and secondary earnings impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year (in thousands of dollars).[a,b,c]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Total earnings	18,213	19,011	13,396	3,512	-4,035	-19,624	-37,924	-39,463	-39,463	-39,463
Direct	9,421	9,834	7,042	1,809	-2,456	-10,891	-20,804	-21.648	-21,648	-21,648
Construction	9,421	9,834	5,059	1,936	4,001	2,065	0	0	0	0
Operations	0	0	1,983	-127	-6,457	-12,955	-20,804	-21,648	-21,648	-21,648
Secondary	8,792	9,178	6,353	1,702	-1,579	-8,734	-17,120	-17,815	-17,815	-17,815
Construction-related	8,792	9,178	4,721	1,807	3,734	1,927	0	0	0	0
Operations-related	0	0	1.632	-104	-5.313	-10.661	17,120	-17.815	-17,815	-17,815
Alternative B (Ten-Year Plan)										
Total earnings	18,712	24,650	27,717	23,426	30,243	35,441	12,828	28,246	26,768	28,864
Direct	9,679	12,750	14.464	12,244	15,778	18,707	6,756	14,731	13,959	15,043
Construction	9,679	12,750	12,234	10,014	13,421	12,131	4,646	12,621	11,976	13,060
Operations	0	0	2,230	2,230	2,357	6,577	2,110	2,110	1,983	1,983
Secondary	9,033	11.900	13,253	11,181	14,465	16,734	6,072	13,515	12,809	13,821
Construction-related	9.033	11.900	11.418	9.346	12,526	11,321	4,336	11,779	11,177	12,189
Operations-related	0	0	1.835	1.835	1.939	5.412	1.736	1.736	1.632	1.632
Alternative C (Minimum Treatment, Storage, and Disposal)										
Total earnings	20,708	28,991	20,880	10.996	3,449	-10,892	-36,677	-29,483	-29,483	-29,483
Direct	10,711	14.995	10,914	5,681	1,415	-6,374	-20,159	-16,487	-16,487	-16,487
Construction	10,711	14,995	8,930	5,807	7,872	6,581	645	5,162	5,162	5,162
Operations	0	0	1,983	-127	-6,457	-12,955	-20,804	-21,648	-21,648	-21,648
Secondary	9,997	13,995	9,967	5,316	2,034	-4,518	-16,518	-12,997	-12,997	-12,997
Construction-related	9,997	13,995	8,335	5,420	7,347	6,143	602	4,818	4,818	4,818
Operations-related	0	0	1.632	-104	-5.313	-10.661	-17.120	-17.815	-17.815	-17,815
Alternative D (Maximum Treatment, Storage, and Disposal)										
Total earnings	18.712	32,134	35,202	30.911	47,707	52.905	30.292	37,028	37,546	46,328
Direct	9,679	16.621	18,335	16,116	24,811	27,741	15,789	19,273	19,534	24,077
Construction	9.679	16,621	16,105	13,886	22,454	21,164	13,679	17,163	17,551	22,093
Operations	0	0	2,230	2,230	2,357	6,577	2,110	2,110	1,983	1,983
Secondary	9,033	15,513	16,866	14,795	22,896	25,164	14,503	17,755	18,012	22,252
Construction-related	9,033	15,513	15,031	12,959	20,957	19,752	12,767	16.019	16,380	20,620
Operations-related	0	0	1.835	1,835	1,939	5,412	1,736	1,736	1,632	1,632

a. Sources: USBEA (1993) and project data sheets found in Appendix C, Volume 2, of this Environmental Impact Statement.
b. See Section F-1.3 for assumptions regarding wages and salaries.
c. Totals may not add due to rounding.

Table F-1-5. Direct and secondary population impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year, not including baseline effects.[a,b,c]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Population impact	350	365	340	62	-346	-916	-1595	-1659	-1659	-1659
Direct-related	180	188	224	29	-337	-791	-1334	-1388	-1388	-1388
Secondary-related	170	177	116	33	-9	-125	-261	-272	-272	-272
Alternative B (Ten-Year Plan)										
Population impact	360	474	625	543	679	955	334	631	597	637
Direct-related	185	244	377	335	408	654	224	377	357	377
Secondary-related	174	229	248	208	271	301	110	254	240	260
Alternative C (Minimum Treatment, Storage, and Disposal)										
Population impact	398	557	484	206	-202	-749	-1571	-1468	-1468	-1468
Direct-related	205	287	298	103	-263	-704	-1321	-1289	-1289	-1289
Secondary-related	193	270	186	103	61	-44	-249	-179	-179	-179
Alternative D (Maximum Treatment, Storage, and Disposal)										
Population impact	360	618	769	687	1015	1290	670	799	804	973
Direct-related	185	318	452	409	581	827	397	464	463	550
Secondary-related	174	299	318	278	434	463	273	335	341	422

a. Sources: USBEA (1993) and project data sheets found in Volume 2, Appendix C, of this Environmental Impact Statement.
b. See Section F-1.3 for assumptions regarding population migration.
c. Totals may not add due to rounding.

Table F-1-6. Direct and secondary population impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year, including baseline effects.[a,b,c]

	Fiscal year									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Baseline effects										
Change from 1995	0	-1451	-1620	-2715	-3638	-4534	-4561	-4561	-4561	-4561
Direct-related	0	-1213	-1355	-2271	-3042	-3792	-3814	-3814	-3814	-3814
Secondary-related	0	-237	-265	-444	-595	-742	-747	-747	-747	-747
Alternative A (No Action)										
Population impact	350	-1085	-1280	-2653	-3984	-5451	-6155	-6220	-6220	-6220
Direct-related	180	-1025	-1131	-2242	-3380	-4583	-5148	-5202	-5202	-5202
Secondary-related	170	-60	-149	-411	-605	-868	-1008	-1018	-1018	-1018
Alternative B (Ten-Year Plan)										
Population impact	360	-977	-994	-2172	-2959	-3579	-4226	-3930	-3964	-3924
Direct-related	185	-969	-977	-1936	-2634	-3138	-3590	-3437	-3458	-3437
Secondary-related	174	-8	-17	-236	-324	-441	-636	-493	-506	-487
Alternative C (Minimum Treatment, Storage, and Disposal)										
Population impact	398	-893	-1136	-2509	-3840	-5283	-6131	-6028	-6028	-6028
Direct-related	205	-926	-1056	-2168	-3306	-4496	-5136	-5103	-5103	-5103
Secondary-related	193	32	-80	-342	-535	-786	-996	-925	-925	-925
Alternative D (Maximum Treatment, Storage, and Disposal)										
Population impact	360	-833	-851	-2028	-2623	-3244	-3891	-3761	-3757	-3588
Direct-related	185	-895	-903	-1862	-2461	-2965	-3417	-3350	-3351	-3264
Secondary-related	174	62	53	-167	-162	-279	-474	-411	-406	-324

a. Sources: Tellez (1995), DOE-ID (1994), USBEA (1993), and project data sheets found in Volume 2, Appendix C, of this Environmental Impact Statement.
b. See Section F-1.3 for assumptions regarding population migration.
c. Totals may not add due to rounding.

Table F-1-7. Baseline employment: Idaho National Engineering Laboratory direct employment, secondary employment, and total employment.[a,b]

	Fiscal year														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct employment															
Contractors	7,500	7,985	7,901	7,820	7,700	6,097	6,047	6,097	5,847	5,597	5,347	5,347	5,347	5,347	5,347
DOE-ID	402	531	587	491	499	499	499	499	499	499	499	499	499	499	499
Argonne National Laboratory-West	786	882	905	943	890	880	860	850	800	800	800	800	800	800	800
Naval Reactors Facility	2,434	2,252	2,263	2,017	1,640	1,144	777	686	656	628	608	600	600	600	600
Total direct employment	11,122	11,650	11,656	11,271	10,729	8,620	8,183	8,132	7,802	7,524	7,254	7,246	7,246	7,246	7,246
Secondary employment															
Secondary employment	17,415	18,242	18,251	17,648	16,799	13,497	12,813	12,733	12,216	11,781	11,358	11,346	11,346	11,346	11,346
Total employment															
Total employment	28,537	29,892	29,907	28,919	27,528	22,117	20,996	20,865	20,018	19,305	18,612	18,592	18,592	18,592	18,592

a. Sources: Tellez (1995), DOE-ID (1994b), USBEA (1993).

b. Direct employment is defined as historical and projected baseline employment at INEL. Secondary employment is defined as non-DOE employment generated in the region as a result of baseline INEL employment and activity. Total employment is direct plus secondary employment.

SECTION F-2 CONTENTS

TABLES

F-2 GEOLOGY AND WATER

This section describes the methodology used to support the conclusions regarding the geologic hazards at the INEL site and local and regional water resource impacts for the four alternatives evaluated in Volume 2 of this Environmental Impact Statement. These conclusions resulted from an extensive review of existing documentation characterizing the geologic and hydrologic conditions at the INEL site and a compilation of this material into a concise description of the existing conditions and potential impacts. This portion of Appendix F directly supports the summaries provided in Sections 4.6 and 5.6 (Geology) and 4.8 and 5.8 (Water Resources) of Volume 2 of this Environmental Impact Statement.

F-2.1 Geology

The evaluation of geology at the INEL site focused on the geologic hazards that could potentially impact the environmental restoration, waste management, and spent nuclear fuel management activities proposed under the four alternatives. The following sections discuss the methods used to determine the magnitude and likelihood of the hazards associated with seismicity and volcanism at the INEL site.

F-2.1.1 Seismic Hazards Assessment

Since the early 1970s, seismic hazards assessments have been conducted at the INEL site to evaluate potential earthquake ground motions for establishing seismic design criteria. Since that time, ground motion seismology hazard assessment and Federal regulations evolved. To keep pace with these changes, deterministic evaluations were conducted for specific sites (WCC 1990), and deterministic and probabilistic seismic hazards assessments were conducted for the proposed New Production Reactor site at the INEL site (WCC 1992). Also, an INEL site probabilistic seismic hazard assessment is underway to assess the contributions from potential local and regional earthquake sources on the magnitude and frequency of ground motions and their estimated return periods for all facility areas (WCFS 1993).

F-2.1.1.1 Current Deterministic and Probabilistic Evaluations. Both deterministic and probabilistic evaluations used the same geologic information and numerical techniques as for the 1990 INEL deterministic evaluation (WCC 1990) and additional information collected under the New Production Reactor Geologic/Seismological/Geotechnical Studies program, which was conducted during the period 1991 to 1992. Under this program, paleoseismic investigations were conducted on the Lemhi Fault to determine maximum magnitude and recurrence, and a deep hole [1,520 meters (5,000 feet)] was drilled at the proposed New Production Reactor site to determine the near-surface geology (core samples). Additional paleoseismology studies are being conducted to assess the seismogenic potential of the Arco Segment of the Lost River Fault.

The INEL site is located adjacent to the Basin and Range province, which is characterized by extensional tectonics and associated normal faulting earthquakes. Limited empirical data on strong ground motion attenuation exist from the Basin and Range province, necessitating the use of empirical data from other regions and direct modeling results of ground motions using numerical techniques. In the seismic hazards evaluations, seismic wave transmission characteristics were developed using empirical attenuation relationships based mostly on California data and a site-specific model based on the interbedded basalt stratigraphy obtained from the deep hole. To model the effects of INEL site geology, a state-of-the-art stochastic ground motion modeling approach was used to develop site-specific attenuation relations. The Band-Limited-White-Noise model, combined with random vibration theory, captures the features of strong ground motion with a minimum of free parameters (WCC 1990).

The sources for the New Production Reactor site deterministic evaluation included (a) a moment magnitude (M_W) 7.0 earthquake on the Lemhi fault, (b) a M_W 5.5 earthquake randomly located within a 25-kilometer (15.5 mile) radius of the proposed New Production Reactor site, and (c) a M_W 5.5 volcanic earthquake associated with the axial volcanic zone. Peak horizontal and vertical accelerations and response spectra were estimated for the 50th and 84th percentiles based on the range of uncertainties in geologic input and ground motion model. The predicted 50th percentile peak horizontal accelerations were 0.21g from the Lemhi fault and 0.18g from the volcanic earthquake at the New Production Reactor site. The vertical accelerations would be approximately two-thirds of the horizontal accelerations (WCC 1992).

The New Production Reactor site probabilistic evaluation considered ground motion contributions from the following earthquake sources: (a) Basin and Range faults, (b) Eastern Snake River Plain volcanic rift zones and the axial volcanic zone, (c) the Eastern Snake River Plain areal source (random earthquake), and (d) the Yellowstone Plateau and Idaho Batholith tectonic provinces (WCC 1992). Results of sensitivity analyses performed with the input source parameters and choice of attenuation relationships indicate that the size and location of the random earthquake and seismicity rates in the Eastern Snake River Plain are important contributors to the uncertainty in the hazard at high peak acceleration levels (WCC 1992).

A probabilistic evaluation is underway to estimate site-specific seismic hazard curves and response spectra for major INEL site facility areas. This evaluation will incorporate geologic data collected by the New Production Reactor geological, seismological, and geophysical studies and the results of the Lost River fault paleoseismological studies. As with past studies, the results will undergo extensive peer review before being considered for use in INEL site seismic design criteria. Preliminary results suggest that at low ground motion levels, the Lemhi and Lost River faults are the largest contributors to the total hazard. At high ground motion levels, the hazard is dominated by the Eastern Snake River Plain areal source (random earthquake) because it considers the occurrence of an earthquake in the immediate INEL site vicinity (WCFS 1993).

F-2.1.1.2 Seismic Design Criteria. Following completion of the 1990 deterministic evaluation, the results were subjected to extensive peer review by the U.S. Geological Survey, University of Utah, Risk Engineering, INEL subcontractors, the U.S. Department of Energy (DOE), and the Defense Nuclear Facilities Safety Board. The deterministic peak accelerations were adopted into the INEL architectural and engineering standards in 1991 (DOE-ID 1993a). The results of the New Production Reactor 1992 deterministic and probabilistic evaluations were extensively reviewed by a panel of experts. This panel included nationally recognized experts in the fields of seismology, tectonics, statistics, and structural engineering. They were convened by DOE through Lawrence Livermore National Laboratory to review and approve recommendations for New Production Reactor structural design criteria (including seismic design criteria). Ground motion results of the 1990 and 1992 studies indicate that INEL seismic design criteria are appropriate for the estimated seismic hazards. The probabilistic seismic hazard assessment study (WCFS 1993) has undergone this review process.

F-2.1.2 Volcanism

Hazards associated with INEL-area volcanism, as well as distant volcanic sources, have been evaluated by several investigators. A Volcanism Working Group consisting of experts from the INEL, other national laboratories, the U.S. Geological Survey, and universities was convened in 1990 to assess the potential for volcanism on the INEL site (VWG 1990).

For volcanic areas such as the Eastern Snake River Plain with no historical volcanism and an incomplete chronologic record of prehistoric volcanism, assessments of potential volcanic hazards and volcanic risks are estimated based on interpretation of the long-term geologic record and on the documented effects of historical eruptions in analog regions such as Iceland and Hawaii. Volcanic hazards to the INEL site are related to future basaltic and rhyolitic eruptions along volcanic-rift zones and the axial volcanic zone. The most significant volcanic hazard to the INEL site is the inundation or burning of facilities by basaltic lava flows from volcanic-rift zones. A significant related hazard is disruption of facilities due to ground deformation accompanying magma intrusion along volcanic-rift zones: opening of fissures, normal faulting, and broad-region tilting and uplift within several kilometers of vents. Other, less significant basaltic hazards include volcanic-gas emission and disruption of groundwater.

Available geologic map data, flow volume estimates, and geochronometry of INEL site basalt lava flows suggest maximum (most conservative) volcanic frequencies of 10^{-4} to 10^{-5} per year for the axial volcanic zone, and the Arco and Lava Ridge-Hell's Half Acre volcanic-rift zones. The probabilistic risk of basalt-lava inundation or intrusion-related ground disturbance at a specific facility is, therefore, estimated to be less than 10^{-5} per year for facilities on the southern INEL site. Risk from these phenomena at northern INEL site facilities is still lower because volcanism there has been less frequent and less recent. The probability of significant impact from all other volcanic phenomena, such as growth of new rhyolite domes on the Eastern Snake River Plain or thicker than 8-centimeter (3-inch) tephra fall from non-Eastern Snake River Plain vents, is estimated to be much less than 10^{-5} per year due to the combined effects of great distance, infrequency, low volume, and topographic or atmospheric barriers to the dispersal of tephra on the INEL site.

F-2.2 Water Resources

The evaluation of potential consequences to water resources at the INEL site focused on flooding potential and water quality and use. The following sections discuss the methods and references used to determine impacts resulting from the implementation of environmental restoration and waste management activities proposed under the alternatives.

F-2.2.1 Surface Water

Surface water studies and data were reviewed during a literature search performed for this Environmental Impact Statement (EIS). This section presents the methodology used for the analyses of potential impacts of the proposed alternatives to natural and artificial (manmade) surface waters on, and in the vicinity of, the INEL site. These methods were used to determine existing surface water quality and flood potential (which could conceivably cause surface contamination to enter surface water bodies). The U.S. Geological Survey has been compiling surface water quality data for many years. In addition, several U.S. Geological Survey and INEL studies have been conducted concerning flood potential at the INEL site.

F-2.2.1.1 Surface Water Quality. INEL site activities do not directly affect the quality of surface water outside the INEL site because the INEL site is located within a closed drainage basin and surface water does not flow directly offsite (Hoff et al. 1990). All major drainages within the INEL site terminate in the Big Lost River Playa in the northern portion of the INEL site. However, water from the Big Lost River, as well as from seepage of evaporation basins and storm water injection wells, does infiltrate into the Snake River Plain Aquifer.

Physical, chemical, and radioactive water quality parameters have been measured along the Big Lost River, the Little Lost River, and Birch Creek. As a result of intermittent flow along these drainages and consequently limited sampling opportunities, insufficient information is available to make statistical comparisons. However, the water quality of these three intermittent streams is similar and appears to have varied relatively little over time (USGS 1963-1993). Chemical and physical parameters measured in these three water tributaries do not exceed water quality standards (Estes et al. 1995), and water quality is adequate for all INEL site uses. However, surface water is not withdrawn from these tributaries for use at the INEL site.

The Big Lost River System (the Big Lost River, Little Lost River, Birch Creek, and their tributaries and playas) is defined as "waters of the United States" as specified by the Clean Water Act. Under the Clean Water Act, two National Pollutant Discharge Elimination System General Permits for Storm Water Discharges were issued for the INEL site, one for industrial activities and one for construction activities. The permit requirements for both of these activities specify the development of a site-wide Storm Water Pollution Prevention Plan. Any facility at the INEL site having the potential to discharge storm water to the Big Lost River System associated with industrial or construction activities is subject to the monitoring and reporting requirements of the INEL Storm Water Pollution Prevention Plans (FR 1992a, b). The INEL Storm Water Pollution Prevention Plans (DOE-ID 1993b, c) were established to assess potential storm water pollution sources; select and implement appropriate management practices and controls to prevent contamination of storm water runoff; and implement monitoring, inspection, and notification programs. Periodic evaluations are performed to determine the effectiveness of the plans to prevent storm water pollution.

Many potential sources of surface water contamination are also identified in the Federal Facility Agreement/Consent Order. All potential contamination sources must be evaluated, including facility-specific activities, material inventory, past spills and leaks, nonwater discharge, and existing storm water monitoring data. Other activities required under the Federal Facility Agreement/Consent Order include identifying risk, summarizing potential pollutants, identifying and implementing best management practices, developing water runoff maps, and identifying potential pollutants in the runoff.

F-2.2.1.2 Flood Analysis. Several studies have been performed to evaluate the potential for flooding to occur at the INEL site. A frequency analysis of local basin snowmelt for several facilities at the INEL site was conducted in 1986 using historical data (Koslow and Van Haaften 1986). Precipitation data from the Central Facilities Area weather station for 1956 to 1985 were used in the analysis. Precipitation data from the Central Facilities Area station were assumed to be representative of precipitation across the INEL site (Koslow and Van Haaften 1986).

In general, flood plains at the INEL site are poorly defined, primarily because detailed topographic and flood hydrographic data are not available for much of the INEL site. Studies are currently underway to determine the 100-year flood plain for the Big Lost River at the INEL site. These studies will lead to a rigorous assessment of the relationship between the Mackay Dam failure probable maximum flood (discussed in Section F-2.2.1.3) and the INEL site 100-year flood plain for the Big Lost River. A recent investigation by Sagendorf (1991) for a design analysis conducted by Zukauskas et al. (1992) used meteorological data from Central Facilities Area for 1950 through 1990 and, for the 25- and 100-year return periods, determined maximum 24-hour precipitation amounts and 25- and 100-year maximum snow depths at the Radioactive Waste Management Complex.

During the winter months, mid-November through mid-March, a rain-on-snow event could occur when the ground is frozen. The 25- and 100-year, 24-hour duration rainfall amounts for these months were determined to be 2.3 and 2.9 centimeters (0.92 and 1.13 inches), respectively. Based on records for the full year, the 25- and 100-year, 24-hour duration amounts were found to be 3.5 and 4.2 centimeters (1.36 and 1.64 inches), respectively. The expected 25-year maximum snow depth was determined to be 57.4 centimeters (22.6 inches), and the 100-year maximum snow depth was found to be 77.7 centimeters (30.6 inches). The peak discharges for the 25- and 100-year rainfall-on-snowmelt floods for the Radioactive Waste Management Complex watershed were estimated by Zukauskas et al. (1992) to be 18.2 and 19.9 cubic meters per second (643 and 704 cubic feet per second), respectively.

Zukauskas et al. (1992) conducted another flooding study at the Radioactive Waste Management Complex. The effects of natural topographic depressions, railroad embankments, and culverts on peak discharges at the Radioactive Waste Management Complex were evaluated. The study was conducted in two parts. The first part was a hydrologic modeling study that evaluated the adequacy of the existing surface water drainage control system in preventing flooding of the Transuranic Storage Area during the 25- and 100-year return interval, 24-hour duration storm events. The second part of the study presented a grading and drainage plan for the area.

The Zukauskas et al. (1992) study computed reservoir stages and peak discharges at key locations using the U.S. Army Corps of Engineering HEC-1 flood hydrograph package. Precipitation and temperature inputs for modeling the 25- and 100-year return period events were derived from the National Weather Service records for the INEL site. Water surface profiles for the main channel flow system and tailwater elevations for computing culvert flow at critical locations were computed with the HEC-2 water surface profiles program. The study concluded that, with some minor reconfigurations and grading in the main channel and the upgrading of two berms, the existing surface water drainage control system would prevent flooding resulting from the 25- and 100-year, 24-hour rainfall/snowmelt storm.

McKinney (1985) documents flooding events that have occurred at the INEL Diversion System on the Big Lost River. The report presents an evaluation of Big Lost River flow records, the INEL Diversion System, the 1983 Mount Borah Earthquake, record low temperatures in December 1983, and the resulting ice jam on the diversion system that forced the river to pond along and nearly overtop Dike 1.

Several flood routing studies have been conducted over smaller areas near specific INEL site facilities. One of these was conducted by Martineau et al. (1990) at the Subsurface Disposal Area within the Radioactive Waste Management Complex. The objective of this study was to determine if the current Subsurface Disposal Area berm is sufficient to prevent floodwater from entering the Subsurface Disposal Area if Dike 2 fails. The Martineau et al. (1990) investigation showed that the Subsurface Disposal Area berm could be in danger of being overtopped by a breach flood from Dike 2. For example, the breach flood from Dike 2 could be initiated by a large flood in the Big Lost River.

F-2.2.1.3 Probable Maximum Flood. Analysis of high-magnitude flooding caused by a dam failure relies on hydrodynamic theory to describe the dam-break wave and to propagate the wave downstream. Closed-form solutions do not exist for the partial differential equations of unsteady flow in open channels, so numerical techniques are employed to achieve solutions. Koslow and Van Haaften (1986) used the DAMBRK model developed by the National Weather Service to simulate four different postulated Mackay Dam failure scenarios: seismic dam failure, hydraulic (piping) failure of the dam with 100-year flood, hydraulic (piping) failure with 500-year flood, and overtopping failure. DAMBRK has been successfully tested against data from a number of actual dam failures, including the 1976 Teton Dam failure in eastern Idaho.

Three functional elements are involved in DAMBRK: description of the dam failure mode and initial conditions; computation of the time-varying flow and water surface elevations at the breach; and routing of the flood through the downstream valley. These functions are accomplished using a number of input elements, including breach description, reservoir inflow and storage characteristics, downstream frictional resistance, flow losses, and downstream channel geometry. The DAMBRK simulation routed the flood wave along the Big Lost River channel from Mackay Dam to Test Area North at the INEL site. Outflows from the river into the INEL site diversion channel were estimated by the broad-crested weir outflow model included in DAMBRK. Koslow and Van Haaften (1986) used a total of 259 channel cross sections in the Mackay Dam flood analysis.

Peak flow rate, peak water surface elevation, flood wave arrival time, and maximum water velocity were presented for eight cross sections along the Big Lost River. In the event of a Mackay Dam failure from any of the four scenarios, there would be flooding along the Big Lost River channel with low velocities and water depths on the INEL site. The water velocity on the INEL site would range from 0.18 to 1.04 meters per second (0.6 to 3.4 feet per second), with water depths outside the banks of the Big Lost River ranging from 0.61 to 1.22 meters (2 to 4 feet) (Koslow and Van Haaften 1986). No significant difference in flood inundation was formed for the seismically induced dam failure and the piping failures that occur during the 100- and 500-year floods. Significantly higher flow downstream and a greater extent of flooding result from the overtopping failure of the dam from a probable maximum flood.

The flat, open topography on the INEL site results in considerable spreading of floodwaters. The facilities subject to encroaching floodwaters are the Idaho Chemical Processing Plant, the Naval Reactors Facility, and the Loss-of-Fluid Testing Facility near Test Area North. As part of an overall evaluation by Koslow and Van Haaften (1986) of the flood potential at the INEL site facilities, Schreiber (1986) developed a probable maximum flood inflow hydrograph to the Mackay Reservoir.

The use of the probable maximum flood represents a conservative estimate of the Mackay Dam failure because the amount of water resulting as inflow into the reservoir would be far greater than either the 100-year or 500-year storm events. Inflow resulting from the probable maximum flood would be 2,300 cubic meters per second (82,100 cubic feet per second) compared with 140 and 160 cubic meters per second (4,870 and 5,760 cubic feet per second) for the 100-year or 500-year storm event, respectively (Koslow and Van Haaften 1986). Modeling of the probable maximum flood scenario was performed assuming the water levels rose above the dam and caused failure. This is likely because the spillways built into the dam would not be able to release the flow fast enough. Results predict that 8,700 cubic meters per second (306,700 cubic feet per second) would be released immediately downstream of the dam. This peak flow attenuates to 2,030 cubic meters per second (71,850 cubic feet per second) at the INEL Diversion Dam and to 990 cubic meters per second

(34,810 cubic feet per second) at the Test Area North. The flood wave reaches the INEL Diversion Dam in 10 hours with flow rates of 0.028 to 0.085 cubic meters per second (1 to 3 cubic feet per second) on the INEL site. These flow rates would not be great enough to cause structural damage to tbe INEL site facilities.

F-2.2.2 Subsurface Water

Subsurface water quality and quantity, hydrologic properties, waste inputs, and other data were gatbered through a literature search. This section contains a summary of the documentation and methods used to characterize subsurface water quality and use at the INEL site and to support conclusions on the impacts to water resources from tbe proposed alternatives. Section F-2.2.2.1 discusses data collection techniques; Section F-2.2.2.2 presents metbodologies and references utilized to characterize subsurface water resources. Section F-2.2.2.3 discusses modeling methodologies, individual modeling studies used in tbis EIS, and the assumptions on which the models are based.

F-2.2.2.1 Data Collection Techniques. Hydrologic parameters at tbe INEL site, specifically hydraulic conductivity and transmissivity, are often determined by single-well pumping tests (Driscoll 1986, Ackerman 1991). Storativity values must be determined from multi-well pumping tests. The standard method for determining transmissivity involves pumping water from a well at a rate which stresses the aquifer and creates drawdown in the well. The amount of drawdown is inversely related to the transmissivity of the aquifer. The drawdown in the well is recorded as a function of time. Time-well recovery techniques are also used and involve measuring the water level recovery as a function of time (Freeze and Cherry 1979). Curve matching techniques that compare the observed curves against type curves are used to determine aquifer parameters (Freeze and Cherry 1979, Driscoll 1986, Domenico and Schwartz 1990).

Finite-difference computer modeling as performed by Garabedian (1992) can also be used to assess the hydraulic parameters by matching observed water levels to simulated levels. The codes are based on finite-difference approximations of equations representing the hydrologic flow, which are dependent on the hydraulic conductivity, storativity, porosity, hydraulic gradient, and transmissivity. By iterative varying of parameters until a match between actual and modeled water levels occurs, the parameters can be estimated. Linear regression techniques have also been used to estimate transmissivity from specific capacity (Ackerman 1991).

Groundwater chemistry data are obtained by water sampling and chemical analysis. Monitoring wells sampled are purged until field parameters (that is, pH, temperature, conductivity) stabilize (Driscoll 1986). This ensures that the water sampled is formation water and not residual water that has been chemically altered in the well. The U.S. Geological Survey has been routinely monitoring wells at the INEL site since 1949 and uses these methods of sampling (Barraclough et al. 1976, Pittman et al. 1988). Analytical techniques used to determine concentrations of solutes include liquid scintillation and alpha, beta, and gamma testing for radionuclides; atomic adsorption for metals and anions; and gas chromotography/mass spectrometry for volatile organic compounds (Mann 1990, Driscoll 1986). Recently, studies have used inductively coupled plasma-mass spectrometry for chemical analysis of cations, which offers lower detection limits and an expanded analyte list (McCurry et al. 1994).

F-2.2.2.2 Water Resources Characterization. This section presents the methodologies and briefly summarizes sources of information used to characterize subsurface conditions. Specifically, sources describing aquifer properties, water quality, and contaminant distribution are identified and important elements are highlighted. Factors affecting background water chemistry and groundwater quality and references for source term determination are also provided.

F-2.2.2.2.1 Description of Physical Properties and Flow Characteristics—Determining the aquifer properties of the Snake River Plain Aquifer has been a long-standing goal of the U.S. Geological Survey, INEL, and other investigators. Aquifer properties of interest include the hydraulic conductivity, transmissivity, specific capacity, flow rates and directions, and distribution of static head levels. Because of the significant heterogeneity of the aquifer, these parameters vary locally by several orders of magnitude (tens to hundreds of meters) within the Snake River Plain Aquifer (Ackerman 1991, Robertson et al. 1974). Several investigators attribute the heterogeneity to the complicated stratigraphy, which consists of numerous relatively thin basalt flows with rubble zones and intercalated sedimentary interbeds (Robertson et al. 1974, Whitehead 1992). Groundwater flow velocities within the aquifer are greatest along fractures, rubble zones, and boundaries between basalt flow lobes (McCurry et al. 1994). Locally, the variance can be important; but on an intermediate (hundreds of meters to kilometers) or regional (kilometers to tens of kilometers) scale, the properties are easier to model because the heterogeneities average out (Garabedian 1986, 1992). References that address hydrologic property testing, specific values of hydrologic parameters, and modeling of properties in the Snake River Plain Aquifer include

Pittman et al. (1988), Ackerman (1991), Garabedian (1986, 1992), Robertson et al. (1974), and Barraclough et al. (1976).

Of these references, Ackerman (1991) and Garabedian (1986, 1992) are the most recent and provide details on transmissivity distributions at the INEL site. Ackerman (1991) utilized data from previous single-well pumping tests within the Snake River Plain Aquifer to determine the distribution of transmissivity values under the INEL site. Type-curve matching methods as discussed by Driscoll (1986) were used, as well as linear regression of specific capacity-transmissivity relationships. Conclusions showed that specific capacity values ranged from 0.6 to 70,000 liters per minute per meter (0.05 to 6000 gallons per minute per foot) and transmissivity values varied over six orders of magnitude from 0.09 to 90,000 square meters per day (1 to 1×10^6 square feet per day). Garabedian (1986) used parameter estimation techniques to estimate transmissivity and estimated values ranged from 400 to 3.5×10^5 square meters per day (4,300 to 3.8×10^6 square feet per day) on a regional scale.

F-2.2.2.2.2 Subsurface Water Quality and Contaminant Distribution—The natural groundwater chemistry of the Snake River Plain Aquifer is determined by inputs from precipitation, recharge, anthropogenic inputs, and water-rock reactions (Wood and Low 1988). The background chemistry of the Snake River Plain Aquifer has been the subject of investigation and is important for determining locations where elevated contaminant levels may exist. Robertson et al. (1974) provides a detailed analysis of the recharge water quantity and quality entering the Snake River Plain Aquifer and presents reasons for the evolution of the natural groundwater chemistry. The study was a mass balance approach and considered inputs from the Mud Lake area, the Big Lost River System, and local precipitation.

Water-rock interactions taking place from the recharge to discharge zones of the aquifer impact the natural water chemistry of the aquifer. Robertson et al. (1974) and Wood and Low (1986, 1988) devised mass balance studies consisting of a series of equations to explain chemical changes from the northern to southern part of the INEL site. The equations consist of dissolution reactions for basaltic minerals such as anorthite, pyroxenes, and olivines, as well as precipitation reactions for calcite and quartz. Incongruent reactions, which are responsible for the formation of clays (Drever 1988), were also considered. Results of the calculations indicate that about 20 percent of the solutes in the groundwater can be attributed to dissolution reactions and that precipitation of quartz and calcite have an important impact on the buffering capabilities of the aquifer.

Knowledge of individual contaminant behavior is also necessary to understand contaminant transport and residence times below the surface. Properties affecting contaminant behavior include retardation, dispersion, and radioactive decay. These parameters are used in transport models; therefore, accurate values are required. Retardation factors are typically determined by laboratory column and batch experiments, which are performed considering site-specific conditions (for example, soil and rock type, porosities, pH) (Drever 1988, Domenico and Schwartz 1990). Retardation factors of 5-130, 1, and 2 for strontium-90, tritium, and iodine-129, respectively, have been used for modeling studies at the INEL site (Arnett and Rohe 1993, 1994).

Strontium-90 was chosen for modeling conducted in support of this EIS for several reasons. Although cesium-137 and strontium-90 were both disposed of by direct injection into the Snake River Plain Aquifer from 1953 to 1984, extensive aquifer sampling showed that cesium-137 had not migrated a significant distance from the injection well, while strontium-90 has been detected in enough wells to delineate the geometry of plumes over time and space (Arnett and Rohe 1993). This observation supports recent laboratory data regarding the relatively greater sorbtion and retardation properties of cesium-137 with respect to strontium-90 (Arnett and Rohe 1993), clearly indicates that strontium-90 has more of a potential impact on INEL and regional water quality, and provides strontium-90 plume migration data for parameter estimation.

Dispersivities used in contaminant transport models range from 91 to 140 meters (298 to 459 feet) for the longitudinal and transverse directions, respectively. Radioactive decay is constant under all conditions, and the values used for the radionuclides are 26.6, 12.5, and 15,700,000 years for strontium-90, tritium, and iodine-129, respectively (Arnett and Rohe 1993, 1994; Schafer-Perini 1993; Robertson 1974, 1977). References that address the determination of retardation factors and dispersion coefficients and discuss their use in transport equations include Freeze and Cherry (1979), Domenico and Swartz (1990), and Drever (1988).

Contaminants interact differently below the surface, depending on whether they are in the vadose zone or the saturated zone. The vadose zone at the INEL site is very thick and acts as a buffer for contaminants between the surface and the saturated zone. As a result, several studies have examined specific aspects of the vadose zone, such as the infiltration rates of water in basalt and sediments, location and chemical quality of perched water zones, and location of contaminants sorbed to interbeds and the basalt matrix (Bishop et al. 1992, Marts and Barrash 1991, Ackerman 1992, Hubbell 1990, and Cecil et al. 1991). Kaminsky (1991), Bishop (1991), and Cecil et al. (1992) address infiltration rates of water in subsurface soils and basalts. Results indicate that the infiltration rates are highly dependent on the degree of saturation and matric suction. Under highly unsaturated conditions, rates can be as slow as 0.36 centimeter per year (0.14 inches per year). Bishop (1991) showed rates of water movement in a dry block of basalt to be approximately the same. Other investigators have shown rates to be higher under saturated conditions in the vadose zone (Hubbell 1990).

Water quality evaluation and determining distribution of contaminants in the Snake River Plain Aquifer beneath the INEL site is the primary goal of the U.S. Geological Survey monitoring program. The U.S. Geological Survey has conducted routine sampling of monitoring wells and maintains records of the chemical analyses in a database (Barraclough et al. 1981). Typically, wells are sampled on a semiannual basis for major anions and cations, radionuclides, some trace metals, and field physical measurements (that is, temperature, conductivity, pH). Many wells constructed within the perched zones beneath the percolation ponds at the Test Reactor Area and Idaho Chemical Processing Plant are sampled quarterly for the same parameters but include an expanded list of radionuclides (Cecil et al. 1991, Marts and Barrash 1991). In addition to the routine studies, special studies have been conducted to define the distribution of specific contaminants. For example, several studies evaluated the distribution of volatile organic compounds (Mann 1990, Liszewski and Mann 1992, Mann and Knobel 1987). Routine monitoring is required to maintain updated information characterizing the levels and distribution of contaminants. This is vital because subsurface distributions of contaminants are transient. Hubbell (1990) describes the fluctuation in water levels and perched water chemistry at the Radioactive Waste Management Complex as a function of recharge. Cecil et al. (1991) and Robertson (1977) discuss the relationship between waste inputs and perched zone chemistry at the Test Reactor Area. The distribution of contamination within the aquifer has also changed over time. Golder (1994) discusses the time relation of contaminant distribution and provides several maps of the plumes at various time intervals. Additional references addressing aquifer chemistry and distribution of contaminants include Robertson et al. (1974), Barraclough et al (1976), Cecil et al. (1991, 1992), Pittman et al. (1988), Whitehead (1992), and Barraclough et al. (1981).

F-2.2.2.2.3 Source Terms—Many references provide information identifying and characterizing source terms of liquid effluents as well as discuss the processes that produced the wastes. This information is important for the overall characterization of the contaminant budget for the system. Records kept by INEL site facility operating personnel and from monitoring devices are used to determine these inputs. Input data from 1953 to 1970 are sparse compared to after 1970, because recordkeeping and sampling programs were not as comprehensive as they are today. References addressing source terms at the INEL site include Creed (1994), Lehto (1993), Arnett and Brower (1994), Arnett and Rohe (1993, 1994), Golder (1994), IDHW (1994), Arnett (1994a), and Bobo (1993).

Golder (1994), prepared for this EIS, describes the baseline contaminants in the subsurface. The history of contaminant plumes, background chemistry, concentrations of contaminants within the Snake River Plain Aquifer, and contaminants within the perched zones is summarized in this report from preexisting studies. Lehto (1993) was also prepared for this EIS and addresses the past history of waste injection. It summarizes the volumes and radionuclide concentrations disposed of at the Test Reactor Area, Idaho Chemical Processing Plant, Test Area North, and several inactive areas. Data in this report were obtained from the Radioactive Waste Management Information System and Non-Radioactive Waste Management Information System and were used as input for the modeling performed by Arnett and Rohe (1993, 1994) and Arnett (1994b).

Creed (1994) discusses source terms for a generic spent nuclear fuel storage facility based on water quality data from the Idaho Chemical Processing Plant Fluorinel and Storage Facility and a generic spent nuclear fuel storage facility design (Hale 1994) used to identify impacts to the water quality from an unintentional discharge of 18.9 liters per day (5 gallons per day) for 30 days consisting of the following radionuclide concentrations:

- Tritium - 10,000 picocuries per liter
- Strontium-90 - 810 picocuries per liter
- Antimony-125 - 100 picocuries per liter
- Cobalt-60 - 9,290 picocuries per liter

- Cobalt-58 - 148 picocuries per liter

- Cesium-137 - 101 picocuries per liter.

Creed (1994) also describes tbe scenario leading to the hypotbetical leak, which consists of canal water leakage from secondary containment around tbe spent nuclear fuel storage pools.

Constant process monitoring, mass-balance, and facility design in accordance with current standards, including double-walled confinement of all vessels and piping, would be used by DOE to limit potential operational releases from a new spent nuclear fuel storage facility to a goal of essentially zero. Any operational releases postulated would result from degraded equipment. Arnett (1994a) addresses the effects that this leak would have on subsurface water resources. Results indicate tbat tbere would be no contaminants above maximum contaminant levels at the INEL site boundary resulting from a postulated operational leak.

F-2.2.2.2.4 Water Use—The amount of water consumed above the baseline differs for each alternative, witb Alternative B (Ten-Year Plan) consuming the greatest quantity of water. Even under tbis alternative, tbe impacts to water quantity are expected to be minor compared to tbe volume of water flowing under the INEL site yearly [1.77×10^9 cubic meters (470×10^9 gallons)] (Robertson et al. 1974). Moreover, 65 percent of the water consumed under current operations is returned to tbe aquifer by subsurface discharge and infiltration. Similar returns to the aquifer are expected to occur regardless of tbe EIS alternative chosen. The amount of water to be consumed under each alternative is estimated based on an evaluation of project descriptions and conversations witb project personnel.

F-2.2.2.2.5 Data Limitations—Groundwater samples used to characterize subsurface water quality are taken from dedicated pumps that access tbe most permeable parts of tbe aquifer, but tbe samples are homogenized by tbe pump and represent a composite of the entire well. Chemical constituents may vary depending on tbe particular interval being sampled, and some intervals may have higher concentrations tban otbers (McCurry et al. 1994). Hence, intervals with elevated concentrations of constituents may not be detected.

Retardation coefficients and dispersivity values used in contamination transport models for the INEL site are not well known and were initially estimated from previous investigations (Robertson 1974, 1977; Arnett and Rohe 1993, 1994) The final values used are from calibration of the models where the retardation factor and dispersivity are varied until a match is obtained between the simulated and observed plume concentrations for a 20-year timeframe. In that sense, they are fitting parameters, rather than empirically derived parameters from field or laboratory experiments. The significant contaminant plumes can be considered as large-scale, long-term tracer tests that provide intermediate scale parameters. The retardation factors obtained in this manner were lower than those obtained from laboratory scale tests. The value for retardation estimated by model calibration for strontium-90, for example, was five, which was much lower than obtained from laboratory tests. The lower, more conservative value was used in the aquifer modeling.

This is more important for the nonconservative contaminants because the values vary for specific elements. An assumed retardation factor of one for conservative contaminants (indicates no retardation) was used in all models for tritium and volatile organic compounds (Schafer-Perini 1993; Arnett and Rohe 1993, 1994; Robertson 1974, 1977). A small value of two was used for iodine-129. Laboratory experiments are difficult to extrapolate to the field because of large scale differences. In addition, the tests are run under specific laboratory conditions that may or may not accurately reflect real conditions. Field-scale experiments are preferred because of the scaling towards a larger system. Other than the migration of the contaminant plumes themselves, no empirical studies to date have been performed at the INEL site for determining field dispersivities or retardation coefficients for radionuclides. A large-scale aquifer infiltration test is planned for a site on the INEL to determine field-scale contaminant transport properties (Wood et al. 1994). Flow and transport parameters, including retardation and dispersion used in contaminant transport modeling for this EIS have been conservatively estimated to account for potential uncertainties in parameter estimation and ensure that modeled impacts to the Snake River Plain Aquifer equal or exceed potential future impacts with a high degree of certainty (Arnett and Rohe 1993, 1994; Arnett 1994a, b).

Values for hydrologic parameters derived from pumping tests (for example, conductivity, transmissivity) are difficult to determine in the Snake River Plain Aquifer because the aquifer has a high transmissivity and is difficult to stress. Formations yielding large volumes of water require high pumping rates, but drawdowns of more than a few feet are difficult to obtain (Ackerman 1991, Robertson et al. 1974). Transmissivity values determined from pump tests are underestimated due to effects of partial penetration with the aquifer by the wells (Garabedian 1986, 1992). The effective portion of the aquifer is not well understood, especially beneath individual wells (Ackerman 1991, Garabedian 1986, 1992). Garabedian (1992) compared modeled values to empirical values and determined that the empirical values represent smaller values, because the wells tested are only completed in the upper portion of the aquifer.

Porosity values are a limiting factor in transport modeling. Highest porosity zones in the Snake River Plain Aquifer are the rubble zones and fractures, although saturated vesicular basalts contain a large storage capacity. Porosity estimates range from near zero to 20 percent (Robertson et al. 1974), and porosity estimates of 5 to 10 percent are commonly used in modeling studies (Robertson 1974, Arnett and Rohe 1993, Schafer-Perini 1993). Because the Snake River Plain Aquifer is semiconfined, storativity is approximately equal to porosity, and values for storativity are also estimated.

The levels of contaminants in the vadose zone need further study because their distribution is only moderately characterized and concentrations change with time (Cecil et al. 1991, Marts and Barrash 1991). The lack of information is partially due to the lack of monitoring wells that access the vadose zone perched water zones. Several perched water zones are known and have been characterized for quantity and quality of water, but other perched zones may exist that have not been studied yet. Hubbell (1990), Bobo (1993), Marts and Barrash (1991), and Cecil et al. (1991) suggest the presence of possible perched zones other than the ones documented, located along deeper sedimentary interbeds. Known perched zones are being monitored and characterized at the Idaho Chemical Processing Plant and Test Reactor Area with sampling performed quarterly. Nonradiactive metallic contaminants in unsaturated parts of the vadose zone are likely to exist locally but would probably be bound to sediments by sorption.

Infiltration rates in the vadose zone are one of the most poorly characterized but important parameters for modeling contaminant transport to the saturated zone. Two of the important studies on infiltration rates of water in the surface sediments near the Radioactive Waste Management Complex have been performed by Cecil et al. (1992) and Kaminsky (1991). Arnett and Rohe (1993) use a rate of 47 meters per year (153 feet per year) as a conservative assumption in modeling the flow of liquids from the Idaho Chemical Processing Plant and Test Reactor Area surface ponds to the saturated zone.

F-2.2.2.3 Modeling Contaminant Transport. For this EIS, computer modeling was performed to predict the fate and transport of contaminants in the vadose and saturated zones (Arnett and Rohe 1993, 1994; Schafer-Perini 1993; Dames and Moore 1993; Arnett 1994b). The modeling characterizes contaminant behavior in the subsurface based on established theories of contaminant interaction, contaminant transport, and hydrologic flow. The models are capable of estimating contaminant migration for any timeframe specified by the user and results provide information on future impacts. This section describes the general approach to modeling, provides a discussion of the modeling studies used, and includes a description of limitations and assumptions on which the models are based. See Table F-2-1 for a summary of the contaminant transport models used to evaluate consequences to subsurface water resources. The table includes a brief model description, assumptions, calibration methods, modeling results, and predicted consequences to water resources.

F-2.2.2.3.1 Techniques in Contaminant Fate and Transport Modeling—Fate and transport modeling requires an understanding of the subsurface in addition to understanding how the models work. The steps involved in modeling include (a) data assembly and verification, (b) development of a conceptual model, (c) code selection, (d) model calibration, and (e) computer simulation.

Conceptual model development is one of the first steps in the modeling process and consists of taking a complicated system such as the aquifer located under the INEL site and making simplifying assumptions. This simplification process involves defining (a) the geometry, including boundaries of the aquifer; (b) flow input and output; (c) locations of important features such as sedimentary interbeds; and (d) locations of wastes and rates of discharge. Depending on the area being modeled, several different conceptual models were developed for the models addressed in this EIS (Arnett 1994b; Arnett and Rohe 1993, 1994; Schafer-Perini 1993; Dames and Moore 1993; Robertson 1974, 1977).

For the modeling conducted in this EIS, several codes are available to model contaminant transport in the Snake River Plain Aquifer. Arnett et al. (1993) provides a detailed discussion of the code selection and bases for selecting the codes used. The codes MODFLOW and MT3D were chosen because of their wide acceptance in the scientific community. GFLUX is a modification of a U.S. Nuclear Regulatory Commission code, GWSCREEN, which is widely used in the scientific

Table F-2-1. Matrix of contaminant transport models used to evaluate consequences to subsurface water resources at the Idaho National Engineering Laboratory site.

Reference	Model description	Assumptions[a]	Calibration	Results	Water resources consequences
Arnett and Rohe (1993)	Used a storage/drainage model coupled with the GFLUX code to determine the amount of strontium-90, iodine-129, and tritium expected to migrate through the vadose zone at the Test Reactor Area and Idaho Chemical Processing Plant. Considered inputs from past waste disposal to the percolation ponds and produced results of the amount of material migrating on a yearly basis.	Model assumed one-dimensional flow (1D) with travel times to the aquifer of three years.	Not applicable	Indicated tritium would migrate through the vadose zone to the aquifer in a relatively short period of time from both facilities. Strontium-90 is not expected to migrate through the vadose zone. Iodine-129 would migrate into the aquifer from the Idaho Chemical Processing Plant. Results were used as input into the MT3D code.	Tritium and iodine-129 would continue to migrate into the aquifer until at least 2010, but in concentrations decreasing with time. No new inputs of strontium-90 to the aquifer are expected. Overall the vadose zone would become "cleaner" with time as nonconservative contaminants decay in place, and conservative constituents flush out of the system.
	Used the code MODFLOW for groundwater flow simulation coupled with the contaminant transport code MT3D to determine the fate and transport of strontium-90, iodine-129, and tritium plumes in the aquifer extending from the Idaho Chemical Processing Plant and Test Reactor Area. Modeling was from 1995-2035, or until contaminant levels dropped below the maximum contaminant level.	(a) Transient approach; (b) Two-dimensional (2D) flow of water; (c) model boundaries correlate with geographic boundaries on the west and far enough east that uncertainties in water flow would not effect water levels at the INEL; (d) No future discharge of liquids with concentrations above the maximum contaminant levels or derived concentration guides; (e) Precipitation has an insignificant effect on recharge; (f) Sources of waste can be lumped for convenience; (g) wastes are in the upper 100 m (328 ft) of the aquifer; and (h) no speciation of contaminants.	Calibrated using water level data and plume distributions for the years 1970-1990.	Results show that the tritium plume would decay significantly with time and maximum concentrations would be below the maximum contaminant level by the year 2000. Strontium-90 plume is not anticipated to migrate very far from the Idaho Chemical Processing Plant, but max. concentrations would not be below the maximum contaminant level until 2030. Iodine-129 plume would migrate southward towards the INEL boundary and max. concentrations would be above the maximum contaminant level beyond 2035, but within the INEL southern boundary.	The contaminant plumes currently have isolated adverse consequences because of concentrations above the maximum contaminant level. Over time concentrations would decrease and residual contamination would migrate southward. Contaminants would not pose a threat to offsite water quality because only tritium and iodine-129 would migrate off site, but at concentrations below their respective maximum contaminant levels.

Table F-2-1. (continued).

Reference	Model description	Assumptions[a]	Calibration	Results	Water resources consequences
Schafer-Perini (1993)	Used the code FLASH to simulate groundwater flow coupled with the code FLAME to simulate contaminant transport. Modeling was used to simulate the fate and transport of trichloroethylene, tetrachloroethylene, dichloroethylene, tritium, and strontium-90 plumes extending from Test Area North. Modeling was performed for the time period from 1994-2094.	Modeling was performed under two assumptions: (a) source was immobile and would act as a constant, infinite source; (b) source was limited in amount and free to migrate in the groundwater; (c) high strontium-90 retardation.	Hydrologic flow was calibrated using 1990 data and contaminant transport using 1991 data.	Results show that trichloroethylene and dichloroethylene plume migration depended on the choice of assumptions. Under the first, the plumes extended from Test Area North in concentration well above maximum contaminant levels. Under the second, the plumes migrated away from Test Area North in concentrations above maximum contaminant levels. Tetrachloroethylene would migrate away from the Test Area North at concentrations above the maximum contaminant level under either assumption. Tritium and strontium-90 migration did not depend on assumptions used. Tritium is at concentrations below the maximum contaminant level, and the plume would not migrate far. The strontium-90 plume would not migrate very far from Test Area North, but would exhibit concentrations well above the maximum contaminant level.	Test Area North represents one of the most significant contamination problems at the INEL. Modeling suggests organics would significantly affect groundwater quality in the future as plumes spread. Plumes are not anticipated to migrate to the INEL boundary due to the remote location of Test Area North. Radionuclides do not pose a threat to offsite water quality because of low concentrations, short half-lives, and chemical retardation of constituents in the vadose zone. Remediation to extract organics and strontium-90 would start within the next year and is expected to reduce plumes to eliminate adverse impacts.
Dames and Moore (1993)	Used the code PORFLOW to model organic vapor transport through the vadose zone to the aquifer at the Radioactive Waste Management Complex. Contaminant migration in the aquifer to the INEL boundary was simulated by the code AT123D.	(a) Organics were assumed to travel in the vapor stage and advectively with vadose water towards the saturated zone; (b) complete mixing at saturated zone interface.	To be determined	Results indicate that a significant amount of organic material might enter the aquifer. Peak concentrations were predicted in the year 2070. Once chemicals enter the aquifer, material would migrate to the southern INEL boundary with some contaminant concentrations above the maximum contaminant level.	Volatile organic compounds at the Radioactive Waste Management Complex pose a potential threat to water quality. Most of the contamination is contained within the vadose zone [183 meters (600 feet) thick at the Radioactive Waste Management Complex]. A planned remediation project performing vapor extraction of organics should alleviate the potential of organic vapor migration into the aquifer, thus reducing impacts.

Table F-2-1. (continued).

Reference	Model description	Assumptions[a]	Calibration	Results	Water resources consequences
Robertson (1977)	Used a numerical model to determine the potential of tritium and strontium-90 migrating from the vadose zone into the aquifer at Test Reactor Area. The subsurface was divided into three sections representing the upper and lower perched zones and the migration pathway beneath the perched zones.	(a) 1D flow in Sections 1 and 3. (b) 2D flow in Section 2.	Simulated flow for 1.6 years from the percolation ponds to the perched zones to simulate observed contours.	Results indicate that tritium is expected to migrate from Test Reactor Area perched zones, but that strontium-90 would not breakthrough the vadose zone for the 35 year modeling time. Results are consistent with the vadose zone modeling by Arnett and Rohe (1993).	The only impact shown from this study is that tritium would migrate to the aquifer and act as a continued source of this contaminant. Concentrations were predicted to be low and would not significantly effect the current tritium plume. Strontium-90 would not migrate into the aquifer, hence no adverse impacts are expected due to this radionuclide.
Robertson (1974)	Modeled strontium-90, tritium and chlorine plume migration from the Idaho Chemical Processing Plant and the Test Reactor Area using a predecessor of the USGS code for groundwater flow contaminant transport. Modeling considered different source terms and slightly different effects, however, from recharge by the Big Lost River. The approach is very similar to the methods of Arnett and Rohe (1993) and was based on the same principles.	(a) no speciation of contaminants; (b) transient flow; (c) flow is in the upper 76 meters of the aquifer; (d) 2D flow; (e) porosity is 10 percent; (f) inputs from 1973-2000 are the same as for 1973; (g) recharge quantities along the Big Lost River; and (h) model boundaries correlate with geographic boundaries on the west and far enough east that uncertainties in water flow would not effect water levels at the INEL.	Calibrated the groundwater flow using data from 1964, strontium-90 plumes against 1964 and 1972 data, and tritium plumes against 1968.	Results of the model are similar to those produced by Arnett and Rohe (1993) for tritium and strontium-90 but slightly different due to differing source terms. Strontium-90 plume was not anticipated to migrate very far from sources and would have a restricted distribution, but maximum concentrations would be above the maximum contaminant level. Tritium plume was shown to migrate past the southern INEL boundary with concentrations below the maximum contaminant level.	Predictions from this study show that the plume contaminant concentrations would decrease eventually to levels below the maximum contaminant level, but that the plume front would continue to migrate towards the INEL boundary. No adverse impacts to areas outside the INEL are expected because contaminants would leave the site below maximum contaminant levels.
Arnett (1994a)	Considered the affects on the environment of an unintentional discharge from a generic SNF storage facility.	(a) 5 gallons per day for one month; (b) radionuclide concentrations in the leak were equal to those in the storage pool water; (c) leakage from secondary containment.	To be determined.	Preliminary results indicate that the concentrations of strontium-90 above maximum contaminant level would not migrate to the southern INEL boundary.	Only localized impacts to the subsurface beneath the Idaho Chemical Processing Plant.

a. Input parameters for the equations are estimates based on the best available data.

community and is accepted for use at the INEL site. Schafer-Perini (1993) use the codes FLASH and FLAME for modeling organic plumes.

Calibration is an important step in the modeling process, because the validity of future predictions relies on the accuracy of the match between simulated groundwater flow patterns and contaminant plumes and observed data. Calibration of a flow model of the regional aquifer involved preparation of hydraulic head contours for multiple time periods (Arnett and Brower 1994, Arnett 1994b). Time versus head plots (hydrographs) were also prepared for selected wells. Hydrologic parameters were varied until hydraulic heads resembled observed contours. This method required several iterations with manual parameter adjustment before a suitable match was obtained. Calibration of the contaminant transport model followed a similar approach (Arnett and Rohe 1994). Errors in calibration are usually associated with areas where hydrologic parameters are uncertain because of the high degree of heterogeneity within the basalts. Contaminant transport modeling typically requires adjustment of the retardation and dispersion coefficients because field-scale values are not known (Arnett and Rohe 1993, 1994; Schafer-Perini 1993, Dames and Moore 1993, Robertson 1974).

The general approach to groundwater modeling by computer simulation is to solve the groundwater flow equation to predict hydraulic heads and to use the head distribution in the transport model to calculate the advective flow (velocity). Hydrologic flow equations for transient conditions are a function of the changing hydraulic gradient in time and space (water input and output), storativity, porosity, fluid density and compressibility, and transmissivity. Contaminant transport equations are a function of time, retardation factors, dispersion coefficients, decay constants, advective transport, and rates of waste input. Hydrologic flow equations must be solved first because results provide input into contaminant transport equations. The flow and transport equations used in this EIS are widely accepted and utilized in many types of computer codes (Arnett 1994b; Arnett and Rohe 1993, 1994; Robertson 1974). Flow and contaminant transport theory are discussed in Freeze and Cherry (1979), Driscoll (1986), and Domenico and Schwartz (1990).

A primary step in performing computer simulation is to establish the model's spatial domain which is then divided into a set of similar units of specified dimensions which are assigned a computational node. Each node is assigned material properties. The edges of the domain are assigned boundary conditions from information external to the model (Arnett 1994b; Arnett and Rohe

1993, 1994). In general, the finer the grid, the more accurate the predictions, but the longer the computational time. Grid patterns in Arnett (1994b), Arnett and Rohe (1993, 1994), and Robertson (1974) consisted of a rectangular pattern stretching from the northwestern mountain range and east about 16 kilometers (10 miles) past the INEL site boundary; the northern grid boundary was along the mountain front, and the southern boundary extended about 8 kilometers (5 miles) south of the INEL site. A submodel with a final grid was set up within the INEL site over the contaminant plumes for finer detail. The finite-element grid formed by Schafer-Perini (1993) was similar but contained more complicated triangular elements near sources of contamination (for example, TSF-05 injection well).

The flow and contaminant transport equations are solved by finite-difference or finite-element techniques (approximations of the partial differential equations) for each node within the grid. Solutions predict hydraulic head and concentrations of contaminant distributions as a function of time. Fine grid patterns are needed around some waste sources to simulate steeper hydrologic and chemical gradients. Finite-element techniques have some advantages in these situations. Arnett (1994b), Arnett and Rohe (1993, 1994) and Robertson (1974) used the finite-difference techniques, whereas Schafer-Perini (1993) used finite-element techniques. After completion of the simulation (that is, equations solved for each node at all time increments) the concentrations and hydraulic heads within the nodes are contoured, thus producing simulated plume maps and hydraulic head contours. The modeling grid used for this EIS was bounded by specified variable head and no-flow boundaries to the west. No-flow boundaries were assigned to the contacts between the mountains and Snake River Plain Aquifer, whereas variable head boundaries were assigned to recharge areas such as mouths of the Big Lost River, Little Lost River, and Birch Creek. Schafer-Perini (1993) considered variable head boundaries for the Test Area North model. Eastern and southern boundaries were considered constant head and at sufficient distances from contaminant plumes such that reasonable errors in defining the boundary conditions had a negligible effect on the simulated groundwater velocity in the plume areas.

F-2.2.2.3.2 Modeling Studies—Table F-2-1 presents the different models used in the assessment of predicted consequences to water resources. Table F-2-1 describes the individual models used, results produced, potential impacts to the water resources, calibration of the models, and assumptions the models are based on. Modeling was performed by several investigators for the vadose zone, the saturated zone, for a bounding accident scenario, and for an unintentional release from a generic spent nuclear fuel storage facility. Iodine-129, tritium, and strontium-90 plumes extending from the Test Reactor Area and Idaho Chemical Processing Plant were modeled by Arnett and Rohe (1993). Organic contaminants at Test Area North and the Radioactive Waste Management Complex were modeled by Schafer-Perini (1993) and Dames and Moore (1993), respectively. In addition, an accident scenario for a high-level waste tank failure at the Idaho Chemical Processing Plant was modeled. The accident scenario model concluded that strontium-90 would not extend beyond the INEL site boundary above maximum contaminant levels throughout the implementation period (Arnett 1994a). The results of the tank failure model were dependent on limited amount of liquid in the tank being the only hydraulic driver; it appears reasonable that prompt action would be taken by authorities to mitigate the impacts of such an accident through capping, pumping, and other means. The source terms for unintentional discharges at a generic spent nuclear fuel storage facility are negligible compared with the strontium-90 source terms in the high-level waste tank and small compared to past strontium-90 discharges.

A simple, one-dimensional model was used to estimate flow and contaminant transport in the vadose zone below the disposal ponds. Average vertical water velocity was calculated from average water transport time and vadose zone thickness. The conclusion that strontium-90 is strongly retarded in the vadose zone is based on laboratory and theoretical data to a limited degree. It is based more on the fact that considerable amounts of strontium-90 have been discharged to the Test Reactors Area radioactive waste pond over the past 40 years and very little, if any, strontium-90 (near detection limit) concentrations have been found in the aquifer directly beneath or near the Test Reactors Area perched water body. Again, appropriate scale field data (which integrate the effects of local heterogeneities) were available to provide a good estimate for the model parameter. In the case of strontium-90, the retardation factor was calculated assuming that strontium-90 would experience break-through in the near future.

F-2.2.2.3.3 Modeling Assumptions and Limitations—Table F-2-1 lists the assumptions that provide the bases for the different models used to support the environmental consequences described in Section 5.8, Water Resources, of Volume 2 of this Environmental Impact Statement. The following briefly discusses the assumptions and limitations.

- **Transient versus steady-state modeling**: Garabedian (1986, 1992), Arnett (1994b), Arnett and Rohe (1993, 1994), and Robertson (1974) concluded that the Snake River Plain Aquifer system is best simulated by considering transient conditions and a transient hydraulic flow. Modeling can be conducted under transient (time-dependent) or steady-state conditions. Steady-state modeling is used when aquifer conditions (for example, water levels, recharge) can be considered constant for approximately the period of simulation. Mathematically, the change in hydraulic gradient with time is considered zero, and storativity terms are not needed when assuming steady-state conditions. The steady-state assumption cannot be made because water levels and recharge volumes change with time.

- **Aquifer anisotropy and two dimensional flow:** Garabedian (1992) concluded that on a regional scale the groundwater flow is predictable and can be simulated in two dimensions. Vertical flow was found to be several orders of magnitude less than horizontal flow. On local scales vertical flow may be significant, but on regional scales the assumption is valid.

- **No new discharge of radioactive wastes with concentrations above the maximum contaminant level or derived concentration guides**: One of the primary assumptions used for modeling and in the evaluation of impacts to the water resources is that no new intentional discharges of radioactive wastes with concentrations above the maximum contaminant levels or derived concentration guides will be discharged to the subsurface. Modeling performed for the fate and transport of contaminant plumes assumes this in evaluating baseline contaminant migration from the vadose zone to the saturated zone (Arnett and Rohe 1993). Review of individual project descriptions indicates that wastes will be disposed of in evaporation basins and liquid waste condensers. Sources of wastes are slowly declining due to improved management practices and engineering and institutional controls; therefore, under standard operating conditions no liquid wastes will have concentrations above maximum contaminant levels or derived concentration guides which would enter the subsurface. However, this assumes no accidental or unintentional releases will occur. Bounding conditions on possible effects from a series of accidental spills indicate that even under conservative estimates, spills will not likely affect water quality beyond the immediate facility area (Arnett 1994a).

- **Boundary conditions:** The boundary conditions imposed for the INEL site model grids consisted of constant head, no-flow, and variable head. Boundaries to the east were considered to have sufficient distances from contaminant plumes such that reasonable errors in defining the boundary conditions have negligible effects on the simulated groundwater velocity in the plume areas. These boundaries were assigned constant heads. The boundaries along the western border were considered to have no flow along the mountain fronts and variable head along the recharge zones. Variable head boundaries were used on the Schafer-Perini (1993) model among northern recharge zones. Model calibration indicates that these boundaries appear reasonable because a suitable match between simulated and observed flow patterns was made for the 1970-to-1990 time period (Arnett 1994b).

- **Precipitation is insignificant to recharge**: The amount of precipitation that accumulates in the vadose zone and migrates to the aquifer is negligible when compared to the amount from underflow. This is a good assumption considering the amount of precipitation (22 centimeters per year, 8.7 inches per year) and the evaporation rate (125 centimeters per year, 49.2 inches per year). Thirty percent of the average annual precipitation at the INEL site results from water content in snow (Bishop 1993). Snowmelt creates ponding in localized areas, which eventually infiltrates to the Snake River Plain Aquifer. However, this recharge is insignificant given that the water flow under the INEL site each year is 1.77 billion cubic meters (470 billion gallons) (Robertson et al. 1974).

- **Contaminant transport occurs in the upper 74-100 meters (243-325 feet) of the aquifer**: Several modelers assume that the contaminant transport occurs in the upper 100 meters (325 feet) of the aquifer because this is the portion with the highest hydraulic conductivity (Arnett and Rohe 1993, 1994; Schafer-Perini 1993; Robertson 1974, 1977). Vertical migration of wastes downward below this zone is considered insignificant. Several studies concluded this to be the effective portion of the aquifer (Ackerman 1991; Robertson et al. 1974, Barraclough et al. 1976, Garabedian 1986, 1992), hence for regional scale modeling this is likely a valid assumption. On a local scale, downward vertical movement of contaminants may be significant.

- **No speciation of the contaminant of interest:** The models that were used in this EIS do not consider speciation of contaminants (specifically strontium-90) with other anions in the water. The contaminants are assumed to be in their valance state and not bound to other constituents, thus preventing sorption. Equilibrium modeling using the U.S. Environmental Protection Agency-developed code MINTEQA2 indicated that the contaminants of interest in the plume would be unspeciated and would be expected to sorb as discussed in the models.

The mathematics used in the models are founded on other assumptions that are not described here. For example, it is assumed that flow can be described by Darcy's Law and that the partial differential equations can be approximated for solution by numerical methods. For more detail, see Domenico and Schwartz (1990).

F-2.2.2.3.4 Potential Contaminant Migration from Solid Waste—Solid low-level radioactive and transuranic waste have been disposed of in several pits at the Subsurface Disposal Area within the Radioactive Waste Management Complex since 1952, and these dispositions are projected to continue until 2020. Transuranic waste disposal at the complex was discontinued in 1970; however, disposal of low-level radioactive waste is projected to continue until 2020. A preliminary scoping risk assessment of radioactive waste disposal practices during the time period from 1952 to 1996 is currently being performed as part of a Comprehensive Environmental Response, Compensation, and Liability Act investigation. The investigation is being conducted under the Federal Facility Agreement/Consent Order that resulted from negotiations among DOE, the U.S. Environmental Protection Agency, and the State of Idaho. For the purposes of this EIS, impacts are being evaluated from 1995 to 2005. Results of the preliminary risk assessment indicate that contaminants would not reach the INEL site boundary exceeding Federal primary drinking water standards through 2005 (Loehr et al. 1994). For the next 100 years, the radionuclides with the highest 30-year average concentration in groundwater are predicted to be carbon-14 and tritium at 586 and 4,510 picocuries per liter, respectively. These levels are well below DOE's Derived Concentration Guide established for carbon-14 (70,000 picocuries per liter) and the U.S. Environmental Protection Agency's Maximum Contaminant Level established for tritium (20,000 picocuries per liter).

A radiological performance assessment was also conducted for low-level waste buried at the Radioactive Waste Management Complex from 1984 through present operations and projected to be disposed through 2020 (Maheras et al. 1994). The results of the assessment indicate that the maximum total pathway exposure occurring by the year 2060 at the INEL site boundary would be less than 0.60 millirem per year (Maheras et al. 1994). No significant impacts are expected to occur within the implementation period of the EIS. However, further information is required before an accurate evaluation of the potential for contaminant transport from the Radioactive Waste Management Complex to the environment can be completed. Information is currently being compiled to characterize source terms, migration rates of vadose water, infiltration rates through soil coverings, sorptive characteristics of contaminants, and other information. A Remedial Investigation/Feasibility Study and a risk assessment is being prepared to evaluate the potential impacts of past, present, and future activities at the Radioactive Waste Management Complex, but is not available for this EIS.

New wastes resulting from sources outside the INEL site identified under the proposed alternatives would not be addressed by the Remedial Investigation/Feasibility Study or the risk assessment. Additionally, new wastes transported to the INEL site under the alternatives would be addressed under separate National Environmental Policy Act documentation, and/or as specified under the Resource Conservation Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act.

Loehr et al. (1994) and Maheras et al. (1994) used computer models including GWSCREEN and PORFLOW to predict the levels of contaminants that would occur at the INEL site boundary. The models considered the leaching and migration of contaminants through the vadose zone and into the regional aquifer. For a detailed discussion of methods used in the modeling approach, refer to these reports.

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SECTION F-3 CONTENTS

FIGURES

TABLES

F-3 AIR RESOURCES

Section F-3 provides supplemental information on methodology and other technical support for the air resources sections of Volume 2 of the Spent Nuclear Fuel and INEL Environmental Restoration and Waste Management Environmental Impact Statement (SNF and INEL EIS).

F-3.1 Overview

Activities proposed under the Environmental Restoration and Waste Management (ER&WM) Program at the Idaho National Engineering Laboratory (INEL) site may affect the quality of existing air resources in various ways. The alternative courses of action proposed under this Program have consequences that vary both in nature and magnitude. These consequences must be thoroughly characterized to provide information needed to support the selection of proper courses of action. Assessments have been performed to characterize the existing conditions of radiological and nonradiological air quality, as well as the consequences of alternative courses of action. Section F-3 presents background information related to these assessments, including descriptions of

- The regulatory framework under which air quality standards and criteria are established and administered
- Airborne emissions of radiological and nonradiological pollutants from existing INEL site facilities and proposed projects
- The data, methods, and computer models applied to estimate concentrations of pollutants at various locations as a result of airborne emissions.

The information presented herein supports the summary results presented in Sections 4.7 and 5.7 (Air Resources) of Volume 2 of the SNF and INEL EIS, which respectively describe the affected environment and consequences of alternatives on air quality. In addition to establishing the technical basis for those summary results, this section presents detailed emissions estimates for specific proposed facilities. Additional details on the assessment results, including predicted consequences for all combinations of alternative and waste management options and selected individual projects (including incineration at the Waste Experimental Reduction Facility), are presented in the *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs* (Belanger et al. 1995a).

F-3.1.1 Scope

The assessments described in Section F-3 consider both nonradiological and radiological air quality related to baseline conditions, projected increases to the baseline, and the consequences of ER&WM alternative courses of action. Specifically, the scope includes background information on air resources, air quality regulation, and assessments related to (a) existing conditions associated with actual emissions from INEL site facilities (termed the actual emissions baseline), (b) conditions that would be experienced if existing facilities operated to the maximum extent allowed by applicable permits or limits (termed the maximum emissions baseline), and (c) the estimated consequences of emissions from projects associated with each of the four ER&WM alternatives.

The assessments focus on conditions or impacts that result at onsite and offsite locations from the release of contaminants from various categories of sources. The types of emissions assessed include radionuclides and the two major categories of nonradiological pollutants—the so-called criteria pollutants and toxic air pollutants. The categories of sources assessed include stationary sources (such as facility stacks and vents), mobile sources, and sources related to construction activities. The locations for which baseline conditions and impacts are assessed include major work areas within the INEL site, locations along the INEL site boundary and public roads, and the Craters of the Moon Wilderness Area. Assessment results are summarized in Sections 4.7 and 5.7 (Air Resources) of the main text and are presented in additional detail in Belanger et al. (1995a).

F-3.1.2 Supporting Documentation

Section F-3 summarizes the methods of independent analyses performed by several different specialists from contractor organizations. In some cases, those analyses are documented in reports prepared for this EIS. These documents are considered key references. Their contents and the manner in which they were used in the air resources assessments are summarized as follows:

- A report prepared by Science Applications International Corporation (Belanger et al. 1995a), which provides additional detail on assessment methodology and results, including projected emissions and impacts for specific projects and waste management options.

- Two reports prepared by Science Applications International Corporation (Raudsep et al. 1995 and Belanger et al. 1995b), which provide specific information on the assessment of Prevention of Significant Deterioration.

- A report prepared by EG&G Idaho, Inc. (Leonard 1993), which presents estimated radiological doses resulting from airborne radionuclides released by facilities at the INEL site. This report was used as a basis for the existing radiological air quality conditions.

- A document prepared by Ecology and Environment, Inc. (E&E 1994), describing the methods and results of the assessment of baseline conditions for toxic air pollutants. These results were used to establish the actual and maximum baseline levels of toxic air pollutants.

- An Engineering Design File prepared by EG&G Idaho, Inc. (Leonard 1994), which presents estimated radiation doses to the maximally exposed worker and offsite individual and population dose resulting from specific projects associated with ER&WM alternative actions. These results were used as the basis for estimating radiological doses for radionuclide emissions associated with specific alternatives and waste stream management options.

- Engineering Design Files prepared by EG&G Idaho, Inc., describing the source terms estimated for no action projects (Staley 1993a) and proposed action projects (Staley 1993b). These source terms were used as input to the air quality assessments for projected increases to the baseline and ER&WM alternatives, which included no action and proposed action projects.

- A document prepared by Ecology and Environment, Inc. (E&E 1993), describing the methods and results of assessments to estimate impacts from mobile and construction source emissions. These results were used as a basis for estimating consequences of mobile sources and construction activities related to ER&WM alternatives.

Section F-3 attempts to integrate the descriptions of methods, assumptions, and other key information from the analyses cited above into a single source.

F-3.1.3 Organization

The remainder of this section is organized as follows:

- Section F-3.2 presents the background environmental information on the INEL site, including background levels of radiation, radioactivity, and nonradiological pollutants

- Section F-3.3 contains a description of air quality regulations and guidelines and a discussion of how they apply to sources at the INEL site

- Section F-3.4 describes the methods and assumptions used to estimate emissions and assess conditions and impacts for releases of radiological and nonradiological pollutants and presents listings of these emissions for specific projects proposed for ER&WM alternatives.

F-3.2 The Idaho National Engineering Laboratory Site Environment

This section describes background levels of radiation, airborne radioactivity, and nonradiological air quality in the environs of the INEL site.

F-3.2.1 Radiation and Airborne Radioactivity

The population of the Eastern Snake River Plain is exposed to environmental radiation from both natural and anthropogenic sources (that is, sources of human origin). This section describes background levels of radiation and airborne radioactivity in this geographical region and other sources of population exposure not related to INEL site emissions. Monitoring data for areas beyond the influence of INEL site emissions are also presented. Additional infonnation related to radiological conditions (including monitoring results and airborne radioactivity associated with existing INEL site facilities) is presented in Hoff et al. (1993).

F-3.2.1.1 Sources of Radiation Exposure Not Related to Idaho National Engineering Laboratory Site Operations. The predominant source of radiation in the region is the natural radiation background, a term that refers to natural sources of radiation to which humans are continuously exposed. Background radiation includes sources such as cosmic rays; radioactivity naturally present in soil, rocks, and the human body; and airborne radionuclides of natural origin (such as radon). The dose from background radiation results from sources that can be either external (outside the body) or internal (within the body). External sources consist primarily of cosmic rays and radioactivity within soil and rocks. Internal sources include radioactivity naturally present within the human body and airborne radioactivity that can deposit in the lungs when inhaled. The natural background dose is increased by radioactivity still remaining in the environment as a result of atmospheric testing of nuclear weapons, although this increase is very minor (less than one percent).

Table F-3-1 presents a summary of the estimated background dose by various exposure categories for residents of the Eastern Snake River Plain. As can be seen from these results, the cumulative annual dose, 351 millirem, is due largely to the inhalation of airborne radioactivity. This radioactivity consists almost entirely of radioactive particles formed by the decay of naturally occurring radon.

In addition to natural background sources, residents of the Eastern Snake River Plain receive exposure from radiation sources of human origin (anthropogenic sources), including medical x-rays, nuclear medicine diagnostic procedures, consumer products (such as televisions, smoke detectors, or self-luminous products), and radioactivity remaining in the environment as a result of atmospheric testing of nuclear weapons. Collectively, these result in an annual dose of about 68 millirem to the average U.S. population member, with most of this dose (about 54 millirem per year) resulting from the medical use of radiation (NCRP 1987). This dose does not include the contribution from radioactivity in tobacco products, which results in a substantial radiation dose (several rem per year) to the lungs of smokers.

Table F-3-1. Summary of environmental radiation dose from natural background sources to residents of the Eastern Snake River Plain for 1991.[a]

Source	Annual dose (millirem)
External sources[b]	
Terrestrial radioactivity	73
Cosmic rays	39
Total external	112
Internal sources[c]	
Airborne (inhaled) radioactivity	200
Radioactivity in the body	39
Total internal	239
Total dose	351

a. Dose is expected to vary by a small amount from year to year.
b. Source: Hoff et al. (1992).
c. Regional data are not available; internal dose values are effective doses for an average member of the U.S. population but are likely to be representative of the Eastern Snake River Plain (NCRP 1987).

F-3.2.1.2 Radiological Environmental Monitoring. Over the years, radiological conditions in the INEL site environs have been characterized by various monitoring programs. Monitoring refers to a variety of activities (for example, sampling, analysis, and direct measurements) performed to measure ambient radiation exposure rates and airborne radioactivity levels. The INEL Environmental Surveillance Program includes a comprehensive network of 23 continuous air samplers. Twelve of the sampling locations are located within the boundaries of the INEL site; 11 are located offsite, including seven stations near the INEL site boundary and four distant stations located within the communities of Blackfoot, Idaho Falls, and Rexburg, and in Craters of the Moon Wilderness Area. It is assumed that results from onsite and boundary community locations include contributions from background conditions and INEL site emissions, while distant locations represent background conditions beyond the influence of INEL site emissions. A summary of gross alpha and beta activity measurement results for distant and INEL site boundary community locations, presented in Table F-3-2, indicates that there is no significant difference in airborne radioactivity levels among these locations. Additional details regarding this program are provided in Hoff et al. (1992).

The Environmental Surveillance Program also includes direct measurements of ambient (environmental) radiation levels using thermoluminescent dosimeters (TLDs). These devices measure

Table F-3-2. Airborne radioactivity levels for Idaho National Engineering Laboratory onsite, site boundary communities, and distant locations for 1991.[a]

Location	Average concentration[b] (10^{-15} microcuries per milliliter) Alpha	Beta
Distant	2.0 ± 0.2	27 ± 1
Boundary	1.8 ± 0.1	28 ± 1
Onsite	1.7 ± 0.1	29 ± 1

a. Source: Hoff et al. (1992).
b. Values are arithmetic means with 95 percent confidence interval.

ionizing radiation exposure rates due to the combined sources of natural radioactivity in the air and soil, cosmic rays, residual fallout from nuclear weapons tests, and radioactivity from INEL site operations. Dosimeters are placed at seven distant community locations and six boundary locations. The average annual exposure measured by the thermoluminescent dosimeters for 1991 was 123 milliroentgen (which corresponds to a dose of 127 millirem) for distant locations, and 121 milliroentgen (125 millirem) for boundary community locations (Hoff et al. 1992).

F-3.2.2 Background Nonradiological Air Quality

As used here, the term background air quality refers to the levels of nonradiological air pollutants in ambient air that are not attributable to INEL site activities. Limited information is available for characterization of background air quality levels, since only particulate matter has been monitored at locations beyond the influence of the INEL site. The INEL Environmental Surveillance Program, which is conducted by the Department of Energy (DOE) Idaho Operations Office Radiological and Environmental Sciences Laboratory (RESL), monitors airborne particulate matter concentrations at INEL site boundary communities and distant and onsite locations, as illustrated in Figure F-3-1. Onsite data are considered to include background levels plus contributions from INEL site activities. Results for airborne particulate monitoring at distant, INEL site boundary, and onsite locations for the period 1988 through 1992 are presented in Table F-3-3. Monitoring of other pollutant levels, including nitrogen dioxide and sulfur dioxide, is performed at onsite locations. Nitrogen dioxide is monitored at two locations onsite to fulfill one of the conditions in a Permit to Construct issued by the State of Idaho. Sulfur dioxide is also measured at one of these locations.

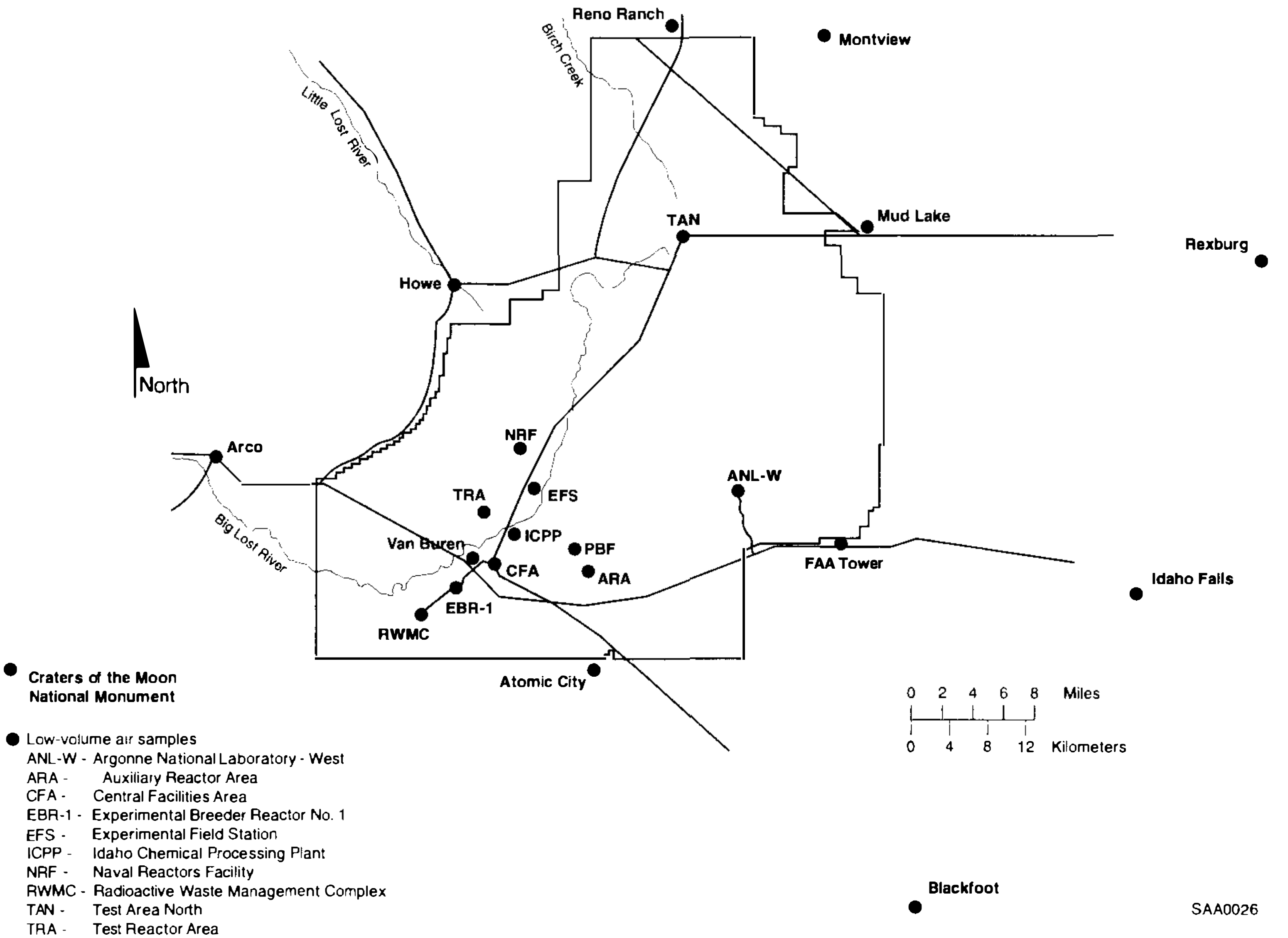

Figure F-3-1. The airborne radioactivity monitoring network operated by the Radiological and Environmental Sciences Laboratory at the Idaho National Engineering Laboratory.

Table F-3-3. Environmental surveillance program particulate matter monitoring data at the Idaho National Engineering Laboratory for 1988 through 1992.[a]

Year	Concentration[b] (micrograms per cubic meter)		
	Distant group	Boundary group	Onsite group
1988	50 ± 20	35 ± 9	32 ± 13
1989	40 ± 14	30 ± 7	17 ± 2
1990	36 ± 12	32 ± 8	20 ± 9
1991	30 ± 20	28 ± 12	18 ± 3
1992	26 ± 19	23 ± 10	13 ± 2

a. Source: Hoff et al. (1993).
b. Values are arithmetic group means of quarterly composites of weekly samples with 95 percent confidence level for the mean.

The State of Idaho has conducted particulate monitoring at the Craters of the Moon Wilderness Area. Monitoring results for this activity, which was discontinued in 1990, are presented in Table F-3-4. Since this location is approximately 20 kilometers (12.4 miles) from the INEL site boundary (and much further from most major emissions sources), these levels can be considered representative of general background.

Table F-3-4. Summary of total suspended particulate matter monitoring data for Craters of the Moon Wilderness Area.[a]

Year	Concentration (micrograms per cubic meter)			
	24-hour maximum	Standard[b]	Annual average	Standard[b]
1984	41	260	6	75
1985	48	260	10	75
1986	41	260	10	75
1987	35	260	15	75
1988	43	260	14	75

a. Source: IDHW (1991). Data are for the last five years for which results are available.
b. These are primary State standards for total suspended particulates; secondary standards are 150 micrograms per cubic meter for 24-hour total suspended particulates and 60 micrograms per cubic meter for annual average.

F-3.3 Air Quality Standards and Regulations

To protect the public from potential harmful effects of air pollution, air quality regulations have been established by Federal and State agencies. These regulations are based on an overall strategy that incorporates the following principal elements:

- Designation of acceptable levels of pollution in ambient air to protect public health
- Establishment of limits on emissions of air pollutants from vehicular and man-made sources
- Implementation of a permitting program to regulate (control) emissions from stationary (nonvehicular) sources of air pollution
- Issuance of prohibitory rules, such as rules prohibiting open burning.

At the INEL, programs have been developed and implemented to ensure compliance with air quality regulations by (a) identifying sources of air pollutants and obtaining necessary State and Federal permits, (b) providing adequate control of emission of air pollutants, (c) monitoring emissions sources and ambient levels of air pollutants to ensure compliance with air quality standards, (d) operating within permit conditions, and (e) obeying prohibitory rules.

This section describes Federal and State air quality regulations that are applicable to the proposed actions and programs established by DOE to comply with environmental, safety, and health requirements in general and air quality requirements in particular.

F-3.3.1 Federal and State Air Quality Requirements

The Federal Clean Air Act establishes the framework to protect the nation's air resources and public health and welfare. The U.S. Environmental Protection Agency (EPA) and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the Act. Facilities planned or currently operating at the INEL are subject to air quality regulations and standards established under the Clean Air Act and by the State Department of Health and Welfare

(IDHW), Division of Environmental Quality, and to internal policies and requirements of DOE. Air quality standards and programs applicable to INEL operations are summarized in Figure 4.7-2 of Volume 2 of this EIS and are described in furtber detail below.

F-3.3.1.1 Ambient Air Quality Standards. The Federal Clean Air Act establishes National Ambient Air Quality Standards (NAAQS) to protect public healtb and welfare. Primary standards define tbe ambient concentration of an air pollutant below which no adverse impact to human healtb is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts on public welfare, including aestbetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions tbat persist for periods ranging from one hour to three months, depending on the toxic properties of tbe pollutant in question. Ambient standards have been developed for only a few specific contaminants, namely, respirable particulate matter (particles not larger than 10 micrometers in diameter, which tend to remain in the lung when inhaled), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. In addition, tbe State of Idaho has also established an additional State ambient air quality standard for total suspended particulates (all airborne particles regardless of size) and a standard for fluorides in vegetation.[a] These pollutants have been termed criteria air pollutants. A listing of National Ambient Air Quality Standards is provided in Table F-3-5.

The U.S. Environmental Protection Agency and State of Idaho have monitored ambient air quality in an attempt to define areas as eitber attainment (tbat is, the standards are not exceeded) or nonattainment of the ambient air quality standard, although many areas are unclassified due to a lack of regional monitoring data. The attainment status is specific to each pollutant and averaging time. Designation as either attainment or nonattainment not only indicates the quality of the air resource but also dictates the elements that must be included in local air quality regulatory control programs. Unclassified areas are generally treated as being in attainment. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that

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a. In the assessments perfonned for this EIS, all particulate matter was assumed to be of respirable size (termed PM-10), with the exception of fugitive dust sources. Since the standard for PM-10 is more stringent than that for total particulates, the former standard was used as basis for comparison in these assessments. The assessment for fluorides in vegetation was omitted in favor of a more stringent comparative standard for levels of toxic air pollutants in air (see Section F-3.3.1.5). Therefore, discussions that follow do not include specific detail on total suspended particulates and fluorides.

Table F-3-5. National Ambient Air Quality Standards and increment values for Prevention of Significant Deterioration (micrograms per cubic meter).

Pollutant	Averaging time	Standard: Primary	Standard: Secondary	Increment: Class II area	Increment: Class I area
Sulfur dioxide	3-hour	(a)	1300	512	25
	24-hour	365	(a)	91	5
	Annual	80	(a)	20	2
Particulate matter[b]	24-hour	150	150	30	8
	Annual	50	50	17	4
Nitrogen dioxide	Annual	100	100	25	2.5
Carbon monoxide	1-hour	40,000	(a)	(a)	(a)
	8-hour	10,000	(a)	(a)	(a)
Lead	Quarterly	1.5	1.5	(a)	(a)
Ozone	1-hour	235	235	(a)	(a)

a. No standard or increment for this pollutant or averaging time.
b. Refers to particulate matter less than 10 microns in size (PM-10). Includes recently promulgated increment for PM-10.

encompasses the environs of the INEL has been classified as attainment or unclassified for all National Ambient Air Quality Standards, meaning that air pollution levels are expected to be considered healthful. The nearest nonattainment area lies some 50 miles south of the INEL site in Power and Bannock Counties. This area has been designated as nonattainment for the standards related to respirable particulate matter.

F-3.3.1.2 Prevention of Significant Deterioration. The Clean Air Act contains requirements to prevent the deterioration of air quality in areas designated as attainment of the ambient air quality standards. These requirements are contained in the *Prevention of Significant Deterioration* (PSD) amendments and are administered through a program that limits the increase in specific air pollutants above the levels that existed in what has been termed a baseline (or starting) year. The amendments specify maximum allowable ambient pollutant concentration increases, or increments. Increment limits for pollutant level increases are specified for the nation as a whole (designated as Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for designated national resources, such as national forests, parks, and monuments (designated as Class I areas). In Southeastern Idaho, the Craters of the Moon Wilderness Area is the only Class I area. Increment values applicable to the INEL site are presented in Table F-3-5.

The State of Idaho Department of Health and Welfare, Division of Environmental Quality (DEQ), administers the Prevention of Significant Deterioration Program. Proposed new sources of emissions at the INEL site and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEL site is considered a major source, since facility-wide emissions of some air contaminants exceed 250 tons per year. As such, a Prevention of Significant Deterioration analysis must be performed whenever any modification would result in a significant net increase of any air pollutant. Levels of significance range from very small quantities (less than one pound) to over 100 tons per year, depending on the toxic nature of the substance. For radionuclides, significance levels range from any increase in emissions to that which would result in an offsite dose of 0.1 millirem per year or greater, depending on total facility emissions. If an INEL site facility requires a Prevention of Significant Deterioration permit, it must be demonstrated that the source

- Will be constructed using best available control technology (a level of control which is technologically feasible and considered cost-effective) to control significant increases in air emissions

- Will operate in compliance with all prohibitory rules

- Will not cause a detriment to ambient air quality at the nearby Craters of the Moon Wilderness Area, a Prevention of Significant Deterioration Class I area

- Will not result in an exceedance of an ambient air quality standard.

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values—visibility, vegetation, and soils. Generally, all Prevention of Significant Deterioration projects must go through a public comment period with an opportunity for public review. The INEL has been granted a total of 23 Prevention of Significant Deterioration permits to construct by the Division of Environmental Quality; applications for an additional six permits have been submitted and are pending approval (Hoff et al. 1992).

F-3.3.1.3 National Emission Standards for Hazardous Air Pollutants. In addition to ambient air quality standards and Prevention of Significant Deterioration requirements, the Clean Air Act designates requirements for sources that emit substances designated as hazardous air pollutants. These requirements are specified in a program termed *National Emission Standards for Hazardous Air Pollutants* (NESHAPs). This program was substantially amended in 1990 and has yet to be fully implemented. However, one section of the National Emission Standards for Hazardous Air Pollutants program that currently applies to INEL operations is contained in Title 40 of the Code of Federal Regulations (CFR) Part 61, Subpart H, *National Emissions Standards for Radionuclides from Department of Energy Facilities*. This regulation establishes a limit to the dose that may be received by a member of the public due to operations at the INEL. The annual dose limit (10 millirem) applies to the maximally exposed offsite individual and is designed to be protective of human health with an adequate margin of safety. The regulation also establishes requirements for monitoring emissions from facility operations and analysis and reporting of dose.

The INEL complies with the requirements of the National Emission Standards for Hazardous Air Pollutants through programs to monitor radionuclide emissions, evaluate dose to nearby residences, and report doses annually to the U.S. Environmental Protection Agency. Proposed new sources of emissions at the INEL and modifications are evaluated to identify the expected contribution to dose to nearby residents. If specified levels (fractions of the acceptable dose for combined site operations) are exceeded, a National Emission Standards for Hazardous Air Pollutants permit application is prepared for submittal to the U.S. Environmental Protection Agency. New sources are also evaluated to determine emissions monitoring requirements. The INEL currently holds 27 National Emission Standards for Hazardous Air Pollutants Permits granted by the U.S. Environmental Protection Agency (Hoff et al. 1992).

In addition to radionuclides, emissions standards have been established under the National Emission Standards for Hazardous Air Pollutants Program for several nonradiological hazardous air pollutants, including benzene, asbestos, and others. The INEL complies with the requirements for evaluation, control, and permitting of nonradiological hazardous air pollutants through programs that are also administered by the U.S. Environmental Protection Agency. In accordance with the 1990

Amendments to the Clean Air Act, maximum achievable control technology (MACT) will be specified by the U.S. Environmental Protection Agency for various sources. Those sources will have to implement programs or controls to achieve maximum achievable control technology by the scheduled implementation date and analyze residual risk. If the residual risk is above specified acceptable limits, additional controls will be required. Only a few maximum achievable control technology levels have been proposed, and the INEL is not yet directly affected. It is expected that future controls will be required as maximum achievable control technology levels are promulgated for source categories, including (but not limited to) waste treatment, storage and disposal facilities, industrial boilers, process heaters, stationary internal combustion engines, hazardous waste incinerators, and site remediation activities.

F-3.3.1.4 State of Idaho Permit Programs. The Idaho Air Pollution Control Program, administered by the Division of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt from permitting requirements, a Permit to Construct must be obtained before a source can be constructed. The list of exemptions is very specific and limited; most new INEL sources and modifications to existing sources would be subjected to a Permit to Construct. Under Title V of the 1990 Clean Air Act Amendments, the INEL would also be subjected to an Operating Permit, which must be renewed periodically. Permits are typically issued with specific emissions limits and conditions for operation. This formal permitting process allows the State to determine that emissions will be adequately controlled, the source will comply with all emission standards and regulations, and public health and safety will be adequately protected. Generally, Operating Permit reviews must go through a public review period with an opportunity for public comment.

In addition to the Prevention of Significant Deterioration permits cited in Section F-3.3.1.2, as of January 1992 the State had issued 29 Permits to Construct for sources at INEL. These sources do not exceed the threshold for Prevention of Significant Deterioration; the estimated emissions from these sources are less than 10 percent of levels deemed significant by the Division of Environmental Quality and Prevention of Significant Deterioration analysis is not required (DOE-ID 1992a).

F-3.3.1.5 State of Idaho Rules for Toxic Air Pollutants. The Idaho Division of Environmental Quality has recently promulgated rules and methodologies to estimate and control the potential human health impacts of toxic air pollutants (pollutants which by their nature are toxic to human or animal life or vegetation) from new or modified sources. These rules are contained in Title 1, Chapter 1, of the Rules for the Control of Air Pollution in Idaho (IDHW 1994) and are implemented through the air quality permit program described above. Emission levels of significance have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected emissions above administrative screening levels must be evaluated using standard air dispersion modeling techniques (computerized programs to predict pollutant concentrations based on source emissions, release characteristics, and meteorological conditions) and risk assessment methodologies to assess potential impacts. A facility will not be granted a permit unless it can be shown that the emissions will comply with all applicable toxic air pollutant increments for carcinogenic (cancer-causing) and noncarcinogenic substances (IDHW 1994). As part of the permit evaluation process, requirements related to toxic air pollution control equipment, facility modifications, and materials substitutions may be specified to limit ambient levels of toxic air pollutants.

The State has defined acceptable ambient concentration levels for many toxic air pollutants, including both carcinogenic and noncarcinogenic contaminants. These levels are increments over existing levels and apply only to sources that became operational after May 1, 1994. For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen (AACC). The acceptable ambient concentration for a carcinogen is based on risk and corresponds to that concentration at which the probability of contracting cancer is one in a million, assuming continuous exposure over a 70-year lifetime.[a] The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the U.S. Environmental Protection Agency. (The method used to assess cancer health risk associated with air emissions from current INEL site facilities and proposed actions is summarized in Section F-4, Health and Safety, of this appendix.) The State will grant a permit if the calculated incremental risk due to project emissions does not exceed the acceptable ambient concentration for a carcinogen (that is, does not result in an individual excess cancer risk greater than one in a million). If this level is expected to be exceeded, a permit may still be granted if (a) the calculated risk does not exceed ten in a million and (b) toxic reasonably achievable control

a. This probability is often described as an "individual excess cancer risk." Excess, in the sense used here, means above the normal cancer incidence rate, which is currently about one in three for the U.S. population. An individual excess cancer risk of one in a million or less is generally considered an acceptable level of risk.

technology (which is similar to best available control technology, or BACT) is employed to limit emissions of carcinogenic substances.

Many air contaminants are not carcinogens but may contribute to other health impacts, such as respiratory or eye irritants, or impacts to the cardiovascular, reproductive, central nervous or other body systems. Levels of significance for noncarcinogenic substances are called acceptable ambient concentrations (AAC). The acceptable ambient concentration is based on acceptable exposure limits for occupational workers and other reference sources of information for the contaminant in question. For an added margin of safety, the State generally sets the acceptable ambient concentration at one hundredth of the acceptable occupational exposure level. Permits are granted if incremental emissions from the new or modified source are expected to result in annual average concentrations below the acceptable ambient concentration. However, if the acceptable ambient concentration is expected to be exceeded, a permit may still be granted based on consideration of other factors, such as the toxicity of the substance and anticipated level of exposure.

The acceptable concentration levels specified in the regulation are increment (not cumulative) standards that apply to new and modified stationary sources. They are used as guidelines for comparison (called reference levels) with the results of the toxic air pollutant assessments presented in Section 5.7, Air Resources, of Volume 2 of this EIS.

F-3.3.2 Department of Energy Orders and Guides

The DOE has developed and issued a series of orders and guides to ensure that all operations comply with applicable environmental, safety, and health regulations and DOE internal policies, including the concept of maintaining emissions and exposures to the public and workers at levels that are as low as reasonably achievable (ALARA). The as-low-as-reasonably-achievable concept is employed in the design and operation of all facilities and applies to all types of air pollutants (for example, radionuclides, carcinogens, and toxic and criteria air pollutants). Orders specifically designed for protection of environment, safety, and health are

- DOE Order 5400.1, "General Environmental Protection Program," establishes environmental protection program requirements pertaining to air and other environmental media intended to ensure that operations comply with applicable

Federal, State, and local laws and regulations, as well as DOE internal policies. This Order defines environmental protection requirements established in more general terms in DOE Order 5480.1B.

- DOE Order 5480.1B, "Environment, Safety, and Health Program for Department of Energy Operations," details overall requirements for environmental, safety, and health programs.

- DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards," specifies and provides requirements for the application of mandatory standards applicable to DOE and contractor operations.

- DOE Order 5400.5, "Radiation Protection of the Public and the Environment," prescribes exposure limits for exposure of the public to radiation from sitewide activities that are equivalent to the 40 CFR 61 limits described in Section F-3.3.1.3. As of December 1994, this order was in the process of being codified as Title 10, Part 834, of the Code of Federal Regulations (that is, 10 CFR 834).

- DOE policy further requires effluent and environmental air monitoring programs to determine whether the public and the environment are adequately protected and whether operations are in compliance with applicable regulations. The "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" (DOE 1991) has been issued to assist operating facilities in implementing this policy and specifies the required elements of a radiological air monitoring program.

- DOE Order 5483.1A, "Occupational Safety and Health Program for DOE Contractor Employees at Government Owned, Contractor Operated Facilities," establishes requirements and procedures to ensure that worker protection is consistent with that afforded private industry employees by the Occupational Safety and Health Act of 1970.

- DOE Order 5480.11, "Radiation Protection for Occupational Workers," establishes standards for protection of workers from occupational exposure to radiation. This Order has been codified as Title 10, Part 835, of the Code of Federal Regulations (that is, 10 CFR 835).

F-3.4 Air Quality Impact Assessment Methodology

Distinct types of assessments have been performed to assess air quality for existing conditions and future actions. These are

- Radiological air quality assessments, which are performed for radionuclide emissions from stationary sources

- Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources and fugitive dust and combustion product emissions associated with construction equipment and some operational sources

- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources

- Assessments of criteria pollutant emissions from mobile sources.

This section describes the methodology used in each type of air quality assessment, including the general approach to source term estimation and atmospheric dispersion modeling, as well as specific information on related assumptions, methods, and data used in the analyses.

F-3.4.1 Source Term Estimation

The type and quantity of pollutants emitted to air from a specific source, or group of sources, is often referred to as the source term. This section summarizes methods used to estimate radiological and nonradiological source terms for current and projected INEL site facilities.

F-3.4.1.1 Source Terms for Existing Facilities. The source terms used for existing radiological conditions were obtained primarily from Engineering Design Files (EDFs) used to prepare the *1991 INEL National Emission Standard for Hazardous Air Pollutants, Annual Report* (DOE-ID 1992a) and *Supplement* (DOE-ID 1992b). Other source term-related data were obtained from the INEL Radioactive Waste Management Information System (RWMIS) (Litteer et al. 1993, Taylor 1994) and from operating contractors of existing facilities. Radiological source terms for existing INEL site facilities are summarized in Table 4.7-1 of Volume 2 of this EIS and are detailed in Leonard (1993).

The maximum hourly and annual average emission rates for criteria and toxic air pollutants from existing facilities and anticipated projects are listed in Table 4.7-2 of Volume 2 of this EIS. Criteria pollutant emission rates for existing facilities are based on data contained in the INEL Air Emissions Inventory for 1991 (DOE-ID 1992c). Toxic pollutant emission rates are from the INEL Toxic Air Pollutant Emissions Inventory for 1989 (DOE-ID 1993a). These are the two most recent years for which the required data are available. To characterize a maximum emissions baseline, actual emission rates were increased by appropriate scaling factors. In general, these scaling factors are based on maximum emission rates allowed by facility operating permits or on maximum throughput or capacity of the process producing the emissions. The rationale and method for this process is described in further detail in E&E (1994) and Belanger et al. (1995a).

Emission rates are estimated for all criteria pollutants. However, since there are so many toxic air pollutants (many of which are released in only trace quantities), analysts used a screening approach to reduce the number requiring assessment to only those toxic emissions that have the potential to result in concentrations approaching applicable standards or guidelines. For the baseline assessment, this was done by comparing current (1989) emission rates to the screening emission level proposed by the State of Idaho (IDHW 1994). Emission rates below this level are considered by the State as not likely to have significant impacts and therefore do not warrant further analysis. Notably, the proposed State regulations would apply only to new (and not existing) facilities; nevertheless, the screening emission levels are useful as indicators of potentially significant emissions.

Some projects that were originally considered part of Alternative A (No Action) are now considered as projected increases to the baseline (that is, it was assumed, at the time of the analysis, that they would become operational prior to the implementation start date for the ER&WM alternatives). Source terms for these projects were estimated as described below for ER&WM alternative projects but are reported on Table 4.7-2.

F-3.4.1.2 Source Term Estimation for Environmental Restoration and Waste Management Alternatives. Emission rates were estimated for each project associated with one or more of the ER&WM alternatives. Source terms for specific projects associated with ER&WM alternatives were estimated using conservative engineering calculations based on knowledge of the proposed facility or activity. Typically, these evaluations considered the processes to be incorporated, materials to be used, activities to be performed within the systems, and operating experience with similar systems. For some projects, emissions estimates had previously been made and documented as part of an Environmental Assessment, Permit to Construct, or other action. In such cases, the previously estimated source terms were either used directly or were revised to reflect updated project information. Where applicable, the analysis used emission factors from authoritative reference sources, such as EPA (1992a).

Source term estimates for ER&WM projects include the following components:

- Radionuclide emissions from projected facility operation: as a minimum, all radionuclides that collectively contribute 95 percent or more of the projected dose are specified individually

- Criteria pollutant emissions from facility operations: all criteria pollutants are included in the estimates

- Toxic air pollutant emissions from facility operations: the toxic air pollutants that are assessed were those that were either (a) included in the baseline assessment and emitted by any proposed project or (b) emitted by proposed projects in a cumulative quantity that exceeds the screening level emission rate proposed by the State of Idaho (even if the toxic was not assessed in the baseline)

- Fugitive dust and criteria pollutant emissions from construction and demolition (that is, decontamination and decommissioning projects) activities

- Fugitive dust and criteria pollutant emissions from mobile sources.

The radiological and nonradiological source terms for ER&WM projects are documented in Staley (1993a, 1993b) for no action and proposed action projects, respectively. However, since tbe time tbose documents were prepared, projects have been added, deleted, or changed in scope or definition. Emissions data have been revised to reflect updated project information. Revised emission rates for radionuclides, criteria pollutants, and toxic air pollutants are presented in Tables F-3-6, F-3-7, and F-3-8, respectively. These tables present emission rates for each project for which emissions are expected, as well as tbe ER&WM alternative and waste stream or program with which each project is associated.

F-3.4.2 Radiological Assessment Methodology

This section summarizes information on tbe data and metbods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEL site facilities.

F-3.4.2.1 Model Selection and Application. The computer program GENII (Napier et al. 1988) was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to tbe total dose from airborne releases. These are

- External radiation dose from radionuclides in air
- External dose from radionuclides deposited on ground surfaces
- Internal dose from inhalation of airborne radionuclides
- Internal dose from ingestion of contaminated food products.

GENII incorporates algoritbms, data, and metbods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International

Table F-3-6. Listing of projected Idaho National Engineering Laboratory site radionuclide emissions by project and alternative.

Project, location, and program or waste stream[a,b,c]	Associated alternative[d]	Radionuclide emission rates (Curies per year) Hydrogen-3/carbon-14	Cobalt-60	Krypton-85	Xenon-131m/xenon-133	Strontium-90[e]	Antimony-125	Iodine-129/iodine-131	Cesium-134/cesium-135	Uranium	Plutonium	Americium-241	Other
TAN Pool Fuel Transfer, TAN, spent nuclear fuel	A,B,D												
Drying operations		9.6×10^{2}	(f)	(f)	(f)	2.9×10^{-2}	(f)	3.4×10^{-2}	(f)	(f)	6.6×10^{-4}	2.2×10^{-4}	(f)
Storage operations		3.9×10^{-1}	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)
Pit 9 Retrieval, RWMC, remediation	A,B,C,D												
Retrieval of waste and soil		(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	4.1×10^{-4}	2.1×10^{-4}	(f)
Thermal treatment		(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	8.1×10^{-3}	4.2×10^{-3}	(f)
Transuranic Storage Area Enclosure and Storage, RWMC, transuranic waste	A,B,C,D	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	4.2×10^{-8}	1.5×10^{-8}	(f)
Waste Characterization Facility, RWMC, transuranic waste	A,B,C,D	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	2.7×10^{-5}	9.3×10^{-6}	(f)
New Calcine Storage, ICPP, high-level waste	D	(f)	(f)	(f)	(f)	1.5×10^{-6}	2.0×10^{-8}	(f)	2.0×10^{-6}	(f)	2.2×10^{-7}	(f)	8.9×10^{-6}
Additional Increased Rack Capacity, ICPP, spent nuclear fuel	B,D	2.0×10^{-1}	1.2×10^{-8}	(f)	(f)	3.8×10^{-7}	1.0×10^{-4}	(f)	1.3×10^{-5}	(f)	(f)	(f)	3.1×10^{-6}
Dry Fuel Storage Facility, ICPP, spent nuclear fuel	B,C,D	1.8×10^{-2}	1.9×10^{-6}	(f)	(f)	1.8×10^{-5}	2.2×10^{-3}	4.2×10^{-3}	6.8×10^{-7}	(f)	2.6×10^{-7}	(f)	1.9×10^{-5}
Waste Immobilization Facility,[g] ICPP, high-level waste													
Separations	C,D	4.2×10^{2}	(f)	(f)	(f)	1.6×10^{-1}	(f)	1.5×10^{-1}	3.8×10^{-2}	(f)	0.0×10^{0}	(f)	3.0×10^{-1}
Direct vitrification	B	4.2×10^{2}	(f)	(f)	(f)	5.8×10^{-4}	(f)	1.5×10^{-1}	1.1×10^{-2}	(f)	0.0×10^{0}	(f)	1.0×10^{-3}
Mixed/Low-Level Waste Treatment Facility, east of RWMC,[h] low-level and mixed low-level waste	D												
Incineration		(f)	7.3×10^{-2}	(f)	(f)	1.2×10^{-2}	2.7×10^{-2}	(f)	3.1×10^{-1}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	4.7×10^{-1}
Sizing and compaction		(f)	7.0×10^{-2}	(f)	(f)	2.0×10^{-3}	2.7×10^{-2}	(f)	5.0×10^{-2}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	1.8×10^{-1}
Remote Mixed Waste Treatment Facility, ANL-W, mixed low-level waste	B,D	1.7×10^{3}	(f)	1.6×10^{3}	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage, ICPP, spent nuclear fuel	B,D	(f)	5.6×10^{-8}	(f)	(f)	1.8×10^{-6}	(f)	(f)	2.4×10^{-7}	(f)	5.6×10^{-7}	(f)	2.4×10^{-7}
Greater-Than-Class-C Dedicated Storage, TAN, greater-than-Class-C low-level waste	B,D	3.2×10^{-8}	(f)	(f)	(f)	1.4×10^{-5}	(f)	(f)	5.3×10^{-2}	8.6×10^{-8}	7.8×10^{-4}	5.1×10^{-5}	1.2×10^{-5}
Idaho Waste Processing Facility,[i] east of RWMC,[h]	B,D												
transuranic waste		(f)	1.9×10^{-5}	(f)	(f)	4.0×10^{-4}	(f)	(f)	4.4×10^{-4}	1.9×10^{-4}	5.4×10^{-2}	1.8×10^{-2}	1.5×10^{-4}

Table F-3-6. (continued).

Project, location, and program or waste stream[a,b,c]	Associated alternative[d]	Radionuclide emission rates (Curies per year)											
		Hydrogen-3/carbon-14	Cobalt-60	Krypton-85	Xenon-131m/xenon-133	Strontium-90[e]	Antimony-125	Iodine-129/iodine-131	Cesium-134/cesium-135	Uranium	Plutonium	Americium-241	Other
low-level and mixed low-level waste		(f)	1.3×10^{-5}	(f)	(f)	2.8×10^{-4}	(f)	(f)	3.1×10^{-4}	1.9×10^{-6}	6.0×10^{-4}	2.0×10^{-4}	1.2×10^{-6}
Increased Rack Capacity, ICPP, spent nuclear fuel	B,D	2.0×10^{-1}	1.2×10^{-8}	(f)	(f)	3.8×10^{-7}	1.0×10^{-4}	(f)	1.3×10^{-5}	(f)	(f)	(f)	3.1×10^{-6}
Waste Experimental Reduction Facility Incineration,[j] PBF, low-level and mixed low-level waste	B,D	1.3×10^{0}	7.3×10^{-2}	(f)	(f)	1.2×10^{-2}	2.7×10^{-2}	(f)	3.1×10^{-1}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	6.1×10^{-1}
RWMC Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste, RWMC, transuranic waste	B,D												
Drum venting		(f)	(f)	(f)	(f)	4.6×10^{-8}	(f)	(f)	(f)	(f)	2.1×10^{-8}	4.0×10^{-5}	(f)
Retrieval enclosure		(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	1.7×10^{-7}	6.0×10^{-8}	(f)
Nonincinerable Mixed Waste Treatment, PBF, mixed low-level waste	B,D	(f)	4.7×10^{-7}	(f)	(f)	9.0×10^{-5}	(f)	(f)	7.3×10^{-5}	4.1×10^{-4}	(f)	(f)	(f)
EBR-II Blanket Treatment, ANL-W, spent nuclear fuel	B,D	1.6×10^{2}	(f)	4.9×10^{3}	5.1×10^{1}	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)
Plasma Hearth Process, ANL-W, mixed low-level and hazardous waste	B,D	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	2.3×10^{-7}	1.6×10^{-7}	9.4×10^{-10}	7.6×10^{-10}
Electrometallurgical Process Demonstration, ANL-W, spent nuclear fuel	B,C,D	8.4×10^{2}	(f)	1.4×10^{4}	1.3×10^{2}	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)
Sodium Processing, ANL-W, mixed low-level waste	B,D	5.0×10^{-2}	(f)	(f)	(f)	5.0×10^{-4}	(f)	(f)	1.0×10^{-3}	(f)	(f)	(f)	8.0×10^{-3}
New Calcine Storage, ICPP, high-level waste	B,D	(f)	(f)	(f)	(f)	3.2×10^{-4}	(f)	(f)	3.8×10^{-4}	(f)	(f)	(f)	3.0×10^{-7}
Fuel Processing Complex, ICPP, spent nuclear fuel	D	3.1×10^{3}	1.9×10^{-6}	5.0×10^{3}	(f)	5.8×10^{-2}	1.6×10^{1}	4.4×10^{-1}	1.8×10^{-1}	(f)	7.7×10^{-3}	(f)	2.1×10^{-1}
Total[k]		7.2×10^{5}	2.2×10^{-1}	5.2×10^{5}	1.8×10^{2}	1.1×10^{-1}	1.6×10^{1}	6.3×10^{-1}	9.1×10^{-1}	8.1×10^{-3}	7.5×10^{-2}	2.3×10^{-2}	1.5×10^{0}

a. TAN = Test Area North; RWMC = Radioactive Waste Management Complex; ICPP = Idaho Chemical Processing Plant; ANL-W = Argonne National Laboratory-West; EBR-II = Experimental Breeder Reactor-II; PBF = Power Burst facility.
b. All projects with projected radionuclide emissions are listed.
c. The radiological air emissions given in the description for the Expended Core Facility Dry Cell Project in Appendix C of Volume 2 of this EIS are within the present operating envelope for that facility.
d. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).
e. An equal amount of yttrium-90 is assumed to accompany all strontium-90 emissions.
f. No emissions of radionuclides are expected from this project.
g. The Waste Immobilization Facility may operate in either of two modes-direct vitrification (under Alternative B) or separations (under Alternative C or D).
h. The precise location for these facilities has not yet been determined; for purpose of analysis, the reference location is slightly east of RWMC.
i. Emissions for this facility depend on waste type; separate emissions are listed for the processing of transuranic waste or alpha-contaminated low-level or mixed low-level wastes. Emissions listed are for Alternative D, and are estimated to be 15 percent higher than for the same facility operating under Alternative B. Similar emissions would be projected for the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, which is a competing project that would have a similar design and process the same types of waste.
j. This project includes incineration only; other waste processing is assessed as anticipated increases to the baseline.
k. This total would apply only to Alternative D and only if all facilities were operating simultaneously; total also assumes that Idaho Waste Processing Facility is processing transuranic waste. See Table 5.7-1 for total radionuclide emissions by alternative and source group.

Table F-3-7. Listing of projected Idaho National Engineering Laboratory site criteria air pollutant emissions by project and alternative.

Project, location, and program or waste stream[a]	Associated alternative[b]	Carbon monoxide Max.hr. (g/hr)	Carbon monoxide Annual (kg/yr)	Nitrogen dioxide Max.hr. (g/hr)	Nitrogen dioxide Annual (kg/yr)	Particulate matter Max.hr. (g/hr)	Particulate matter Annual (kg/yr)	Sulfur dioxide Max.hr. (g/hr)	Sulfur dioxide Annual (kg/yr)	Volatile organic compounds Max.hr. (g/hr)	Volatile organic compounds Annual (kg/yr)	Lead Max.hr. (g/hr)	Lead Annual (kg/yr)
Radiological and Environmental Sciences Laboratory Replacement, CFA, infrastructure	A,B,C, D	14	118	66	580	3	29	7	60	3.5	130	(c)	(c)
BORAX-V D&D, EBR-I/BORAX-V area, D&D													
Emergency generator	A,B,C, D	200	176	940	814	67	58	63	55	75	65	(c)	(c)
Demolition (blasting)		(c)	292	(c)	52	(c)	(c)	(c)	6.5	(c)	(c)	(c)	(c)
Pit 9 Retrieval, RWMC, remediation	A,B,C, D												
Retrieval of waste and soil		(c)	(c)	(c)	(c)	0.67	1.3	(c)	(c)	(c)	(c)	0.0004	0.0007
Thermal treatment		4,250	16,600	32,600	127,000	3.6	14	144	562	(c)	(c)	2.6	10
Boiler		418	3,680	1,880	16,500	136	1,190	5,580	48,900	341	2,970	0.15	1.3
Transuranic Storage Area Enclosure and Storage, RWMC, transuranic waste	A,B,C, D	1,660	14,500	3,530	30,900	145	1,270	415	3,640	612	5,360	0.16	1.4
Waste Characterization Facility, RWMC, transuranic waste	A,B,C, D	1,700	3,450	6,800	13,600	0.25	0.49	0.0009	0.002	14	28	0.0003	0.0005
Waste Handling Facility, ANL-W, low-level waste	A,B,C, D	122	23	564	11	40	7.7	38	7.2	(c)	(c)	(c)	(c)
Waste Immobilization Facility,[d] ICPP, high-level waste													
With separations	C,D	1,300	420	190,000	1,650,000	530	4,600	6.5	57	7.8	68	0.000003	0.00002
With direct vitrification	B	0.04	0.4	190,000	1,630,000	420	3,700	130	1,100	84	740	0.000002	0.00001
Mixed/Low-Level Waste Treatment Facility, RWMC,[e] low-level and mixed low-level waste	D												
Incineration		24	137	232	1,330	0.003	0.02	68	390	24	137	4.9	28
Sizing, compaction, treatment		(c)	(c)	(c)	(c)	0.12	0.24	(c)	(c)	12,700	1,940	0.01	0.08

Table F-3-7. (continued).

Project, location, and program or waste stream[a]	Associated alternative[b]	Carbon monoxide Max.hr. (g/hr)	Carbon monoxide Annual (kg/yr)	Nitrogen dioxide Max.hr. (g/hr)	Nitrogen dioxide Annual (kg/yr)	Particulate matter Max.hr. (g/hr)	Particulate matter Annual (kg/yr)	Sulfur dioxide Max.hr. (g/hr)	Sulfur dioxide Annual (kg/yr)	Volatile organic compounds Max.hr. (g/hr)	Volatile organic compounds Annual (kg/yr)	Lead Max.hr. (g/hr)	Lead Annual (kg/yr)
Emergency generator		4,060	211	18,800	978	1,340	70	1,250	65	1,500	78	(c)	(c)
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage, ICPP, spent nuclear fuel	B,D	5.0	0.17	25	0.82	1.3	0.04	0.26	0.008	1.4	0.04	(c)	(c)
Idaho Waste Processing Facility,[f] RWMC, transuranic, low-level, and mixed low-level waste													
Incineration	B	6,790	17,650	18,430	7,210	0.27	0.63	660	520	27	6	2,420	172
Incineration	D	7,810	20,300	21,200	8,290	0.32	0.73	756	595	31	7	2,780	198
Emergency generator	B,D	7,290	379	27,700	1,400	2,770	144	3,270	170	729	38	(c)	(c)
Heating boiler	B,D	386	1,270	4,250	14,000	541	1,780	9,830	32,300	87	287	0.6	2.0
RWMC modifications to support private sector treatment of alpha-contaminated mixed low-level waste, RWMC, transuranic waste	B,D	1,200	11,000	5,500	49,000	400	3,500	370	3,300	680	4,600	0.5	4
Waste Experimental Reduction Facility Incineration,[g] PBF, low-level and mixed low-level waste	B,D	330	1,900	400	2,300	47	271	660	3,800	2.2	13	2.9	17
Plasma Hearth Process, ANL-W, mixed low-level and hazardous waste	B,D	82	257	2,200	6,850	0.001	0.005	18	57	(c)	(c)	0.14	0.42
Total[h]		29,550	74,295	316,686	1,903,623	5,916	12,037	22,528	94,986	16,883	16,395	2,792	262

a. Only those projects with criteria pollutant emissions are listed; CFA = Central Facilities Area; BORAX-V = Boiling Water Reactor Experiment-V; EBR-I = Experimental Breeder Reactor-I; D&D = decontamination and decommissioning; RWMC = Radioactive Waste Management Complex; ICPP = Idaho Chemical Processing Plant; PBF = Power Burst Facility; ANL-W = Argonne National Laboratory-West.
b. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).
c. No emissions of this type are predicted for the project.
d. The Waste Immobilization Facility may operate in either of two modes: direct vitrification (under Alternative B) or separations (under Alternative C or D).
e. The precise location for these facilities has not yet been determined; for purpose of analysis, the reference location is slightly east of RWMC.
f. Incinerator emissions under Alternative D are assumed to be 15 percent higher than for the same facility operating under Alternative B; similar emissions would also be projected for the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility, which is a competing project that would have a similar design and process the same type of waste.
g. This project includes incineration only; other waste processing is assessed as anticipated increases to the baseline.
h. This total would apply only to Alternative D and only if all facilities were operating simultaneously; see Table 5.7-2 for totals by alternative and program or waste stream.

Table F-3-8. Listing of projected Idaho National Engineering Laboratory site toxic air pollutant emission rates by project and alternative.

Project name, location, and associated program or source group[a]	Associated alternative[b]	Compound	Emission rate: Maximum hourly (Grams per hour)	Maximum hourly (Pounds per hour)	Annual average (Kilograms per year)	Annual average (Tons per year)
Radiological and Environmental Science Laboratory Replacement, Central Facilities Area, infrastructure	A,B,C,D	Hydrochloric acid	1.5×10^{1}	3.2×10^{-2}	2.9×10^{1}	3.2×10^{-2}
		Hydrofluoric acid[c]	3.0×10^{0}	6.5×10^{-3}	6.9×10^{0}	7.6×10^{-3}
		Nitric acid	7.0×10^{0}	1.5×10^{-2}	1.4×10^{1}	1.5×10^{-2}
		Sulfuric acid	2.0×10^{1}	4.4×10^{-2}	4.0×10^{1}	4.4×10^{-2}
Boiling Water Reactor Experiment-V (BORAX-V) Decontamination and Decommissioning, Experimental Breeder Reactor-I/BORAX-V area, decontamination and decommissioning	A,B,C,D	Ammonia	1.1×10^{2}	2.4×10^{-1}	1.6×10^{0}	1.8×10^{-3}
		Benzene	3.0×10^{0}	6.6×10^{-3}	2.6×10^{0}	2.9×10^{-3}
		Formaldehyde	5.8×10^{0}	1.3×10^{-2}	5.0×10^{0}	5.5×10^{-3}
Pit 9 Retrieval, Radioactive Waste Management Complex, remediation	A,B,C,D	Asbestos	1.1×10^{-1}	2.5×10^{-4}	4.4×10^{-1}	4.8×10^{-4}
		Benzene	4.7×10^{0}	1.0×10^{-2}	4.1×10^{1}	4.5×10^{-2}
		Beryllium	9.8×10^{-3}	2.2×10^{-5}	3.8×10^{-2}	4.2×10^{-5}
		Carbon tetrachloride	5.7×10^{0}	1.2×10^{-2}	9.4×10^{0}	1.0×10^{-2}
		Chloroform	1.3×10^{0}	2.8×10^{-3}	2.1×10^{0}	2.3×10^{-3}
		Chromium	6.4×10^{-2}	1.4×10^{-4}	5.6×10^{-1}	6.2×10^{-4}
		Formaldehyde	5.2×10^{1}	1.1×10^{-1}	4.5×10^{2}	5.0×10^{-1}
		Hydrochloric acid	2.1×10^{1}	4.6×10^{-2}	8.1×10^{1}	8.9×10^{-2}
		Mercury	9.3×10^{-1}	2.1×10^{-3}	3.6×10^{0}	4.0×10^{-3}
		Nickel	7.3×10^{-1}	1.6×10^{-3}	6.4×10^{0}	7.0×10^{-3}
		Perchloroethylene	1.3×10^{0}	2.9×10^{-3}	2.2×10^{0}	2.4×10^{-3}
		Trichloroethylene	1.9×10^{0}	4.1×10^{-3}	3.1×10^{0}	3.4×10^{-3}
Transuranic Storage Area Enclosure and Storage, Radioactive Waste Management Complex, transuranic waste	A,B,C,D	Asbestos	5.0×10^{-9}	1.1×10^{-11}	1.6×10^{-8}	1.8×10^{-11}
		Benzene	8.4×10^{0}	1.9×10^{-2}	7.4×10^{1}	8.2×10^{-2}
		Beryllium	7.5×10^{-13}	1.7×10^{-15}	2.4×10^{-12}	2.6×10^{-15}
		Cadmium	1.1×10^{-11}	2.4×10^{-14}	3.5×10^{-11}	3.9×10^{-14}
		Carbon tetrachloride	2.3×10^{-1}	5.0×10^{-4}	7.3×10^{-1}	8.0×10^{-4}
		Chromium	6.8×10^{-2}	1.5×10^{-4}	6.0×10^{-1}	6.6×10^{-4}
		Formaldehyde	9.3×10^{1}	2.0×10^{-1}	8.2×10^{2}	9.0×10^{-1}
		Methylene chloride	1.5×10^{-2}	3.2×10^{-5}	4.8×10^{-2}	5.2×10^{-5}
		Nickel	7.8×10^{-1}	1.7×10^{-3}	6.8×10^{0}	7.5×10^{-3}
		Perchloroethylene	2.3×10^{-2}	5.0×10^{-5}	7.3×10^{-2}	8.0×10^{-5}
		Trichloro-trifluoroethane	1.4×10^{-1}	3.0×10^{-4}	4.3×10^{-1}	4.7×10^{-4}
		Trichloroethylene	1.5×10^{-1}	3.2×10^{-4}	4.8×10^{-1}	5.2×10^{-4}
Vadose Zone Remediation, Radioactive Waste Management Complex, remediation	A,B,C,D	Carbon tetrachloride	2.7×10^{1}	6.0×10^{-2}	2.3×10^{2}	2.5×10^{-1}
		Chloroform	9.0×10^{-1}	2.0×10^{-3}	7.6×10^{0}	8.3×10^{-3}
		Perchloroethylene	1.1×10^{0}	2.3×10^{-3}	8.8×10^{0}	9.7×10^{-3}

Table F-3-8. (continued).

Project name, location, and associated program or source group[a]	Associated alternative[b]	Compound	Emission rate: Maximum hourly (Grams per hour)	Emission rate: Maximum hourly (Pounds per hour)	Emission rate: Annual average (Kilograms per year)	Emission rate: Annual average (Tons per year)
		Trichloroethylene	4.7×10^{0}	1.0×10^{-2}	4.0×10^{1}	4.4×10^{-2}
Waste Characterization Facility, Radioactive Waste Management Complex, transuranic waste	A,B,C,D	Asbestos	2.9×10^{-9}	6.4×10^{-12}	5.8×10^{-9}	6.4×10^{-12}
		Benzene	1.9×10^{-1}	4.2×10^{-4}	3.9×10^{-1}	4.3×10^{-4}
		Beryllium	2.2×10^{-10}	4.8×10^{-13}	4.4×10^{-10}	4.8×10^{-13}
		Cadmium	3.2×10^{-12}	7.0×10^{-15}	6.4×10^{-12}	7.0×10^{-15}
		Carbon tetrachloride	4.5×10^{-1}	9.9×10^{-4}	9.0×10^{-1}	9.9×10^{-4}
		Chromium	1.2×10^{-4}	2.6×10^{-7}	2.3×10^{-4}	2.5×10^{-7}
		Formaldehyde	2.1×10^{0}	4.6×10^{-3}	4.3×10^{0}	4.7×10^{-3}
		Mercury	1.5×10^{-9}	3.3×10^{-12}	3.0×10^{-9}	3.3×10^{-12}
		Methylene chloride	1.1×10^{3}	2.4×10^{0}	2.0×10^{3}	2.2×10^{0}
		Nickel	1.3×10^{-3}	2.9×10^{-6}	2.6×10^{-3}	2.9×10^{-6}
		Nitric acid	1.0×10^{2}	2.2×10^{-1}	1.8×10^{2}	2.0×10^{-1}
		Polychlorinated biphenyls	9.0×10^{-9}	2.0×10^{-11}	1.8×10^{-8}	2.0×10^{-11}
		Perchloroethylene	4.5×10^{-2}	9.9×10^{-5}	9.0×10^{-1}	9.9×10^{-4}
		Sulfuric acid	1.4×10^{1}	3.1×10^{-2}	2.5×10^{1}	2.8×10^{-2}
		Trichloro-trifluoroethane	2.8×10^{-1}	6.2×10^{-4}	5.6×10^{-1}	6.2×10^{-4}
		Trichloroethylene	1.6×10^{-1}	3.5×10^{-4}	3.2×10^{-1}	3.5×10^{-4}
Waste Immobilization Facility, (separations)[d], Idaho Chemical Processing Plant, high-level waste	C,D	Cadmium	8.1×10^{-5}	1.8×10^{-7}	7.1×10^{-4}	7.8×10^{-7}
		Chromium	2.6×10^{-5}	5.7×10^{-8}	1.6×10^{-4}	1.8×10^{-7}
		Hydrofluoric acid[c]	1.2×10^{2}	2.6×10^{-1}	1.1×10^{3}	1.2×10^{0}
		Mercury	2.7×10^{1}	5.9×10^{-2}	2.4×10^{2}	2.6×10^{-1}
		Nickel	9.1×10^{-6}	2.0×10^{-8}	8.0×10^{-5}	8.8×10^{-8}
		Tributyl phosphate	1.1×10^{2}	2.4×10^{-1}	9.5×10^{2}	1.0×10^{0}
Waste Inunobilization Facility, (direct vitrification)[e], Idaho Chemical Processing Plant, high-level waste	B	Cadmium	3.4×10^{-6}	7.5×10^{-9}	3.0×10^{-5}	3.3×10^{-8}
		Chromium	4.4×10^{-5}	9.7×10^{-8}	1.0×10^{-4}	1.1×10^{-7}
		Hydrofluoric acid[c]	1.2×10^{2}	2.6×10^{-1}	1.1×10^{3}	1.2×10^{0}
		Mercury	2.7×10^{1}	5.9×10^{-2}	2.4×10^{2}	2.6×10^{-1}
		Nickel	1.4×10^{-8}	3.1×10^{-11}	1.2×10^{-7}	1.3×10^{-10}
Mixed/Low-Level Waste Treatment Facility, east of Radioactive Waste Management Complex, low-level and mixed low-level waste	D	Arsenic	1.4×10^{-1}	3.0×10^{-4}	8.0×10^{-1}	8.8×10^{-4}
		Benzene	6.0×10^{1}	1.3×10^{-1}	3.1×10^{0}	3.4×10^{-3}
		Cadmium	1.9×10^{-1}	4.2×10^{-4}	1.1×10^{0}	1.2×10^{-3}
		Chromium	5.6×10^{-1}	1.2×10^{-3}	3.2×10^{0}	3.5×10^{-3}
		Formaldehyde	1.2×10^{2}	2.6×10^{-1}	6.0×10^{0}	6.6×10^{-3}
		Mercury	1.5×10^{1}	3.3×10^{-2}	1.9×10^{0}	2.1×10^{-3}
		Polychlorinated biphenyls	4.8×10^{-3}	1.1×10^{-5}	4.8×10^{-6}	5.3×10^{-9}
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage, Idaho Chemical Processing Plant, spent nuclear fuel	B,D	Benzene	5.6×10^{-2}	1.2×10^{-4}	1.8×10^{-3}	2.0×10^{-6}
		Formaldehyde	1.1×10^{-1}	2.4×10^{-4}	3.4×10^{-3}	3.7×10^{-6}

Table F-3-8. (continued).

Project name, location, and associated program or source group[a]	Associated alternative[b]	Compound	Emission rate: Maximum hourly (Grams per hour)	Maximum hourly (Pounds per hour)	Annual average (Kilograms per year)	Annual average (Tons per year)
Idaho Waste Processing Facility, site not determined (reference site is east of Radioactive Waste Management Complex); transuranic, low-level, and mixed low-level waste	B	Asbestos	1.8×10^{-1}	4.0×10^{-4}	5.7×10^{-3}	6.3×10^{-6}
		Benzene	3.4×10^{1}	7.5×10^{-2}	7.3×10^{0}	8.0×10^{-3}
		Beryllium	2.7×10^{-2}	5.9×10^{-5}	2.9×10^{-2}	3.2×10^{-5}
		Cadmium	4.0×10^{-2}	8.9×10^{-5}	6.3×10^{-2}	6.9×10^{-5}
		Carbon tetrachloride	3.4×10^{0}	7.4×10^{-3}	2.2×10^{0}	2.4×10^{-3}
		Chromium	2.5×10^{-1}	5.5×10^{-4}	8.4×10^{-1}	9.3×10^{-4}
		Formaldehyde	8.1×10^{1}	1.8×10^{-1}	6.5×10^{1}	7.2×10^{-2}
		Hydrochloric acid	2.7×10^{3}	5.8×10^{0}	5.7×10^{3}	6.3×10^{0}
		Hydrofluoric acid[c]	1.3×10^{1}	2.9×10^{-2}	3.5×10^{1}	3.8×10^{-2}
		Mercury	6.0×10^{-4}	1.3×10^{0}	5.6×10^{1}	6.1×10^{-2}
		Methylene chloride	6.7×10^{-2}	1.5×10^{-4}	1.4×10^{-1}	1.5×10^{-4}
		Nickel	2.9×10^{0}	6.4×10^{-3}	9.5×10^{0}	1.0×10^{-2}
		Polychlorinated biphenyls	3.7×10^{1}	8.2×10^{-2}	3.0×10^{0}	3.3×10^{-3}
		Perchloroethylene	3.4×10^{0}	7.4×10^{-3}	2.2×10^{-1}	2.4×10^{-4}
		Trichloro-trifluoroethane	3.4×10^{0}	7.4×10^{-3}	1.3×10^{0}	1.4×10^{-3}
		Trichloroethylene	1.0×10^{1}	2.2×10^{-2}	1.4×10^{0}	1.5×10^{-3}
Idaho Waste Processing Facility,[f] site not determined (reference site is east of Radioactive Waste Management Complex); transuranic, low-level, and mixed low-level waste	D	Asbestos	2.1×10^{-1}	4.6×10^{-4}	6.6×10^{-3}	7.3×10^{-6}
		Benzene	3.4×10^{1}	7.5×10^{-2}	7.3×10^{0}	8.0×10^{-3}
		Beryllium	3.1×10^{-2}	6.8×10^{-5}	3.4×10^{-2}	3.7×10^{-5}
		Cadmium	4.6×10^{-2}	1.0×10^{-4}	7.2×10^{-2}	7.9×10^{-5}
		Carbon tetrachloride	3.9×10^{0}	8.5×10^{-3}	2.5×10^{0}	2.8×10^{-3}
		Chromium	2.5×10^{-1}	5.5×10^{-4}	8.4×10^{-1}	9.3×10^{-4}
		Formaldehyde	8.1×10^{1}	1.8×10^{-1}	6.5×10^{1}	7.2×10^{-2}
		Hydrochloric acid	3.1×10^{3}	6.7×10^{0}	6.6×10^{3}	7.2×10^{0}
		Hydrofluoric acid[c]	1.5×10^{1}	3.4×10^{-2}	4.0×10^{1}	4.4×10^{-2}
		Mercury	7.0×10^{2}	1.5×10^{0}	6.4×10^{1}	7.0×10^{-2}
		Methylene chloride	7.7×10^{-2}	1.7×10^{-4}	1.6×10^{-1}	1.8×10^{-4}
		Nickel	2.9×10^{0}	6.4×10^{-3}	9.5×10^{0}	1.0×10^{-2}
		Polychlorinated biphenyls	4.3×10^{1}	9.5×10^{-2}	3.4×10^{0}	3.8×10^{-3}
		Perchloroethylene	3.9×10^{0}	8.5×10^{-3}	2.5×10^{-1}	2.7×10^{-4}
		Trichloro-trifluoroethane	3.9×10^{0}	8.5×10^{-3}	1.5×10^{0}	1.6×10^{-3}
		Trichloroethylene	1.2×10^{1}	2.6×10^{-2}	1.6×10^{0}	1.7×10^{-3}
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha Mixed Low-Level Waste Treatment of Alpha Mixed Low-Level Waste, Radioactive Waste Management Complex, transuranic waste	B,D	Asbestos	2.0×10^{-8}	4.4×10^{-11}	6.4×10^{-8}	7.1×10^{-11}
		Benzene	9.4×10^{0}	2.1×10^{-2}	6.3×10^{1}	7.0×10^{-2}
		Beryllium	3.0×10^{-12}	6.6×10^{-15}	9.6×10^{-12}	1.1×10^{-14}
		Cadmium	4.3×10^{-11}	9.5×10^{-14}	1.4×10^{-10}	1.5×10^{-13}
		Carbon tetrachloride	9.0×10^{-1}	2.0×10^{-3}	2.9×10^{0}	3.2×10^{-3}

Table F-3-8. (continued).

Project name, location, and associated program or source group[a]	Associated alternative[b]	Compound	Emission rate: Maximum hourly (Grams per hour)	Emission rate: Maximum hourly (Pounds per hour)	Emission rate: Annual average (Kilograms per year)	Emission rate: Annual average (Tons per year)
		Chromium	1.9×10^{-1}	4.1×10^{-4}	1.6×10^{1}	1.8×10^{-3}
		Formaldehyde	1.0×10^{2}	2.3×10^{-1}	7.0×10^{2}	7.7×10^{-1}
		Methylene chloride	5.8×10^{-2}	1.3×10^{-4}	1.9×10^{-1}	2.1×10^{-4}
		Nickel	2.1×10^{0}	4.7×10^{-3}	1.9×10^{1}	2.1×10^{-2}
		Perchloroethylene	9.0×10^{-2}	2.0×10^{-4}	2.9×10^{-1}	3.2×10^{-4}
		Trichloro-trifluoroethane	5.4×10^{-1}	1.2×10^{-3}	1.7×10^{0}	1.9×10^{-3}
		Trichloroethylene	5.8×10^{-1}	1.3×10^{-3}	1.9×10^{0}	2.1×10^{-3}
Nonincinerable Mixed Waste, Power Burst Facility, mixed low-level waste	B,D	Mercury	5.5×10^{-3}	1.2×10^{-5}	2.2×10^{-5}	2.4×10^{-8}
Waste Experimental Reduction Facility Incineration,[g] Power Burst Facility, low-level and mixed low-level waste	B,D	Arsenic	8.4×10^{-2}	1.9×10^{-4}	4.8×10^{-1}	5.3×10^{-4}
		Beryllium	1.9×10^{-2}	4.2×10^{-5}	1.1×10^{-1}	1.2×10^{-4}
		Cadmium	2.0×10^{-1}	4.4×10^{-4}	1.2×10^{0}	1.3×10^{-3}
		Chromium	3.8×10^{-3}	8.4×10^{-6}	2.2×10^{-2}	2.4×10^{-5}
		Hydrochloric acid	1.8×10^{3}	4.0×10^{0}	1.0×10^{4}	1.1×10^{1}
		Mercury	2.5×10^{1}	5.5×10^{-2}	1.4×10^{2}	1.6×10^{-1}
		Nickel	2.0×10^{-1}	4.4×10^{-4}	1.2×10^{0}	1.3×10^{-3}
		Trichloroethylene	1.4×10^{0}	3.1×10^{-3}	8.2×10^{0}	9.0×10^{-3}
Plasma Hearth Process, Argonne National Laboratory-West, mixed low-level and hazardous waste	B,D	Arsenic	4.5×10^{-3}	9.9×10^{-6}	1.4×10^{-2}	1.5×10^{-5}
		Beryllium	8.5×10^{-6}	1.9×10^{-8}	2.7×10^{-5}	3.0×10^{-8}
		Cadmium	9.1×10^{-3}	2.0×10^{-5}	2.8×10^{-2}	3.1×10^{-5}
		Chromium	2.0×10^{-3}	4.4×10^{-6}	6.1×10^{-3}	6.7×10^{-6}
		Hydrochloric acid	4.5×10^{1}	9.9×10^{-2}	1.4×10^{2}	1.6×10^{-1}
		Mercury	2.3×10^{-2}	5.1×10^{-5}	7.1×10^{-2}	7.8×10^{-5}
		Nickel	1.4×10^{-1}	3.1×10^{-4}	4.2×10^{-1}	4.6×10^{-4}
Spent Fuel Processing, Idaho Chemical Processing Plant, spent nuclear fuel	D	Ammonia[h]	1.8×10^{4}	4.0×10^{1}	1.6×10^{3}	1.8×10^{0}
		Hydrofluoric acid[c]	3.8×10^{0}	8.4×10^{-3}	1.6×10^{1}	1.8×10^{-2}
		Methyl isobutyl ketone	2.7×10^{3}	5.9×10^{0}	2.3×10^{4}	2.5×10^{1}
		Tributyl phosphate	8.6×10^{0}	1.9×10^{-2}	5.5×10^{1}	6.1×10^{-2}
Total[i]			2.9×10^{4}	6.3×10^{1}	4.8×10^{4}	6.0×10^{1}

a. Only those emissions that meet assessment criteria are listed (see text for explanation); projects with no emissions are not listed.
b. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).
c. Hydrofluoric acid is not listed as a toxic air pollutant by IDHW (1994), but is included and evaluated as a fluoride, which is listed.
d. Separations process is proposed under Alternatives C and D.
e. Direct vitrification process is proposed under Alternative B.
f. Under Alternative D, similar emissions would also be projected for the Private Sector Alpha-Contaminated Mixed Low-Level WasteTreatment Facility, which is a competing project that would have a similar design and process the same type of waste.
g. Includes incineration only; other waste processing is assessed as foreseeable increases to the baseline.
h. Includes emissions of ammonium hydroxide.
i. Total would apply only to Alternative D and only if all facilities were operating simultaneously.

Commission on Radiological Protection (ICRP), as contained in Publications 26 and 30 (ICRP 1977, 1979). This model has several technical advantages over other available methods, including the ability to assess dose from many different release scenarios and exposure pathways. In addition, it conforms to the strict quality assurance requirements of NQA-1, Basic Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control), which includes requirements for verification and validation of computer codes.

An additional dose model, CAP-88 (Clean Air Act Assessment Package), is routinely used at the INEL for the specific purpose of evaluating compliance with National Emission Standards for Hazardous Air Pollutants standard 40 CFR 61. As prescribed by that standard, CAP-88 is used to calculate the highest offsite dose to any member of the public resulting from annual airborne radionuclide emissions from cumulative INEL site operations. The result must be below 10 millirem to demonstrate compliance with the standard. The CAP-88 model was used in the prescribed manner to support the 1991 and 1992 INEL National Emission Standards for Hazardous Air Pollutants Reports (DOE-ID 1992a, b; 1993). As part of that effort, detailed comparisons between results obtained with GENII and CAP-88 were made and documented (Maheras 1992, Ritter 1992). A comparison of GENII and CAP-88 dose results for the maximally exposed individual is presented in Table F-3-9. In both cases, the dose results represent a summation of the external effective dose equivalent (EDE) from the ground deposition and air immersion pathways and the 50-year committed effective dose equivalent (CEDE) from the inhalation and ingestion pathways. These results are not directly comparable in that there were minor differences in the source terms used. Benchmarking of the GENII and CAP-88 codes for application at the INEL site has been performed and documented (Maheras et al. 1994). These tests provide confidence that the application of GENII, including the source term and receptor-related assumptions used in this Environmental Impact Statement, produces results that are likely to be conservative.

F-3.4.2.2 Release Modeling—Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this EIS, the decision whether to model a given emission point as a stack or ground-level release was based on guidelines issued by the U.S. Environmental Protection Agency (EPA 1993a) and the National Council on Radiation Protection and Measurements NCRP 1986). In essence, if the height of the release point is less than or equal to 2.5 times the height of attached or nearby buildings, turbulent (wake and downwash) effects are assumed to

Table F-3-9. Comparison of doses to maximally exposed individual due to Idaho National Engineering Laboratory site emissions as calculated by the GENII and CAP-88 computer codes.

	Dose to maximally exposed individual (millirem)		
Source category	GENII 1991[a]	CAP-88 1991[b]	CAP-88 1992[c]
Monitored	9.8×10^{-3}	4.1×10^{-3}	1.4×10^{-3}
Diffuse	3.0×10^{-3}	2.4×10^{-5}	3.1×10^{-5}
Unmonitored	3.0×10^{-4}	1.2×10^{-4}	1.0×10^{-4}
Total	1.3×10^{-2}	4.2×10^{-3}	1.5×10^{-3}

a. Source: Leonard (1993); calculation for monitored source emissions from Idaho Chemical Processing Plant has been revised (Leonard, 1994).
b. Source: 1991 INEL National Emission Standards for Hazardous Air Pollutants Report and Supplement (DOE-ID 1992a, b).
c. Source: 1992 INEL Annual National Emission Standards for Hazardous Air Pollutants Report (DOE-ID 1993b).

influence the release, effectively lowering the release height to ground level. In some cases, stacks were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, elevated sources at the Power Burst Facility (the Waste Experimental Reduction Facility North and South Stacks, and the Power Burst Facility Stack) were modeled as individual elevated releases. Conversely, effluents from various vents at the Naval Reactors Facility were summed and treated as a single ground-level release. The manner in which specific sources were modeled is described in Leonard (1993, 1994). Additional related information, including specific facility locations and stack data, are presented in Belanger et al. (1995a)

F-3.4.2.3 Meteorological Data. The atmospheric transport modeling performed as part of these radiological assessments was based on actual meteorological conditions measured at eight different locations at the INEL site. In particular, the data files prepared for these assessments were derived from observations at INEL site weather stations over the period 1987 through 1991, which was assumed to be representative of conditions during the years covered by the Environmental Impact Statement (1995 through 2005). The method used for incorporating these data into wind files that can be used by the GENII program is documented in Leonard (1992).

F-3.4.2.4 Receptor Locations. Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, described as follows. In each case, the dose was assessed for baseline conditions, projected increases to the baseline, and ER&WM alternatives.

Maximally Exposed Individual. The offsite individual whose assumed location and habits are likely to result in the highest dose is referred to as the maximally exposed individual (MEI). The location of the maximally exposed individual was identified on the basis of the source-receptor distance and direction combination that yielded the highest predicted offsite dose. For each INEL site area, radionuclide concentrations were calculated for the minimum distance to the INEL site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the INEL site areas, the maximally exposed individual receptor locations are merely points on the INEL site boundary and do not correspond to any actual residences or quarters. These maximum impacts were conservatively summed to derive cumulative impacts, although they occur at spatially distant locations. (The actual maximally exposed individual locations for five of the major INEL site facilities are all located along a segment of the southern boundary, southwest of the facilities in question.) Although unrealistic, this cumulative maximally exposed individual assessment process serves to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low; and further resolution of the actual maximally exposed individual location and dose was not necessary. The same general method for dose determination to the maximally exposed individual is used in the annual National Emission Standards for Hazardous Air Pollutants compliance evaluation.

Population Dose. Dose was assessed for the collective population residing in a circular area defined by a radius of 80 kilometers (50 miles) extending out from each major INEL site facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with ER&WM alternatives and for projects expected to become operational before June 1, 1995, growth projections for the counties surrounding INEL were applied. These growth estimates are approximately 10 percent per decade. Since the period of analysis for this EIS extends to the year 2005, the population doses reported in Section 5.7, Air Resources, of Volume 2 of this EIS are the highest obtained for any year throughout this period.

INEL Site Worker. INEL site workers may be exposed to radiation attributable to INEL sources both as a direct result of job performance (such as work within a radiologically controlled area) and incidentally (such as from airborne releases from facilities within their work area, as well as more distant sources within the INEL site). Onsite concentrations of radionuclides due to incidental exposure were assessed as described in this section. (Direct, job-related occupational exposure is discussed in Section 4.12, Health and Safety, of Volume 2 of this EIS.) An individual who would receive the highest dose due to incidental exposures is termed the maximally exposed worker. The dose to the maximally exposed worker was assessed for all major INEL site work areas as a result of radionuclide emissions from all current and projected sources. The dose was calculated using the general methodology described in previous sections. One major difference is the fact that the worker dose calculations did not include the food ingestion pathway, since workers do not consume food products grown onsite.

F-3.4.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by the application of air dispersion computer models that incorporate mathematical functions to simulate transport of pollutants in the atmosphere. The modeling methodology conforms to that recommended by the U.S. Environmental Protection Agency (EPA 1993a) and the State of Idaho (DOE-ID 1991) for such applications. The models and application methodology are designed to be conservative; that is, they employ data and algorithms designed to prevent underestimating the pollutant concentrations that would actually exist. In general, the methods used to assess consequences of proposed actions were identical to those used in the baseline assessments. Minor exceptions (such as the use of refined versus screening-level modeling) will be noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison (a) to applicable standards or guidelines and (b) between alternative courses of action.

The types of pollutants assessed include the criteria pollutants and certain types of toxic air pollutants. Criteria pollutant concentrations were estimated for locations and over periods of time corresponding to State of Idaho and National Ambient Air Quality Standards. Since these standards apply only to ambient air (that is, locations to which the general public has access), criteria pollutant concentrations were assessed for offsite locations and public roads traversing the INEL site. The nonradiological assessment did not specifically address impacts related to ozone formation because

(a) volatile organic compound emission levels are below the significance level designated by the State of Idaho; (b) no simple, well-defined method exists to assess ozone formation potential (Wilson 1993); and (c) while the Idaho Division of Environmental Quality has no ozone monitoring data from the vicinity, it is not aware of problematic ozone levels in the area (Andrus 1994).

Offsite levels of carcinogenic and noncarcinogenic toxic air pollutants were evaluated on the basis of annual average emission rates and compared with annual average standards (increments) recently promulgated by the State of Idaho. Toxic air pollutants were also assessed for onsite locations because of potential exposure of workers to these hazardous substances. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared with occupational exposure limits set for these substances by either the Occupational Safety and Health Administration (OSHA) or the American Conference of Governmental Industrial Hygienists (the lower of the two limits being used).

F-3.4.3.1 Atmospheric Dispersion Models for Criteria and Toxic Air Pollutant Evaluations. Atmospheric dispersion models used to estimate upper-bound levels of toxic and criteria impacts, as well as impacts to visibility and highway hot spots, are described below.

F-3.4.3.1.1 Model Description and Application—The modeling effort employed two levels of sophistication—screening-level and refined. Screening-level modeling was used in many cases where a source's contribution to air quality levels was expected to be minimal (that is, well below acceptable standards). This method is less rigorous mathematically than refined modeling and results in an overestimation of pollutant concentrations (greater than that of refined modeling).

The short-term version of the U.S. Environmental Protection Agency Industrial Source Complex-2 (ISC-2) computer code (EPA 1992a) is a refined model that was used to estimate concentrations resulting from routine operational emissions of criteria pollutants. The ISC-2 model incorporates site-specific data (such as meteorological observations from INEL site weather stations). This model takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. Account was taken for building wake effects in the baseline assessments of criteria pollutant emissions. However, it was not feasible to include wake effect calculations into the proposed action assessments, since building dimensions and distances have not been defined. This is not expected to show appreciable differences in results other than in locations in very close proximity of sources. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations can be calculated over a range of durations, from one-hour maximum values to annual averages. The ISC-2 model is not well suited for conditions where the receptor elevation exceeds the stack height. However, this is not the case for the INEL; the terrain is generally flat enough to avoid use of models developed for complex terrain (DOE-ID 1991). In summary, dispersion modeling using ISC-2 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for use in the Environmental Impact Statement process.

The SCREEN model (EPA 1992b) was used to estimate toxic air pollutant concentrations. SCREEN is a relatively simple model that incorporates conservative data and methods. SCREEN is limited to the calculation of only one-hour maximum concentrations from a single source for various user-specified or predefined distances and performs iterations to determine the distance and concentration at the point of maximum impact. Persistence factors (averaging time adjustment factors) recommended by the U.S. Environmental Protection Agency or the Idaho Division of Environmental Quality were used to scale one-hour SCREEN results to other required averaging times. A persistence factor of 0.125 was used to scale one-hour results to annual average estimates, as recommended by IDHW (1994). For onsite concentrations, a factor of 0.7 was used to scale one-hour results to eight-hour estimates suitable for comparison to occupational exposure limits.

Since SCREEN can only accommodate a single source, most cases required multiple sources within an area to be grouped and treated as a single source. This model incorporates building wake algorithms; however, in the manner employed herein (that is, combining impacts from multiple stacks and simulating as a single source), this feature was not used. Wind direction is not taken into account; therefore, impact levels were assumed to be equal in all directions from the source. SCREEN was used in these assessments only to estimate baseline concentrations of toxic air pollutants and to identify which of these pollutants warranted further refined modeling. For cases where the SCREEN model predicted that toxic air pollutant concentrations were close to (within 50 percent or so) an acceptable level, remodeling with ISC-2 was performed to provide a more realistic estimate.

Those operations that would result in the generation of fugitive dust, including construction activities and equipment, travel on paved or unpaved roads, the concrete batch plant, mixing and pouring, and gravel pit and landfarming operations, were assessed using the U.S. Environmental

Protection Agency-recommended Fugitive Dust Model (FDM) (Winges 1991). The Fugitive Dust Model was designed specifically for computing concentration and deposition impacts from fugitive dust sources through improved algorithms for deposition. Sources may be either point, area, or line. Model execution may include up to 20 particle size classes, with calculation of gravitational settling and deposition velocity for each hour. Similar to ISC-2, concentrations may be calculated over a range of durations, from one-hour maximum values to annual averages; 24-hour and annual average assessments were conducted. Modeling of fugitive dust sources with the Fugitive Dust Model has been shown to be superior to ISC-2 for area ground-level ambient temperature releases (Winges 1991).

F-3.4.3.1.2 Model Input Data—The use of air dispersion models requires emission parameters, such as stack height and diameter and exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. For the most part, emission parameter data were obtained from the INEL site air emissions inventories discussed above. In some cases, data were observed to be missing or in error. The missing data were replaced by substituting parameter values from similar sources at the INEL site. (For example, data for emergency generator combustion engines were obtained from other generators of the same capacity.) The specific values used for stack-related parameters (height, diameter, flow rate, and temperature) are presented in Belanger et al. (1995a).

The estimation and evaluation of impacts from fugitive dust sources was dependent on the type of source (see Section F-3.4.3.2). For construction sources, the size of the disturbed area was assumed to be two times the construction project footprint. For example, construction of a 100-by-100-meter building is expected to disturb a 200-by-200-meter area during construction. Use of watering was assumed, providing a 50 percent reduction in fugitive emissions and preferentially removing larger-diameter particles. The resultant distribution was estimated to contain 64 percent dust of respirable size. [This follows methods developed by EPA (1993b)]. Construction-related emissions were averaged over the expected hours of construction activity—12 hours per day, 6 days per week, for 26 weeks per year. Fugitive dust emissions were similarly calculated for demolition projects. Emissions related to the use of unpaved roads were divided equally across INEL site areas. Emissions of dust from paved roads were assumed to be generated primarily by the INEL bus fleet. These emissions include tire wear and road dust but exclude exhaust particulates, which were calculated separately in the evaluation of mobile source emissions. Paved road use within the INEL site is heaviest along State Route 33 and U.S. Route 20/26. All emissions, therefore, were assumed to occur along these routes. Because approximately 11.4 percent of the buses travel to Test Area North, 11.4 percent of the total paved road emissions was assigned to State Route 33, the primary route to the Test Area North facility, and 88.6 percent to U.S. Route 20/26. The estimation of emissions from employee vehicles assumed 1.5 persons per vehicle, 100 mile round trip, and 250 trips per year in light-duty (pickup) trucks.

F-3.4.3.1.3 Meteorological Data—The modeling effort made use of two types of meteorological data: (a) ISC-2 and the Fugitive Dust Model modeling incorporated data from measurements of meteorological conditions (temperature, wind speed and direction, atmospheric stability, and so forth) made at the INEL site by the National Atmospheric and Oceanic Administration (NOAA); and (b) SCREEN modeling used a standard (not specific to INEL) set of meteorological data, which are incorporated into the model to derive a worst-case approximation of pollutant concentrations. The following description pertains only to the site-specific data used by ISC-2 and the Fugitive Dust Model.

Meteorological data collected by the National Oceanic and Atmospheric Administration meteorological monitoring towers located at Grid 3 (lower, north of Central Facilities Area), Test Area North, and Argonne National Laboratory-West were used in the assessment of source impacts. Conditions at these three locations are representative of the three major wind flow regimes at the INEL site (Clawson et al. 1989). Sources at Test Area North and Argonne National Laboratory-West were modeled with meteorological data from those respective locations. All other sources were modeled using data from the Grid 3 Station. The locations of these and other meteorological monitoring stations on and around the INEL are shown in Figure F-3-2. The meteorological data used contained hourly observations of wind speed, direction, temperature, and stability class for the years 1991 and 1992. Data required for the calculation of mixing height are currently being collected at the INEL but are not available for these periods. Therefore, default mixing heights were used. For short-term assessments, a value of 150 meters (500 feet), which represents the lowest value measured at the INEL site, was used. For annual average evaluations, 800 meters (2,600 feet) was used. This value has been calculated by the National Oceanic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Each case was assessed separately using data from these years, and the highest of the predicted concentrations was selected.

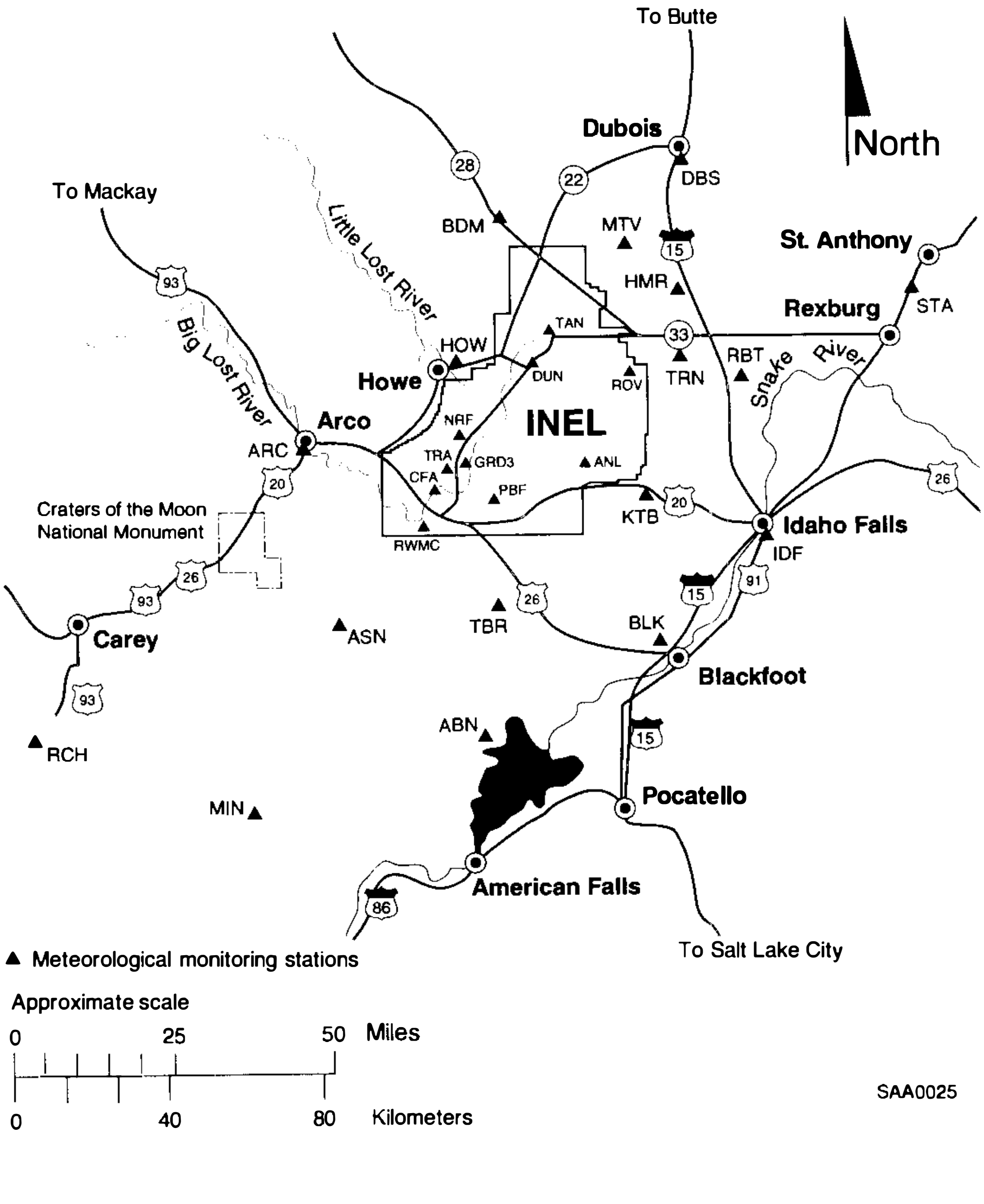

Figure F-3-2. Locations of meteorological monitoring stations at the Idaho National Engineering Laboratory site and surrounding communities.

F-3.4.3.1.4 Receptor Locations—The ISC-2 and Fugitive Dust Model are capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. Based on modeling efforts performed previously, maximum impacts at ambient receptor locations are expected to occur either (a) along public roads that traverse the INEL site or (b) along the INEL site boundary. No points of maximum impact are expected to occur at locations beyond the INEL site boundary. Thus, only discrete receptors at those locations (as opposed to a gridded array) have been used for regulatory air assessments at those locations and at the Craters of the Moon Wilderness Area. (Gridded arrays were used, however, in modeling performed to identify the areas where fine spacing of discrete receptors points is necessary.)

Due to the large areal extent of the INEL site, fine spacing of discrete receptor locations at regular intervals is not feasible. Therefore, an approach has been employed that utilizes a mix of coarse and fine receptor intervals, ranging from 100 meters (330 feet) to 2,500 meters (8,200 feet), depending on the potential for maximum impact. The process used to develop the receptor array used as a starting point the complete coarse grid of ambient air locations described in the INEL Air Permitting Handbook (DOE-ID 1991). This grid incorporates receptor locations spaced at approximately 500-meter (1,640-foot) intervals along (a) the entire perimeter of the INEL site; (b) public roads traversing the INEL site; and (c) the eastern and northern boundaries of the Craters of the Moon Wilderness Area. Fine-grid modeling [using intervals of approximately 100-meter (330-foot) x-y coordinate spacing] was then performed, and the results were plotted to identify those areas where closer receptor spacing was warranted. A substantial margin of conservatism was provided by extending the range of 100-meter (330-foot) spacing to well beyond the expected range of maximum impact (from several hundred to several thousand meters, depending on the uncertainty of the case.) Once these ranges were established, Universal Transverse Mercator (UTM) coordinates were determined for receptor locations at 100-meter (330-foot) intervals along these ranges, and these coordinates were incorporated into the receptor array file. The modeling also revealed the areas that are clearly beyond the locations of maximum impact and that could be eliminated from the receptor array. Additional details of the method for identifying the receptor areas of maximum impact, including examples of isopleth plots used for this purpose, are presented in Belanger et al. (1995b) and Raudsep et al. (1995).

Ambient air impacts, including Prevention of Significant Deterioration increment consumption, have also been assessed for the Craters of the Moon Wilderness Area, the Class I area nearest the INEL site. Previous modeling has shown that there is only minor variation in concentrations between coarsely spaced receptor locations at the Craters of the Moon—a fact that is not surprising in light of the substantial distance between this Class I area and the INEL sources. Thus, Class I area increments have been assessed at discrete receptor locations along the eastern and northern boundaries at intervals of 2,500 meters (8,200 feet) (that is, using every fifth coarse grid receptor point).

Concentrations of air pollutants at onsite facility areas were assessed to indicate potential levels to which workers may be subjected. For the onsite assessments, 11 separate receptor grids were developed. In general, these were 2-by-2-kilometer (1.2-by-1.2-mile) grids with fine [100-meter 330-foot)] spacing centered on the major source groups at each facility. The grids for Test Area North, Power Burst Facility, and Central Facilities Area were made larger to accommodate the distribution of sources within those areas. These grids are described in detail in Belanger et al. (1995b) and were used to determine maximum impacts as a result of emissions from sources where low release elevations or building effects are prevalent. In addition to a fine grid, the assessments for each facility area also included discrete receptor locations of other facilities. For example, assessments for sources at the Central Facilities Area included discrete receptor points at the Idaho Chemical Processing Plant, Power Burst Facility, and other facilities. In this way, it was ensured that contributions of sources at locations other than the facility being assessed were represented in the total concentration.

F-3.4.3.2 Summation of Results. An important function of the modeling effort is to identify the location of highest predicted impact and the magnitude of the impact. This is complicated by the fact that there are numerous sources in widely dispersed locations at the INEL site, and the determination of the highest concentration must consider the contributions from each of these sources. Also, in some cases, sources at different facility areas required different meteorological input data. These factors precluded the execution of a single modeling run in which all sources and receptor arrays could be included and necessitated the application of computer-aided data consolidation techniques. Since a common receptor array was used for all ambient air assessments, a summation of concentrations at each receptor point as a result of emissions from each source was possible. The value and location of highest impact were identified by entering the results from individual modeling runs for a specific type of assessment (for example, maximum one-hour carbon monoxide concentrations) into a spreadsheet program, summing the values for each receptor point, and identifying the maximum value and corresponding location. The same process was used to sum the contributions from baseline sources, projected increases to the baseline, and proposed action sources.

As provided by applicable regulations, the estimated impacts from temporary fugitive dust sources, including construction and demolition activities, were characterized and evaluated with respect to ambient air quality standards (but not for Prevention of Significant Deterioration standards, which exclude these types of activities from review). The cumulative emissions from fugitive dust sources of a more permanent nature, including vehicle travel on paved and unpaved roads and landfill and concrete batch plant operations, were assessed for compliance with ambient air quality standards. However, these sources were not analyzed for Prevention of Significant Deterioration because they became operational prior to the baseline date and are not associated with net emissions increases.

The onsite assessments used separate grids, and the results had to be processed differently. This involved summing the contribution from each area to each area-specific discrete receptor point. This discrete receptor summation was then added to the maximum value calculated with use of the fine-grid network for the area under review. For example, maximum impacts at the Central Facilities Area consist of the maximum-predicted impact from sources within the Central Facilities Area and the sum of contributions from all other areas. In this way, it was ensured that contributions of sources at locations other than the facility being assessed were represented in the total concentration.

F-3.4.3.3 Impacts on Visibility. 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. Therefore, in the assessment of proposed projects that invoke Prevention of Significant Deterioration review (see Section F-3.1.1.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. The Craters of the Moon Wilderness Area, located approximately 20 kilometers (12.4 miles) southwest of the INEL site, is the only Class I area in the Eastern Snake River Plain.

The U.S. Environmental Protection Agency has designed methodologies to estimate potential plume visual impacts due to emissions of proposed sources. The methodologies include three levels of sophistication. Level-1 is designed to be very conservative; it uses assumptions and simplifying methodologies that will predict plume visual impacts larger than those calculated with more realistic input and modeling assumptions. Level-2 visual impact modeling employs more site-specific information than that of Level-1. It is still conservative and designed to overestimate potential visibility deterioration. Level-3 visual impact modeling is more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. The U.S. Environmental Protection Agency has developed computer codes to implement the calculations associated with each level of visual impact modeling. The VISCREEN model is designed to implement the methodology of the Level-1 analysis (EPA 1992c).

The VISCREEN model was used to evaluate the potential visual impact of the cumulative emissions of proposed sources at the INEL site on the Craters of the Moon Wilderness Area. As stated above, Level-1 screening is designed to provide a conservative estimate of plume visual impacts, that is, to estimate impacts that would be larger than those calculated with more realistic input and modeling assumptions. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (class F) stability coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind that would transport the plume directly adjacent to a hypothetical observer in the Class I area. Maximum short-term (hourly) emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area are used. The U.S. Environmental Protection Agency recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration, for which a site-specific value of 0.06 parts per million was used. Use of this value has been agreed to by the Idaho Division of Environmental Quality (DOE-ID 1991) and the National Park Service (NPS) (Notar 1993a). The annual average background visual range as measured by the National Park Service at Craters of the Moon is estimated to be 140 kilometers (87 miles) (Notar 1993b); however, as suggested by the National Park Service, the maximum seasonal average of 158 kilometers (98 miles) was used in this assessment (Notar 1993a, b).

The objective of the VISCREEN analysis was to calculate the potential visual impact of a plume of specified emissions for specific transport and dispersion conditions. If screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions a plume is either imperceptible or, if perceptible, is not likely to be considered objectionable, further analysis of plume visual impact would not be required (EPA 1992c). The VISCREEN model determines whether a plume is visible by calculating contrast. If a viewed object, such as a snow-covered peak, is brighter than its background, it will have a positive contrast; alternatively, if an object is darker than its background, its contrast is negative. In VISCREEN, contrasts at three visual wavelengths are calculated to characterize blue, green, and red regions of the visual spectrum to determine if a plume will be brighter, darker, or discolored compared to its viewing background. If plume contrast is positive, the plume is brighter than its viewing background; if negative, the plume is darker. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background. With a range of wavelengths, a measure of contrast must recognize both overall intensity and perceived color; perceptibility is a function of changes in both brightness and color. To address the dimension of color, a parameter called delta E is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. In order to ascertain whether the plume from a facility has the potential to be perceptible to untrained observers under worst-case conditions, the VISCREEN model calculates both delta E and contrast for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. Results are provided for two assumed worst-case sun angles (to simulate forward and backward scattering of light), with the sun in front and behind the observer, respectively. If either of two screening criteria is exceeded, more comprehensive and realistic analyses should be carried out. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

For this assessment, the potential impact of incremental emissions of particulate matter and oxides of nitrogen associated with each project was evaluated. Cumulative impacts were estimated for each alternative as the sum of the impacts from specific projects associated with those alternatives and waste stream options. Current operations were considered in the baseline [that is, the impact of current emission levels is monitored at the Craters of the Moon, resulting in a 158-kilometer (98-mile) value for maximum seasonal visual range]; however, projected increases to the baseline were also evaluated and added to the cumulative assessment for each alternative. All emission sources were included except construction emissions and emergency diesel generators, which are not evaluated in a Prevention of Significant Deterioration assessment.

F-3.4.3.4 Mobile Source Assessment Methodology. Ambient air quality impacts at offsite receptor locations due to INEL bus fleet operations, INEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEL site facilities were quantitatively predicted using emission factors and screening-level methodologies developed by the U.S. Environmental Protection Agency. The methodology included the use of a computerized mathematical model, CALINE-3 (Benson 1979), recommended for analysis of highways characterized by uninterrupted traffic flows (EPA 1993a). CALINE-3 is designed to simulate traffic flow conditions and pollutant dispersion from traffic and was used to predict maximum one-hour ambient air concentrations of carbon monoxide and inhalable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters (10 feet) from the edge of the roadway, in accordance with U.S. Environmental Protection Agency guidance.

Receptor locations were selected in accordance with DOE guidance for air permit modeling (DOE-ID 1991), including locations in the City of Idaho Falls near the central bus garage, along streets that are heavily travelled by INEL buses, and at selected ambient air locations along major routes to the INEL site. The receptor locations on the INEL site are accessible to the public and where INEL traffic is heaviest. These locations include the INEL site main entrances on U.S. Highway 20, the northern access point to Test Area North from State Highway 33, and other points where public highways carrying INEL site traffic cross site boundaries.

Modeling was conducted for the year 1993 to quantify the current impact due to INEL buses and traffic and projected impact of projects that would be constructed before 1995, together with the projected impacts of alternatives. Additional details on the methodology used for mobile sources are presented in E&E (1993).

F-3.5 Data Analysis

The previous subsections describe the methodology used to perform and the technical basis for the air analysis for this Environmental Impact Statement. The results of these analyses are summarized in Sections 4.7 and 5.7 (Air Resources) of Volume 2 of this Environmental Impact Statement and are not repeated here. Additional details on the analysis, including predicted consequences for various combinations of alternative and waste management options and selected individual projects, are presented in the *Technical Support Document for Air Resources, Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs* (Belanger et al. 1995a).

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SECTION F-4 CONTENTS

TABLES

F-4 HEALTH AND SAFETY

Potential health impacts to the public and workers can arise from a variety of sources under several distinct circumstances. The appropriate methods for evaluating health impacts are somewhat different under each of these conditions. This appendix describes the methods used and presents the key data required for evaluating the health effect impacts reported in this EIS.

The methods presented here are organized under three broad categories: (a) health impacts from effluent releases, (b) normal workplace hazards, and (c) chemical releases under accident conditions. The first category includes effluent releases of radioactivity, carcinogenic chemicals, and chemical toxins to air and water, and addresses health effects to both the public and workers. The second category includes radiological and nonradiological hazards to INEL workers in the normal conduct of their jobs. The final category of methods addresses the special case of toxic chemicals released under accident conditions.

F-4.1 Background Information

This section provides essential background information on health effects to INEL workers and the public surrounding the INEL. The information provides a historical perspective on health and safety concerns, and a basis for projecting future impacts to workers from normal occupational hazards.

F-4.1.1 Public Health and Safety

The primary public health and safety concern at the INEL is the potential for exposure of the surrounding public to radioactivity. The principal pathway by which the public may be exposed to radioactivity is through releases to the atmosphere. Radiation doses to members of the public from airborne releases at the INEL are calculated annually by the Radioactive and Environmental Sciences Laboratory using information from the Radioactive Waste Management Information System database (Chew and Mitchell 1988, Hoff et al. 1989, 1990, 1991, and 1992). Table F-4-1 presents the results of these calculations for the five years of site operation from 1987 through 1991. The table indicates that offsite radiation doses to any individual member of the public from normal operations have been

Table F-4-1. Estimated doses to members of the public from Idaho National Engineering Laboratory airborne releases 1987 to 1991.

Year	Maximally exposed individual (millirem)	Principal radionuclides	Percent of dose	Population dose (person-rem)
1987	0.54	Sb-125	96.0	4.5
		I-129	1.1	
		Ar-41	1.0	
1988	0.13	Sb-125	68.0	1.7
		I-129	19.6	
		Ar-41	6.1	
1989	<0.01	Ar-41	59.9	0.04
		Kr-88	12.3	
		Xe-138	11.6	
1990	<0.01	Ar-41	82.2	0.04
		Kr-88	6.3	
		I-129	3.4	
1991	0.02	Ar-41	45.1	0.06
		I-129	40.3	
		Cs-137	4.8	

substantially less than 1 millirem per year over the 5-year period examined. Current regulations limit releases of airborne radioactivity from DOE facilities to no more than 10 millirem per year to any member of the public.

The principal radionuclides contributing to offsite doses reflect the operation of different site facilities. During 1987 and 1988, for example, the fuel dissolution facility at the Idaho Chemical Processing Plant was operating and the antimony-125 releases characteristic of that facility were the largest contributors to offsite dose. The fuel dissolution facility at the Idaho Chemical Processing Plant did not operate during 1989 or 1990. Consequently, offsite doses were smaller and were dominated by releases of argon-41 and other noble gases from the Advanced Test Reactor. In 1991, the New Waste Calcining Facility operated for part of the year and contributed a small amount of other radionuclides such as iodine-129 and cesium-137.

Collective doses to the population residing in the vicinity of the INEL are also estimated annually by the Radioactive and Environmental Sciences Laboratory (Chew and Mitchell 1988, Hoff et al. 1989, 1990, 1991, and 1992). These calculations sum the potential radiation doses to the population of approximately 121,000 people living within 80 kilometers (50 miles) of the INEL facilities. As indicated in Table F-4-1, site operations have resulted in an offsite collective dose of 6.3 person-rem for a five-year period. The average for the period 1987 through 1991 was about 1.3 person-rem.

Past activities at the INEL have resulted in larger doses to the public than current operations. Estimates of these doses have been made for all years of INEL operation before 1989 (DOE-ID 1991). The largest doses were during the late 1950s and mid-1960s and ranged between 1 and 10 millirem. The organ receiving the largest dose has been the thyroid during years when large quantities of radioactive iodine were released, or the skin during years when releases were dominated by radioactive noble gases. Since the early 1970s, there has been a steady decline in offsite doses as controls on emissions have improved and various reactor programs at the INEL have been completed.

To put the offsite doses from the INEL into perspective, it is useful to compare them to the levels of natural background radiation in the vicinity of the INEL. Table F-4-2 summarizes the estimated annual dose equivalent from natural sources for an individual living on the Snake River Plain (DOE-ID 1991).

Doses from airborne releases over the operating history of the INEL site have been small compared to doses from sources of natural background radiation, a maximum of 3 percent of the natural background effective dose equivalent in 1956. Since the early 1970s, doses from airborne releases have been small, even when compared to the variability in natural background.

F-4.1.2 Occupational Health and Safety

F-4.1.2.1 Radiological Hazards. Because of the nature of the work done at the INEL site, occupational radiation exposures above background levels will inevitably occur for some workers. The radiation protection programs required by regulations and DOE orders are designed to ensure that no worker receives doses larger than the applicable limits and that worker doses are kept as low as reasonably achievable. In addition, Federal regulations and DOE orders require that records of occupational exposure are maintained. Reports of radiation doses are provided annually to each worker. Summary reports are also provided to DOE and published periodically.

Table F-4-2. Estimated natural background radiation dose for the Snake River Plain.[a]

Source	Annual effective dose equivalent (millirem)
External	
Terrestrial	75
Cosmic	39
Subtotal	114
Internal	
K-40 and others	40
Inbaled nuclides[b]	200
Subtotal	240
Total	354

a. From: Idabo National Engineering Laboratory Historical Dose Evaluation, Volume 1, DOE/ID-12119 (DOE-ID 1991).

b. The dose from inbaled radionuclides is due primarily to short-lived decay products from radon and varies widely with geographic location. The value shown represents the United States population average.

Workers at the INEL site may be exposed either internally or externally to radiation. Internal exposures arise when radioactive materials are deposited in the body through inhalation, ingestion, or absorption through intact skin or wounds in the skin. External exposures in the workplace are those received from radiation-emitting sources outside the body.

All workers in areas with a potential for airborne or surface contamination are monitored routinely for internal radioactivity using bioassay techniques. Whole body counting is used to detect internally deposited gamma emitters. Urinalysis and fecal analysis are used to detect beta and alpha emitters that cannot be measured adequately using whole body counting, for instance, monitoring for uranium and plutonium uptakes. Radiation workers participate in the bioassay program if there is a potential that they could receive intakes resulting in a dose of 100 millirem or more in the 50-year period following an intake. If routine bioassay results indicate measurable intakes, workers participate in follow-up bioassay programs to determine the date and source of the intake and to estimate the radiation dose received. Internal radiation doses constitute a small fraction of the occupational dose at the INEL site. All cases of measurable internal radioactivity are investigated thoroughly to determine the cause and to assess the potential for additional internal dose to the workforce.

External radiation dose is the largest fraction of the occupational dose received at the INEL site. There are many more facilities at the INEL site with a potential for external exposure to workers than there are with a potential for internal exposure. Facilities with a potential for external radiation exposure are those containing large quantities of gamma-emitting radioactive materials. Certain devices, such as accelerators, x-ray machines, and nuclear reactors, can produce external radiation exposure while operating, whether or not radioactive materials are present. In addition, there is a potential for external radiation dose during any maintenance, construction, environmental remediation, or decontamination activities at facilities where gamma-emitting radioactive materials have been used in the past.

Personnel that could potentially receive annual external radiation exposures greater than 100 millirem are assigned a thermoluminescent dosimeter that must be worn at all times during work on the INEL site. The dosimeter measures the amount and type of external radiation dose the worker receives.

All INEL site facilities are required to keep records of the individual exposure of each employee. For normal INEL site operations, the summary establishes a baseline for comparing the potential impacts of alternatives considered in this EIS. Reported doses resulting from normal INEL site operations for a recent five-year period of site operation are representative of current INEL site operations, and are used here as a baseline for routine operational activities. Table F-4-3 shows the collective dose equivalent measured on personnel dosimeters for each of the last five years of data. The number of individuals monitored for radiation exposure over the last five years has averaged about 6,000. Of these, an average of about 31 percent receive measurable radiation doses. The average dose equivalent of those individuals with measurable exposure ranges from about 130 to 180 millirem. The average dose equivalent of all monitored individuals ranges from 27 to 60 millirem.

The average radiation dose rate to all INEL site workers over this five-year period was 27 millirem per year. This is the dose rate that is used to project doses to workers at the INEL site under each of the alternatives of this EIS.

Table F-4-3. Total collective dose equivalent for Idaho National Engineering Laboratory site workers from normal operations.

Year	Number of individuals monitored	Number of individuals with measurable exposure	Collective dose equivalent[a] (person-rem)	Average dose equivalent[b] per individual for all monitored individuals (millirem)	Average dose equivalent[b] per individual with measurable exposure (millirem)
1987	5,588	1,831	290	52	158
1988	5,799	2,201	288	50	131
1989	5,883	2,118	351	60	166
1990	6,381	2,138	381	60	178
1991	6,646	1,224	182	27	149
Five-year average	6,060	1,902	298	49	156

a. Collective Dose Equivalent: The sum of the dose equivalents to all members of a group of interest. For example, if 100 workers each received a dose equivalent of 0.1 rem, the collective dose equivalent would be 10 person-rem (100 persons × 0.1 rem).

b. Average Dose Equivalent: The average dose to members of a group of interest. For example, if the collective dose equivalent for a group of 100 workers was 1 person-rem, then the average dose equivalent for each member of the group would be 0.01 rem (1 person-rem ÷ 100 persons).

F-4.1.2.2 Workplace Hazards Other Than Radiation. There is widespread diversity of the types and quantities of chemicals used at the various INEL facilities. Consequently, industrial hygiene monitoring and sampling programs are designed to ensure that personal and/or area monitoring strategy is directed toward the chemicals that pose the greater risks and hazards. All aspects of the toxic chemical control program are designed to reduce risks and maintain potential exposures to hazards as low as reasonably achievable. The sampling and monitoring programs at the INEL provide data to enable assessments for characterizing the more common materials and toxic chemicals, such as asbestos, lead, cadmium, beryllium, formaldehyde, benzene, hydrogen chloride, nitric acid, sulfuric acid, hydrogen fluoride, sulfur dioxide, welding by-products, coal dust from coal-fired generation plants, solvents, NO_X, and other potentially hazardous substances. The more common physical agents encountered include noise, heat stress, nonionizing radiation sources, and ergonomic factors. Use of chemical carcinogens at the INEL is extremely limited and occurs only when absolutely required for a specific activity, and no other practical substitute can be found. When used, every effort is made to minimize the potential of exposure to as low as reasonably achievable levels and to limit the size of and access to the work area.

The primary source of information on nonradioactive hazards to the workers at the INEL are reports of occupational injuries. Data for DOE contractors were obtained from the EG&G Safety Performance Measurements System to provide comparative statistics for total recordable injury and illness cases, lost workday cases, and lost workdays for 1987 to 1991 (EG&G Idabo 1993a, b). There were 1,337 total recordable injury/illness cases experienced at the INEL from 1987 to 1991 by an average of 8,385 employees that worked a total of 79,654,000 hours (EG&G Idabo 1993d). The total recordable injury/illness cases rate of 3.4 for the INEL was slightly above the DOE-wide rate of 2.9, but less than half the Bureau of Labor Statistics rate of 8.5.

Of the 1,337 total recordable injury/illness cases at the INEL from 1987 to 1991, 668 (50 percent) of the cases resulted in lost workdays or lost workdays restricted (EG&G Idabo 1993c). The INEL lost workdays rate of 1.7 was slightly higher than the DOE-wide rate of 1.4, but less than half the Bureau of Labor Statistics rate of 4.0. A total of 8,497 lost workdays resulted from the 668 lost workdays cases. The INEL lost workdays rate of 21.3 is nearly half that of the DOE-wide rate of 36.0, and almost four times better than the Bureau of Labor Statistics rate of 79.1.

Of the 1,337 total recordable injury/illness cases at the INEL, 114 cases were classified as occupational illnesses falling into the following six categories: (a) 34 cases were skin diseases or disorders, (b) 55 cases were repeated trauma disorders, (c) 13 cases were respiratory condition because of toxic agents, (d) 4 cases were disorders caused from physical agents, (e) 2 cases were dust diseases of the lungs, and (f) 6 cases were from all other illnesses (EG&G Idaho 1993a).

Other measures of occupational hazards include motor vehicle accidents and property loss due to fire and other causes. The average number of government vehicles driven at the INEL was 805 for the five-year period of 1987 to 1991 (EGG 1993d). The INEL experienced 90 recordable motor vehicle accidents (over $500 loss) during 64,711,000 miles of travel (EG&G Idaho 1993d). The resultant accident rate of 1.4 compares very favorably with the DOE-wide rates for the same five-year period of 2.4, and is nearly nine times better than the National Safety Council five-year rate.

The INEL Motor Vehicle accident loss was a total of $202,000 for the 1987 to 1991 period (EG&G Idaho 1993d). An average loss rate of $3.11 per 1,000 miles traveled is only 65 percent of the DOE-wide average loss of $4.76 per 1,000 miles of travel (EG&G Idaho 1993d) and four times less than the National Safety Council rate of $12.47 for the same five-year period. The INEL loss rate for each of the five years is considerably below the DOE-wide average loss.

The INEL fire loss experience for the five-year period from 1987 to 1991 shows only two reportable losses over $1,000. A loss in 1989 resulted in $25,000 damage and one in 1991 totaled $63,000 in damage loss. The INEL experienced a total of 20 reportable non-fire property damage losses (over $1,000) from 1987 to 1991. The total value of the loss from these 20 cases was $1,292,000. In 1988, seven cases accounted for a loss of $1,026,000, which represents 80 percent of the five-year total.

F-4.2 Health Effects Methodology

This section describes the methods used to evaluate (a) potential adverse health effects to workers and members of the public from releases of radioactive and nonradioactive effluents to the environment under routine operating conditions, and (b) hazards to workers from normal workplace conditions. The scope of the health effects evaluation in the EIS follows the recommendations specified by the DOE Office of National Environmental Policy Act Oversight in their *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DOE 1993a).

F-4.2.1 Health Effects from Effluent Releases to the Environment

In general, health impacts are estimated for releases of radioactive and nonradioactive contaminants to air and groundwater. However, the "sliding scale" concept has been applied to the evaluation of health effects by considering the relative importance of specific contaminants and exposure pathways. For example, there are no permanent surface waters on the INEL site and no surface drainage from the INEL to offsite locations. Therefore, this EIS does not include a detailed analysis of this exposure pathway.

For routine or accidental releases from facilities, the following three categories of exposed individuals are addressed as a minimum: (a) maximally exposed individual located at the INEL site boundary, (b) population within 80 kilometers (50 miles) of the operating facilities, and (c) nearby workers. For routine releases, the population within an 80-kilometer (50-mile) radius was evaluated. For releases from accidents, the most populous section of a 16-point compass section was evaluated. In special circumstances, a fourth receptor location may be appropriate for evaluating accidental releases at individual sites. For example, at the INEL, where the site is traversed by public highways, it is possible that a member of the public on or near the highway could be affected by some potential accidents.

For offsite transportation accidents, four categories of exposed individuals are addressed: (a) maximally exposed individual located 100 meters downwind of the accident scene, (b) urban population density (3,861 persons per square kilometer), (c) suburban population density (719 persons per square kilometer), and (d) rural population density (6 persons per square kilometer). Onsite transportation accidents are treated similar to facility accidents. However, onsite transportation accidents may be treated using the methods described for offsite transportation accidents where deemed appropriate on a case-by-case basis. Impacts from transportation are presented in Section 5.11 of this EIS.

Health effects from radioactive and nonradioactive contaminants are reported separately and are not summed. Adding these impacts can be misleading because of the differences in environmental modeling methodology, health effect end-point, and basis for the risk factors used. Similarly, where distinctly different types of effects are reported for chemical exposures (that is, carcinogenic and noncarcinogenic) they are reported separately and not summed.

F-4.2.1.1 Radiological Health Effects from Effluent Releases. Estimation of health effects from radionuclides are based on the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991). The risk factors from Table F-4-4 were used.

In the interests of clear and consistent presentation and to allow ready comparison with health impacts from other sources, such as chemical carcinogens, the measure of impact used for evaluation of potential radiation exposures in this EIS is risk of fatal cancers. Population effects are reported as

Table F-4-4. Risk of fatal cancers and other health effects from exposure to radiation.[a]

	Fatal cancer	Nonfatal cancer	Genetic effects	Total detriment
Workers	4.0×10^{-4}	8.0×10^{-5}	8.0×10^{-5}	5.6×10^{-4}
General public	5.0×10^{-4}	1.0×10^{-4}	1.3×10^{-4}	7.3×10^{-4}

a. Units when applied to an individual are "lifetime probability of cancer per rem of radiation dose". Units when applied to a population of individuals are "excess number of cancers per person-rem of radiation dose". Genetic effects apply to populations, not individuals.

collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of fatal cancer. Estimates of health effects from routine and accidental radiation exposures are based on the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991). The risk factors to be used in this EIS are consistent with those recommended by the DOE Office of National Environmental Policy Act Oversight and contained in the *Preamble to Standards for Protection Against Radiation* (FR 1991) .

The risk factors in Table F-4-4 are applicable for all cases involving low individual doses (<20 rem) and low individual dose rates (< 10 rem/hour). At higher doses, near-term effects other than cancer are the primary concern. Those unusual accident situations that may result in high radiation doses to individuals are considered as special cases.

As indicated in Table F-4-4, the risk per unit of radiation exposure is slightly smaller for workers than for the general public. This is because the working population is made up of a narrow age group that excludes infants, children, and the elderly.

Other health impacts could result from environmental and occupational levels of exposure to radiation. Additional health effects that contribute to total impacts include nonfatal cancers in the exposed population and genetic effects in subsequent generations. The combined incidence of all adverse health effects determines the "total detriment."

Risk factors have been provided in Table F-4-4 so that anyone desiring to calculate other impacts and total detriment from the fatal cancer risk estimates reported in this EIS may do so. As an example, total detriment from radiation exposures for a given case can be obtained by multiplying a latent cancer fatality estimate by a factor of 1.4 for workers and by 1.46 for the general public. In all cases, risks expressed as total detriment are only slightly larger than the fatal cancer risk.

For the calculation of health effects from exposure to airborne radionuclides, the actual or modeled exposure (in either rem for individuals or person-rem for populations) provided in Sections 4.7 and 5.7 of this EIS is multiplied by the appropriate risk factor from Table F-4-4 . The measure of impact used for evaluation of potential radiation exposures in this EIS is risk of fatal cancers. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of fatal cancer.

The concentration of radionuclides in water is reported in Sections 4.8 and 5.8 of this EIS. To calculate health effects from radionuclide concentrations in water, the total quantity of radionuclide ingested must be converted to an effective dose equivalent and then the appropriate risk factor applied. This is accomplished by multiplying the concentration of radionuclide in the drinking water (microcurie per liter) by the consumption rate (liter per day) and by the consumption period (days) to obtain the quantity of radionuclide ingested. This ingested quantity (microcurie) is then multiplied by the appropriate exposure to dose conversion factor (millirem per microcurie) to obtain the dose which is then multiplied by the appropriate risk factor.

Exposure to dose conversion factors were obtained from Federal Guidance Report No. 11 *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (EPA 1988). These dose conversion factors were used to convert a quantity of intake to an effective dose equivalent for the subsequent application of the appropriate risk factor obtained in ICRP (1991). The dose-to-conversion factors used in this EIS have been provided in Table F-4-5.

F-4.2.1.2 Nonradiological Health Effects from Effluent Releases. For public exposures data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose-response values approved by the U.S. Environmental Protection Agency. These values include slope factors and unit risks for evaluating cancer risks, reference doses, and reference concentrations for evaluating exposure to noncarcinogens, and primary National Ambient Air Quality

Table F-4-5. Exposure to dose conversion factors.

Isotope	Exposure to dose conversion factor (millirem per microcurie)
Tritium	6.4×10^{-2}
Iodine-129	2.76×10^{2}
Strontium-90	1.42×10^{2}

Standards (CFR 1977) for evaluating criteria pollutants. When possible, all values were taken from the Integrated Risk Information System database (EPA 1994). If the information was not available in the Integrated Risk Information System database, other sources were used, primarily the U.S. Environmental Protection Agency's Health Effects Assessment Summary Tables (EPA 1993) and the National Ambient Air Quality Standards (CFR 1977).

For occupational exposures, data were obtained from occupational standards. These include eight-hour time-weighted averages established by either the American Conference of Governmental Industrial Hygienists (ACGIH 1993) or Occupational Safety and Health Agency and proposed standards for carcinogens from new sources under State of Idaho Rules for the Control of Air Pollution in the State of Idaho (IDHW 1994).

Per U.S. Environmental Protection Agency's guidance, each contaminant was categorized as carcinogenic or noncarcinogenic. Exposures to contaminants were then evaluated for potential health effects. The method used was dependent on whether the exposure was to the public or to a worker and whether the contaminant was classified as a carcinogen or a noncarcinogen. Health effects were reported separately and were not summed where distinctly different types of effects were reported for chemical exposures (that is, carcinogenic and noncarcinogenic).

The organization of the following sections is based on the difference in evaluation methods used for nonradiological health effects to the public and to workers.

F-4.2.1.2.1 Nonradiological Health Effects to the Public—For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (that is, incremental or excess individual lifetime cancer risk).

Values for slope factors and unit risk were taken from the Integrated Risk Information System database (EPA 1994). If the information was not available in the Integrated Risk Information System database, other sources were used, primarily the Health Effects Assessment Summary Tables (EPA 1993).

For carcinogenicity, the probability of an individual developing cancer over a lifetime is estimated by multiplying the slope factor (milligram per kilogram-day) for the substance by the chronic 70-year average) daily intake. Hence, the slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. This risk is considered a conservative estimate because the upper bound estimate for the slope factor is used with the "true" risk likely being less.

The unit risk that is calculated from the slope factor is an estimate in terms of either risk per microgram per liter drinking water, or risk per microgram per cubic meter air concentration. In assessing the carcinogenic potential of a chemical, the Human Health Assessment Group of the Environmental Protection Agency classifies the chemical into one of the following groups, according to the weight of evidence from epidemiologic and animal studies:

- Group A—Human Carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B—Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
- Group C—Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)
- Group D—Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)
- Group E—Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

Quantitative carcinogenic risk assessments are performed for chemicals in Groups A and B, and on a case-by-case basis for chemicals in Group C. Cancer slope factors [formerly called cancer potency factors in the Superfund Public Health Evaluation Manual (EPA 1989)] are estimated through the use of mathematical extrapolation models, most commonly the linearized multistage model, for estimating the largest possible linear slope (within the 95 percent confidence limit) at a low extrapolated dose that is consistent with the data. The slope factor or risk is characterized as an upperbound estimate, that is, the true risk to humans, while not identifiable, is not likely to exceed the upper-bound estimate and in fact may be lower.

Unit risk estimates for inhalation and oral exposure can be calculated by dividing the appropriate slope factor by 70 kilograms and multiplying by the inhalation rate (20 cubic meters per day) or the water consumption rate (2 liters per day), respectively, for risk associated with unit concentration in air or water. Hence,

$$\text{risk per } \mu g/m^3 \text{ (air)} = \text{(risk per mg/kg/day)} \times 1/70 \text{ kg} \times 20 \text{ m}^3\text{/day} \times 10^{-3} \text{ (mg/}\mu g)$$

$$\text{risk per } \mu g/L \text{ (water)} = \text{(risk per mg/kg/day)} \times 1/70 \text{ kg} \times 2 \text{ L/day} \times 10^{-3} \text{ (mg/}\mu g).$$

Ingestion and inhalation slope factors are best estimates (that is, median or 50th percentile values) of the age-averaged, lifetime excess cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk per picocurie or risk per becquerel.

In the interest of simplicity, and to ensure a bounding assessment, all U.S. Environmental Protection Agency weight-of-evidence classes were pooled and Class C (those with equivocal evidence of carcinogenicity) were included with Classes A and B.

Noncarcinogenic and criteria pollutant health effects are presented using the method described in the *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (EPA 1989). This approach presents noncarcinogenic effects in terms of a hazard quotient, which is the ratio between the calculated concentrations in air or drinking water and the reference dose or reference concentration, respectively. Doses or concentrations for each chemical and exposure pathway are compared with the route-specific reference dose or reference concentration. If the hazard index (the summed hazard quotients) for all chemicals and pathways exceeds one, the potential may exist for noncarcinogenic health risks. If the hazard quotient is less than one, then no adverse health effects are expected. In situations where simultaneous exposure to maximum baseline chemical concentrations is not feasible, the hazard quotients are reported separately and are not summed.

For criteria pollutants (ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead) that are regulated through the National Ambient Air Quality Standards, the potential for health effects was based on a hazard quotient given by the ratio of calculated air concentration to the appropriate regulatory limit. Because the primary National Ambient Air Quality Standards (CFR 1977) and the inhalation reference concentration serve essentially the same function, and the primary National Ambient Air Quality Standards have extensive databases rigorously reviewed, the primary National Ambient Air Quality Standards with annual averaging times was used *in lieu* of an inhalation reference concentration. Primary standards are designed to protect public welfare.

The measures used to describe the potential for noncarcinogenic toxicity to occur in an individual are not expressed as the probability of an individual suffering an adverse effect. Instead, the potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (for example, lifetime) with a reference dose derived from a similar exposure period. This ratio is called a hazard quotient and is described below.

Noncancer Hazard Quotient = E/RfC

where:

E = exposure level (or intake)

RfC = reference concentration

E and RfC are expressed in the same units and represent the same exposure period (that is, chronic, subchronic, or shorter term).

The noncancer hazard quotient assumes that there is a level of exposure (that is, reference concentration) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) exceeds this threshold (that is, if E/RfC exceeds unity), there may be concern for potential noncancer effects. As a rule, the greater the value of E/RfC above unity, the greater the level of concern. Be sure, however, not to interpret ratios of E/RfC as statistical probabilities; a ratio of 0.001 does not mean that there is a 1 in 1,000 chance of the effect occurring. Further, it is important to emphasize that the level of concern does not increase linearly as the reference dose is approached or exceeded because reference concentrations do not have equal accuracy or precision and are not based on the same severity of toxic effects. Thus, the slopes of the dose-response curve in excess of the reference concentration can range widely depending on the substance.

Where appropriate, to assess the overall potential for offsite (public) noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach was used following the Environmental Protection Agency's *Guidelines for Health Risk Assessment of Chemical Mixtures* (FR 1986). This approach assumes that simultaneous subthreshold exposure to several chemicals could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to acceptable exposures. The hazard index is equal to the sum of the hazard quotients, as described in the box below, where exposure level and the reference concentration represent the same exposure period (for example, subchronic, chronic, or shorter-term). When the hazard index exceeds unity, there may be concern for potential health effects. While any single chemical with an exposure level greater than the toxicity value will cause the hazard index to exceed unity, for multiple chemical exposures, the hazard index can also exceed unity even if no single chemical exposure exceeds its reference concentration.

$$\text{Noncancer Hazard Index} = E_1/RfC_1 + E_2/RfC_2 + \ldots + E_i/RfC_i$$

where:

E_i = exposure level (or intake) for the i^{th} toxicant

RfC_i = reference concentration for the i^{th} toxicant

E and RfC are expressed in the same units and represent the same exposure period (that is, chronic, subchronic, or shorter-term).

F-4.2.1.2.2 Nonradiological Health Effects to Workers—The primary difference between health effects evaluation of nonradiological exposures to workers and to the public is due to exposure duration. For the public, exposure is assumed to occur, at the given concentration, for the individual's lifetime (70 years). For the worker, exposure occurs only in the workplace and is, therefore, of a limited duration.

The potential for occupational health effects from exposure to all chemical contaminants is evaluated using the method outlined for public exposures to noncarcinogens, with the exception that all occupational concentrations were compared with the applicable occupational standards. The hazard quotient for occupational exposure then becomes the ratio of the chemical concentration to the occupational standard.

Table F-4-6 provides the appropriate reference concentrations, unit risk factors, National Ambient Air Quality Standards, and occupational standards for evaluating exposure to chemicals in air. To estimate the potential for health effects, these values were applied to the air emission concentrations given in Sections 4.7 and 5.7 of Volume 2, of this EIS. Note that all values presented in this table were obtained from the reference published as of January 1, 1994.

F-4.2.1.3 Additional Assumptions. In addition to the values reported in Tables F-4-4 through F-4-6, the following assumptions were made. Where modeled plume concentrations are predicted to impact site drinking water, the following assumptions were made:

- The facility worker consumes 1 liter of water (one-half of the total daily consumption) from a contaminated onsite well.

- Consumption of the contaminated water is assumed to occur for a sample interval (a sample interval is the time between samples plus two weeks). The additional two weeks is used to allow sufficient time for the sample to be analyzed and the results of the analysis returned to the appropriate water control personnel.

- All workers at the facility are assumed to obtain water from the same water supply.

- The level of drinking water contamination is equal to the modeled groundwater plume concentration (no allowance is made for treatment).

Table F-4-6. Chemical contaminant risk evaluation factors (airborne).[a]

Carcinogens	Occupational exposure limit ($\mu g/m^3$)[b]	Unit risk ($\mu g/m^3$)
Arsenic	1.0×10^1	4.3×10^{-3}
Asbestos	3.0×10^{0}[c]	2.3×10^{-1} (fiber/mL)
Benzene	3.0×10^3	8.3×10^{-6}
Beryllium	2.0×10^0	2.4×10^{-3}
Cadmium	5.0×10^0	1.8×10^{-3}
Carbon tetrachloride	1.3×10^4	1.5×10^{-5}
Chloroform	9.8×10^3	2.3×10^{-5}
Formaldehyde	3.7×10^2	1.3×10^{-5}
Hexavalent chromium	5.0×10^1	1.2×10^{-2}
Methylene chloride	1.7×10^5	4.7×10^{-7}
Nickel	1.0×10^2	2.4×10^{-4}
Perchloroethylene	1.7×10^5	4.8×10^{-7}
Trichloroethylene	2.7×10^5	1.7×10^{-6}

Noncarcinogens	Occupational exposure limit ($\mu g/m^3$)[b]	Chronic reference concentration ($\mu g/m^3$)
Ammonia	1.7×10^4	1.0×10^2 (subchronic)
Freon	7.6×10^6	3.0×10^4
Hydrochloric acid	7.0×10^3	7.0
Hydrofluoric acid	2.6×10^3	2.6×10^3
Lithium	2.5×10^1	None Available
Mercury	5.0×10^1	3.0×10^{-1}
Methyl isobutyl ketone (Hexone)	2.1×10^5	80
Nitric acid	5.0×10^3	50 (AAC)
Sulfuric acid	1.0×10^3	70 (AAC)
Tributyl phosphate	2.2×10^3	2.2×10^3
Trivalent chromium	5.0×10^2	5 (AAC)[d]

Criteria pollutants[e]	Primary standards	Average time
Carbon monoxide	10 mg/m^3	8-hours[f]
Lead	1.5 $\mu g/m^3$	quarterly
Nitrogen dioxide	100 $\mu g/m^3$	annual
Particulate matter	50 $\mu g/m^3$	annual[g]
Sulfur dioxide	80 $\mu g/m^3$	annual

a. All values presented in this table were obtained from the most recent data as of January 1, 1994.

b. Occupational exposure limits are 8-hour, time-weighted averages established by either the American Conference of Government Industrial Hygienists (ACGIH) or Occupational Safety and Health Administration (OSHA); the lower of the two is used.

c. Value reported for asbestos standard is mass equivalent of most restrictive National Institute of Occupational Health and Safety standard of 0.1 fibers per cubic centimeter.

d. AAC = Acceptable Air Concentration.

e. Criteria pollutant, from the National Ambient Air Quality Standards (NAAQS); EPA HEAST Table A-V-1.

f. Not to be exceed more than one per year.

g. The standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 $\mu g/m^3$.

- The water supply is assumed to be isolated from human consumption at the time sample results are obtained.

Where actual facility drinking water data are used, the following assumptions are made:

- The facility worker consumes 1 liter of water (one-half of the total daily consumption) from the contaminated drinking water distribution system.

- Consumption of the contaminated water occurs 5 days per week for 50 years.

Offsite health effects were calculated assuming:

- The individual would have access to the highest modeled or measured offsite contaminant concentration.

- The individual's entire water consumption would be from the contaminated water supply.

- The consumption would occur for 70 years.

F-4.2.2 Hazards to Workers from Normal Workplace Conditions

The primary impacts to workers at the INEL are not a result of effluent releases, but arise from occupational exposure to radioactivity and other workplace hazards. This section describes the methods used to evaluate these occupational hazards.

F-4.2.2.1 Radiological Exposure and Health Effects. The activities to be performed by workers under each of the alternatives are similar to those currently performed at each site. Therefore, the potential hazards encountered in the workplace will be similar to those that currently exist. Further, these hazards will be controlled by occupational and radiological safety programs operating under the same regulatory standards and limits that currently apply at DOE facilities. For these reasons, the average collective radiation dose to the INEL workforce is anticipated to be proportional to the number of workers employed under each alternative.

The average annual dose rate for INEL workers was derived from the measured doses reported over the period 1987 to 1991, as presented in Table F-4-3. The value used for projecting doses to the INEL workforce is 27 millirem per worker per year. The number of workers under each alternative is based on the values reported in this Appendix F, Section F-1, Socioeconomics.

F-4.2.2.2 Workplace Hazards Other than Radiation. The measures of impact for workplace hazards used in this EIS are (a) total reportable injuries and illness, and (h) fatalities in the workforce. Injury and fatality rates for construction workers are considered separately because of the relatively more hazardous nature of construction work. Table F-4-7 gives the rates for reportable injury and illness and for workplace fatalities for DOE and its contractors. The rates for DOE construction workers include both categories reported by DOE, that is, direct DOE contractors (cost contractors) and their subcontractors (lump contractors). These rates are applied to the estimated workforce under each alternative to evaluate potential occupational health effects. The number of workers under each alternative is based on the values reported in this Appendix F, Section F-1, Socioeconomics.

The average rates for private industry in the United States are also provided for perspective. While the reporting practices of the DOE and the National Safety Council are not identical, they are similar enough to provide a good basis of comparison between DOE and private industry.

F-4.2.3 Accidents

For evaluation of accident scenarios, health effects from exposure to radiation are evaluated using the methodology outlined in Section F-4.2.1.1. However, due to acute exposure conditions under accident scenarios, it is inappropriate to apply either occupational or public standards to chemical releases. Therefore, the following methods have been used to evaluate chemical concentrations under accident scenarios.

F-4.2.3.1 Nonradioactive Releases from Accidents. For accident conditions, possible impacts to human health are assessed by comparing the airborne concentrations of each substance at specified downwind locations to standard accident exposure guidelines for chemical toxicity.

Table F-4-7. Average occupational injury/illness and fatality rates at the Idaho National Engineering Laboratory.[a]

	All labor categories		Construction workers	
	Total injury/illness	Fatalities	Total injury/illness	Fatalities
DOE and contractors[b]	3.2	0.0032	6.2	0.011
Private industry[c]	8.4	0.0097	13	0.034

a. All incidence rates are given per 100 worker-years.
b. 1988-1992 averages (DOE 1993b).
c. 1983-1992 averages (NSC 1993).

Where available, Emergency Response Planning Guideline values are used for this comparison (Homann 1988). The Emergency Response Planning Guideline values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects. The Emergency Response Planning Guideline values are specific for each substance, and are derived for each of three general severity levels:

- Exposure to concentrations greater than Emergency Response Planning Guideline-1 values results in an unacceptable likelihood that one would experience mild transient adverse health effects, or perception of a clearly defined objectionable odor.

- Exposure to concentrations greater than Emergency Response Planning Guideline-2 values results in an unacceptable likelihood that one would experience or develop irreversible or other serious health effects, or symptoms that could impair one's ability to take protective action.

- Exposure to concentrations greater than Emergency Response Planning Guideline-3 values results in an unacceptable likelihood that one would experience or develop life-threatening health effects.

Where Emergency Response Planning Guideline values have not been derived for a toxic substance, other chemical toxicity values are substituted, as follows:

- For Emergency Response Planning Guideline-1, Threshold Limit Value, Time-Weighted Average values (ACGIH 1993) are substituted: The Time-Weighted Average is the time-weighted average concentration for a normal eight-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effects.

- For Emergency Response Planning Guideline-2, Level of Concern values (equal to 0.1 of Immediately Dangerous to Life or Health) are substituted: Level of Concern is defined as the concentration of a hazardous substance in air, above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (EPA/FEMA/DOT 1987).

- For Emergency Response Planning Guideline-3, Immediately Dangerous to Life or Health values are substituted: Immediately Dangerous to Life or Health is defined as the maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any effects which would impair the ability to escape or irreversible side effects (NIOSH 1990).

Possible health effects associated with exceeding an Emergency Response Planning Guideline-2 or -3 are specific for each substance of concern, and must be characterized in that context. When concentrations are found to exceed an Emergency Response Planning Guideline or substitute value, the specific toxicological effects for the chemicals of concern are considered in describing possible health effects associated with exceeding a threshold value.

Emergency Response Planning Guideline values are based upon a one-hour exposure of a member of the general population. In this EIS, exposures resulting from the release of toxic chemicals during an accident condition were postulated to occur over a period of 1 hour or less to allow for a direct comparison to the Emergency Response Planning Guideline values. This approach provides an additional element of conservatism in the evaluation of accidents with releases that last much less than one hour.

F-4.3 Data Analysis

The previous subsections describe the methodology used in evaluating the potential health impacts to the public and workers for this EIS. The results of these analyses are summarized in Sections 4.12 and 5.12 (Health and Safety) of this EIS and are not repeated here.

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SECTION F-5 CONTENTS

TABLES

F-5 FACILITY ACCIDENTS

F-5.1 Introduction

Section F-5 provides background information for Volume 2, Section 5.14 (facility accidents at the INEL associated with environmental restoration and waste management operations as well as the receipt, storage, and handling of spent nuclear fuel). For this EIS, the likelihood of accidents has been categorized into events that are abnormal (for example, minor spills), design basis (accidents a facility was designed to withstand), and beyond design basis (accidents a facility is not designed to withstand). This section presents analyzed consequences of facility accidents in these categories for a member of the public at the nearest INEL site boundary, for the collective population within 80 kilometers (50 miles), and for workers.

An accident is an unplanned sequence of events that results in undesirable consequences. Initiating events for accidents were defined in three broad categories: external initiators, internal initiators, and natural phenomena initiators. All types of initiators were defined in terms of those events that cause or may lead to a release of materials and energy by failure or bypass of confinement.

To obtain a perspective on potential accidents involving spent nuclear fuel and waste management and environmental restoration operations at the INEL, the approach was as follows:

- Summarize historical accidents at the INEL
- Review previous accident analyses for spent nuclear fuel, waste management, and environmental restoration activities
- Perform an independent analysis of the accidents with the greatest potential consequences.

This section describes the selection of locations or operations for analysis, the process used to identify maximum reasonably foreseeable accident scenarios, the basis for evaluating selected scenarios, and the selection of computer codes and modeling assumptions used to estimate health effects consequences. The analyses of accidents are intended to be conservative in the sense that where uncertainties exist, assumptions that bound the potential for credible environmental consequences are used.

F-5.2 Methodology

F-5.2.1 Accidents with Potential Release of Radioactive Material

Radioactive materials are involved in a wide variety of operations at the INEL, including scientific research and engineering development for both domestic and national defense purposes. In the past four decades, the INEL has been the world's most notable research and development center for testing of nuclear power reactor concepts, their fuels, their stability, and their behavior in accidents, as well as a center for the reprocessing of spent nuclear fuel. Radioactive materials encompass potentially valuable resources, such as spent nuclear fuels and various isotopes, but also include waste products ranging in form from contaminated laboratory equipment and metal filings to contaminated trash and liquids. These resources and wastes present a potential for releases of radioactive materials caused by human error, equipment failure, or severe natural phenomena such as earthquakes.

This section describes the selection of facilities and operations for analysis and discusses the computer codes used in the analysis. The assumptions concerning atmospheric dispersion, scenarios, and generic data used to calculate consequences is presented in Section F-5.3.

F-5.2.1.1 Selection of Facilities and Operations for Radiological Accident Scenarios.

Radiological accident scenarios were selected and classified as described in the following sections.

F-5.2.1.1.1 Selection Process—The accident analysis considered all INEL nonreactor nuclear facilities (accidents at the Naval Reactors Facility are considered in Appendix D of Volume 1). U.S. Department of Energy (DOE) Order 5480.23 (DOE 1994) defines nonreactor nuclear facilities as those with activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. Excluded from the definition are facilities with generation of radioactive emissions (for example, x-ray machines, industrial lasers, radiography sources, or electron microscopes).

After excluding offices and facilities without radioactive materials (that is, considering only nonreactor nuclear facilities), facilities were screened using preexisting "hazard classifications." Contractors operating nonreactor nuclear facilities are required by DOE Order 5480.23 (DOE 1994) and DOE guidance (DOE 1992a) to perform a hazard classification of a facility to assess the consequences of an unmitigated release of radioactive and/or hazardous material in one of the following categories:

- *Category 1.* The hazard analysis shows the potential for significant offsite consequences
- *Category 2.* The hazard analysis shows the potential for significant onsite consequences
- *Category 3.* The hazard analysis shows the potential for only significant localized consequences.

These categories (or the equivalent classifications performed under the previous DOE order) were used as a screening threshold. Category 3 (low) hazard facilities were excluded since accidents in these facilities would be bounded by those in Category 2 (moderate) or Category 1 (high) hazard facilities. Those facilities with a hazard classification of Category 2 or greater were evaluated further. They were ranked on the basis of their total quantities of radioisotopes, their potential and likelihood of an accident occurring, and their relationship with surrounding facilities. Changes in projected inventories by alternative at the various facilities were considered.

F-5.2.1.1.2 Determination of Qualitative Likelihood of "Reasonably Foreseeable" Accidents—The estimated frequency of each postulated accident was based on an identification of the physical basis for the accident and estimates of the frequency or probability of independent events combined with the conditional probability of the dependent events required for the accident to occur. Once the frequency was estimated for each accident, they were classified by a frequency range. Descriptions of the accidents and data obtained from a variety of sources were used to estimate accident frequency. Once an accident frequency was estimated, it was categorized into one of the likelihood ranges described below. In addition, a brief description was developed on the basis of the frequency determination for each accident.

The three frequency ranges chosen, based on the frequency of an accident per facility year, are as follows:

Category	Frequency range (accidents per year)
Abnormal events	frequency $> 1 \times 10^{-3}$
Design basis events	$1 \times 10^{-3} >$ frequency $\geq 1 \times 10^{-6}$
Beyond design basis events	$1 \times 10^{-6} >$ frequency $\geq 1 \times 10^{-7}$

Results of the screening process are given in Section F-5.4.

F-5.2.1.2 Computer Modeling to Estimate Radiation Doses. To determine dose from radioactive material releases using computer codes, factors such as receptor locations and biological uptake parameters, material transport mechanisms, and radionuclide inventory are required as input variables. This section explains these input parameters, notes the degree of conservatism, and describes computer models used to perform dose estimates. Generic input parameters used in the accident analyses are summarized in Section 3.

The Radiological Safety Analysis Computer Program (RSAC-5) (Wenzel 1993) was the computer code chosen for estimating radiation doses resulting from the accidental airborne release of radionuclides. Two other computer codes, ORIGEN2.1 (Croff 1983, RSIC 1991), and Microshield 3.13 (Grove 1988) are used for some accident scenarios to calculate radionuclide inventories as input to RSAC-5.

F-5.2.1.2.1 RSAC-5 Code—The computer code RSAC-5 was developed for the DOE Idaho Operations Office by Westinghouse Idaho Nuclear Co., Inc. (Wenzel 1993) and is in the public domain.

RSAC-5 simulates potential radiation doses to maximally exposed individuals or population groups from accidental airborne releases of radionuclides to the environment. From a specified or RSAC-calculated source term users can calculate the environmental transfer, uptake, and human exposure. Individual doses are determined at specific distances onsite, at the site boundaries, and away from the site via airborne plume immersion, ground surface contamination (shine), inhalation, and ingestion. (The ingestion pathway applies only where food is raised locally and potentially consumed there.) Population doses are the product of individual dose and the number of people in the affected population.

Source Term Calculation. For most accident scenarios, the radioactive source term is calculated separately by the analyst for input to RSAC-5. Alternatively, for accident scenarios involving reactor fuel, the source term can be calculated by RSAC-5 directly. The latter option is useful for calculating fission product inventories. However, activation products and actinide inventories (for example, uranium and plutonium) must be calculated separately and input by the analyst. RSAC-5 includes an option to calculate radioactive decay of the entire radionuclide inventory or selected specific nuclides.

Atmospheric Dispersion Calculations. Because this analysis addresses accidents, doses are calculated for discrete releases of specific quantities of radioactive material.

The RSAC-5 code uses a two-dimensional Gaussian atmospheric-dispersion model to estimate the dispersion of the radioactive-material plume at various distances downwind from the point of release. INEL-specific values of these dispersion coefficients are built into RSAC-5 for calculation of dispersion factors (χ/Qs).

The user has the option of directly entering χ/Q or having the χ/Qs calculated by the code. Other code options for calculating atmospheric transport include plume depletion by wet or dry deposition and building wake effects.

Dose Calculations. As recommended by the International Commission on Radiological Protection (ICRP 1974, 1979), RSAC-5 uses weighting factors for various body organs to calculate a "committed effective dose equivalent" (CEDE) from radioactivity deposited inside the body by inhalation or ingestion.

RSAC-5 calculates an effective dose equivalent (EDE) for the external exposure pathways (immersion in plume, from ground surface contamination) and a 50-year CEDE for the internal exposure pathways (inhalation, ingestion). The sum of the EDE from external pathways and the

CEDE from internal pathways is called the "total effective dose equivalent" (TEDE). The TEDE summation is performed external to RSAC-5.

Doses may be calculated for an individual at a specified receptor location out to 100 kilometers (62 miles) or for a population within a 80-kilometer (50-mile) radius of the point of release. Population doses are determined by calculating an average individual TEDE at 16-kilometer (10-mile) radial intervals of a compass sector and then multiplying by the number of people to whom that average TEDE applies.

F-5.2.1.2.2 ORIGEN2.1: Isotope Generation and Depletion Code—ORIGEN (Croff 1983, RSIC 1991) is a computer code system for calculating the buildup, decay, and processing of radioactive materials (fission products, actinides, and activation products). It is one of two computer codes recommended by the NRC (1977a) for calculating the radioactivity initially present and later produced in an inadvertent nuclear chain reaction in a fuel reprocessing plant.

ORIGEN2.1 was used in accident analyses involving significant contribution of actinides and activation products to the radioactive source term associated with spent fuel and inadvertent nuclear chain reaction accidents. The radioactivity of each such radionuclide (in curies) in the material damaged by the accident, as calculated by ORIGEN2.1, was multiplied by the appropriate release fraction and supplied as input to subsequent RSAC-5 calculations.

F-5.2.1.2.3 Microshield 3.13—Microshield (Grove 1988) is a radiation shielding code developed for analysis of shielding design, container design, and selection of temporary shielding. Another use of Microshield, employed in some of the accident analyses performed for this EIS, is the calculation of source strength on the basis of radiation measurements from a shielded source of known material and dimensions. This calculation is an iterative process of estimating values of the source strength until the measured radiation values are matched by the calculation.

Microshield has solution algorithms for 14 different geometries, including sources configured as points, lines, spheres, disks, cylinders, slabs, and rectangular solids. Microshield 3.13 contains a library of approximately 500 radionuclides. The user selects the nuclides appropriate for the application and enters the activity in curies for each. A later version of Microshield (Version 4) has been issued. The changes from Microshield 3.13 do not affect the validity of the calculations presented in the EIS.

F-5.2.2 Accidents With Potential Release of Hazardous Material

Like radioactive materials, hazardous materials are involved in a variety of operations at the INEL. As a result of these operations, a potential exists for releases of hazardous materials due to human error, failure or malfunctioning of equipment, and severe natural phenomena such as earthquakes.

This section describes the selection of facilities and operations for analysis and discusses the computer codes used in the analysis. The assumptions about weather conditions, atmospheric dispersion, scenarios, and generic data utilized to calculate consequences are presented in Section F-5.3.2.1.

F-5.2.2.1 Selection of Facilities and Operations for Hazardous Material Accident Scenarios.

F-5.2.2.1.1 Selection of Hazardous Material Accident Scenarios—Starting with a compilation of INEL hazardous chemicals (Priestley 1992) used in the preparation of the Superfund Amendments and Reauthorization Act of 1986 (SARA) 112 Report for 1992 (CFR 1993a), a search was made for those chemical quantities that were (a) in excess of 227 kilograms (500 pounds), or (b) in excess of reportable quantities (usually one pound) on the U.S. Environmental Protection Agency (EPA) Title III List of Lists (EPA 1990), which includes hazardous chemicals defined in the following lists:

- SARA Section 302 Extremely Hazardous Substances (CFR 1993a)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hazardous Substances (CFR 1993b)
- SARA Section 313 Hazardous Chemicals (CFR 1993c)

- Resource Conservation and Recovery Act (RCRA) Hazardous Wastes (CFR 1993d)

- Environmental Protection Agency (EPA) list of 100 extremely hazardous chemicals (EPA 1990)

- EPA, 40 CFR Part 9 and 68 (FR 1994) list of regulated substances.

As part of the initial screening, facilities were assigned classifications on the basis of the chemical inventories provided in the SARA list of Extremely Hazardous Substances. Final hazard classifications were based on the reportable chemical quantities within the facilities, Environmental Protection Act (FR 1994) classifications of chemicals stored at the facilities, and the potential consequences of mixing chemicals during an accident. Reviews of existing safety analysis documentation and discussions with plant personnel confirmed that accidents in the resulting facilities would have the potential of producing bounding consequences.

F-5.2.2.1.2 Determination of Qualitative Likelihood of "Reasonably Foreseeable" Accidents—The method of estimating qualitative likelihoods is the same as that described in Section F-5.2.1.1.2 for radiological accidents.

F-5.2.2.2 EPIcode™. Like RSAC-5, EPIcode™ (Homann 1988) uses the well-established Gaussian Plume Model to calculate the dispersion of airborne hazardous chemicals usually at the same receptor locations as used for RSAC-5; that is, facility worker, nearest public access, nearest site boundary, and nearby communities. The EPIcode™ library contains information on over 600 hazardous substances listed in ACGIH (1988); all substances analyzed for the INEL were contained in the library.

The continuous release models require specifying the source term as an ambient concentration and a release rate. For term releases, the user specifies the release duration and the total quantity of material released.

By specifying a release quantity, release duration, and release area, the user effectively proposes a release rate per unit spill area. EPIcode™ confirms that the volatility of the spilled substance can support such a release rate. If the proposed release rate exceeds the saturation conditions at the release temperature, the EPIcode™ calculates a more realistic release rate and a corresponding longer release time based on the properties of the spilled materials.

In calculating effective release height, the actual plume height may not be the physical release height, for example, the stack height. Plume rise can occur because of the velocity of a stack emission and the temperature differential between the stack effluent and the surrounding air. EPIcode™ calculates both the momentum plume rise and the buoyant plume rise and chooses the greater of the two results. In this application, the standard terrain calculation of EPIcode™ is always used. Except as otherwise noted, the established 95 percent meteorological (stability class and wind speed) conditions for INEL are input into EPIcode™. The receptor height is always ground level (0 meters) and, as in RSAC-5, the mixing layer height is always 400 meters (1,300 feet). The deposition velocities listed in Table F-5-2 in the next section are used.

F-5.3 Generic Input Parameters

F-5.3.1 Accidents with Potential Release of Radioactive Material

Calculation of doses rely upon numerous input parameters. Generic input requirements and parameters are discussed below.

F-5.3.1.1 Source Term. The source term is expressed as the fraction of the radioactive material at risk that is released into the immediate environment. The material at risk is specific to a given process in the facility of interest. It is the material the scenario postulates to be potentially available for release, and is not necessarily the total quantity of material present. The release fraction is a multiplier applied to material at risk to estimate initial source term.

For airborne releases, the overall release fraction is the product of the damage ratio, the airborne and respirable fractions, and the leak path factor. The source term (Q) for each scenario is therefore developed as follows:

Q = material at risk × damage ratio × airborne release fraction × respirable fraction × leak path factor.

F-5.3.1.1.1 Damage Ratio—The damage ratio is the fraction of material exposed to the effects of the energy/force/stress generated by the postulated event. A damage ratio of one is applied for accidents involving 100 percent of the material at risk.

F-5.3.1.1.2 Airborne Release Fraction—The airborne release fraction is the fraction of the material that is made airborne due to the accident. Values from generic DOE guidance are used for the analyses unless more specific information is provided in source documents applicable to a particular accident scenario. These generic values are summarized in Table F-5-1.

Table F-5-1. Release fractions for various release mechanisms for accidents at the Idaho National Engineering Laboratory.[a]

	Release mechanisms			
Material	Failed fuel gap	Fire	Explosion	Inadvertent nuclear chain reaction
Gases				1.00
Noble gas	0.10	1.00	1.00	—[b]
Krypton	0.30	—	—	—
Halogens	0.10	1.00	1.00	0.25[c]
Iodine-129	0.30	—	—	—
Solids				(d)
Volatile	0.01	0.01	(e)	—
Nonvolatile	0.01[f]	0.01	0.01	—
Fly ash	—	0.01	0.01	—

a. Source: Elder et al. (1986).

b. — indicates no recommendation or not applicable.

c. Includes release and plateout.

d. Use Regulatory Guide values (NRC 1977a, 1979a,b).

e. 100 mg/m^3 for particulate airborne material.

f. Actually semivolatile (cesium, rubidium, ruthenium, antimony, selenium, technetium, and tellurium); review on a case-by-case basis.

F-5.3.1.1.3 Respirable Fraction—The respirable fraction is the fraction of the material with particle sizes less than 10 microns (DOE 1993) that could be retained in the respiratory system following inhalation. It is applied only to the source term for the inhalation pathway.

F-5.3.1.1.4 Leak Path Factor—The leak path factor accounts for the action of removal mechanisms, such as containment systems, filtration, deposition, etc., to reduce the amount of airborne radioactivity that is ultimately released to occupied spaces of the facility or to the environment. A leak path factor of one is assigned for a major failure of confinement barriers.

F-5.3.1.2 Meteorological/Dispersion Parameters. For accidents initiated within the INEL site, radiological doses are calculated not only for the general population, but also usually at three locations: (a) for facility workers within the originating facility area (for example, Idaho Chemical Processing Plant), at 100 meters (328 feet) from the source, (b) at the nearest public access to the accident location, and (c) at the nearest INEL site boundary. A qualitative assessment of representative accidents for workers less than 100 meters (328 feet) from the source is given in Slaughterbeck et al. (1995).

Except for releases through operable discharge systems such as the main stack at the Idaho Chemical Processing Plant, most releases of radioactive material are assumed to be at ground level. The ground-level release assumption is conservative because the slower dispersion compared to elevated releases results in higher ground-level concentrations and, therefore, higher estimates of radiation exposures near the point of release. Credit is taken for plume rise where applicable, such as that due to thermal buoyancy of combustion products from a fire. Release of a plume either from a height above ground level or with an elevated temperature could cause the plume to partially or completely miss nearby receptors.

The assumed mixing height puts a limit on vertical dispersion of the plume. The selected value of the mixing height of the plume is 400 meters (1,300 feet), considered to be conservative (Clawson et al. 1989). Both conservative and average meteorological conditions were assessed. For the conservative assessment, meteorological conditions were selected that would be unfavorable to atmospheric dispersion of contaminants, and would not be exceeded more than 5 percent of the time. Applicable parameters are listed in Table F-5-2.

Table F-5-2. Meteorological/dispersion parameters used in dosimetry calculations for accidents at the Idaho National Engineering Laboratory.[a]

Parameter	Facility worker	Nearest public access	Nearest site boundary[b]
Receptor distance (m)	100	Specific[c]	Specific[c]
Wind velocity[d] (m/s)			
95 percent	0.5	0.5/2.0	2.0
50 percent	0.5	0.5/4.0	4.0
Release elevation[e] (m)	0	0	0
Wind stability class			
95 percent	F	F	F
50 percent	Not applicable	Not applicable	D[f]
Dry deposition velocity[g] (m/s)			
Solids	0.001	0.001	0.001
Halogens	0.01	0.01	0.01
Noble gases	0	0	0
Cesium	0.001	0.001	0.001
Ruthenium	0.001	0.001	0.001
Release duration[c]	Specific	Specific	Specific
Release coefficient[e]	Linear	Linear	Linear
Diffusion coefficients[e]	Markee	Markee	Markee

a. To convert meters to feet, multiply by 3.28.

b. Nearest site boundary values also used in population dose calculations.

c. Specific to accident scenario.

d. 0.5 meters per second for less than 2 kilometers from source; 2.0 meters per second for greater than 2 kilometers with 95% meteorological conditions and 4.0 meters per second for 50% meteorological conditions. For cases with plume rise, fumigation is employed.

e. Applies to most accident scenarios; deviations identified in specific accident descriptions (Markee 1967).

f. 50% meteorology is used only for the population dose calculations.

g. Applies to materials (element and physical state) included in specific source terms.

Dry deposition, as modeled in RSAC-5, is assumed so no washout factor is specified. Plume depletion by dry deposition means that ground surfaces are contaminated during plume migration as particles fall to ground surfaces by gravitational settling. Dry deposition is conservative for the ground surface and biological uptake pathways because radionuclides are made available for uptake. It is slightly nonconservative for inhalation and immersion pathways due to the fractional loss of activity within the plume.

To model the atmospheric transport of released radioactive materials from the INEL, site-specific meteorological data were reviewed to determine the prevailing meteorological conditions. Accidents were evaluated for both average and conservative meteorological conditions. For results that represent the upper bound on consequences, stable meteorological conditions that give rise to minimal dispersion are assumed.

Workers within the facility area and individuals at the nearest public access and nearest site boundary are assumed directly downwind from the accident location. For population doses the wind direction is constrained to the directions with the highest consequences for the general population.

F-5.3.1.3 Biological Parameters. Inhalation and ingestion pathway parameters are discussed below.

F-5.3.1.3.1 Inhalation Pathway Parameters—Inhalation parameters are the same for all radiological scenarios. Breathing rates are assumed to be 3.33×10^{-4} cubic meters per second (worker average) for exposures at controlled areas like the Idaho Chemical Processing Plant facility area [DOE Order 5480.11 (DOE 1992b)] and 2.66×10^{-4} cubic meters per second (member of public average) for uncontrolled areas like public highways inside the INEL site and at the nearest INEL site boundary.

RSAC-5 provides options for specifying pulmonary clearance classes for each isotope in the inventory, or for using code-selected default clearance classes. Clearance classes are selected on the basis of conservatism, unless otherwise supported by available data on the chemical form of isotopes. For INEL facility accidents, the RSAC-5 default selections are used except for the alternate classes of weekly for plutonium and yearly for strontium.

Another conservatism in RSAC-5 involves tritium as a radioactivity source, that is, the source terms for H-3 (tritium) are assumed to be 100 percent tritiated water (HTO).

F-5.3.1.3.2 Ingestion Pathway Parameters—Constants used for calculation of internal dose from ingestion of agricultural products such as leafy vegetables, stored vegetables, meat, and milk are default parameters in the RSAC-5 code. They are based on the most current available guidance from the NRC and DOE (NRC 1977b, Moore et al. 1979, DOE 1988). The fraction of the food consumed locally that is grown locally is assumed to be 10 percent, and this assumption is implemented by multiplying the calculated ingestion dose by 0.1. Consumption rates for the average population are lower than the maximum individual values from the above references. They are based on Rupp (1980). Concentration ratios and transfer coefficients are based on the data of Baes et al. (1984).

F-5.3.1.4 Dose Estimates for Individuals. Underlying assumptions for exposure times, for purposes of dose estimates are discussed below. The following assumptions apply to workers within the facility area:

- Workers are exposed unprotected to the plume for a limited time (a maximum of five minutes). An alarm and/or a "Take Cover Alert" is assumed to sound shortly after accident initiation. Workers, as they are trained to do, would immediately take cover inside the nearest building or, particularly in case of an earthquake, evacuate upwind or crosswind from the release location.

- After the accident is over and the airborne release is terminated, workers are evacuated to buses in a nearby parking lot. During transit from buildings to the buses, workers are exposed to radioactivity deposited on the ground surface for a limited time (a maximum of 15 minutes).

- Workers are exposed to radioactivity via the inhalation, air immersion, and ground surface pathways only. Ingestion of food plants or animals grown onsite at INEL is not expected for facility workers.

The following assumptions apply to the maximally exposed individual at the nearest public access:

- The nearest public access to the location of an accident is usually a public highway [for example, for the Idaho Chemical Processing Plant, U.S. Highway 20/26 near the Experimental Breeder Reactor I National Historic Monument is approximately 5.9 kilometers (3.7 miles) from the Chemical Processing Plant area]. This location is within the INEL site boundaries and is patrolled by the INEL Security force. In the event of an accident with potential impacts outside the complex boundary, public access to the highway was assumed to be controlled by INEL Security and State Highway Patrol. It is conservatively assumed that a motorist could be on such a highway for up to two hours before being evacuated by INEL Security personnel.

- A member of the public on such a public highway directly downwind of an accident location would be exposed to radioactivity via the inhalation, air immersion, and ground surface pathways only. Consumption of food plants or animals grown onsite is not expected for a member of the public temporarily on INEL site. For the inhalation and air immersion pathways, exposure time to the plume would be for the entire release duration up to a maximum of two hours. Exposure time to radioactivity deposited on the ground surface would be a maximum of two hours.

The following assumptions apply to the maximally exposed individual at the nearest site boundary:

- A hypothetical member of the public resides at the INEL nearest site boundary (for example, for Idaho Chemical Processing Plant, approximately 14 kilometers or 22.5 miles). This individual grows crops and raises animals for personal food consumption. The wind is assumed to blow directly toward this person and this person's land when the accident occurs, and this person is assumed to receive no warning of the accident.

- This hypothetical member of the public at the nearest site boundary directly downwind of the accident would be exposed to radioactivity via the inhalation, air immersion, ingestion, and ground surface pathways. For the inhalation and air immersion pathways, exposure time to the plume would be for the entire release duration. Crops and grazing land are exposed for the entire duration of plume passage.

- Food contaminated by the accidental release of radioactivity is assumed to be ten percent of the hypothetical individual's diet during the ensuing year. This percentage is considered consistent with normal practices that would reduce contamination, such as sprinkler irrigation and washing of vegetables. It does not take credit for interdictive measures, such as enforced limits on consumption unless exposures reach values where protective action guidelines are exceeded.

- Exposure time to radioactivity deposited on the ground surface would be a maximum of 70 percent of the year following the accident, because the individual could reasonably be expected to spend, on the average, at least 30 percent of each day indoors and shielded from ground surface radioactivity.

F-5.3.1.5 Population Dose Estimates. The RSAC-5 option for calculating population doses (in person-rem) involves determining a total effective dose equivalent (TEDE), in rem, for an average individual at several locations within an 80-kilometer (50-mile) radius and multiplying that TEDE by the number of persons for whom it applies. The TEDE calculation is similar to that for the maximum exposed individual at the nearest site boundary, with some limitations and exceptions:

- For the population option, RSAC-5 limits the radionuclide inventory to 100 entries. For scenarios with more than 100 nuclides, such as those for inadvertent nuclear chain reactions, a screening step is performed. Only those nuclides that produce an EDE or CEDE greater than one millirem for any one of the four pathways at any of the three locations are included.

- In the ingestion pathway, the consumption rates are reduced as described in Section F-5.3.1.3.2.

- The adjustment for respirable fraction in the inhalation pathway is done outside RSAC-5.

The method for calculating population dose effectively assumes that the plume travels at a constant velocity (under both 95 percent and 50 percent meteorological conditions) in a straight line out to 80 kilometers (50 miles) over the sector with the maximum population. This method is conservative because changes in actual wind directions and speeds that vary with time and distance from the accident would cause greater diffusion of the plume and result in lower doses.

F-5.3.1.6 Health Effects. Health effects expected from the estimated doses are discussed in the following sections. The risk factors used for calculation of these health effects are taken from ICRP Publication 60 (ICRP 1991), NCRP Report No. 80 (NCRP 1985), and NUREG/CR-4214 (Abrahamson et al. 1990) and are presented in Table F-5-3.

Table F-5-3. Risk estimators for health effects from exposure to ionizing radiation from accidents at the Idaho National Engineering Laboratory.

		Risk factor (probability per rem)	
Effect	Nuclide	Facility worker	General population
Fatal cancer (all organs)	All	4.0×10^{-4}	5.0×10^{-4}
Fatal, nonfatal, and severe genetic effects (all organs)	All	5.6×10^{-4}	7.3×10^{-4}
Cancer and severe genetic effects (thyroid)	Iodine-131	1.05×10^{-5}	1.05×10^{-5}
	Iodine 132	3.15×10^{-5}	3.15×10^{-5}
Lifetime risk of hypothyroidism	Iodine-131	1.7×10^{-5}	1.7×10^{-5}
	Iodine-132	1.7×10^{-5}	1.7×10^{-5}

F-5.3.2 Accidents with Potential Chemical Exposures

Input parameters for the analyses and the potential health effects of accidents with potentital chemical exposures are discussed below.

F-5.3.2.1 Input Parameters. Factors such as receptor locations, terrain, meteorological conditions, release conditions, and characteristics of the chemical inventory are required as input parameters for hand calculations or computer codes to determine human exposure from airborne releases of hazardous chemicals. This section discusses these input parameters, notes the degrees of conservatisms, and describes the computer models used to perform exposure estimates. Generic input parameters used in the accident analyses are given in Table F-5-4.

Table F-5-4. Release and dispersion parameters used for calculating hazardous chemical concentrations resulting from accident scenarios at the Idaho National Engineering Laboratory.[a]

Meteorological/dispersion parameter	Facility worker	Co-located facilities and nearest public access	Nearest site boundary
Receptor distance (m)	100	Specific[b]	Specific[b]
Wind velocity (m/s)	0.5[c,d]	0.5/2.0[c,d,e]	2.0[c,d]
Release elevation[c](m)	0	0	0
Wind stability class[c,d]	F	F	F
Deposition velocity[f] (m/s)			
Solids	0.01	0.01	0.01
Gases/vapors/liquids	0.001	0.001	0.001
Unspecified	0.001	0.001	0.001
Release duration[b]	Specific	Specific	Specific
Release area[g]	Point	Point	Point

a. To convert from meters to feet, multiply by 3.28.

b. Specific to accident scenario.

c. Applies to most accident scenarios; deviations identified in specific accident descriptions

d. Worst-case meteorological conditions are calculated for some scenarios by optional routine.

e. 0.5 meters per second for less than or equal to 2 kilometers from source; 2.0 meters per second for greater than 2 kilometers.

f. Applies to materials (element and physical state) included in specific source terms.

g. Unless area-release calculational option is used.

F-5.3.2.2 Health Effects. Hazardous constituents dispersed during an accident could induce adverse health effects among exposed individuals. This possible impact is assessed by comparing the airborne concentrations of each substance at specified downwind receptor locations to standard exposure guidelines for chemical toxicity.

Where available, Emergency Response Planning Guideline (ERPG) values are used for this comparison. ERPG values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects (Rusch 1993). ERPG values are specific for each substance, and are derived for each of three general severity levels:

- Exposure to concentrations greater than ERPG-1 values result in an unacceptable likelihood that one would experience mild transient adverse health effects, or perception of a clearly defined objectionable odor.

- Exposure to concentrations greater than ERPG-2 values result in an unacceptable likelihood that one would experience or develop irreversible or other serious health effects, or symptoms that could impair one's ability to take protective action.

- Exposure to concentrations greater than ERPG-3 values result in an unacceptable likelihood that one would experience or develop life-threatening health effects.

Where ERPG values have not been derived for a toxic substance (Weitzman 1992), other chemical toxicity values are substituted, as follows:

- For ERPG-1, threshold limit value/time-weighted average (TLV-TWA) values (ACGIH 1988) are substituted: The TWA is the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

- For ERPG-2, level-of-concern values (equal to 0.1 of the immediately dangerous to life or health value—see below) are substituted: level-of-concern value is defined as the concentration of a hazardous substance in air, above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (EPA/FEMA/DOT 1987).

- For ERPG-3, immediately dangerous to life or health (IDLH) values are substituted: IDLH is defined as the maximum concentration from which a person could escape within

30 minutes without a respirator and without experiencing any escape impairing or irreversible side effects (NIOSH 1990).

Possible health effects associated with exceeding an ERPG-2 or -3 are specific for each substance of concern and must be characterized in that context. ERPG values are based upon a one-hour exposure of a member of the general population. In this EIS, ERPG values are applied only to time-averaged exposures of one hour or less in duration. This approach provides an additional element of conservatism in the evaluation of accidents with releases that are significantly less than one hour.

F-5.4 Accident Screening Methodology

F-5.4.1 Screening and Selection Process

There are many types of postulated events that may lead to accidental release of radioactive and/or hazardous material of which only some have the potential to cause consequences away from the facility or immediate local area. These events could generate consequences to the environment, workers, and the public at the nearest site boundaries. The screening and selection process focused on events with potential to generate consequences to the public at the nearest site boundary locations. This screening may not identify maximum consequences to the worker within the facility or within 100 meters (328 feet) of the accident location. These consequences are addressed qualitatively and by analysis of accident consequences in terms of worker injuries, deaths, or exposures from a historical perspective.

F-5.4.2 Screening of Locations, Spent Nuclear Fuel, Waste and Activity Types

Sufficient quantities of each material type to cause a potential impact if released are defined in accordance with DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports" (DOE 1994) for a Category 2 hazard. Results by waste stream or material type for the nine major areas are given in Volume 2, Section 5.14.

F-5.4.3 Screening of Accident Initiating Event Types

Each INEL facility area was screened for initiating events with the potential to cause consequences to the worker, environment, or public at the nearest site boundary.

F-5.4.4 Estimation of Accident Event Release Frequency Ranges

Most types of accident events considered in this screening have never occurred at the INEL. They are defined as rare events in that the frequency with which these events are expected to occur is very small. The estimation of the frequency of occurrence is based on analytical analysis and statistics of the occurrence of conditions and contributing events leading to an accident. Frequencies are defined in terms of annual frequency of occurrence.

Annual frequency range estimates are derived from three sources: (a) existing safety analysis documentation, (b) other accident safety analysis documentation with similar frequency of occurrence information, or (c) best engineering judgment if no other reference or similar information is available.

F-5.4.5 Summary of Accident Event Selection and Categorization

The selected accident events are categorized in Table F-5-5 according to the expected annual frequency of occurrence range of the event. Table F-5-5 also summarizes these accidents by frequency of occurrence, source term, dose at the nearest site boundary, and dose to populations.

Table F-5-5. Accident screening process summary: events selected for consequence analysis and consequence assessment information for accidents at the Idaho National Engineering Laboratory.[a]

Accident	Frequency	Approximate total source term[b]	Largest source contributor[c]	Total EDE at site boundary (rem)[d]	Maximum dose to sector population[e] (person-rem)
Spent Nuclear Fuel—Abnormal Events and Design Basis Accidents					
Idaho Chemical Processing Plant (ICPP)/ Spent Fuel Storage Facility inadvertent nuclear chain reaction (1 × 10^{19} fissions, 8-h release)	1 × 10^{-3}	4.2 × 10^{3} Ci	Xe-138	1 × 10^{-3}	0.59
Argonne National Laboratory-West (ANL-W)/Hot Fuel Examination Facility (HFEF) earthquake-induced breach and fuel melt	1 × 10^{-5}	1.7 × 10^{5} Ci	Xe-133	5	1.4 × 10^{4}
ANL-W/Fuel Cycle Facility (FCF) earthquake-induced breach and fuel fire	1 × 10^{-5}	8.5 × 10^{3} Ci	Cs-137	5	6.1 × 10^{3}
ANL-W/HFEF fuel handling accident, fuel pin breach, noble gas venting	1 × 10^{-2}	(f)	(f)	2 × 10^{-3}	(f)
ICPP dissolver hydrogen explosion	1 × 10^{-5}	(f)	(f)	6.3 × 10^{-4}	0.81
ICPP inadvertent dissolution of 30-day cooled fuel	1 × 10^{-6}	(f)	(f)	3.0 × 10^{-2}	29
Spent Nuclear Fuel—Beyond Design Basis Accidents					
Test Area North (TAN) Hot Cell Complex inadvertent nuclear chain reaction in spent fuel (3 × 1010^{19} fission, 1-h release)	5 × 10^{-7}	3.1 × 10^{6} Ci	Kr-85	16	4.0 × 10^{3}
TAN Hot Cell Complex inadvertent nuclear chain reaction in spent fuel (1 × 1010^{19} fissions, 8-h release)	5 × 10^{-7}	3.0 × 10^{6} Ci	Kr-85	0.29	3.4 × 10^{2}
ANL-W/HFEF aircraft crash (radiological)	1 × 10^{-7}	1.8 × 10^{5} Ci	Xe-133	5	2.0 × 10^{3}
ANL-W/FCF aircraft crash (radiological)	1 × 10^{-7}	1.1 × 10^{4} Ci	Cs-137	1.8	2.6 × 10^{3}
ICPP/Spent Fuel Storage Facility seismic pool drain and nuclear chain reaction at CPP 603 (3 × 10^{19} fission, 1-h release)	1 × 10^{-7}	8.5 × 10^{3} Ci	Xe-138	2.8 × 10^{-2}	5.6

Table F-5-5 (continued).

Accident	Frequency	Approximate total source term[b]	Largest source contributor[c]	Total EDE at site boundary (rem)[d]	Maximum dose to sector population[e] (person-rem)
High-Level Waste—Abnormal Events and Design Basis Accidents					
ICPP filter bank fire	3×10^{-5}	1.3×10^{-2} Ci	Sb-125	1.2×10^{-5}	0.13
ICPP main stack earthquake-induced collapse	3×10^{-4}	15	Sb-125	9.1×10^{-2}	17
ICPP/Calcined Solids Storage Facility earthquake-induced structural collapse	1×10^{-5}	95	Cs-137	7.6×10^{-2}	4.3×10^{2}
ICPP/New Waste Calcining Facility explosion	3×10^{-6}	(f)	(f)	0.2	(f)
ICPP earthquake-induced high-level waste (HLW) tank failure	1×10^{-5}	3×10^{6} Ci	Cs-137	NA	NA
High-Level Waste—Beyond Design Basis Accidents					
ICPP/CSSF aircraft crash (radiological)	2×10^{-7}	2.9×10^{4} Ci	Cs-137	1.1	1.0×10^{4}
Transuranic Waste—Abnormal Events and Design Basis Accidents					
Radioactive Waste Management Complex (RWMC) lava flow (radiological)	2×10^{-5}	4.3 Ci	Pu-241	9.4×10^{-2}	96
RWMC/Transuranic Storage Area (TSA) fire	4×10^{-6}	(f)	(f)	1×10^{-6}	(f)
RWMC/TSA explosion	2×10^{-4}	(f)	(f)	2.0×10^{-7}	(f)
Transuranic Waste—Beyond Design Basis Accident					
RWMC/TSA aircraft crash	1×10^{-7}	(f)	(f)	6×10^{-4}	(f)
Mixed Low-Level Waste—Abnormal Events and Design Basis Accidents					
RWMC/Subsurface Disposal Area (SDA) fire	1×10^{-3}	(f)	(f)	4×10^{-4}	(f)
Waste Experimental Reduction Facility (WERF) design basis fire	1×10^{-3}	(f)	(f)	2.8×10^{-3}	(f)

Table F-5-5 (continued).

Accident	Frequency	Approximate total source term[b]	Largest source contributor[c]	Total EDE at site boundary (rem)[d]	Maximum dose to sector population[e] (person-rem)
Mixed Low-Level Waste—Beyond Design Basis Accidents					
WERF Waste Storage Building beyond design basis fire	1×10^{-7}	(f)	(f)	1.4×10^{-2}	(f)
Hazardous Materials—Abnormal Events and Design Basis Accidents					
ANL-W chlorine and sodium hydroxide release	1×10^{-5}	300 lb 6×10^{5} lb	chlorine[g] sodium	35% of ERPG 3	NA
RWMC lava flow (hazardous material)	2×10^{-5}	1.4×10^{4} kg	mercury	30% of ERPG 3	NA
Central Facilities Area (CFA):	1×10^{-4}				
Hazardous Waste Storage Facility fire		660 gal	nitric acid	4% of ERPG 3	NA
Sewage Treatment Plant chlorine release		150 lb	chlorine	10% of ERPG 3	NA
ICPP chlorine release	5×10^{-6}	270 lb	chlorine	7% of ERPG 3	NA
ICPP earthquake-induced HLW tank failure (hazardous material)	1×10^{-5}	300,000 gal	nitrates	4% of MCL	NA
INEL Research Center hazardous material release	1×10^{-4}	68 kg	sulfur dioxide	33% of ERPG 3	NA
ICPP hydrofluoric acid spill	1×10^{-5}	3,000 gal	hydrofluoric acid	0.2% of ERPG 3	NA
ICPP nitric acid spill	1×10^{-5}	300 gal	nitric acid	0.05% of ERPG 3	NA
ICPP anhydrous ammonia release	1×10^{-6}	36,000 gal	anhydrous ammonia	12% of ERPG 3	NA
Hazardous Materials—Beyond Design Basis Accidents					
ICPP/CSSF aircraft crash (hazardous material)	2×10^{-7}	30 kg	ZrO_2	<ERPG 1	NA
ANL-W/HFEF aircraft crash (hazardous material)	1×10^{-7}	9.7×10^{4} g	TCE mercury	<ERPG 1 0.2% of ERPG 3	NA
ANL-W/FCF aircraft crash (hazardous material)	1×10^{-7}	5.6×10^{3} g	cadmium	<ERPG 1	NA
Test Area North depleted uranium fire	1×10^{-7}	1.3×10^{3} kg	depleted uranium	<ERPG 1	NA

Table F-5-5 (continued).

Accident	Frequency	Approximate total source term[b]	Largest source contributor[c]	Total EDE at site boundary (rem)[d]	Maximum dose to sector population[e] (person-rem)
Environmental Remediation and Decontamination and Decommissioning Waste—Abnormal Events and Design Basis Accidents[h]					
RWMC/Pit 9 vent release	2×10^{-3}	(f)	(f)	5.1×10^{-2}	(f)
RWMC/Pit 9 design basis fire	9×10^{-5}	(f)	(f)	0.8	(f)
RWMC/Pit 9 beyond design basis fire	1×10^{-5}	(f)	(f)	0.33	(f)

Definition of acronyms:

EDE - effective dose equivalent
ERPG - Emergency Response Planning Guideline
MCL - maximum contaminant level
NA - not applicable
TCE - 1,1,1 trichloroethane

a. All analyses use RSAC-5 (Wenzel 1993) for radiological consequences and EPIcode (Homann 1988) for hazardous material consequences.

b. Sum of the individual source terms.

c. Largest source by magnitude (activity or mass).

d. For hazardous material, exposures are given in terms of percentage of ERPG 3 values (immediately dangerous to life or health) or less than ERPG 1 values (mild transient health effects or objectionable odor).

e. 95% meteorology.

f. The safety analysis report used for this accident does not provide this information because it was developed before the DOE orders specifically required this information.

g. An estimated 20 lb of chlorine were released in an accident on April 15, 1994.

h. No beyond design basis accidents were identified for environmental remediation and decontamination and decommissioning activities.

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